EDUCATIONAL AND BUSINESS CENTER FOR DEVELOPMENT OF HUMAN RESOURCES, MANAGEMENT AND SUSTAINABLE DEVELOPMENT, NOVI SAD, SERBIA

INTERNATIONAL SCIENTIFIC CONFERENCE:

"CHALLENGES OF MODERN ECONOMY AND SOCIETY THROUGH THE PRISM OF GREEN ECONOMY AND SUSTAINABLE DEVELOPMENT" – CESGED2023

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NOVI SAD, 27-30 April 2023

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  - healthcare;
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PREFACE

International scientific conference: Challenges of modern economy and society through the prism of green economy and sustainable development - CESGED 2023, was held from April 27 to 30, 2023 year in Novi Sad, with the aim of analyzing the real situation and looking at the perspectives, that is, the key tendencies of changes in contemporary science and society. Some of the key goals of this scientific meeting were the acquisition, expansion and deepening of scientific-theoretical and practical knowledge and findings from the relevant scientific fields, as well as encouraging socially responsible behavior in accordance with the basic principles of sustainable development and green economy. Bearing in mind the socially responsible behavior of the organizers of the conference, these analyzes were viewed primarily through the prism of green economy and sustainable development, while respecting the principle of gender equality.

Several organizations and scientific institutions from the state (public) and private sectors from the Republic of Serbia participated in the organization and implementation of the international scientific conference: Educational and Business Center for Human Resource Development, Management and Sustainable Development from Novi Sad, University of the Business Academy in Novi Sad: Faculty of Economics and Engineering Management - Fimek and Faculty of Law for Commerce and Judiciary in Novi Sad, Educational Center for Training in Work and Professional Skills Novi Sad and State University in Novi Pazar. Also, Comenius University Bratislava, Faculty of Management, Bratislava, from Slovakia (EU) participated as one of the initiators and main organizers of this international scientific meeting.
Since one of the organizers of the scientific conference was the State University in Novi Pazar, as the first and only integrated state university in Serbia that functions on the principle of a departmental model, the conference was interdisciplinary in nature with a multidisciplinary approach to research covering various scientific fields: economic sciences; legal sciences; natural and mathematical sciences; technical and technological sciences; biomedical sciences; philological sciences; philosophical sciences and arts.

We note with particular pleasure that the scientific conference brought together more than seventy eminent scientific workers: professors, researchers and experts from various fields from Australia, Japan, Brazil, Tunisia, the Kingdom of Saudi Arabia, Iran, Libya, Morocco, the United Kingdom (Great Britain), Slovakia, Germany, Austria, Hungary, Romania, Bulgaria, Greece, Turkey, Montenegro, Bosnia and Herzegovina, Republika Srpska, Serbia, as well as representatives of local communities and the public and private sector from the countries of the Western Balkans who took part in the preparation, organization and implementation of the meeting as members of the International Scientific and Organizational Committee.

At the gathering, authors from five different continents (from Europe, Asia, South America, Australia, Africa) from more than fifteen countries presented their scientific and professional works and the results of theoretical and empirical research to an interested scientific and professional public in the framework of plenary introductory lectures and lectures by thematic areas, that is, sessions.

At the very opening of the scientific conference, the representatives of the official organizers of the international scientific conference gave welcoming words and introductory speeches. The plenary - introductory lectures were followed by lectures by participants of the conference who presented the results of their theoretical and empirical research in defined thematic areas and in accordance with the planned agenda of the conference. The authors emphasized the importance of innovative technologies, green financing and entrepreneurship in promoting sustainable development, as well as the necessity of applying the principles of circular economy and reducing greenhouse gas emissions. In addition, an important segment of the scientific conference was devoted to the issues and importance of education, digitization and social networks in promoting sustainability, as well as the critical role that the health sector has and, as the participants of the conference apostrophized, will have more and more in the times ahead, in achieving sustainable development.

The conclusions of the conference highlighted the urgent need for effective solutions to global environmental and social problems, as well as the importance of interdisciplinary research and cooperation to achieve the goals of sustainable development. Finally, the authors-present participants of this meeting emphasized the need for environmental protection, ethical business practices and equal access to education, health care and employment opportunities as essential components of a sustainable economy and society.

From the total number of seventy one submitted abstracts and papers, in accordance with the defined thematic areas of the conference, conditions and deadlines, after the review process was completed, fifty eight papers received double positive reviews and thus met the criteria for publication in the Proceedings of papers of the International scientific meeting with a note that the responsibility for the views, assumptions and conclusions expressed in the papers are exclusively on the authors of the papers. The authors expressed special interest and paid special attention to the research in the field of: Green Economy and Sustainable Development; Management in service activities (tourism and hotel industry; healthcare; agriculture and agribusiness; education and sports; public sector and state administration; banking and finance; transport); Investment and technical-technological development; and Industries 4.0. Proceedings of papers can be downloaded from the official website of the State University in Novi Pazar (www.dunp.np.ac.rs).

Thanks once again to all the participants of the scientific conference, members of the international scientific, organizational and editorial board, authors and all reviewers, I would like to express my special gratitude to professor *emeritus* Ćemal Dolićanin, honorary president of the International Scientific Committee for selfless support and help in the organization and implementation of the scientific meeting at an enviable level and to the satisfaction of all participants who stayed from April 27 to 30, 2023 in the Novi Sad. Professor Ćemal Dolićanin left us suddenly, but his professional, scientific, social and human works we will never forget.

Editor in chief
PhD Jelena Premović, senior research associate

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GREEN ENTREPRENEURSHIP AT THE GLOBAL LEVEL: CHALLENGES AND PERSPECTIVES

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Abstract: Green entrepreneurship is a rapidly growing field that is having a significant impact on the global economy and the environment. It refers to the creation and development of new businesses that prioritize environmental sustainability and social responsibility. This research on green entrepreneurship is helping to shed light on the challenges and opportunities associated with sustainable and environmentally-friendly business practices, and is providing valuable insights into how we can create a more sustainable future. In the paper is concluded that green entrepreneurship presents an opportunity for entrepreneurs to create businesses that address environmental challenges while also contributing to economic growth and social impact. There is a need for further research, as green entrepreneurship is a topic of great interest, and reliable quantitative research will be needed besides our literature review and used relevant statistical data . The contribution of the paper is reflected in the identification of important theories, methods and measures that are taken in the world for the development of green entrepreneurship.

Key words: Green entrepreneurship, global economy, environment, sustainable development
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INTRODUCTION

Green entrepreneurship is the activity of addressing environmental and social problems, and coming up with innovative entrepreneurial ideas that will bring a solution to them (IED, 2020). It is a field that involves the creation of environmentally sustainable businesses, products, and services. Green entrepreneurship refers to the practice of starting and managing a business that focuses on creating products or services that have a positive impact on the environment or promote sustainability. This type of entrepreneurship seeks to balance financial goals with environmental and social responsibility, and often involves the use of innovative technologies and business models to achieve these aims (Vasilescu, Dimian, and Gradinaru, 2023).

More and more individuals and organizations are recognizing the need for sustainable and environmentally-friendly business practices. Some of the key areas of research within green entrepreneurship include:

Renewable Energy: Green entrepreneurs are creating innovative solutions to increase the use of renewable energy sources like solar, wind, and hydroelectric power. This includes creating new products such as solar panels, wind turbines, and energy storage systems. The International Renewable Energy Agency (IRENA) estimates that 90 percent of the world's electricity can and should come from renewable energy by 2050 (UN, 2021).

Sustainable Agriculture: With the growing demand for organic and locally sourced food, green entrepreneurs are developing new technologies and techniques to improve sustainable farming practices. This includes vertical farming, hydroponics, and other innovative methods (Litovchenko Grigorievic, Radović-Marković, 2019; Md. Shajahan, Sahati, Radović-Marković, 2022).

Waste Management: Green entrepreneurs are developing new ways to reduce, reuse, and recycle waste materials. This includes creating biodegradable packaging materials, composting systems, and other waste reduction strategies (Radović -Marković, 2015).

Green Building: Green entrepreneurs are creating innovative building materials and techniques that promote energy efficiency and reduce the environmental impact of buildings. This includes creating new insulation materials, eco-friendly paints, and building designs that maximize natural light and ventilation (Radović-Marković, Vuković , Mityagin, (2021).

THEORETICAL OVERVIEW

There are several theories that have emerged to explain the motivations and drivers behind green entrepreneurship. Here are a few:

Environmental orientation theory*:* This theory suggests that entrepreneurs who prioritize environmental sustainability are driven by their values and beliefs about the importance of protecting the planet. They see their businesses as a way to make a positive impact on the environment while also creating economic value (Chang, 2011).

Resource-based theory: According to this theory, green entrepreneurs are motivated by the desire to create and leverage unique resources and capabilities that are tied to environmental sustainability. These resources might include innovative technologies, specialized knowledge, or access to networks and partnerships (Nikolaou , Tasopoulou , Tsagarakis, 2018). Namely, small firms and entrepreneurs can use their resources to take advantage of new opportunities and expand their market share (Alvarez and Lowell, 2001).

Institutional theory: This theory argues that green entrepreneurship is influenced by the broader institutional context in which businesses operate. This might include factors such as government policies, industry norms, and cultural values that prioritize environmental sustainability (Simón-Moya, Revuelto-Taboada, Guerrero, 2014).

Social entrepreneurship theory: Green entrepreneurship can also be viewed as a form of social entrepreneurship, which prioritizes the creation of businesses that address social and environmental challenges. Social entrepreneurs are driven by a desire to make a positive

impact on society and the environment, and they often pursue innovative business models and partnerships to achieve their goals (Stephan , Uhlaner , Stride, (2015).

These theories suggest that green entrepreneurship is motivated by a range of factors, including personal values and beliefs, the desire to create unique resources and capabilities, and the broader institutional context in which businesses operate.

GREEN ENTREPRENEURSHIP AT THE GLOBAL LEVEL

The initiative to green the economy shows that greening the economy is a new driver of growth that generates new jobs (Radović-Marković, and Živanović, 2019). According to a report by the Global Entrepreneurship Monitor (GEM, 2021), which collects data on entrepreneurship worldwide, the proportion of entrepreneurs who prioritize environmental sustainability has been steadily increasing in recent years. In this context , in 2020, 42% of entrepreneurs worldwide reported that they are considering or are already involved in green business activities. Furthermore, a study by the United Nations Industrial Development Organization (UNIDO) found that the global market for environmental goods and services, which includes products and services that help to protect or restore the environment, was valued at USD 1.5 trillion in 2017. This market is projected to continue growing as the demand for sustainable products and services increases. In addition, UNIDO (2023) shared best practices on developing green industries, resource-efficient and cleaner production, energy efficiency, and the management and financing of clean technologies.
In terms of regions, Europe has been leading the way in green entrepreneurship. A study by the European Environment Agency (EEA) found that the environmental goods and services sector accounted for 2.5% of the EU's gross domestic product (GDP) in 2017 (EEA, 2019). The study also found that the sector employed over 4.2 million people in the EU. In addition, 2021 EU Blue Economy report – Emerging sectors prepare blue economy for leading part in EU green transition (European Commission, 2021)

According to a report by the European Investment Bank, the EU invested a €4.1 billion in renewable energy projects, clean transport and COVID recovery in 2020 (EIB, 2021). This investment supported the installation of new renewable energy capacity, including wind, solar, and biomass projects. Germany, France, Spain, and the Netherlands were among the top countries for renewable energy investments in Europe. In addition to renewable energy, the green economy also includes investments in sustainable transportation, energy efficiency, and circular economy practices (Radović Marković, 2015; Brnjas, Radović-Marković, Golubović-Stojanović, 2019). The European Union has launched several initiatives to support these areas, including the European Green Deal, which aims to reduce in EU carbon emissions by 55% by 2030 (WEF, 2021). This plan includes investments in green infrastructure, the renovation of buildings to improve energy efficiency, and the development of sustainable transportation systems.

A report by the National Renewable Energy Laboratory (NREL) found that the renewable energy industry, which is a major component of green entrepreneurship, were employed over 12 million people in the sector in 2020 (IRENA, 2021).

Overall, it is clear that green entrepreneurship is an important and growing sector of the global economy (Radović Marković, and Tomas, 2019). As more entrepreneurs prioritize sustainability and consumers demand environmentally friendly products and services, the market for green businesses is likely to continue to expand (Natorina, and al., 2023).

IMPORTANCE OF INVESTMENTS IN GREEN ENTREPRENEURSHIP

Investments in green entrepreneurship involve funding startups or small businesses that focus on developing environmentally sustainable products, services, or processes. Green entrepreneurship aims to address the growing concern over climate change, environmental degradation, and resource depletion by promoting environmentally-friendly practices and technologies.

There are several benefits to investing in green entrepreneurship. Firstly, it promotes sustainable economic growth and business resilience while addressing environmental challenges (Radović Marković, 2018). Secondly, it creates new job opportunities, particularly in the green technology sector. In this context , according to ILO around 24 million jobs worldwide could be created by the green economy by 2030 (WEF, 2021a). Thirdly, it helps to reduce the carbon footprint of businesses, which can result in significant cost savings and increased competitiveness in the market.

Investors interested in green entrepreneurship should conduct due diligence to ensure the viability of the startup or small business they are considering investing in. This may include assessing the management team, evaluating the business model and market potential, and examining the potential for scalability and growth.
Investors may also want to consider investing through impact investment funds or socially responsible investment (SRI) funds that focus on investing in companies with strong environmental, social, and governance (ESG) practices. These funds may provide access to a diversified portfolio of green entrepreneurship opportunities, while also incorporating ESG factors into their investment decision-making process. Europe is making significant investments in the green economy, and these investments are likely to continue to grow as the region works to meet its ambitious climate targets.

PROGRAMS FOR ENHANCING GREEN ENTREPRENEURSHIP

There are several programs available that aim to enhance green entrepreneurship at the global level, as following:

- *Green Business Certification Programs*: These programs provide entrepreneurs with training and resources to help them develop and implement environmentally sustainable practices in their businesses. Some examples include the Green Business Certification Program and the Green Seal Certification Program.
- *Incubators and Accelerators*: These programs provide entrepreneurs with mentoring, networking opportunities, and funding to help them grow their businesses. Some examples include the Cleantech Open and the Greenstart Accelerator.

- *Environmental Grants and Loans*: Many organizations and government agencies offer grants and loans to support green entrepreneurs. Some examples include the Small Business Administration's (SBA) Green Business Loan Program and the Environmental Protection Agency's (EPA) Small Business Innovation Research Program.
- *Green Technology Competitions*: These competitions provide entrepreneurs with opportunities to showcase their innovative green technologies and win funding and support. Some examples include the Clean Energy Trust Challenge and the Energy Globe Awards.
- *Sustainability Education and Training*: Programs such as sustainability courses and training programs can help entrepreneurs gain the knowledge and skills they need to develop sustainable business practices. Some examples include the Sustainable Business Network and the Green Economy Post (Nigam, and Rajendra, 2019).

There are various programs that aim to foster green entrepreneurship in the Balkans region. Here are some examples:

- Green for Growth Fund (GGF) - The GGF provides financing and technical assistance to businesses that promote energy efficiency and renewable energy in Southeast Europe, including the Balkans.
- Balkan Green Energy News (BGEN) - BGEN is a media outlet that covers renewable energy and energy efficiency developments in the Balkans. They provide information on funding opportunities and other resources for green entrepreneurs.
- Green Startups Accelerator - This is a program by Impact Hub Belgrade that supports startups in the green energy and sustainability sectors in the Balkans. The program provides mentorship, access to investors, and networking opportunities.
- EIT Climate-KIC - EIT Climate-KIC is an organization that supports innovation in climate change mitigation and adaptation. They offer programs and funding for startups and other organizations in the Balkans that are working on climate solutions.
- Regional Environmental Center (REC) - The REC is a non-profit organization that promotes sustainable development in Central and Eastern Europe, including the Balkans. They offer a range of programs and services to support green entrepreneurship, including training, networking events, and access to funding.

These are just a few examples of programs that support green entrepreneurship in the Balkans. There may be other initiatives at the national or local level as well. It's worth doing some research to find out what resources are available in specific countries or regions.
These programs can help green entrepreneurs develop sustainable business practices, access funding and resources, and connect with a network of like-minded individuals and organizations.

PERSPECTIVES OF GREEN ENTREPRENEURSHIP

Green entrepreneurship refers to the establishment of a business that prioritizes sustainability, environmental responsibility, and social impact. The following are some perspectives on green entrepreneurship:

- **Environmental Sustainability**: Green entrepreneurship is essential in promoting sustainable development. Entrepreneurs can create businesses that minimize the impact of human activities on the environment, such as reducing greenhouse gas emissions, promoting waste reduction, and conserving natural resources.
- **Economic Growth:** Green entrepreneurship can also contribute to economic growth by creating new markets and job opportunities. Entrepreneurs can identify business opportunities that address environmental challenges and create innovative solutions that meet customer needs while also benefiting the environment.
- **Social Impact:** Green entrepreneurship can also have a positive social impact by promoting social and environmental justice. Entrepreneurs can create businesses that promote fair labor practices, support marginalized communities, and contribute to sustainable development.
- **Innovation:** Green entrepreneurship requires innovation and creativity in developing sustainable products and services. Entrepreneurs can leverage technology and research to create new products and processes that are environmentally friendly and have a positive impact on society.
- **Policy Change:** Green entrepreneurship can also contribute to policy change by advocating for environmental regulations and promoting sustainable practices. Entrepreneurs can work with policymakers to create a supportive regulatory environment that encourages sustainability and innovation.

Finally we can stres that the COVID-19 pandemic and the war in Ukraine can have an impact on the green economy. Here are some possible ways:

- Supply chain disruptions: The pandemic has disrupted global supply chains, affecting the production and distribution of renewable energy technologies such as solar panels, wind turbines, and batteries. Similarly, the war in Ukraine can disrupt the supply of critical minerals used in renewable energy technologies, such as lithium and cobalt.
- Reduced demand for fossil fuels: The pandemic has led to a decrease in demand for fossil fuels, as many industries and transportation sectors have slowed down. This could provide an opportunity for renewable energy to fill the gap and gain more market share. The war in Ukraine may also disrupt the supply of fossil fuels, potentially leading to higher prices and increased interest in renewable energy alternatives.

A green recovery is the first of all promotes economic recovery (UNIDO, 2020). In line with this, the governments around the world have implemented various policies to support economic recovery from the pandemic, which could either support or hinder the growth of the green economy. For example, stimulus packages that prioritize investments in renewable energy infrastructure and job creation in the green sector could accelerate the transition to a low-carbon economy. On the other hand, policies that focus on reviving fossil fuel industries could slow down progress towards a sustainable future. The war in Ukraine may also lead to geopolitical shifts that could affect policies related to climate change and energy. In addition , the pandemic and geopolitical tensions can also affect investment decisions in the green economy. Investors may become more risk-averse and shift their focus away from long-term investments in renewable energy and sustainable infrastructure. Alternatively, some investors may see the green economy as a more stable and resilient investment option in the face of global challenges.

Overall, while the COVID-19 pandemic and the war in Ukraine can pose significant challenges to the green economy, they could also create opportunities for innovation, investment, and policy changes that accelerate the transition to a more sustainable future.

CONCLUSION

Green entrepreneurship is the process of creating or developing a business venture that is environmentally sustainable, socially responsible, and economically viable. It involves the use of innovative solutions and technologies to address environmental challenges while also generating profits.Green entrepreneurs may focus on a range of areas, including renewable energy, waste reduction and management, sustainable agriculture, eco-friendly products and services, and more. They may also leverage concepts such as circular economy, which aims to eliminate waste and keep resources in use for as long as possible. It can have a significant impact on society and the environment, as it can contribute to the development of new, sustainable technologies and business practices. It can also create new job opportunities and drive economic growth while minimizing negative impacts on the environment. Overall, green entrepreneurship is essential for creating a sustainable and prosperous future (Munitlak-Ivanović and Radović-Marković, (2016). It is an innovative approach to business that addresses environmental and social challenges while also generating profits.
Europe has been leading the way in the global transition to a green economy, with significant investments in renewable energy, sustainable transportation, and green infrastructure. The European Union has set ambitious targets to reduce greenhouse gas emissions and increase the use of renewable energy sources, and many countries in the region are taking concrete steps to meet these goals.

LITERATURE

1. Alvarez , S. and Lowell,B. (2001). The Entrepreneurship of Resource-Based Theory, *Journal of Management, 27 (6).* Pp. 755-775. Available at:*https://journals.sagepub.com/doi/10.1177/014920630102700609*
2. Brnjas, Z., Radović-Marković, M., Golubović-Stojanović, A., (2019). Circular Economy as an Answer to the Global Development Challenges. У: RADOVIĆ-MARKOVIĆ, Mirjana (ed.), VUKOVIĆ, Natalia (ed.), ĐUKANOVIĆ, Borislav (ed.). Economy and Ecology: Contemporary Trends and Contradictions. Bologna, Italy: Filodiritto, pp.167-177. ISBN 978-1-7923-2782-7. [COBISS.SR-ID 512587618]
3. Chang, C.H. (2011). The influence of corporate environmental ethics on competitive advantage: The mediationrole of green innovation. J. Bus. Ethics, 104, 361–370.
4. EEA , (2019). Employment in the environmental goods and services sector. Available at: https://www.eea.europa.eu/data-and-maps/data/external/employment-in-egss-eurostat
5. EIB, (2021). Available at: https://www.eib.org/en/press/all/2021-204-eib-approves-eur-4-1-billion-financing-for-renewable-energy-clean-transport-covid-recovery-social-housing-and-education
6. European Commission, (2021). Blue Economy report – Emerging sectors prepare blue economy for leading part in EU green transition. https://oceans-and-fisheries.ec.europa.eu/news/2021-eu-blue-economy-report-emerging-sectors-prepare-blue-economy-leading-part-eu-green-transition-2021-05-20_en
7. GEM, (2021). GLOBAL REPORT. Available at: https://www.gemconsortium.org/report/gem-20202021-global-report
8. IED,(2020). Green Entrepreneurship: Sustainable Development for Business. Available at: https://ied.eu/blog/green-entrepreneurship-sustainable-development-for-business/
9. IRENA (2021).Renewable Energy and Jobs - Annual Review 2021.Available at : https://www.irena.org/publications/2021/Oct/Renewable-Energy-and-Jobs-Annual-Review-2021
10. Litovchenko Grigorievic, V., (editor), Radović-Marković, M., (editor), (2019). Ecological Agriculture and Sustainable Development. Belgrade, Serbia; Bologna, Italy: Research Development Center-FBEE; Proceedings Filodiritto, 2019. 381 p., graph. views, illustr. ISBN 978-88-85813-52-6. [COBISS. SR -ID 512555106]
11. Md. Shajahan, K., Sahati, W. Z., Radović-Marković, M., (2022). Women empowerment through agricultural technology : case study of Mymensingh-Bangladesh. International review., no. 3/4, str. 57-66, tabele. ISSN 2217-9739. DOI: 10.5937/intrev2204059M. [COBISS.SR-ID 83800585]. Link: https://www.researchgate.net/publication/366865344_WOMEN_EMPOWERMENT_THROUGH_AGRICULTURAL_TECHNOLOGY_CASE_STUDY_OF_MYMENSINGH-BANGLADESH
12. Munitlak -Ivanović, O., Radović-Marković, M., (2016), Small and medium enterprises and green economy in Serbia. U : SZABÓ, Antal (ur.), DÜRKOP, Colin (ur.). SMEs and green economy. Konrad -Adenauer -Stiftung , Ankara, Turkey, 2016, str. 225-246.

13. Natorina, A., Bavyko, O., Bondarchuk, M., Brahina, O., Puchkova, S. (2023). Accelerating digital business growth in a green economy and environmental sustainability. IOP Conference Series: Earth and Environmental Science 1126:1, pages 012010.
14. Nigam, R., Rajendra, K. (2019). Need for the Human Touch in Technology Intensive Training: A Study Conducted to Gauge into Training Preferences in Delhi Ncr. J Entrep. Bus. Resil, 3, pp. 27-37. [Google Scholar]
15. Nikolaou , I.E., Tasopoulou , K. , Tsagarakis, K. (2018). A Typology of Green Entrepreneurs Based on Institutional and Resource-based Views. Available at :The Journal of Entrepreneurship , https://journals.sagepub.com/toc/joea/27/1
16. Radović -Marković , M. (2015). Towards sustainability in the "green economy" - theoretical overview. U : RADOVIĆ-MARKOVIĆ, Mirjana (ur.), NIKITOVIĆ, Zorana (ur.), JOVANČEVIĆ, Dragica (ur.). Toward green economy: opportunities and obstacles for Western Balkan countries. Bloomington : Xlibris, United States, 2015, str. 1-16 . [COBISS. SR -ID 47834127]. Link: Towards sustainability in the "green economy": theoretical review – CORE
17. Radović-Marković, M.,and Živanović, B. (2019). Fostering Green Entrepreneurship and Women's Empowerment through Education and Banks' Investments in Tourism - evidence from Serbia. Sustainability, 23 (11). ISSN 2071-1050 (M22 SCI list). Link: (1) (PDF) Fostering Green Entrepreneurship and Women's Empowerment through Education and Banks' Investments in Tourism: Evidence from Serbia (researchgate.net)
18. Radović Marković, M., Tomas, R. (2019). GLOBALISATION IMPACT ON ENTREPRENEURSHIP IN SMALL COUNTRIES, Abingdon, Oxon; New York, NY: Routledge, 2019., 189 p.
19. Radović-Marković, M.,Vuković N., Mityagin S. (2021). ICT and Smart Cities: Case Studies of Moscow and Saint-Petersburg, IPSI Transactions on Internet Research, Vol. 17, No. 1, January 2021, pp. 10-14.
20. Radović Marković, M. (2018). Organisational Resilience and Business Intinuity: Theoretical and Conceptual Framework, *Journal of Entrepreneurship and Business Resilience*, FIMEK, Novi Sad, pp. 5-11.
21. Sambharya R, Musteen M. (2014) Institutional environment and entrepreneurship: an empirical study across countries. J Int Entrep 12:314–330.
22. Simón-Moya V, Revuelto-Taboada L, Guerrero R. (2014) .Institutional and economic drivers of entrepreneurship: an international perspective. J Bus Res 67:715–721
23. Stephan, U., Uhlaner, L., Stride ,C. (2015). Institutions and social entrepreneurship: the role of institutional voids, institutional support, and institutional configurations. J Int Bus Stud 46:308–331
24. UN (2021). Renewable energy – powering a safer future.Available at: https://www.un.org/en/climatechange/raising-ambition/renewable-energy
25. UNIDO (2023). Annual Report. Available at :https://www.unido.org/sites/default/files/unido-publications/2023-03/Annual-Report-2017-en.pdf
26. UNIDO (2020). Green industrial policy to power a green recovery. Available at: https://www.unido.org/stories/green-industrial-policy-power-green-recovery

27. Vasilescu, M.D., Dimian, G.C., and Gradinaru, G.L., (2023) . Green entrepreneurship in challenging times: a quantitative approach for European countries, Economic Research-Ekonomska Istraživanja, 36:1, 1828-1847, DOI: 10.1080/1331677X.2022.2093767
28. WEF (2021). What you need to know about the European Green Deal - and what comes next. Available at: https://www.weforum.org/agenda/2021/07/what-you-need-to-know-about-the-european-green-deal-and-what-comes-next/
29. WEF, (2021a). These are the sectors where green jobs are growing in demand. Available at: https://www.weforum.org/agenda/2021/09/sectors-where-green-jobs-are-growing-in-demand/

GREEN ECONOMY AND HUMAN RESOURCE MANAGEMENT: MYTHS AND REALITIES OF GREEN JOBS[1]

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ABSTRACT: The green economy is set up so that it can harmonize economic principles with ecological principles and its role and at the same time, its goal is to support sustainable development in accordance with the protection of nature and biodiversity. This concept puts an end to uncontrolled exploitation of natural raw materials. The emphasis is on green sectors, i.e.to those sectors that support the given goal, and they are expected to create new jobs. The transition to this type of economy requires new investments, the introduction of more expensive ecological production methods and procedures, and there is a need to manage human resources in such a way that they can attract people to those sectors that are ecologically sustainable. Such places are called green jobs and the jobs are called "green jobs". In this way, companies get new markets and new development opportunities, while at the same time care is taken to preserve nature and energy supplies. The green economic concept introduces the principle of rationality into production, and human resources in this concept experience a transformation from "being a cheap resource" to becoming a "trained, professional and well-paid workforce". However, the transition to a green economy requires a new way of organizing social protection, as well as paid and unpaid workers, as well as the stabilization of flexible forms of work.

KEYWORDS: green economy, human resources, companies, green workplaces, green jobs

1. INTRODUCTION

With the development of new technologies, a new way of using materials, requirements to save energy and resources, the issue of green economy has became equally important, which has the same goal: to save natural resources. The implementation of the principles of the green transition and building the foundations of a climate-neutral economy implies the existence of a social consensus on the role of the anthropogenic factor in the ongoing changes (Lobanov, Zvezdanović Lobanova, Zvezdanović, 2023). The following two aspects are crucial: a) the perception (recognition or non-recognition) of the climate problem and people's responsibility for its further deepening; b) readiness to take active action in energy and industrial policy within the framework of the green transition. In order to ensure a resource-

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efficient, climate-neutral and sustainable model of development, most countries have formulated and adopted numerous strategies, plans and measures for their implementation.The aim of this paper is to point out the dynamic ecological development and transformation of the industrial sector towards sustainability. In this regard, we should first present the definition of the green economy. According to the UN Environment Program (UNEP), the green economy is defined as an economy that leads to the improvement of human well-being and social equality, with a significant reduction in environmental risks and disasters. Therefore, briefly, the green economy is low-carbon, socially inclusive and implies the efficient use of resources, in order to achieve economic, social and environmental goals. For these reasons, the green economy should be the carrier of new economic development in many countries. It includes both circular economy (waste recycling) and bioeconomy (rational use of biological resources, materials and bioenergy – biofuels, for example, the forestry sector) (United Nations Economic Commission for Europe [UNECE], 2023a).Then, it is crucial to answer the question about its importance. Therefore, the green economy is important because it calls into question the current economic model characterized by uncontrolled use of natural resources, increasing inequality, which negatively affect human health and jeopardize the survival of living beings on Earth. From the point of view of Human Resource Management, the role of the green economy is to improve human well-being, to foster social equality, but also to reduce the irrational use of natural resources (UN environment programme [UNEP], 2023a).

From a macroeconomic point of view, the economic advantage of a green economy is reflected in the fact that investments in new technologies increase productivity, improve the trade balance, and, in such way, contribute to an increase in real income in a country. From a microeconomic point of view, there are lower operating costs, job growth, income growth, but also a decrease in household electricity consumption, and success in the fight for a cleaner environment (Morriss, Bogart, Dorchak, Meiners, 2009, 329).The green economy is, in fact, low-carbon, socially inclusive and represent "a tool for supporting sustainable development with an emphasis on aligning economic goals with social and environmental goals" (UNECE, 2023b). The inclusive green economy, launched by the United Nations (UN), was tasked to encourage policymakers in member states, to support and stimulate investment in the environment as part of society's transition and sustainable development. This concept has become a strategic priority for almost all countries in the world, and it aims to encourage coping with challenges such as uncontrolled waste of resources which leads to their lack, inadequate urbanization, economic instability, but also the impact of climate change on life and work on Earth. The basic understanding of the green economy is in terms of more efficient and cleaner production (pollution reduction) and inclusive consumption (reducing inequality, solidarity, interdependence). This concept envisages the existence of strong institutions in order to support fiscal policy and social protection measures, as well as to preserve social and environmental development. An inclusive green economy needs to provide benefits in the areas of economy, health and security, aimed to ensure well-being for all people and to meet the set goals for social inequalities reduction and, thus, conflict prevention. Under this concept, by striving to maintain the continuity of development, countries will also seek to ensure well-being, eradicate poverty and preserve a healthy environment. In addition to many developed countries largely formulate industrial policies based on digitalization and new technological developments, the policy makers include green growth in industrial policy, as a way to increase productivity, competitiveness and, thus, improve economic growth which enhance, rather than damage, the environment. The part of industrial policy that includes green economic growth is called green industrial policy, and it

follows the structural changes that occur while promoting social and environmental goals (UNEP, 2023b).
This means, in particular, that governments, in the context of green industrial policy, should accelerate the transition of high-carbon industrial sectors to those sectors where emissions are reduced[2]. Investments in green industry contribute to reducing other negative impacts on society and the economy, such as COVID-19, inflation caused by the war in Ukraine. Therefore, the ultimate goal is to harmonize economic principles with environmental principles, to support sustainable development in accordance with the protection of nature and biodiversity, to stop the uncontrolled exploitation of natural resources and raw materials. The emphasis is on the green sectors, i.e. those sectors that support the given target and are expected to create jobs. However, the transition to this type of economy requires new investments, the introduction of more expensive ecological production methods and procedures, which could slow down the restructuring process towards a green economy. There is also a need for new jobs and human resource management, in such a way that they can engage people to those sectors that are environmentally sustainable. Such jobs are referred to as „green jobs“.

According to this concept, human resources experience a transformation from being "a cheap resource" to becoming a "trained, expert and well-paid workforce". However, the transition to a green economy requires a new way of organizing social protection (paid and unpaid workers, but also the stabilization of flexible employment forms). By "greening the economy“ and the green economic concept, enterprises gain new markets and new development opportunities, introduce the principle of rationality in production process, and, at the same time, take care of the nature conservation of nature and energy supplies. Therefore, the green economy represents a new development paradigm with the aim of providing new ways of economic growth (Brand, Wissen, 2006).

The green transition will bring numerous changes in the economy, especially in the labor market. In addition to numerous positive effects (such as the creation of new green jobs and new industries, changes in existing occupations and further training in accordance with new market needs), the green transformation will lead to the closing of jobs in mines and coal-fired power plants(Sharpe, Martinez-Fernandez, 2021). The traditional form of knowledge will no longer be sufficient for the survival of modern society, but there will be a need for those that will lead to the formation of new social forms, institutions and practices (Zvezdanović Lobanova, 2017). In addition, there is a justified fear that certain regions and sectors will be more affected by these changes, which reduces the readiness of economic policymakers for the implementation of the envisaged measures and actions. Therefore, the process of green transition could be slowed down due to fears and resistance of different structures in society. In this context, reducing labour market tensions, creating new jobs, improving the quality and availability of labour are tasks that could be solved onlytaking into account the specifics of the spatial organization of economic activity (Zvezdanović Lobanova et al. 2021, Zvezdanović, 2012).

[2]UN Institute for Training and Research (UNITAR), UN Environment Programme (UNEP) and UN Industrial Development Organization (UNIDO) developed a course entitled „Green Industrial Policy: Promoting Competitiveness and Structural Transformation“, so that all those interested could be better informed and implement changes in industrial policy that would lead to a green industrial policy.

2. BRIEFLY ABOUT THE 17 WELL-KNOWN SUSTAINABLE DEVELOPMENT GOALS OF THE UNITED NATIONS

In this kind of presentation, it is indispensable to mention the 17 Sustainable Development Goals (SDGs) of the UN, which are: 1. No Poverty; 2. Zero Hunger; 3. Good Health and Well-Being; 4. Quality Education; 5. Gender Equality; 6. Clean Water and Sanitation; 7. Affordable and Clean Energy; 8. Decent Work and Economic Growth; 9. Industry, Innovation and Infrastructure; 10. Reduced Inequality; 11. Sustainable Cities and Communities; 12.Responsible Consumption and Production; 13. Climate Action; 14. Life Below Water; 15. Life on Land; 16. Peace and Justice Strong Institutions; 17. Partnership to achieve the Goal. All 17 goals actually advocate a major green technological transformation of the economy, in order to increase clean technologies, reduce waste, and give priority to sustainable agriculture. Picture 1 shows the UN Sustainable Development Goals (United Nations [UN], 2023a).

Picture 1. The UN Sustainable Development Goals

Source: UN, 2023a.

However, goals 1 – 5, 8 and 10 are directly related to people's lives and work, in the context of green jobs – human resources. For example, goal 8, which addresses decent work and economic growth, involves the promotion of sustainable economic growth, inclusive and decent for all. Its aim is to observe how climate change mitigation leads to a positive impact on the country's employment sector, and, thus, improving the living and working conditions of people around the world. It also contributes to improve livelihoods and thereby provide economic security for many people. If a green economy leads to faster economic growth, it can contribute to wage inequality reduction in a country, which has a direct impact on narrowing the gap between rich and poor (UNEP, 2023d). The 2030 Agenda for Sustainable Development, adopted by all UN Member States in 2015, is very essential for the green

economy and green jobs, because it contains the previously mentioned 17 SDGs. In addition, Paris agreement (2016), which was created in response to climate change, is important because it formalized the transition to a green economy and includes decent work. Following the aforementioned two documents, the International Labour Organization (ILO) adopted in 2018 the document „Just transition towards environmentally sustainable economies and societies for all“. This constitutes guidelines for UN Member States on how to follow the instructions for the implementation of the sustainable development concept and natural resources conservation. The responsible for “greening” are governments, social partners, scientific institutions, international organizations of the UN, ILO, the International Monetary Fund (IMF) and organizations dealing with environmental protection (Maksimović, 2022; UN, 2015).

It is important to emphasize, since it does not seem immediately visible, that work and nature are intrinsically connected, because not only the people’s lives but also businesses depend on the natural environment and a healthy planet. It is expected that the transition to a resource-saving economy such as the green economy will make life better in terms of health. So far, it has been observed that climate change disrupted millions of jobs. Therefore, strong efforts should be made in order to discover opportunities to boost the economy and improve the quality of working life. ILO studies show that implementing the Paris Agreement on Climate Change could create a net gain of 18 million jobs by 2030 (International Labour Organization [ILO], 2023).

3. GREEN ECONOMY, GREEN JOBS AND MANAGEMENT HUMAN RESOURCES (HRM)

This chapter will be started with a quote, which reads “Green economy is the future. It promotes prosperity, creates decent work, resolves the root causes of conflict and contributes to the full enjoyment of all human rights – not only civil and political, but also economic, social and cultural" (UN, 2023b)[3].Within it, the opening of green jobs or the performance of green jobs is foreseen. The question: "What are green jobs?" is justified. Thus, "green jobs are jobs that contribute to the preservation or restoration of the environment, either in traditional sectors (manufacturing or construction) or in new, green sectors (renewable energy sources and energy efficiency)".They help reduce waste and pollution, protect ecosystems, support adaptation to the effects of climate change, improve energy efficiency and should lead to the limitation of greenhouse gas emissions (ILO, 2008)[4]. At the business level, it is important to emphasize a few things, namely that green businesses produce goods or services that are beneficial to the environment, such as green buildings. Such products or services do not necessarily have to be based on green production technologies or green processes. This is exactly why their contribution is different (ILO, 2016).In Chart one, a presentation of green jobs according to the ILO is given, and they are marked with a dotted line (from the perspective of an environmentally friendly process) in all three types of jobs, namely jobs in the production of green products or services, jobs for decent work, jobs and employment in environmentally acceptable processes.

[3]This is a quote from Antonio Guterres, Secretary General of the United Nations.

[4]The key areas of public policies that support environmental, economic and social sustainability are macroeconomic policy and growth policy, industrial and sectoral policy, enterprise policy, skills development policy, occupational safety and health policy, social protection policy, active labour market policy, labour lawand social dialogue and tripartism (ILO, 2015, 7).

Graph 1. Green jobs - jobs that are dotted - according to the ILO

Source: ILO, 2016.

Earlier it was discussed about the industrial policy and its changes with the development of the green sector, and now it is stated which sectors are important in order to be able to say that the transformation of work into a green industry is being carried out, namely agriculture, forestry, water management, the IT sector, the security sector, the sector of renewable energy and waste storage, construction, the transport sector and the sector of small and medium enterprises. Consequently, there are also changes in the domain of occupations, and the most affected occupations are in the mentioned industries, especially in construction, forestry, water management, agriculture, chemical industry production, glass production, cement, steel mills, wind turbine production and the renewable energy sector (Maksimović,2020)[5].Important to the classification of green jobs are jobs in finance and banking.

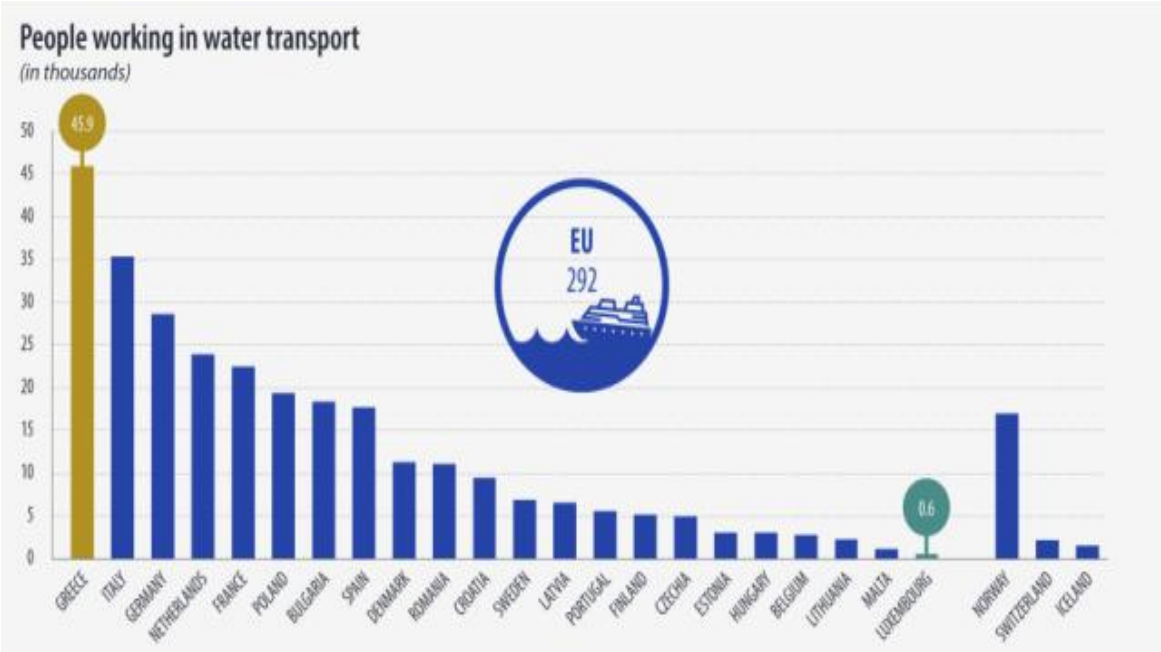
Namely, the "greening" of finances is carried out with the aim that banks would not only worry about profit, although it remains primary, but also behave socially responsibly and encourage the preservation of the environment, thus taking into account the ecological side of work. To this end, new businesses and innovative approaches to banking and finance can be developed, in order to increase investment in green projects. Institutions that adapt their business activities to the green strategy are banks, financial institutions and investment funds. For example, green banking jobs are classic banking jobs that have an added green component, and they can be in the retail sector, which are credit, depository and service jobs.

The most widespread are the jobs of issuing payment cards, green mortgage loans with a lower interest rate, or green car loans.

[5]Digitization also leads to transformation in the field of work, which affects the most: employees in sales, trade and traffic, then office jobs, manufacturing industry, construction, and some types of services such as financial services, tax consulting services and translation.The jobs least at risk from digitization are science, education, health, media, arts, legal services, engineers and computer workers, as well as social and psychological work and beauty care.With all these changes, new occupations such as data analysts, data miners, software and application developers, networking specialists, manufacturers of new machines and 3D printers, digital marketing and e-commerce specialists, as well as data filtering workers (Degryse, 2016).

Apart from them, equally important are green banking operations in the business sector and investment banking, which refers to lending to legal entities (financing of green projects, issuance of green securities, e.g. bonds, issuance of securitized securities, issuance of financial derivatives, issuance of credit guarantees and approval of leasing), property management and insurance activities (Sovilj, 2020, 267 - 268, 269-276).These jobs require additional adaptation and training of employees, so that banks or financial institutions can meet customers. On the other hand, data related to water traffic in the EU are also interesting. For example, according to EUROSTAT, 292,000 people aged 15-64 worked in water transport (inland waterways or shipping) in the EU in 2022 (0.1% of total employment).Of these, 78% were men, and 22% were women. Greece had the largest number of workers in water transport in the EU (45,900 people; 16% of the total number of workers in water transport in the EU), followed by Italy (35,300; 12%) and Germany (28).600;10%).In contrast, the EU countries with the lowest number of employees in water transport are Luxembourg (600; 0.2%), Malta (1,200; 0.4%) and Lithuania (2,300; 0.8%) (EUROSTAT, 2023a).By the way, looking at economic data at the EU level, the unemployment rate in April 2023 was 6%, also in the first quarter of 2023, GDP growth was 0.1%, while the inflation rate was 7.1% in May 2023, and when viewed separately, the food inflation rate was 15.1% in May 2023 (EUROSTAT, 2023b).

Graph 2. Overview of jobs in water transport in the EU, for the year 2022



Source: EUROSTAT, 2023a.

4. MYTHS OF THE GREEN TRANSITION AND HRM

Observing from a scientific-research point of view, the application of the concept of green economy in the states is of a recent date, and this is indicated by economic indicators. However, it is important to emphasize that one should not attach almighty importance to the green economy, because it is only one segment of the entire economy. And one segment of the green economy is human resources. In this regard, there are several general myths, but also those related to human resources, which will be highlighted here.

4.1. General myths about the green economy and transition

When talking about the green economy, there are several general myths: the first myth is that only industrial societies lead to the colonization of nature in a destructive way. The fact that only industrial societies are polluters of the natural environment is not true. Namely, agrarian societies, which increasingly systematically intervene in nature, "colonize" it, do so with the intention of improving productivity. For this purpose, they clear forests, deplete the soil with artificial fertilizers, and this is a structural depletion of natural possibilities. Another myth is the attempt to equalize productivity in agriculture and industry. Of course, this equalization is not possible, because since the third and fourth decades of the 20th century, industry has had primacy, and continues to lead through the development of the IT sector and digitalization (Maksimović, 2014, 179). A third myth is that imposing technological progress through regulation is desirable (Morriss at al. 2009). The reality is that some technological changes cannot be introduced at the speed required by green economy studies, and are unable to meet today's demands due to a lack of funds or expertise, so the projected jobs will not arrive in the foreseeable future. The fourth myth is that technological innovation will be enough without social transformation. Analyzing the transition processes in the energy and agriculture sectors, it was concluded that: - social changes towards sustainability must take place at multiple levels (social niches);- then they are extended to the regime level (institutional structures);- then lead to the transformation of the overall social, political, economic and cultural setting (landscape changes).

The radical change is at the level of NICHE, then gradually at the other levels. These three levels are key to a sustainability transition that is understood as "long-term, multidimensional and fundamental, in order to establish a way to move from a socio technical system to more sustainable ways of production and consumption."Only in this way is the transition the result of clear goals and evolution, although this requires a broader concept of time. Only if, along with technological development in the context of sustainability, social changes take place in parallel, the ecological transition can have the name of a new development paradigm, which simultaneously preserves biodiversity and contributes to the reduction of inequality. It is necessary to have a legal framework that would regulate the innovations that would appear, and the bearers of change would be society, the economy and companies, but also non-governmental organizations and other individuals who are ready to be bearers of value transformation (Brand,Wissen, 2006).

4.2. Myths related to human resource management

Looking a little narrower at the issue of the green economy, i.e.in the context of human resource management and several myths have arisen. Namely, the first myth is the equalization of male and female workforce in the context of green sectors. In the labor market, especially in sectors with green jobs, there are lower activity rates of women compared to the male population. According to data from the International Labor Organization, in 2021, the participation of women in the labor force (women who are employed or actively seeking employment) was about 47%, while the activity rate of the male population was 72% (ILO, 2022).At the level of the European Union, the average activity rate of women between the ages of 20 and 64 is about 73%, while the average activity rate of men of the same age is 84% in 2021 (EUROSTAT, 2021).Also, the average employment rate of women at the level of the European Union is almost 68%, compared to the average employment rate of men, which is 78.5% in 2021.When it comes to Serbia, employment by gender in the green economy sectors (Table 1) in the period 2015–2021.year is such that it indicates a higher number of employed men compared to the number of women. The situation is similar in the EU.

Table 1. Employment by gender in green economy sectors (%) in the period 2015–2021. in Serbia and the EU

	2015		2016		2017		2018		2019		2020		2021	
	Female	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
SERBIA														
Agriculture, forestry, and fishing	36,6	63,4	38,6	61,4	38,9	61,1	38,8	61,2	38,8	61,2	37,4	62,6	39,5	60,5
Manufacturing	36,7	63,3	36,1	63,9	36,8	63,2	38,5	61,5	39	61,0	39,1	60,9	40,7	59,3
Energy sector	26,9	73,1	27,7	72,3	20,6	79,4	19,1	80,9	22,8	77,2	21,0	79,0	20,2	79,8
Water supply and waste management	21,3	78,7	18,3	81,7	24,8	75,2	25,6	74,4	23,3	76,7	21,1	78,9	21,0	79,0
Transport	20,2	79,8	19,9	80,1	21,0	79,0	20,3	79,7	20,1	79,9	20,0	80,0	19,0	81,0
Finance service and insurance	61,1	38,9	63,1	36,9	68,9	31,1	61,9	38,1	66,7	33,3	66,6	33,4	68,2	31,8
EU AVERAGE														
Agriculture, forestry, and fishing	34,4	65,6	33,5	66,5	33,6	66,4	33,4	66,6	33,3	66,7	32,8	67,2	31,2	68,8
Manufacturing	29,9	70,1	29,8	70,2	30,0	70,0	30,1	69,9	30,1	69,9	29,8	70,2	30,2	69,8
Energy sector	23,7	76,3	22,7	77,3	23,8	76,2	24,8	75,2	25,1	74,9	25,9	74,1	27,7	72,3
Water supply and waste management	20,1	79,9	19,9	80,1	20,0	80,0	20,3	79,7	21,7	78,3	20,9	79,1	21,6	78,4
Transport	22,5	77,5	22,5	77,5	22,4	77,6	22,2	77,8	22,5	77,5	22,3	77,7	22,6	77,4
Finance service and insurance	53,3	46,7	52,8	47,2	52,9	47,1	53,0	47,0	53,0	47,0	52,7	47,3	52,8	47,2

Source: Ostojić, Maksimović, Stojković-Zlatanović, 2022.

Another myth is that the creation of green jobs will lead to the stimulation of productive employment. However, the reality is that one should not exaggerate expectations, because green jobs will involve a huge number of officials, bureaucrats and employees in administrative positions who do not produce goods and services for consumption. These are often expensive positions, and as such do not lead to an ecologically acceptable social environment. So many of the forecasts for green business acceptability that will cause some kind of "boom" may be false. The third myth is that green jobs promote employment growth, but the reality is a bit different. Namely, so far it has been established that green jobs do not promote green employment with higher productivity. Not infrequently, green jobs encourage low-paid jobs in rural areas, as shown by the example in this research paper. So, the question is, will the majority of green jobs continue to be those jobs that are less well paid? It is also a big question to what extent the female workforce will be involved. The issue of workforce efficiency is also raised. In addition, it should be taken into account that many jobs will be eliminated, due to the restrictive measures that governments have labeled as a product of backward technology harmful to the environment (Morris at al. 2009). In support of this, he says that it is not good to introduce dubious technologies, which are driven by some special interests, because this generates stagnation. Panama can be cited as a positive example of energy and social inclusion, as it is one of the three winners of the ILO program on energy innovation transition.However, in this example, it is about lower paid jobs in rural areas.Namely, the energy sector is extremely important because it drives countries' economies and maintains jobs, but it also has negative effects because it generates about two-thirds of global greenhouse gas emissions. As part of the Luz en Casa Ngabe-Bugle project *(Luz en Casa Ngabe-Bugle Program - translated as "Light at home"),* the ILO, through a non-profit Panasian organization, launched a program on the use of photovoltaic systems in the community of *Guanabal de Pena Blanca, Comarca Ngabe Bugle*. This program provided electricity to more than 2,700 families and small businesses in the Ngabe-Bugle region. Also, this led to the development of renewable energy companies and technology, and a certain number of people in rural areas of Panama received energy. Due to the geographical distance, conventional electrification was not possible, and through a renewable energy source off the grid, i.e. solar home systems of the third generation, in remote households the quality of life has increased. It was done by selecting companies that provided training, equipment, maintenance to the population in order to successfully use the advantages of the solar panel network. These companies also organized training for indigenous and tribal peoples through ILO Convention C169 (ILO, 2023).

5. CONCLUSION

More relevant than ever, despite the consequences of the Covid-19 pandemic and the consequences of the war in Ukraine, the green economy strives to persevere in the demands of saving natural resources and energy. It requires overall changes, so in addition to technological changes, social changes are also necessary that lead to dignified work, reduction of inequality and well-being for all in accordance with the goals of the United Nations. It is low-carbon, socially inclusive and aligns economic with social and environmental goals that lead to the reduction of biodiversity pollution. Green industrial policy should contribute to the reduction of those sectors with high carbon emissions, although this requires new investments and training of human resources. The assumptions are that human resources in these sectors

will be better paid, although so far all the facts show that jobs are developing in rural areas, as stated in the example (ILO, 2023).It is true that green jobs occupy a part of all total jobs (Graph 1), and that the transformation towards a green industry is carried out primarily through agriculture, forestry, water management, the sector of renewable energy, waste storage, the transport sector, the sector of small and medium enterprises, but also banking and finance sector (Sovilj, 2020).This stage of development is accompanied by green economies and certain myths about excessive benefits, which are possible only after some time and material investments.

However, in today's world of great changes, deep social changes are needed to cope with technological changes and multiple crises, and the green economy is one of them. That is why it is said that she is the bearer of new development in all countries of the world.

REFERENCES

Brend, U. and Wisen, M. (2017). Social-ecological Transformation. In *The International Encyclopedia of Geography*. (pp.1-10). John Wiley & Sons, Ltd. DOI: 10.1002/9781118786352.wbieg0690

Degryse, C. (2016). *Digitalizacija ekonomije i njezin utjecaj na tržišta rada.* Brussels: ETUI aisbl (Europski sindikalni institut), Zagreb: Savez samostalnih sindikata hrvatske. Radni dokument 02.

EUROSTAT. (2023a). Preuzeto 15. 4. 2023., sa https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20230623-1.

EUROSTAT. (2023b). https://ec.europa.eu/eurostat/home?

EUROSTAT (2021) Employment and Activity by Sex and Age - Annual Data. Preuzeto 12. 8. 2022.,sa https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsi_emp_a&lang=en.

International Labour organization [ILO].(2008). Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World. Preuzeto 23. 4. 2023., sa https://www.ilo.org/wcmsp5/groups/public/---ed_emp/--emp_ent/documents/publication/wcms_158727.pdf.

International Labour organization [ILO]. (2023). Innovation challenge: Energy access and social inclusion Preuzeto 25. 4. 2023., sa https://www.ilo.org/global/topics/green-jobs/news/WCMS_880468/lang--en/index.htm

International Labour organization [ILO].(2022). The Gender Gap in Employment: What‘s Holding Women Back? Preuzeto 30. 9. 2022., sa https://www.ilo.org/infostories/en-GB/Stories/Employment/barriers-women.

International Labour organization [ILO]. (2016). What is a green job? Preuzeto 25. 4. 2023., sa https://www.ilo.org/global/topics/green-jobs/news/WCMS_220248/lang--en/index.htm.

International Labour organization [ILO]. (2015). Guidelines for a just transition towards environmentally sustainable economies and societies for all. Preuzeto 23. 04. 2023., sa https://www.ilo.org/wcmsp5/groups/public/---ed_emp/--emp_ent/documents/publication/wcms_432859.pdf.

Maksimović, M. (2014). *Filozofija rada i upravljanja u Japanu.* Beograd: Institut društvenih nauka.

Maksimović, M. (2021). *Tržišna ekonomija i poslovna kultura: Nemačka i Japan.* Beograd: Institut društvenih nauka.

Maksimović, M. 2020. Upravljanje ljudskim resursima i održivi razvoj: zelena radna mesta. U *Izazovi održivog razvoja u Srbiji i Evropskoj Uniji*. (str 244-263). Beograd: Institut društvenih nauka.

Maksimović, M. (2022). Tranzicija u kontekstu održivog ekonomskog razvoja: zeleni rad i digitalizacija. *U Tranzicija, institucije i ekonomski razvoj Srbije.* (str.39). Beograd: Institut društvenih nauka.

Morriss, A. P., Bogart, W. T., Dorchak, A. and Meiners, R. E. (2009). 7 Myths About Green Jobs. *Illinois Law & Economics Research Paper*. No. LE09-007, Case Legal Studies Research Paper No. 09-14. (pp.1-21). http://dx.doi.org/10.2139/ssrn.1357440

Ostojić, I., Maksimović, M., Stojković-Zlatanović, S. (2022). Nejednakost i neravnopravnost žena na tržištu rada u kontekstu zelene ekonomije. TEMIDA, vol. 25, br. 3, str. 251-281. DOI: https://doi.org/10.2298/TEM2203257O

Sharpe, S. A., Martinez-Fernandez, C. M. (2021). The Implications of green employment: Making a just transition in ASEAN. *Sustainability* 13, no. 13: 7389.

Sovilj, R. (2020). Koncept održivog razvoja u savremenom bankarstvu – zeleno bankarstvo. U *Izazovi održivog razvoja u Srbiji i Evropskoj Uniji.* (str. 264 – 281).Beograd: Institut društvenih nauka.

United Nations, [UN]. (2023a). Sustainable Development Goal 16. Preuzeto 25. 4. 2023., sa https://www.un.org/ruleoflaw/sdg-16/.

United Nations, [UN]. (2023b). https://www.un-page,org.

United Nations, [UN]. (2015a). Paris Agreement. Preuzeto 23. 4. 2023., sa https://www.un.org/en/climatechange/paris-agreement.

United Nations, [UN]. (2015b). Transforming our World: The 2030 Agenda for sustainable development. A/RES/70/1.

United Nations Economic Commission for Europe [UNECE]. (2023a). Green economy. Preuzeto 25. 4. 2023., sahttps://unece.org/green-economy-3.

United Nations Economic Commission for Europe [UNECE]. (2023b).

UN environment programme [UNEP]. (2023a). Why does green economy matter? Preuzeto 21. 4. 2023., sa https://www.unep.org/explore-topics/green-economy/why-does-green-economy-matter.

UN environment programme[UNEP]. (2023b). What is an "Inclusive Green Economy"? UN Environment's Green Economy Initiative (GEI). Preuzeto 23. 4. 2023., sa https://www.unep.org/explore-topics/green-economy/why-does-green-economy-matter/what-inclusive-green-economy.

UN environment programme[UNEP]. (2023c). Green economy. What we do economic and trade policy green industrial policy? Preuzeto 25. 4. 2023., sa https://www.unep.org/explore-topics/green-economy/what-we-do/economic-and-trade-policy/green-industrial-policy?_ga=2.247784839.1244152507.1687771260-1186760063.1682538264

UN environment programme. [UNEP]. (2023d). Goal 8. Preuzeto 23. 4. 2023., sa https://www.unep.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-8.

Лобанов, М., Звездановић Лобанова, Ј., Звездановић, М. (2023). Алармисты и скептики: национальные особенности формирования климатического сознания.*Мир перемен*, 1, 154–177, https://doi.org/10.51905/2073-3038_2023_1_154

Zvezdanović Lobanova, J., Lobanov, M., Zvezdanović, M. (2021). Problemi i perspektive razvoja tržišta rada u Srbiji na nacionalnom i regionalnom nivou, *Zbornik Matice srpske za društvene nauke* 179/3, 413-434.

Звездановић Лобанова, J. (2017). Проблеми регионалног тржишта рада у Србији, *Проблеми на тржишту рада, сиромаштво и економске неједнакости*, Институт друштвених наука, Београд.

Zvezdanović, J. (2012). Regionalne razlike na tržištu rada u Srbiji. In: Stanovništvo i razvoj. Centar za ekonomska istraživanja Instituta društvenih nauka, Beograd, 356-363.

GREEN FINANCING IN SERBIA – CHALLENGES AND OPPORTUNITIES[1]

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Abstract: Policymakers are faced with the challenge of achieving sustainable development and avoiding further environmental degradation. With the establishment of national green investment banks, as well as the rapid growth of the green bond market, the interest in green financing grew in the last decade. The regulatory framework, successfully formulated strategies and their effective implementation, as well as the involvement of the private sector and the creation of a larger market, are key factors for attracting green investments.
The primary objective of this paper is to analyze the trends of green financing in the Republic of Serbia, the available sources of green financing, the challenges that the banking sector faces when defining the offer of green financial instruments, as well as the challenges of the sector of micro, small and medium enterprises and entrepreneurs as potential users of green loans. The paper analyzes to what extent banks in Serbia "green" the sector of micro, small and medium enterprises and entrepreneurs, approving loans for green projects with an ecological dimension. The concluding considerations of this research showed that the process of green transformation of the banking sector of the Republic of Serbia requires both financial and regulatory incentives that contribute to the achievement of sustainable development goals through the rational use and preservation of natural resources and the reduction of environmental pollution.

Key words: green financing, green loans, green projects, green investments, micro, small and medium enterprises, banking sector, sustainable development

INTRODUCTION

Green finance refers to the two-way interaction between the environment, finance and investment. Interest in green financing has been growing over the last decade, and one of the reasons is the establishment of national green investment banks, as well as the rapidly growing green bond market (ISO, 2022). Höhne et al., (2012) define green finance as "an investment in sustainable development projects and initiatives, ecological products and policies that encourage the development of a more sustainable economy." Green finance includes climate finance but is a broader concept. In addition to adapting to climate change and mitigating its negative consequences, it may also include "other environmental goals, for example, industrial pollution control, water sanitation or biodiversity protection." Volz et al., (2015) define green finance as "all forms of investment or lending that take into account environmental impact and improve environmental sustainability." A key element of green finance is sustainable investment and banking and decisions on investment and lending are

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based on the assessment of risks and harmful effects on the environment, as well as the assessment of compliance with environmental sustainability standards. Selvapandian, Jeiapaul&Gunabalan (2022) define green finance as a new technology that supports low-carbon environments and point out that renewable energy sources or green resources are the most suitable options to promote economic growth and environmental sustainability. The authors detect long-term financing, project development risks, minimum return values and lack of capacity as the main risks of the green finance management system. Jinru et al., (2022) identify the key role of green financing and logistics in the adoption of sustainable production and the circular economy and conclude that green financing and green logistics have a significant and positive effect on sustainable production and the circular economy. In addition, the authors emphasize the importance of integrating green financing into procurement and strategies for the production of green goods and the promotion of circular economy goals. Ma and Chang (2023) examine the link between green innovation which is the core of enterprise green transformation and green finance, finding that green finance fosters green innovation and sustainable development. Green financing significantly increases the number of green patent applications in underdeveloped countries, which is very important for green development promotion. The authors conclude that green financing has, especially for emerging economies, a key role in the promotion of green innovations. Emerging countries urgently need to develop a foundation for green innovations and sustainable development. Building on previous research, another study examines the role of green technology innovation and green finance in reducing CO_2 emissions and confirms a significant negative impact of green technology innovation and green finance on CO_2 emissions (Sharif et al., 2022). The authors point out that with the representation of green financing and green technology policies, countries could meet the goals of sustainable development such as Affordable and clean energy (SDG 7) and Climate action (SDG 13). Zheng, Du & Wang (2022) explore the bi-directional co integration relationship between green finance and renewable energy development and indicate that the renewable energy development promotion through green financial instruments is an effective approach to achieve the goal of carbon neutrality. Research also shows that green financing promotes the development of renewable energy in the long run.

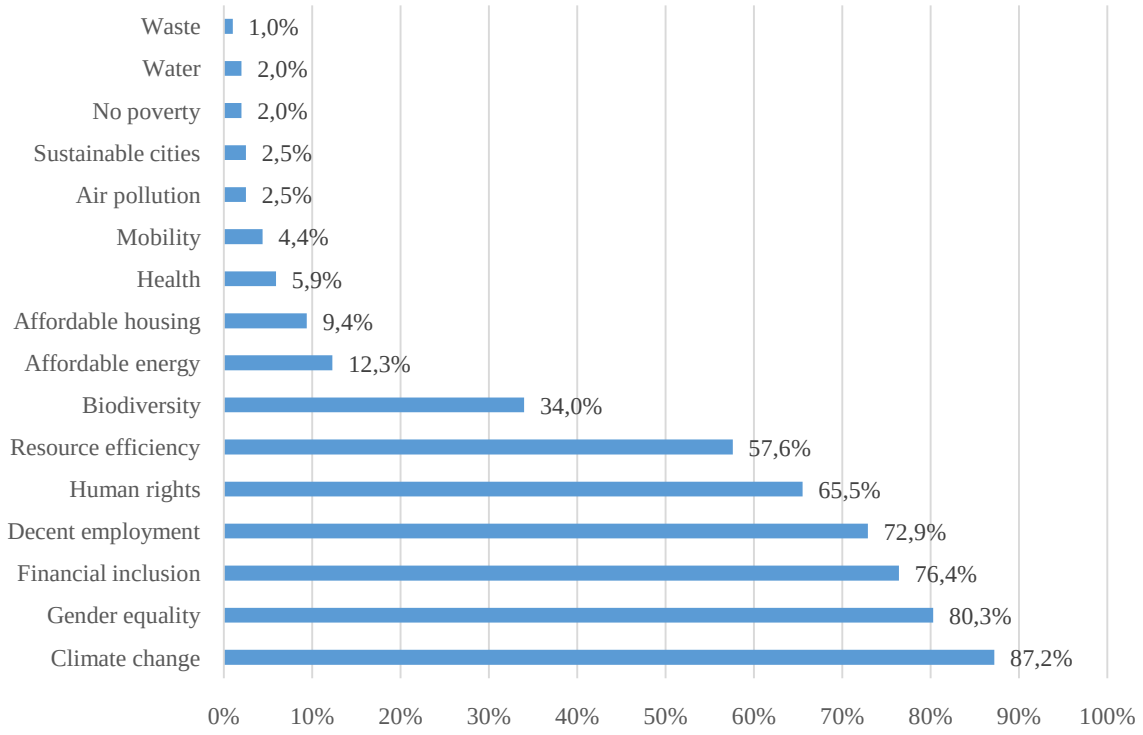
The basic idea of the energy efficiency concept is the use of less energy for the same unit of gross domestic product, with the sustainability of product quality, which results in energy transformation that is reflected in the reduction of energy use and the elimination of environmental pollution. In 2021, the main obstacles preventing the opening of negotiation Chapter 15 related to the field of energy have been removed in Serbia and “the negotiating position for the energy chapter represents the candidate country’s achievement in the harmonization with the acquiscommunautaire, the program of future harmonization, as well as an overview of existing and future administrative capacities for harmonization” (MEI, 2021). In addition to development finance institutions, such as the German Development Bank (KfW), the International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD), support for the sustainable energy-efficient development of Serbia, based on renewable energy sources is also provided by the Global Environment Facility (GEF), the Green for Growth Fund (GGF), the Instrument for Pre-Accession (IPA), the Western Balkans Sustainable Energy Financing Facility (WeBSEFF), Western Balkans Investment Framework (WBIF).

Since it signed the Addis Ababa Action Agenda on Sustainable Development until 2030, Serbia is expected to make significant efforts and mobilize available resources to reduce the rate of poverty, economic and social inequality, the negative effects of climate change through intensive ecologically sustainable investments and the entry to the green transition (Ristanović, 2021). In addition, Serbia is also a candidate country for accession to the European Union, whereby Chapter 27 deals with issues of environmental protection and the consequences of climate change. Despite the 48% increase in allocated funds for the environment in 2020, their further growth and the adoption of more ambitious environmental goals targeting zero carbon emissions are needed. The rules on environmental impact assessment should be strictly followed and priority should be given to projects with the most significant positive impact on the environment with transparent procedures for their selection and implementation (European Commission, 2022). Whether Serbia is on the green path and whether there are incentives and support programs for the green transition will be examined below by presenting the results of research to what extent banks in Serbia "green" the sector of small and medium enterprises by approving loans for projects with an ecological dimension.

GREEN FINANCING IN THE BANKING SECTOR OF SERBIA-EMPIRICAL RESEARCH

With over 300 signatory banks representing almost half of the global banking industry, the UN Principles for Responsible Banking are the world's most important sustainable banking framework that aims to accelerate the global green transition. Through these Principles, banks align their strategy, decision-making process, lending and investments with sustainable development goals and international agreements such as the Paris Climate Agreement (UNEP FI, 2022).As of March 2021, addressing climate change and enhancing gender equality were the most prominent social and environmental sustainability goals among banks that were signatories of the Principles for Responsible Banking worldwide. Then follows financial inclusion and decent employment included in the sustainability strategies of 76.4 percent and 72.9 percent of signatories respectively.

Graph 1. Main social and environmental goals included in banks' sustainability strategy worldwide, 2021



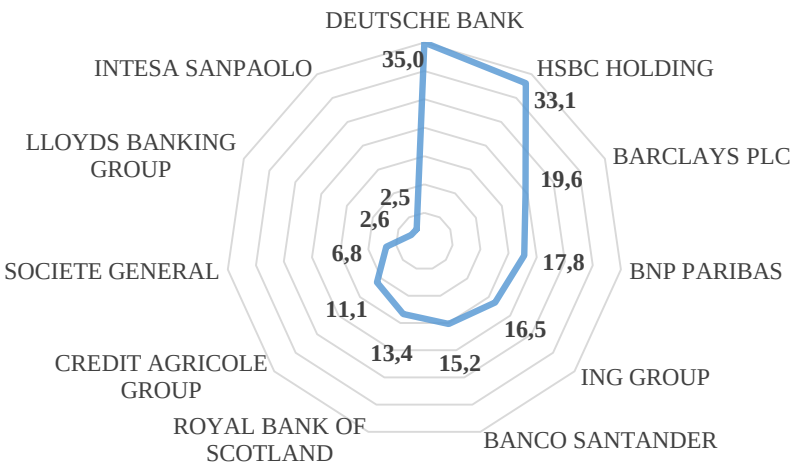
Source: Statista, 2021

The culture of responsible banking encourages doing business with clients that promote sustainable practices and enable economic activities that create prosperity for both current and future generations. In fulfilling that goal, green financial instruments provide support. The development of green financial products is encouraged by the knowledge of the seriousness of the environmental challenges that the world is facing, the country's efforts to achieve sustainable development goals, legislation and regulations in the field of environmental protection as well as the adoption of legislative measures prohibiting unsustainable business practices (Ostojić, 2022).Since green growth represents a new paradigm of economic growth, green financial products are improved over time and become more diverse, as a result of financial innovations and the adoption of green economy principles (Ostojić, 2023).Financial institutions with green financial instruments achieve numerous benefits, which are reflected in the strengthening of the market position and the growth of market share, the growth of profitability, building a base of loyal users of new financial products and services, the creation of partnerships with external stakeholders from the sphere of ecology, building a stronger image through socially responsible business activities (Noh, 2018).

A sustainable financial service should contribute to the realization of benefits not only for the client but for the entire society. A green loan is a form of financing that allows its holder to use borrowed funds exclusively for the achievement of environmental goals. Green loans should have clearly defined positive implications for the environment that can be quantified and valorized. Projects financed from green bank loans are selected and evaluated in compliance with prescribed environmental standards. An important element is the obligation of timely reporting on the environmental results of the implementation of financed green projects, through qualitative and available quantitative indicators, such as energy capacity,

produced electricity, reduced greenhouse gas emissions, etc. The countries that are the global leaders in issuing green loans are the USA, Great Britain, Australia, France, Germany, Japan, China, India, Canada and the Netherlands (Bergedieck, Maheshwari&Ugaz, 2016).Among the largest European banks, with the highest value of sustainable financing of 35 billion euros, Deutsche Bank stands out.

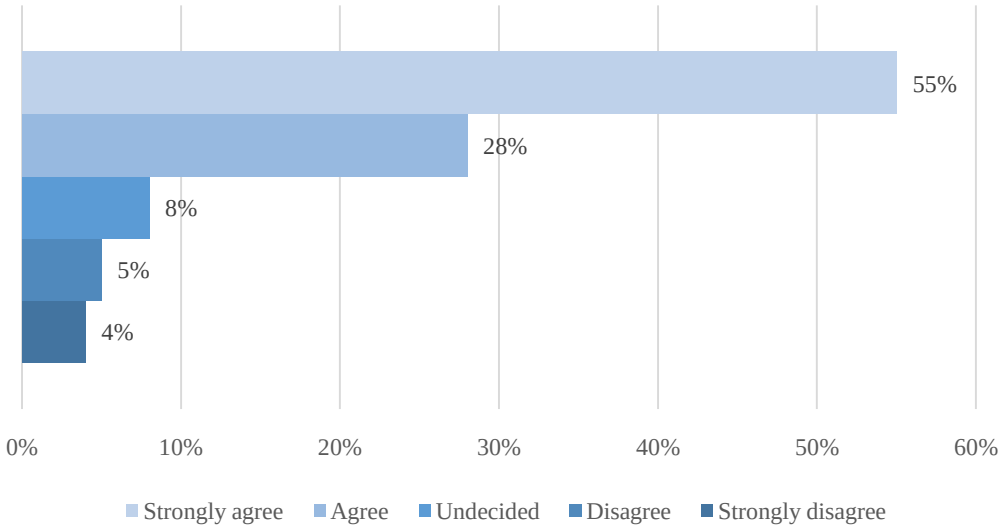
Graph 2.Value of green financing by Europe's largest banks, 2020



Source: Statista, 2020

In the following, the incentives and support programs for the green transition will be analyzed based on practice research in domestic banks and companies whose operations are based on the achievement of a sustainable development model. The subject of the research is the representation of green financing in the Serbian banking sector and the analysis of the advantages of entering the green transition process, which leads in the direction of the development of a low-carbon economy and the reduction of the carbon footprint. In addition to the standardized questionnaire with closed questions, an interview of banking experts and company representatives was also used as a research method. The cross-sectional study design involves the collection of data from respondents from different organizations at the same time. To measure the respondents' attitudes a Likert scale, that provides five possible answers to a question, was used. The total number of respondents is 150 and consists of banking experts and employees in micro, small and medium enterprises and entrepreneurs.

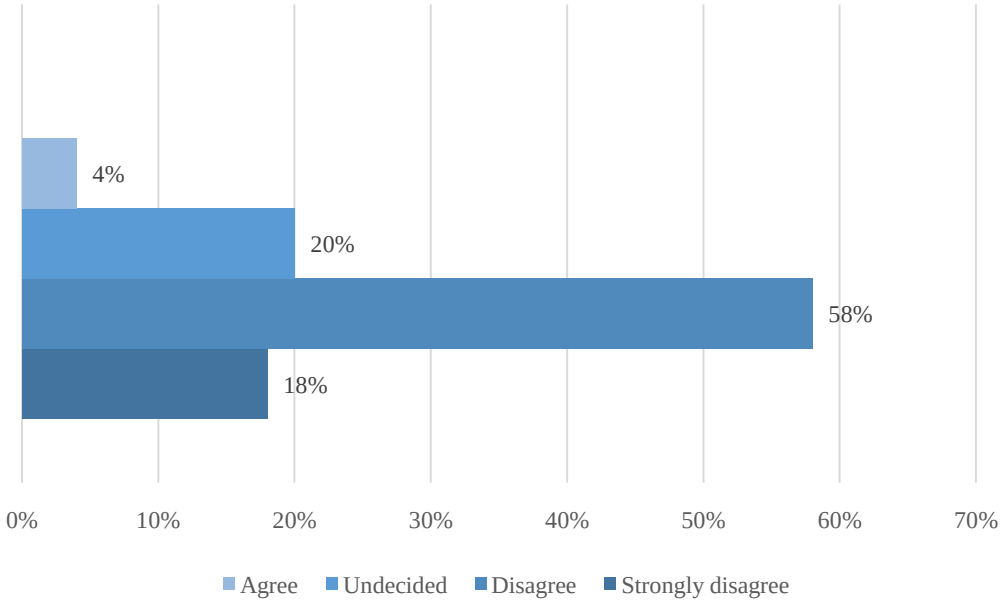
Graph 3. The main business problem of domestic micro, small and medium enterprises and entrepreneurs is the lack of access to finance



Source: Authors' calculations

In addition to achieving measurable positive results in improving the environment, small and medium enterprises will be further encouraged to use green loans from banks if they have more favorable conditions and additional benefits such as effective interest rates, available capital, technical assistance, repayment period, grace period, necessity of security instruments, return of part of invested funds, etc. Analyzing the results of the conducted empirical research, it was confirmed that the biggest business constraint faced by domestic micro, small and medium enterprises and entrepreneurs is the lack of financial funds (28% of respondents agreed with this statement, while 55% strongly agreed).

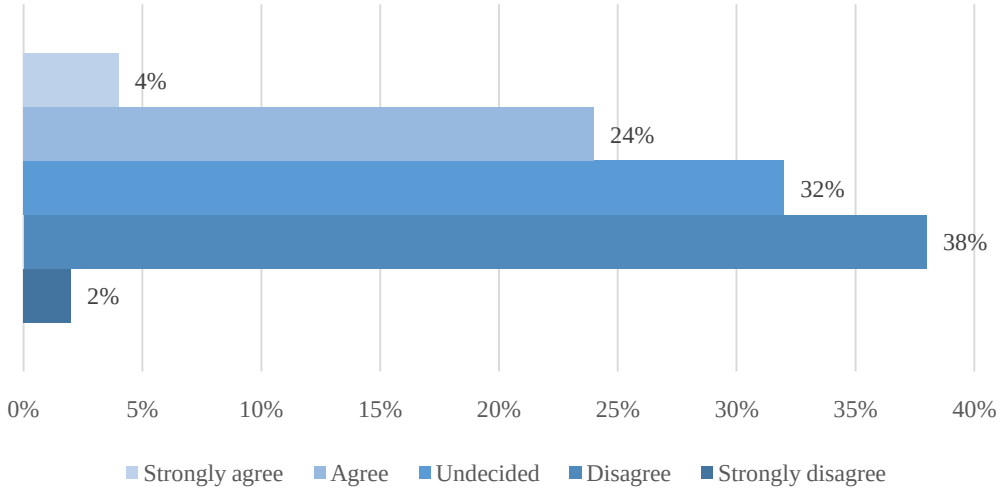
Graph 4. State incentives that promote green investments in the sector of micro, small and medium enterprises and entrepreneurs are sufficiently represented



Source: Authors' calculations

The research confirms that the state does not sufficiently encourage green entrepreneurship through subsidies or tax breaks to reward environmentally oriented business practices, as only 4% of respondents agreed that state incentives promote domestic green investments. Although there is demand for green loans, companies need more information on the principles of green financing, green transition, green inclusive growth, as well as green projects.

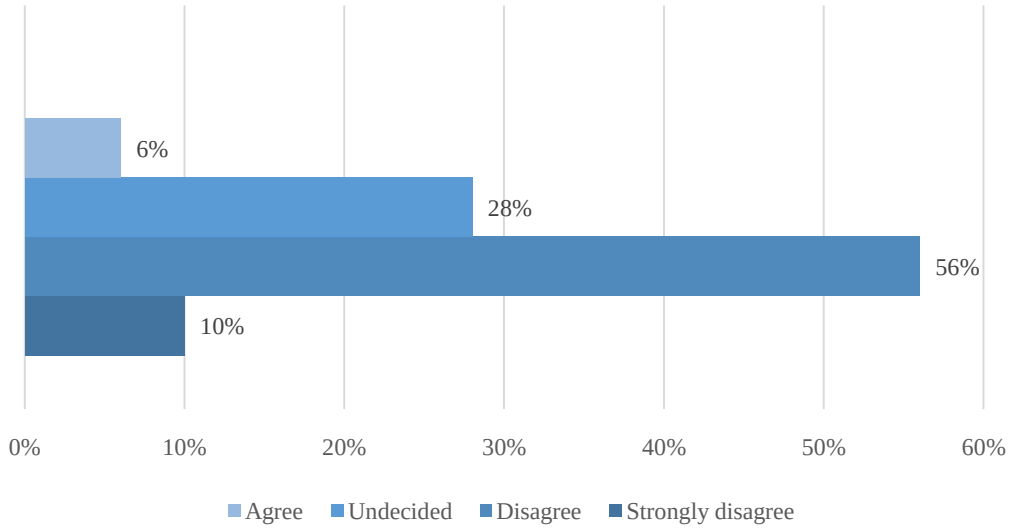
Graph 5. The demand for green loans demand is significant



Source: Authors' calculations

Green loans to the sector of micro, small and medium enterprises and entrepreneurs in Serbia are approved in euros, with a variable interest rate linked to EURIBOR and increased by interest margin. The components of the interest margin are the cost of capital (the cost of the bank's financing sources), the risk premium and the banking margin. Banks provide financial funds from parent banks or international financial institutions, most often the European Bank for Reconstruction and Development (EBRD) or the European Investment Bank (EIB) under certain conditions. The risk of premium depends on the company's financial situation and established indicators of financial stability, profitability, liquidity, indebtedness, etc. Also, depending on the specific bank, a grace period ranging between 6 months and 24 months is provided.

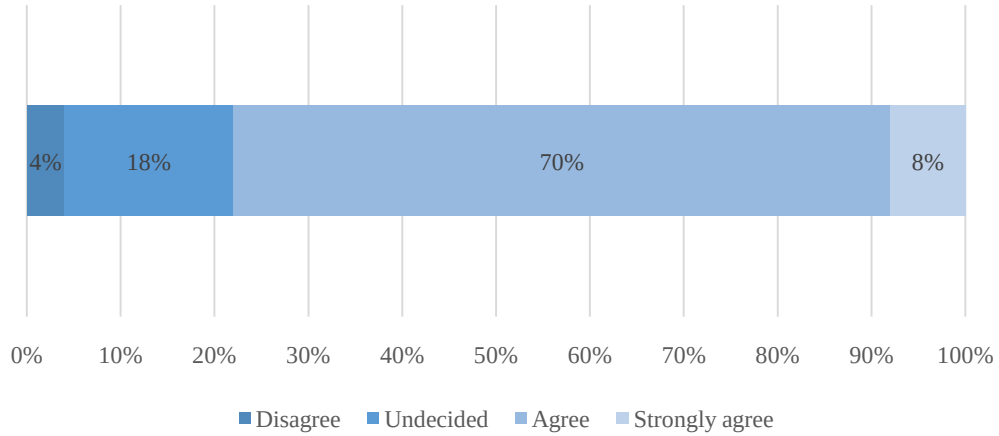
Graph 6. Bank credit lines for green financing are sufficiently represented in Serbia



Source: Authors' calculations

According to the opinion of only 6% of respondents, there is a satisfactory offer of green bank credit lines in Serbia. The most common obstacle for companies to invest in green projects is a poor offer of financial products, an underdeveloped capital market, demanding banking procedures, as well as high interest rates on loans.

Graph 7. An obstacle for companies to invest in green projects is the poor supply of financial products and the underdeveloped capital market

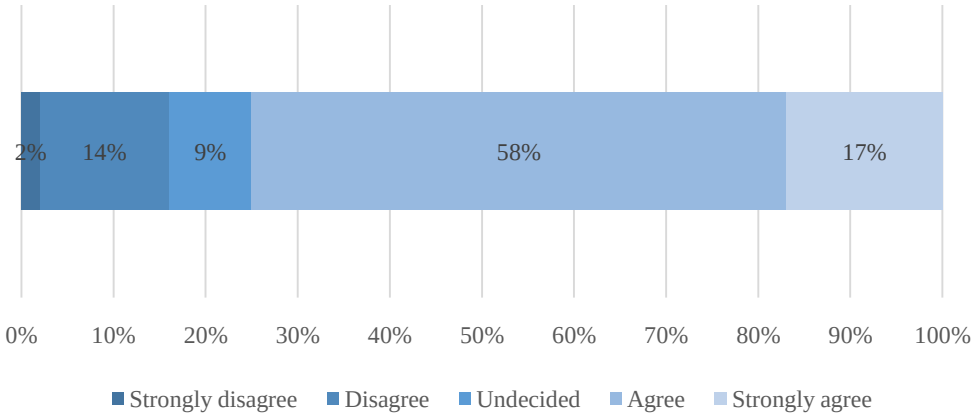


Source: Authors' calculations

A very instructive example of a company's greening strategy is Ireland. The Green Business Initiative significantly improved the environmental results of small and medium enterprises and facilitated the path to green transformation, which involved a dedicated approach to introducing companies to resource efficiency possibilities, defining business segments for potential savings, visiting companies, preparing documentation, providing technical and advisory assistance, developing programs and support tools for the implementation of circular

economy initiatives, connecting companies, organizing seminars, training and encouraging knowledge exchange (European Environment Agency, 2016).

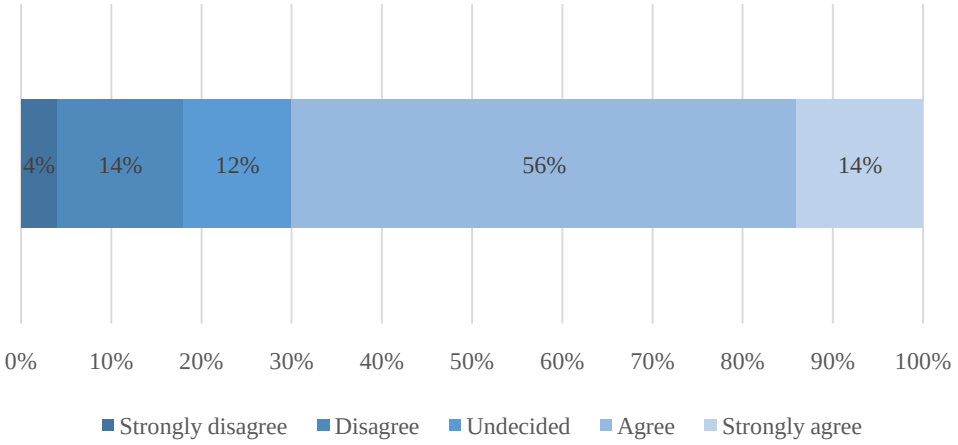
Graph 8. An obstacle for companies to invest in green projects is demanding bank procedure



Source: Authors' calculations

In the domestic banking sector, loans for the improvement of energy efficiency are dominated. The share of respondents who agreed or strongly agreed with the statement that the high interest rate on green loans is one of the obstacles to encouraging green investments and sustainable economic development is 70%, while 75% of the respondents believe that the green loan approval process is too demanding for domestic micro, small and medium enterprises and entrepreneurs.

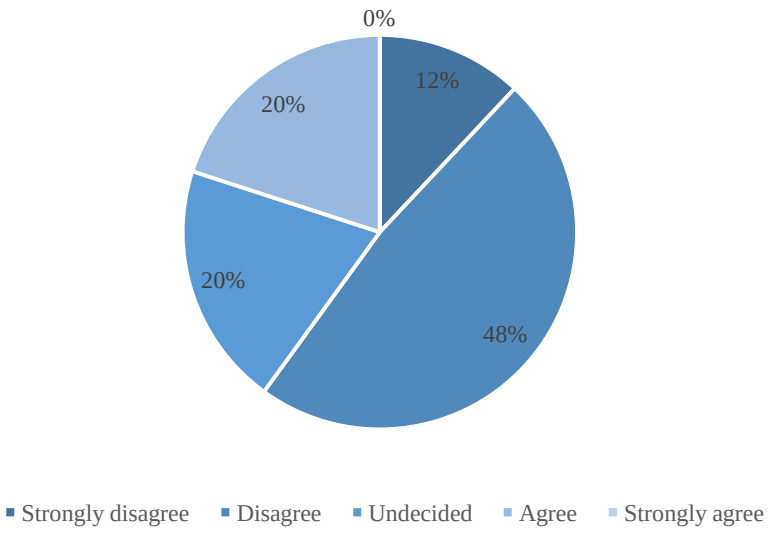
Graph 9. High interest rates on green loans are an obstacle for companies to invest in green projects



Source: Authors' calculations

Only 14% of respondents among banking experts confirmed that the bank where they are employed approves green loans to micro, small and medium enterprises and entrepreneurs, with the share of approved green loans in the bank's total loans less than 10%. This speaks in favor of the statement that green financing in the Serbian banking sector is below its potential.

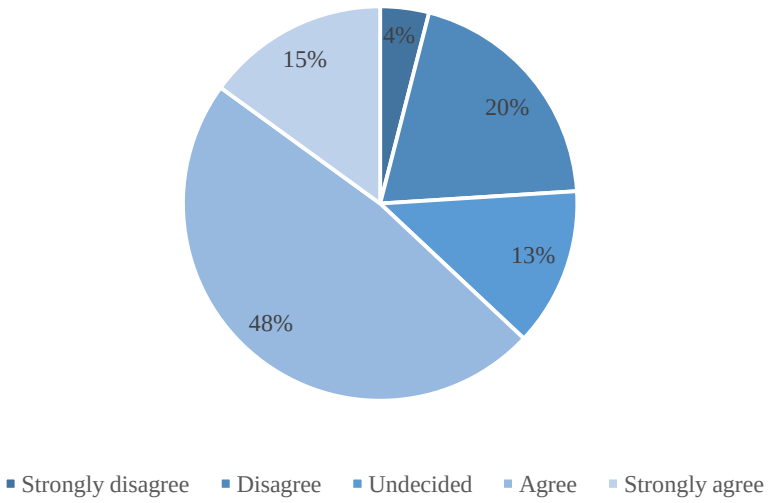
Graph 10. The investment climate in Serbia favors green financing



Source: Authors' calculations

Over 60% of respondents believe that bank green financial instruments, such as loans for financing sustainable development projects, contribute to the improvement of the domestic financial system, while the share of respondents who agree with the statement that the investment climate in Serbia is not conducive to green financing of domestic companies amounts to 60%.

Graph 11. Green financing contributes to the improvement of the domestic financial system



Source: Authors' calculations

How necessary green investments are, shows researches in which the emissions of harmful gases in Serbia have been increasing for years and that they significantly exceed the average of the European Union. In addition, revenues from environmental taxes have increased twice compared to 2015 and reached a value of about 6 billion dinars. It is a devastating fact that for years no taxpayer has contributed to the reduction of its environmental footprint through more responsible business activities (NALED, 2021). Guided by these facts, the Serbian Environmental Protection Agency proposed in 2017 the collection of environmental fees in accordance with the environmental pollution caused by companies through their operations, and not in relation to the size of the company and the activity it is engaged in, because this ignores the actual company's impact on the natural ecosystem. In this way, two positive effects would be achieved: the reduction of the ecological footprint and the growth of funds for investments in green projects (Environmental Protection Agency, 2018).

DISCUSSION

The recognition of the acuteness of environmental problems by the population of certain countries is followed by an appeal to government agencies to fight more actively against the causes of climate change (Lobanov, Zvezdanovič Lobanova & Zvezdanovič, 2023).I n order to contribute to mitigating the negative effects of climate change, the banking sector took part in the green transition through the approval of green loans intended for financing companies that demonstrate their environment responsible behavior through sustainable development projects. The conducted research should provide answers to what extent green financing is represented in the domestic financial system and whether the current investment climate in Serbia favors green financing. Access to finance is the main driver of entrepreneurial initiatives and economic growth. Timely access to finance determines the survival and growth of micro, small and medium enterprises and entrepreneurs. According to Rajamani et al., (2023), the results of the research confirm that the attributes of the firm, the sources of financing and the life cycle of micro, small and medium enterprises and entrepreneurs have a significant positive impact on their access to finance. Examining the views of respondents, micro, small and medium-sized enterprises and entrepreneurs in Serbia are at a disadvantage when it comes to access to finance, which slows down their growth. On the other hand, this sector as a carrier of creativity and innovation, is extremely important since it contributes to the creation of new job opportunities, the growth of tax revenues, promoting economic growth and well-being. If micro, small and medium-sized enterprises and entrepreneurs have access to the required amount of funds at the required moment at a low-interest rate, with fewer procedures, this would help them meet their financial needs.

In the research, which, in addition to the questionnaire, also included interviewing representatives of the private sector, it was determined that the obstacle to green financing in Serbia is the insufficient information of companies about green loans. Companies need to be provided with additional information about green projects that can lead to more efficient use of resources and significant savings in their operations, as well as about the preparation of project proposals and their implementation. This particularly refers to micro-enterprises and entrepreneurs. According to Sheikh et al., (2023) understanding the conditions and requirements of green projects as well as setting green goals for banks effective in applying green financing as a key factor in achieving sustainable entrepreneurship and the emergence of clean industries. The promotion of green entrepreneurship is not sufficiently represented in Serbia. The state does not encourage green growth and green investments through support in the form of subsidies or tax incentives, nor by allocating sufficient budget funds for the

improvement of the environment. The Green Fund, whose establishment was one of the conditions for opening Chapter 27, does not finance environmental projects, which was the purpose of its establishment in 2016. All this indicates that in the current situation, there is a lack of credible institutions that would financially support and manage green projects in Serbia (European Commission, 2022). The OECD report on the progress of small and medium-sized enterprises presents the results of the application of green economy principles in small and medium-sized enterprises through strategic environmental policy frameworks and green incentives and instruments. Serbia achieves poor performance (2.21/5), which has not been improved for years. The goals of supporting the green transition were an integral part of the Strategy to support the development of small and medium-sized enterprises, entrepreneurships and competitiveness for the period from 2015 to 2020, as well as the National Environmental Protection Program, but they were not specified through action plans. As the OECD recommends, the establishment of a coordinating body for the "greening" of small and medium-sized enterprises would contribute to the improvement of green financing, whereby this role could be assigned to the Development Agency of Serbia (OECD, 2019).

Of the green loans, the domestic banking sector is dominated by loans for improving energy efficiency, while loans for green projects of renewable energy sources, as well as loans for projects with a measurable impact on reducing the carbon footprint, are represented in a much smaller proportion. When interviewing representatives of the banking sector, it was found that as the most common reason for low interest in including green loans in their offer, bank experts cite a lack of professional staff who will evaluate green projects and monitor their implementation, as well as the economic profitability of green projects. On the other hand, representatives of micro, small and medium enterprises and entrepreneurs state that green loans are an expensive source of financing. This type of financial arrangement requires the company to prepare specific documentation in the form of an elaborate. If the company's employees do not have the qualifications to prepare studies and accompanying documentation, they have to hire external staff with the necessary knowledge to fulfill green project requirements and create a business plan with estimated positive impacts on the environment, which makes this arrangement financially less favorable. The approval of a green loan is also associated with more complicated banking procedures, since the banks have to perform additional assessments, checks and analyses, and often hire consultants for these specific issues. All the above factors contribute to the growth of green loan interest rates. However, the most important factor affecting the green loan interest rate is the cost of financing sources used by banks (not the risk premium based on the company's financial results).

CONCLUSION

Economies should strive to use their potential for sustainable production towards achieving zero carbon emissions. Due to the scarcity of natural resources, enterprises must focus on green production resources by relying more on the circular economy. As assessed by the Fiscal Council, a significant increase in investment in environmental protection is a budget priority in the coming years. This is supported by the fact that a responsible attitude towards the environment is one of the basic postulates of the European Union, which Serbia is trying to access. Since these investments are mandatory, any postponement of inevitable green investments may cause more serious consequences (freezing wages and pensions, increasing taxes) and will be implemented in a far less favorable fiscal environment. According to the estimates of the Fiscal Council, an increase in public investments in environmental protection

by 1.3% of the gross domestic product (500 million euros) would accelerate the economic growth of Serbia in the short run by at least 0.5% (Fiscal Council, 2018).The regulatory framework, successfully formulated strategies and their effective implementation, as well as involving the private sector and creating a larger market, are key factors for attracting green investments**.**

It can be stated that the offer of green loans in the domestic banking sector is not at a satisfactory level and that the current conditions for green financing of companies do not represent a profitable financial option. In addition to charging high-interest rates on loans related to the achievement of sustainable development goals, banks currently do not have different green financing instruments and the offer is reduced mainly to green loans for improving energy efficiency. Green financing is not yet sufficiently represented in Serbia and improvements are needed both on the supply side and on the demand side. As the awareness of the importance of the circular economy and the necessity of more intensive involvement in the green transition process grows, so will the demand for green sources of financing, as well as the variety of available green financial instruments. It is necessary to provide incentives for green investments in the form of subsidies, grants, tax breaks and credit guarantees from international development finance institutions, but also to adopt and apply regulations in the field of green financing promptly.

REFERENCES

Bergedieck, L., Maheshwari, A., &Ugaz, F. A. (2016). Green Finance - A Bottom-up Approach to Track Existing Flows. Washington: International Finance Corporation.https://www.cbd.int/financial/gcf/ifc-greentracking.pdf (accessed 17 June 2023).

Environmental Protection Agency (2018). Report on economic instruments for environmental protection. Belgrade: Ministry of Environmental Protection Republic of Serbia. http://www.sepa.gov.rs/download/posebni/EkonomskiInstrumenti_2017.pdf(accessed 30 May 2023).

European Environment Agency (2016).Ireland - Country fact sheet: Overview of national waste prevention programmes in Europe. Copenhagen: European Environment Agency.file:///C:/Users/HP/Downloads/Ireland%20fact%20sheet_waste%20prevention_OCT 2016-2.pdf (accessed 20 May 2023).

European Commission (2022). Republic of Serbia-Report for 2022. Strasbourg: European Commission.https://www.mei.gov.rs/upload/documents/eu_dokumenta/godisnji_izvestaji_ek_o_napretku/Serbia_Report_2022_SR.%5B1%5D.pdf (accessed 20 May 2023).

Fiscal Council (2018). Investments in environmental protection: social and fiscal priority. Belgrade: Fiscal Council of the Republic of Serbia.https://www.fiskalnisavet.rs/doc/eng/FC%20-%20Investments%20in%20environmental%20protection.pdf. (accessed 20 June 2023).

Höhne, N.,Khosla, S., Fekete, H., & Gilbert, A. (2012). Mapping of Green Finance Delivered by IDFC Members in 2011. Köln: ECOFYS. https://www.idfc.org/wp-content/uploads/2019/03/idfc_green_finance_mapping_report_2012_06-14-12.pdf (accessed 18 May 2023).

ISO (2022). Green and Sustainable Finance. Geneva: International Organization for Standardization. https://www.iso.org/publication/PUB100458.html (accessed 25 May 2023).
Jinru, L., Changbiao, Z., Ahmad, B., Irfan, M., &Nazir, R. (2022).How do green financing and green logistics affect the circular economy in the pandemic situation: key mediating role of sustainable production. *Economic Research-Ekonomska Istrazivanja*, 35(1), 3836-3856. DOI: 10.1080/1331677X.2021.2004437.

Lobanov, M., Zvezdanovič Lobanova, J., & Zvezdanovič, M. (2023). Алармисты и скептики: национальные особенности формирования климатического сознания. *Мирперемен* (1), 154-177. https://doi.org/10.51905/2073-3038_2023_1_154.

Ma, J.,& Chang, C. P. (2023) The Role of Green Finance in Green Innovation: Global Perspective from 75 Developing Countries. *Emerging Markets Finance and Trade*, 1-20. DOI: 10.1080/1540496X.2023.2210720.

MEI (2021). The negotiating position of the Republic of Serbia for the Intergovernmental Conference on the Accession of the Republic of Serbia to the European Union for Chapter 15 "Energy". Belgrade: Ministry of European Integration. https://www.mei.gov.rs/upload/documents/pristupni_pregovori/pregovaracke_pozicije/pg_pozicija_15.pdf. (accessed 1 June 2023).

NALED (2021). Analiza uspešnosti fiskalnih instrumenata u smanjenju zagađenja vazduha u Republici Srbiji – Trenutno stanje i predlozi za unapređenje. Beograd: Nacionalna alijansa za lokalni ekonomski razvoj (NALED).https://naled.rs/htdocs/Files/07055/Naknade-zivotna-sredina-predlog-reforme-dvolist-v2.pdf. (accessed 18 March 2023).

Noh, H. J. (2018). Financial Strategy to Accelerate Green Growth. Tokyo: Asian Development Bank Institute (ADBI Working Paper 866). https://www.adb.org/publications/financial-strategy-accelerate-green-growth (accessed 11 March 2023).

OECD (2019). SME Policy Index: Western Balkans and Turkey - Assessing the Implementation of the Small Business Act for Europe. Paris: Organisation for Economic Co-operation and Development (OECD).https://www.oecd.org/publications/sme-policy-index-western-balkans-and-turkey-2019-g2g9fa9a-en.htm. (accessed 9 May 2023).

Ostojić, I. (2022). *The Role of Development Finance Institutions in Supporting Sustainable Development* (Doctoral dissertation). Retrieved from SINGIPEDIA https://singipedia.singidunum.ac.rs/doktorski-radovi/1.

Ostojić, I. (2023). Zeleno finansiranje, klimatske finansije i koncept zelene ekonomije. In S. Nikolić Popadić & M. Milenković (Eds.), *Klimatske promene - pravni i društveni izazovi* (pp. 196-213). Belgrade: Institute for Social Sciences.

Rajamani, K., Jan, N. A., Subramani, A. K., & Raj, A. N. (2022). Access to Finance: Challenges Faced by Micro, Small, and Medium Enterprises in India. *Engineering Economics*, 33(1), 73-85. DOI: 10.5755/j01.ee.33.1.27998

Ristanović, V. (2021). Serbia and Agenda 2030: Mapping the National Strategic Framework vis-a-vis the Sustainable Development Goals. Belgrade: Republic Secretariat for Public Policies. https://rsjp.gov.rs/wp-content/uploads/Serbia-and-2030-Agenda_November-2021.pdf. (accessed 17 June 2023).

Selvapandian, G., Jeiapaul, P., & Gunabalan, B. (2022). Adoption of Green Financing Strategies with Renewable Energy Resources for Global Economic Growth. *Global Economy Journal*, 22(4), 1-17. DOI: 10.1142/S2194565923500045.

Sharif, A., Saqib, N., Dong, K., &Khan, S. A. R. (2022). Nexus between green technology innovation, green financing, and CO_2 emissions in the G7 countries: The moderating role of social globalization. *Sustainable Development*, 30(6), 1934-1946. DOI: 10.1002/sd.2360.

Sheikh, A. A., Saeidi, P., Abbasi, E., & Naderian, A. (2023). Designing Model and Levelization of the Factors Affecting Companies' Green Financing through Banking System. *Iranian Journal of Accounting*, Auditing & Finance (IJAAF). 7 (1), 23-38. DOI: 10.22067/ijaaf.2023.42194.1114.

Statista (2020). Value of Green Financing. Database. New York: Statista Research Department. https://www.statista.com/statistics/1283398/banks-main-sustainability-goals-worldwide/ (accessed 21 April 2023).

Statista (2021). Main social and environmental goals included in banks' sustainability strategy worldwide. Database. New York: Statista Research Department. https://www.statista.com/statistics/1283398/banks-main-sustainability-goals-worldwide/ (accessed 19 April 2023).

UNEP FI (2022). Principles for Responsible Banking. Geneva: UNEP Finance Initiative. https://www.unepfi.org/industries/banking/principles-for-responsible-banking/ (accessed 11 June 2023).

Volz, U., Böhnke, J., Knierim, L., Richert, K., Röber, G.M, &Eidt, V. (2015). *Financing the Green Transformation: How to Make Green Finace Work in Indonesia*. London: Palgrave Macmillan.

Zheng, M., Du, Q., & Wang, Q. J. (2023). Nexus between Green Finance and Renewable Energy Development in China. *Emerging Markets Finance & Trade*, 59(4), 1205-1218. DOI: 10.1080/1540496X.2022.2119811.

GENERATION Z IN THE LABOR MARKET[1]

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Abstract: Every 15-20 years a new generation enters the labor market. Each generation has its own peculiarities in different areas of life and work. The emergence of a new generation and the cooperation of different generations also bring changes in the labor market. Computers, mobile devices and the Internet are changing the behavior of individuals, have created new opportunities for education and career advancement. Members of Generation Z were born into a digital age and cannot imagine a world without cell phones, computers or the Internet. They are very adept at handling information and new technological developments are no problem for them. This enables them to contribute to companies and businesses in the market. Generation Z is entering the market at a time of demographic change with an aging population, but also at a time of rapid technological progress those companies cannot afford to neglect if they want to remain competitive.

Key words: generation Z, global workforce by generation, employment worldwide generation

INTRODUCTION

Personal changes in the structure of workforce in the labor market are natural in the development of civilization. The emergence of new generations plays a key role. "Older generations leave the labor market and younger ones gradually enter it. So it is a natural phenomenon that is not unusual (Mitkova Ľ. 2014).

The term generation is used to understand the differences between age groups in a society. The term "generation" is defined as "the number of years assumed to be the average period between the birth of parents and the birth of their offspring"(Online Language Dictionaries 2023). McCrindle and Wolfinger explain, "According to this biological definition, a generation has been a span of 20-25 years for millennia. On average, the time between the birth of parents and the birth of their offspring has expanded from two decades to more than three(Mccrindle, M. et al 2014).As the birth of the first child has shifted to after age 30 for

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women, the traditional understanding of the term generation has changed to "a period of about 30 years (Krátky slovník slovenského jazyka 2023). According to McCrindle and Wolfinger, this definition is now irrelevant and generations are now defined sociologically rather than biologically. A generation refers to a cohort of people born within a similar time span (15 years at the high end), who are of comparable age and stage of life, and who have been shaped by a particular time period (events, trends, and developments)(Mccrindle, M. et al 2014).Moreover, there are different understandings of generations, as Žúborová also notes.
These are:

- assigning individuals to a social group as a developmental stage (child, retiree),
- hierarchical level of an individual within the family (father/mother, son/daughter),
- age interface of a diverse group with different lifespan and different form - this concept is further divided into lifelong generation groups (do not change their attitudes, even in adolescence) and temporary generation groups (change their attitudes with adolescence and are then included in lifelong groups with the same values),
- the temporal interface, after which a generational change occurs every 30 years,
- differences in lifestyle and cultural differences (Žúborová V. 2018).

Every 15-20 years, a new generation enters the labor market and each generation has its own characteristics in different areas of life and thus, of course, in the field of work. In the workplace today, there are employees representing several generations. Often the views of people from different generations are different and this means that individuals have to adapt and learn to work together. The differences between generations are in mindsets, experiences, values, competitive advantages, requirements and expectations. The fact that there are multiple generations in the labor market also brings important changes that will significantly impact and affect human resource management and business leadership. The emergence of a new generation and the collaboration of multiple generations brings new challenges to which management must respond.

Employees are a company's greatest asset. It is necessary to realize that each generation has special skills and characteristics. To successfully integrate the new generation into the workplace, companies must change their hiring practices and adapt their management style and corporate culture.

THE GLOBAL LABOR FORCE BY GENERATION AND IT'S EMPLOYMENT IN THE LABOR MARKET

The labor market is divided into employed, unemployed and others. Employed are those who have a job - do work, pursue their work and receive compensation, a salary. Unemployed people do not have a job - they do not work, do not have a source of income and are registered with the employment office, are actively looking for a job or are not looking for a job. The last, third group consists of those who cannot work due to illness (disability pensioners), pensioners, students, pupils and others. Each generation can be represented in any of the above groups.

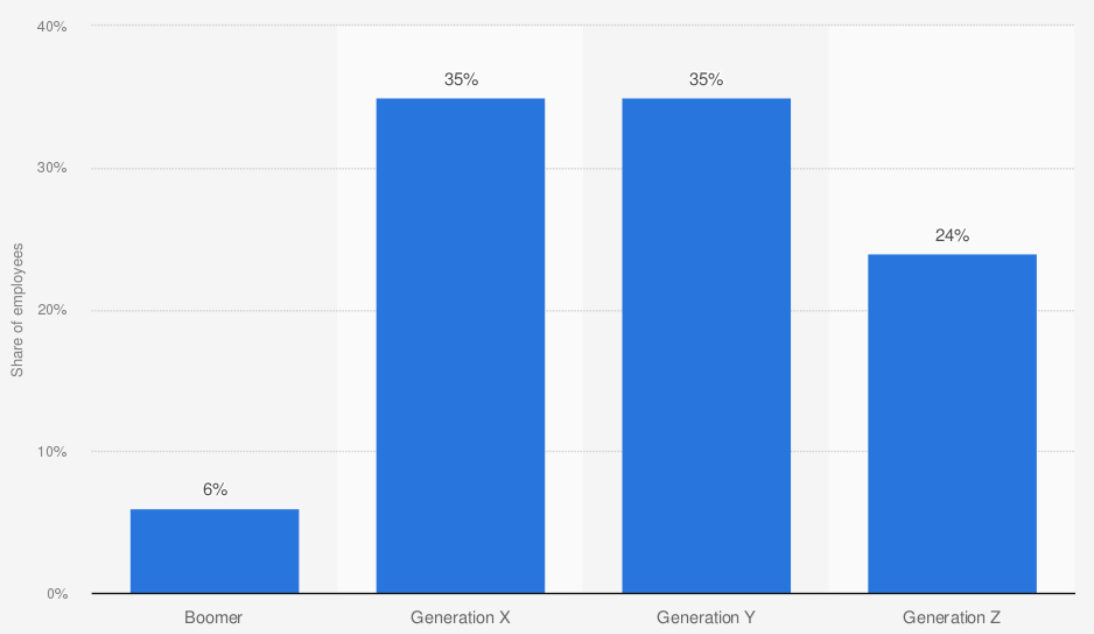
Employers always face the challenge of finding a suitable employee when someone in their company retires or leaves for various reasons. One important element they need to take care of is employee satisfaction in order to keep their employees as long as possible. There are differences between the different generations in today's labor market in terms of satisfaction with their jobs.

In the past, workers were accustomed to working in groups that consisted mostly of one generation, while today they must adapt to individuals who, in most cases, have a different perspective on different situations. Today, the labor market is composed of four generations:

- *Baby Boomers* - people born between 1946 and 1964. This generation received its name due to a large population explosion after World War II. These workers are considered hardworking and highly motivated. They enjoy working overtime and are very loyal employees. This is the oldest generation on the labor market that keeps retiring and leaving their positions to younger colleagues.
- *Generation X* - born 1965 - 1980, this generation is a transitional generation, so to speak, because they remain similar to the older generation in their loyalty, but on the other hand, they are also part of the newer generations associated with technologies. Generation X understands and is in line with the work ethic and focus of the baby boomer generation. However, their common characteristic is that they prefer a work-life balance and are not willing to work at the expense of their family life.
- *Generation Y* - born 1981 - 1995, this is the first wave of a digital generation born in the world of technologies. They use computers, cell phones and the Internet every day for work, but also as a source of entertainment and for private communication. This generation is very skilled in using various information systems and programs, they are interested in new technologies and can quickly adapt to changes. They can easily accept changes, do not like long-term planning and want to be entertained in their own world.
- *Generation Z* - also known as Internet generation (IGeneration, Zoomers), born in 1996 - 2010, is the youngest generation in today's labor market. These people thrive on global communication and trends such as: global music, videos, celebrities, fashion, movies and online entertainment. Some of Generation Z has already found its place in the job market and is the workforce of the future. The beginnings of their careers come at a time of massive population aging, which means they will work longer and retire at an older age than previous generations. Their work and personal relationships will be built mainly through information technologies.

All generations are already represented in the labor market, but as the chart shows, seventy percent of the global workforce is evenly split between Generation X and Generation Y (Statista 2023). However, Generation Z is projected to account for nearly a quarter of the workforce as the later born generation enters adulthood.

Graph 1: Employment worldwide by generation



Source: Employment worldwide by 2020, by generation. In Statista, from https://www.statista.com/statistics/829705/global-employment-by-generation/

Mixing different generations creates a new work environment with new challenges for management. The reason for this is the fact that there are greater differences between generations in terms of approach, values, habits, needs and expectations.
The way of communication in the work environment, the attitude towards work and also the idea of how an employee's work should look like, what benefits the employee prefers, are also different.

CHARACTERISTICS OF GENERATION Z IN THE LABOR MARKET

In case of need for new workforce, employers recruit employees. When recruiting, each organization can choose from internal or external sources. Internal sources include:

a) workers whose job descriptions have been affected by organizational changes,
b) workers whose position has lost its importance due to technological development,
c) employees who are able to perform more difficult tasks than those they previously performed,
d) employees who are in a suitable position but are themselves interested in a new or vacant position.

External sources include available labor, graduates from various disciplines, workers from other companies who show interest in the position. Organizations can also use additional resources of free labor, which include housewives, retirees, students, foreign resources (Koubek J. 2008).

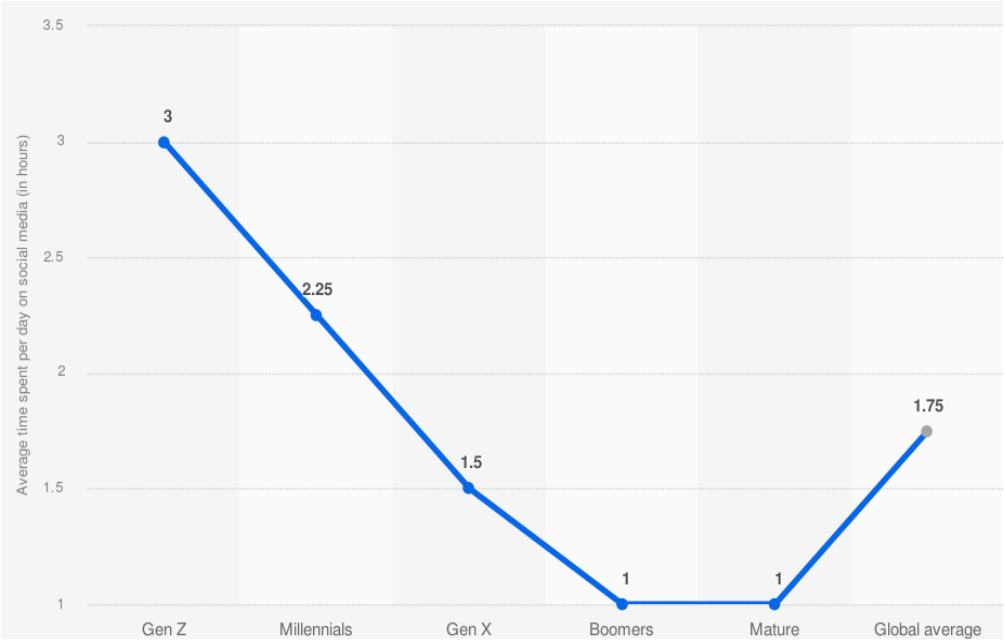
If a person wants to be successful in the labor market, if he wants to find good employment, his education plays an important role. However, the most important principle is lifelong education. It is no longer enough to study and have a specific education, but it is also necessary to have a general overview, to constantly improve and learn. The education of Generation Z requires a special approach. As Mezeiová notes, frontal education is boring and lifeless for Generation Z. Moreover, research shows that learning through games (gamification) can effectively motivate and positively influence creativity. In her own quantitative study, she pointed out that young people are open to new teaching methods, seek challenges and are motivated by a sense of achievement. They do not mind working harder or longer on a task that is interesting to them and that they enjoy doing. Immediate feedback is an inseparable element of communication (Mezeiová A. 2019).

Generation Z comes at a time of demographic change, with a massive aging population, but also at a time of rapid technological advancement, when many employers are feeling a shortage of skilled workers. Generation Z is currently actively trying to integrate into the labor market. It needs to catch up with older generations already active in the labor market, but it also needs to compete with them.

Computers, mobile devices and the Internet bring a lot of opportunities for education and at the same time a lot of information that is useful for job opportunities. When choosing a job, the most important factor is salary. These young people have unrealistic expectations of financial compensation in today's job market. In the workplace, they expect high-quality technological equipment and a stimulating, nontraditional and informal environment with flexible working hours.

In addition, members of Generation Z are not working just to make ends meet; they are also interested in having fun, developing professionally, and having a social life. Because of the use of social media and technologies to which they are accustomed, Generation Z is well prepared for the global entrepreneurial environment.

Graph 2: Average number of hours spent on social media per day worldwide in 2022 by generation



Source: Average amount of hours spent per day on social media worldwide. In Statista. Retrieved May 28, 2023, from https://www.statista.com/statistics/1314973/global-daily-time-spent-on-social-media-networks-generation/

According to a 2022 global survey (Graph 2), respondents belonging to Generation Z reported spending an average of three hours per day on social media. Millennials as a whole reported spending 2.25 hours per day on online social platforms. Members of the baby boomer generation spent an average of one hour per day on social media (Statista 2023).

Generation Z was born in the digital age and cannot imagine a world without cell phones, computers or the Internet. Simply put, they are adapted to a life in front of a screen because they have evolved along with the development of technologies - they have an online life. They are able to adopt information technologies without any major problems and are therefore of great benefit to various companies and businesses on the market. Generation Z communicates mainly through social networks, cell phones, e-mail and various applications, and is accustomed to using new devices and software. This should also be taken into account by employers when advertising jobs, training employees and in internal communications.

To capture the characteristics of Generation Z in terms of workplace requirements, work environment and the work itself, employees of this generation demand more flexibility, a higher salary, as well as the opportunity for growth and the offer of interesting additional benefits. They expect clear and open communication and regular feedback from their employer. This generation has a very unique idea of career (the most important aspects of career are life balance, expertise, learning and freedom), they also value work-life balance (Lalić D. et al 2020). Mental health is very important for a Zoomer, so he/she wants to do a job that he/she likes, where the conditions are appropriate and the environment is pleasant. He/she definitely tries to avoid mental disorders and burnout syndrome. "The characteristics

that most distinguish Generation Z are reliability, freedom, individualism, dependence on technology and speed (Berkup S. B. 2014) . The greatest advantage of Generation Z is their ability to adapt quickly to new technologies and their excellent ability to compare.

To capture the characteristics of Generation Z from the point of view of job demands, work environment and work itself, employees of this generation demand more flexibility, higher salary as well as the possibility of growth and an offer of interesting benefits. They expect from the employer that communication will be clear and open and there will be regular feedback. This generation has a unique view of career (the most important aspects of career are considered life balance, expertise, learning and freedom, it also focuses on work-life balance. Mental health is very important to a Zoomer, thus he/she wants to do a job that he/she likes, where the conditions are suitable and the environment is pleasant. He/she definitely tries to prevent psychological disorders and burnout syndrome. “The features that stand out most for Generation Z are reliability, freedom, individualism, dependence on technology and speed. Generation Z's greatest asset is its ability to adapt quickly to new technologies, as well as the excellent ability to compare.

CONCLUSION

Due to demographic trends, there is a generational change in the workforce, as it is a natural phenomenon of society and working age. Generation Z today brings its opinions, expectations and knowledge to the workplace, which ultimately does not coincide with the opinions and expectations of employees of younger or older generations. In the coming years, workplaces and companies will increasingly engage Generation Z with employees of other older generations in the workplace, which will create tension in intergenerational relationships. Generation Z is interested in being engaged in their community, and they want to feel fulfilled and excited about their work as they help move the world forward and into the future.If we want generations to be able to achieve agreement with each other, we must use effective communication. With a heterogeneous workforce, the right style of communication from managers with employees, from employees with employees of a different generation is important to achieve cohesion and productivity in the workplace. Also, according to a study by Janssen and Carradini, “Employers should resist negative generational stereotypes and develop new communication policies that reflect current and future uses of technology (Janssen D. et al 2021).

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LITERATURE

1. MITKOVÁ, Ľ. 2014. Generačná výmena na trhu práce Slovenskej republiky/The generational change on the labour market in Slovak Republic. Conference: Horizonty podnikateľského prostredia III / Business Environment Horizons III. At: Bratislava, Slovakia, pp. 111 – 120.
2. Online Language Dictionaries. Retrieved May 27, 2023, from https://www.wordreference.com/definition/generation
3. McCRINDLE, M., WOLFINGER, E. (2014). *The ABC of XYZ: Understanding the global generations*. p. 17 Retrieved May 27, 2023, from https://www.researchgate.net/publication/328347222_The_ABC_of_XYZ_Understanding_the_Global_Generations
4. Krátky slovník slovenského jazyka. Retrieved May 27, 2023, from https://slovnik.aktuality.sk/pravopis/kratky-slovnik/?q=gener%C3%A1cia
5. McCRINDLE, M., WOLFINGER, E. (2014). *The ABC of XYZ: Understanding the global generations*. p. 18 Retrieved May 27, 2023, from https://www.researchgate.net/publication/328347222_The_ABC_of_XYZ_Understanding_the_Global_Generations
6. ŽÚBOROVÁ, Viera, 2018. Gen ZY, Generácie budúcnosti. Bratislava: Bratislava Policy Institute – Nadácia Hannsa Seidela. 135 s. ISBN 978-80-973236-0-8.
7. Statista - The Statistics Portal (2023).Employment worldwide. Retrieved from https://www.statista.com/statistics/829705/global-employment-by-generation/
8. KOUBEK, J. 2009. Řízení lidských zdrojů. : základy moderní personalistiky. 4. rozš. a dopl. vyd. - Praha : Management Press, s.r.o., 2009. - 399 s. ISBN 978-80-7261-168-3.
9. MEZEIOVÁ, A. 2019. Virtuálna generácia vo vysokoškolskom prostredí - jej potreby a požiadavky = Virtual Generation in the University Environment - Its Needs and Requirements In: RELIK 2019: the 12th international scientific conference: reproduction of human capital - mutual links and connections: 12. ročník mezinárodní vědecké konference RELIK 2019. Praha: Vysoká škola ekonomická v Praze. Oeconomica Nakladatelstvi VŠE, 2019, s. 325-336 [online]. ISBN 978-80-245-2329-3. Retrieved June 1, 2023, from https://www.researchgate.net/publication/368838557_VIRTUAL_GENERATION_IN_THE_UNIVERSITY_ENVIRONMENT_-ITS_NEEDS_AND_REQUIREMENTS_VIRTUALNA_GENERACIA_VO_VYSOKOSKOLSKOM_PROSTREDI_-JEJ_POTREBY_A_POZIADAVKY
10. Average amount of hours spent per day on social media worldwide. In Statista. Retrieved May 28, 2023, from https://www.statista.com/statistics/1314973/global-daily-time-spent-on-social-media-networks-generation/
11. LALIĆ, D. - STANKOVIĆ, J. - BOŠKOVIĆ, D. - MILIĆ, B. 2020. Career Expectations of Generation Z. In: ANISIC, Z., LALIC, B., GRACANIN, D. (eds.) Proceedings on 25th International Joint Conference on Industrial Engineering and Operations Management – IJCIEOM. IJCIEOM 2019. Lecture Notes on Multidisciplinary Industrial Engineering. Springer, Cham. https://doi.org/10.1007/978-3-030-43616-2_6

12. BERKUP, S. B. 2014. Working with Generations X And Y In Generation Z Period: Management Of Different Generations In Business Life. Mediterranean Journal of Social Sciences, 5(19), 218. Retrieved from https://www.richtmann.org/journal/index.php/mjss/article/view/4247
13. JANSSEN, D. - CARRADINI, S. 2021. Generation Z Workplace Communication Habits and Expectations. In *IEEE Transactions on Professional Communication*, Vol. 64, No. 2, pp. 137-153, June 2021, doi: 10.1109/TPC.2021.3069288.

GENERATION Z ON SOCIAL MEDIA WORLDWIDEAND MARKETING TO GENERATION Z[1]

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Abstract: Nowadays almost the whole world is online which means that the popularity of information technologies and social networks is continuously growing. Both globalization and technology are the reason for visual orientation of Generation Z. Generation Z is well prepared for global entrepreneurial environment and is interested to help the world move forward. In companies Generation Z will bring forward new ideas, trends, and creativity. Generation Z has never known the world without the internet, smart phones and social media. They look up everything on social networks be it for personal life or work. With the emergence of a new generation, the approach of marketers to address these new consumers is also changing. Virtual technologies will be used more and more for sharing ideas, creation of products and coming up with new job opportunities for future generations.

Key words: Generation Z, employment, social media, generation, impact.

INTRODUCTION

Nowadays, every company has employees of different generations. Each generation has its specific characteristics, they differ not only in their behavior, but also in their opinions and attitudes in solving professional, social or personal problems (Grencikova A. et al 2023).Each generation sets new trends and has individual peculiarities that influence, for example, trends and clothing style, financial values, educational methods, work discipline, but also buying behavior.

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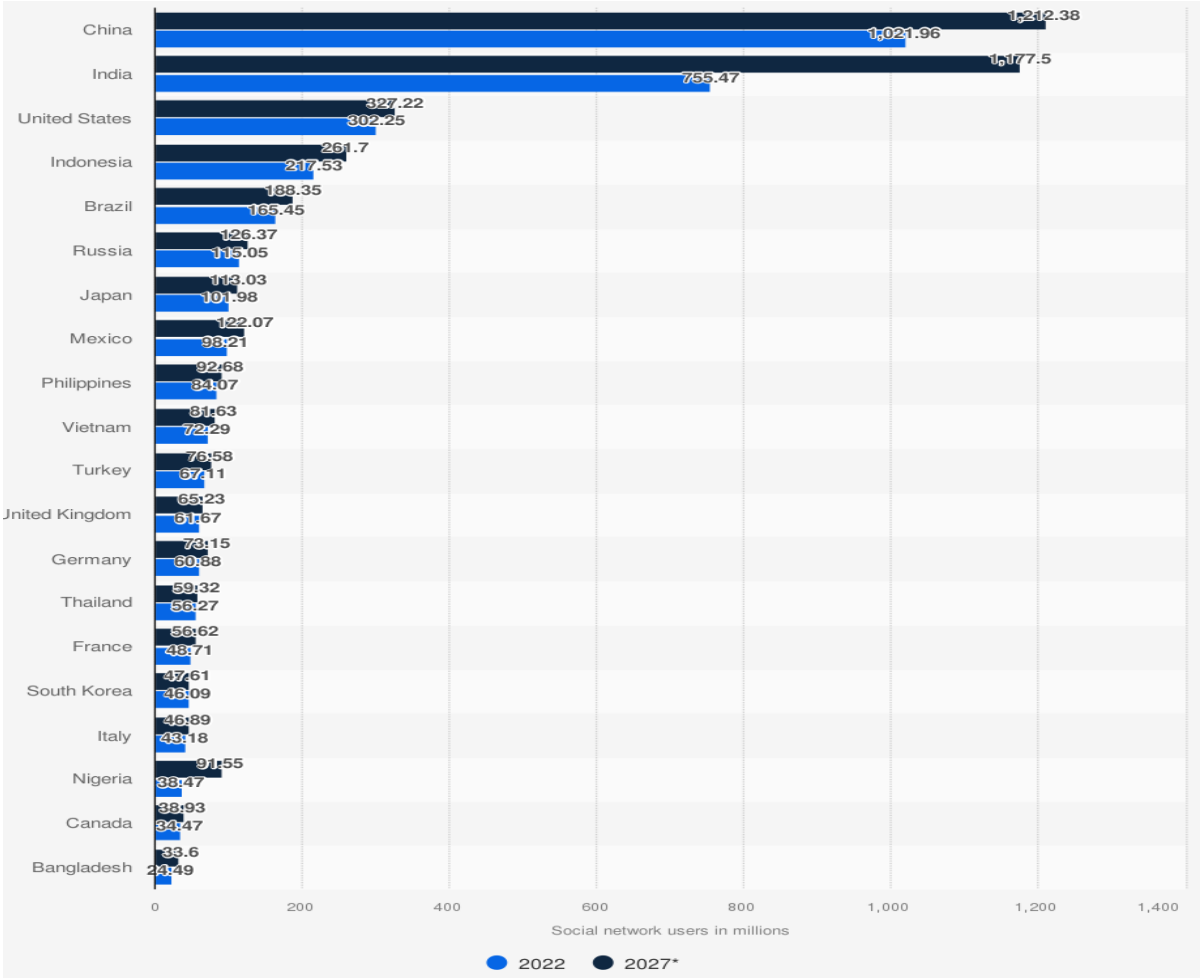
The generations can be divided as follows:

- Baby Boomers (1946 - 1964) - people who grew up after the World War II. It was a time of optimism, new opportunities and economic growth.
- Generation X (1964 - 1980) - This generation was shaped by the Baby Boomers, who were very mature for their time. It was virtually overshadowed by them. The Asian economies, the so-called "Asian Tigers," were growing and getting stronger.
- Generation Y (1981 - 1995). A generation characterized by extremely rapid technological progress.
- Generation Z / Zoomers (1996 – 2010). Also called digital natives because this generation has been growing up in a constantly connected world. Digital technology has been the defining contextual force that shaped this generation (Seemiller C. et al 2019).

Today, almost the whole world is online, which means that the popularity of information technologies and social networks is increasing day by day. Many social media allow their users to specify demographic, geographic and personal information, which allows company managers to customize their messages, publish or adjust the content according to the users' interests. Thanks to this possibility, companies can promote their products, connect with customers and follow their interests. To function, they need employees who can follow these trends. Generation Z employees are suitable for such positions because they have never known the world without the Internet, smart phones and social networks.

The number of users of social networks varies across different countries (Graph 1), and we assume that there is a large representation of users of Generation Z, who are familiar with technologies and use them in various daily activities.

Graph 1: Number of social network users in selected countries in 2022 and 2027
(in millions)



Source: Statista. (June 15, 2022). Number of social network users in selected countries in 2022 and 2027 (in millions) [Graph]. In *Statista*. Retrieved May 06, 2023, from https://www.statista.com/statistics/278341/number-of-social-network-users-in-selected-countries/

According to recent projections, the number of social media users in China reached 1.02 billion in 2022 and is expected to reach 1.21 billion by 2027. India, which ranks second in terms of user numbers, reached 755 million social media users in 2022 and is estimated to reach 1.17 billion by 2027. Overall, the United States has the third largest audience for social networks, followed by Indonesia and Brazil (Statista 2023).

THE MOST POPULAR SOCIAL NETWORKS IN THE WORLD OF GENERATION Z

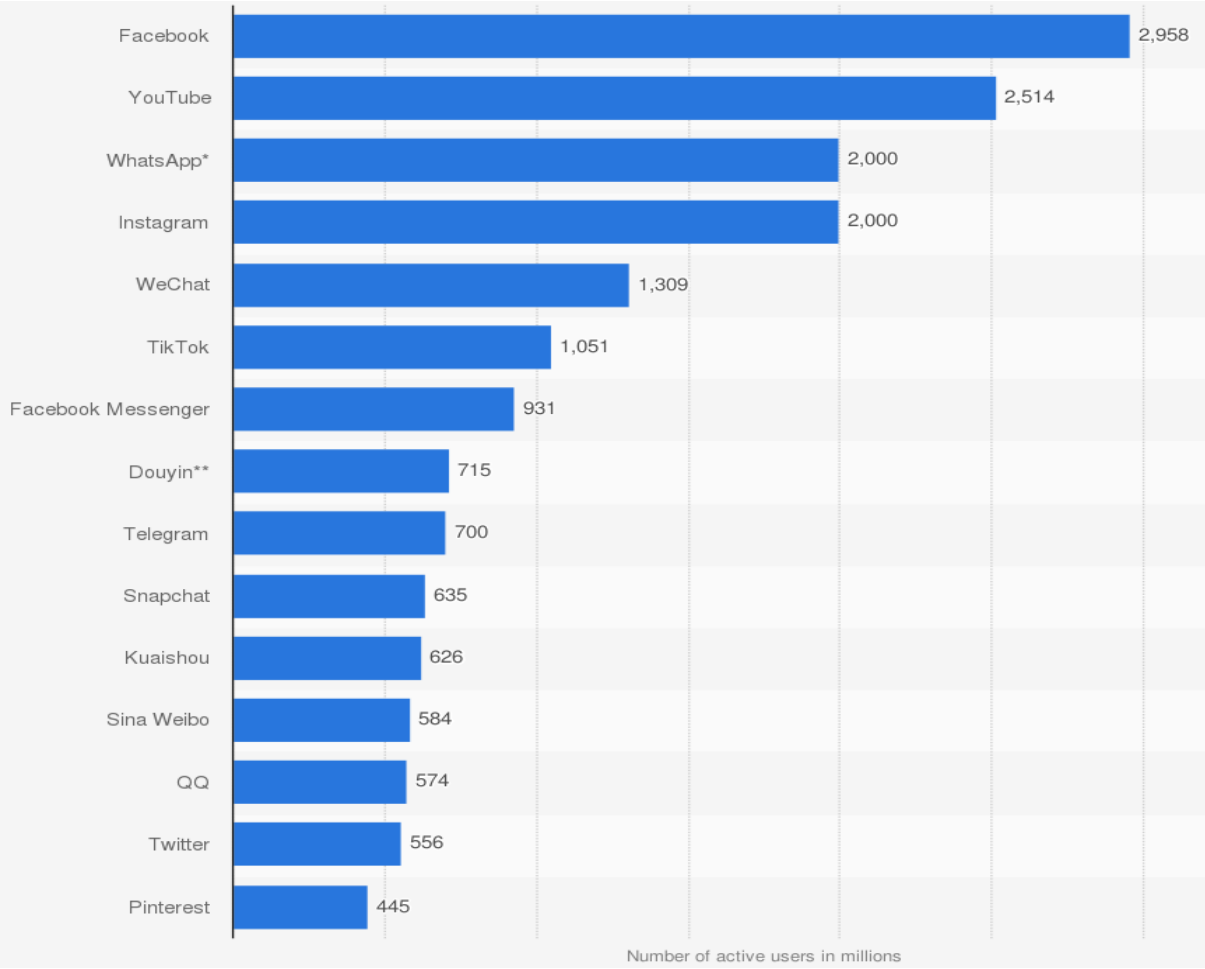
As stated in the divisions of generations above, Generation Z are young people born between 1996 and 2010. These people want unlimited access to information that allows them to explore different topics and deal with current issues. This generation is unique and the most technologically sophisticated. Technological revolution was identified as a major influence for this cohort (Sakdiyakorn M. et al 2021).They have grown up in a world of opportunity, technology and social networking and have a slightly selfish worldview.
Generation Z prefers a work environment that allows them to be flexible and work online from home. At the same time, they have a huge purchasing power.

The word specificity best describes Generation Z. These Zoomers are a certain unique group of young adults and teenagers who have their own characteristics:

- freedom and the freedom to choose,
- having enough of everything
- they want to do things their way,
- preference for convenience,
- a life of integrity,
- preference for conversation,
- scrutinize the employer and the company,
- need fun,
- are fast,
- innovations are part of their daily lives (Tapscott D. 2009).

The strength of Generation Z is the ability to quickly navigate technologies, and the weakness of this technologically capable population is a lack of communication skills (Bejtkovsky J. 2016). Generation Z uses notebooks, smart phones, game consoles, and they take the Internet for granted (Grešková P. 2017). Generation Z is well prepared for the global entrepreneurial environment, and they are interested in advancing the world and leading it into the future. In companies, Generation Z brings new ideas, trends, creativity and entrepreneurship. Social networks are natural to them, they have grown up with them through online sources such as Facebook, Youtube, WhatsApp, Instagram, Tik Tok, etc.

Graph 2: Most popular social networks worldwide as of January 2023, ranked by number of monthly active users *(in millions)*



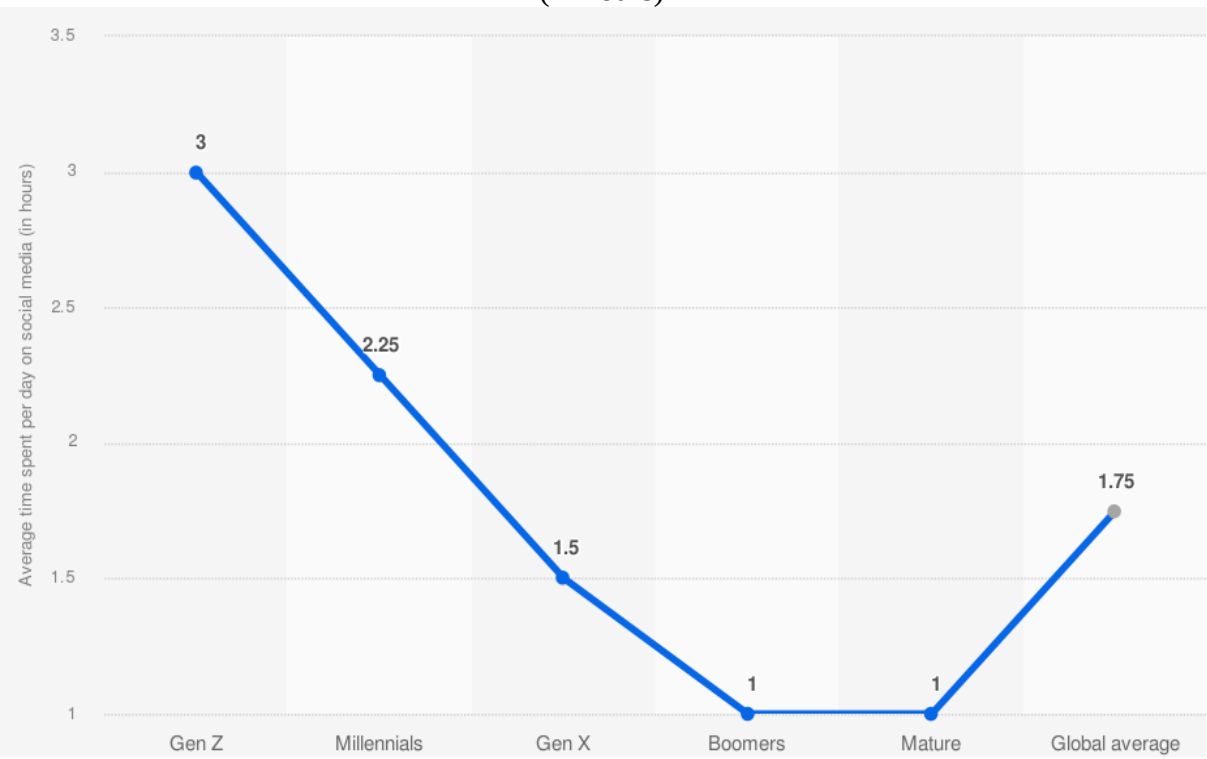
Source: We Are Social, & DataReportal, & Meltwater. (January 26, 2023). Most popular social networks worldwide as of January 2023, ranked by number of monthly active users (in millions) [Graph]. In Statista. Retrieved May 08, 2023, from https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/

Market leader Facebook was the first social network to surpass the one billion registered accounts mark and currently has more than 2.9 billion monthly active users. Meta Platforms owns four of the largest social media platforms, all of which have over one billion monthly active users: Facebook (core platform), WhatsApp, Facebook Messenger and Instagram. In the last quarter of 2022, Facebook reported over 3.7 billion monthly users of its core family product (Statista 2023).

TIME SPENT ON SOCIAL NETWORKS BY GENERATION IN THE WORLD

Representatives of Gen Z are used to communicating via the Internet, they do not prefer face-to-face meetings. A study by Deloitte (2023) found that half of all Gen Zs and Millennials agree with the statement that online experiences are a meaningful substitute for face-to-face experiences. Thus, online experiences have become a meaningful part of their lives, communication takes place through social networks and the positive thing about Generation Z is their ability to quickly navigate technologies (Digital media trends 2023). They can look up anything on social networks, whether it is necessary for their personal life or for work. Generation Z likes to work in a virtual world where they are part of a virtual team via webcams and webinars. Companies are creatively using social networks to promote sales of products and services to customers online. It should be noted that virtual technologies are increasingly being used to share ideas, develop products and create new employment opportunities for future generations.

Graph 3: Average hours spent on social media per day worldwide by 2022 by generation (in hours)



Source: DIW. (February 13, 2022). Average amount of hours spent per day on social media worldwide as of November 2021, by generation (in hours) [Graph]. In *Statista*. Retrieved May 28, 2023, from https://www.statista.com/statistics/1314973/global-daily-time-spent-on-social-media-networks-generation/

According to a 2022 global survey, Generation Z respondents reported spending an average of three hours per day on social media. Millennials overall reported spending 2.25 hours per day on online social platforms. Members of Generation X spent 1.5 hours per day, and the Baby Boomer generation spent an average of one hour per day on social media (Statista 2023).Morning Consult conducted a similar survey in November 2022 among Americans aged 13 to 25. The survey focused on the extent to which young people use one site in particular: social media. From the total number of respondents "Fifty-four percent of Gen Zers said they spend at least four hours daily on social media, and almost 2 in 5 (38%) spend even more time than that.Nearly 9 in 10 (88%) said they use Alphabet Inc.'s YouTube, making it the generation's most-used social platform by a wide margin. Meta Platform Inc.'s Instagram ranked second, used by roughly three-fourths (76%) of Gen Zers (Briggs E. 2023)."Our assumption that representatives of Gen Z use social networks the most was confirmed by this survey.

GEN Z AS CUSTOMERS IN THE ONLINE ENVIRONMENT

Companies try to reach as many consumers/customers as possible. In practice, there are various ways and forms, but with the evolution of time, marketers need to change both approach and tactics to reach the emerging generation. With traditional marketing methods not working, marketers are looking for the best ways to appeal to Generation Z.

"Gen Z often has a very different attitude toward consumption, shaped by the fact that they grew up chronically online and came of age in the midst of a global pandemic (Alves Ch. 2023)."Marketers are trying to reach Gen Z consumers/customers who spend most of their time online - on social networks, via the online world. This method of communication is obviously successful, as the 2022 survey data also shows that nearly 80% of Gen Z and Millennials have purchased something they saw on social media (Statista 2023).

Compared to previous generations, Generation Z is shopping differently as the largest possible group of consumers. Macura discusses 11 strategies for marketing to Generation Z:

1. Create channel-specific content - share content on Instagram with the Instagram audience in mind (there are aspirational posts on Instagram and content needs to be customized accordingly)
2. Keep it short - Generation Z has a short attention span
3. Use a lot of video - to reach this generation, it's tremendously effective
4. Go for authenticity - Generation Z prefers brands that are authentic and fun, too
5. Be transparent and accountable - brand credibility is very important to this generation of consumers
6. Go to influencers - influencers are a must in the marketing budget because they bring the community you want to reach
7. Invite Gen Z to participate in marketing - this kind of transparency creates real and lasting bonds
8. Get everyone involved in creating something
9. Be fun and adventurous
10. Use user-generated content - use images of real people and real customers, rather than a Photoshopped stock image
11. Do not give up on omnichannel marketing - even though Gen Z lives in an online world, they still like to store in a physical store (Macura A. 2022).

An appropriate marketing philosophy that employs strategies and practices to attract potential customers is inbound marketing. This term refers to an activity that aims to attract customers to the website through interesting and useful content. This marketing strategy seeks to create a positive relationship between people and the brand, to entertain, educate and actively engage them in a discussion or in solving a problem. The foundation of inbound marketing is high-quality and relevant content in the form of blog posts, social media activity, and website optimization for search engines (Marketingový slovník 2023).

Inbound marketing focuses on the needs of the customer or potential customer, it provides a systematic process that, thanks to various channels (SEO, PPC, social networks), ensures that the target audience finds this content and, thanks to them, likes the brand and, in the process

- attract people (ATTRACT) to become our visitors,
- they create a path through the site to achieve the goals,
- their conversion (CONVERT) into our contacts,
- the subsequent sale (CLOSE) of a service or product,
- to turn them into customers whose activities we enjoy for a long time (DELIGHT) and thus make them fans of our brand (Inbound marketing 2023).

From the above facts, we can conclude that the best way to reach Gen Z consumers is through social networks. If we use them wisely, we will effectively reach Gen Z consumers.

CONCLUSION

Rapid changes, new trends and technologies in the global labor market are forcing companies to employ Generation Z more in order to remain competitive. Also, the marketing activities of companies in order to reach customers must be directed to the online environment. Generation Z feels comfortable and natural in the virtual world and social networks. The key to success for companies today is to understand Generation Z's values and build a relationship with them. They get along well in a team, are a part of our social community, and they like to work in a team, moreover, they have a strong bond with the web, applications and social networks. It is the generation of the future, we need to understand their behavior.

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LITERATURE

1. GRENCIKOVA, A. – NAVICKAS, V. – SPANKOVA, J. – KRAJCO, K. The motivation of different employee generations: A case of the spa industry. *Entrepreneurship and Sustainability Issues*. Vol 10, No 1, p. 80-90. ISSN 2345-0282, Retrieved April 28, 2023 from http://jssidoi.org/jesi
2. ZEMKE, R. – RAINES, R. – FILIPCZAK B. Generations at Work: Managing the Class of Veterans, Boomers, Xers, Nexters in your Workplace. USA : AMACOM. 1999. s. 3
3. Statista - The Statistics Portal. Retrieved May 06, 2023, from https://www.statista.com/statistics/278341/number-of-social-network-users-in-selected-countries/
4. Sakdiyakorn, M. – Golubovskaya, M. – Solnet, D. Understanding Generation Z through collective consciousness: Impacts for hospitality work and employment. *International Journal of Hospitality Management*, Vol 94, 102822, 2021, p. 1-13. ISSN 0278-4319, https://doi.org/10.1016/j.ijhm.2020.102822
5. TAPSCOTT, Don. Grown up digital. New York: McGraw Hill, 2009. 384 s. ISBN 978-007-150863-6.
6. BEJTKOVSKY, J. The employees of Baby Boomers Generation, Generation X, Generation Y and generation Z in selected Czech corporations as conceivers of development and competitiveness in their corporation. *Journal of Competitiveness*, Vol 8, issue 4, pp 105-123. 2016. ISSN 1804-1728, https://doi.org/10.7441/joc.2016.04.07
7. GREŠKOVÁ, P. 2017. Špecifiká generácie y z pohľadu súčasnej spoločnosti, hodnôt a marketingovej komunikácie. 2. s.l. : Fórum manažéra, 2017. ISSN 1339-9403.
8. Statista - The Statistics Portal. Retrieved May 08, 2023, from https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/
9. 2023 Digital media trends: Immersed and connected. [Online]. April 14, 2023. Retrieved May 28, 2023, from https://www2.deloitte.com/us/en/insights/industry/technology/digital-media-trends-consumption-habits-survey.html
10. Statista - The Statistics. Retrieved May 28, 2023, from https://www.statista.com/statistics/1314973/global-daily-time-spent-on-social-media-networks-generation/
11. BRIGGS, E. Gen Z Is Extremely Online. Morning Consult. [Online]. December 12, 2022. Retrieved June 2, 2023, from https://pro.morningconsult.com/instant-intel/gen-z-social-media-usage
12. ALVES, Ch. How Gen Z Are Using Social Media. In Search Engine Journal - SEO, Search Marketing News and Tutorials, Retrieved June 3, 2023, from https://www.searchenginejournal.com/social-media-gen-z/485152/#close
13. Statista - The Statistics Portal. Retrieved June 3, 2023, from https://www.statista.com/statistics/1260868/social-media-influence-on-shopping-by-generation-us/
14. MACURA, A. Marketing To Gen Z: How To Do It The Right Way. In *Search Engine Journal - SEO, Search Marketing News and Tutorials*. [Online]. November 29, 2022. Retrieved June 5, 2023, from https://www.searchenginejournal.com/marketing-to-gen-z/471784/

15. Marketingový slovník. [Online]. Retrieved June 7, 2023, from https://midasto.sk/inbound-marketing/
16. Inbound marketing. visibility.sk [Online]. Retrieved June 7, 2023, from https://visibility.sk/blog/slovnik/inbound-marketing/

RISK CONTROLLING IN A TIME OF UNPREDICTABLE CHANGES[1]

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Abstract: The burgeoning complexity of the global business environment, characterized by an unprecedented pace of technological innovation and an increasingly unpredictable landscape of risks, necessitates a continuous examination of risk controlling. At the crossroads of technological evolution and unexpected changes, it becomes essential to investigate the capacity of our current risk controlling models to secure the sustainability and competitiveness of enterprises.
In this paper, we explore risk controlling from a comparative perspective, drawing distinctions between the strategies and capacities of large corporations and Small and Medium Enterprises (SMEs). We delve into the organizational structures, risk identification and assessment methods, information flow systems, and the degree of employee involvement in risk management, highlighting the subtle yet significant variances in the risk controlling approach between the two types of enterprises.

Keywords: risk, risk management, risk controlling, SME

INTRODUCTION

In an ever-evolving business landscape marked by uncertainties and varied conditions, risk has embedded itself as an essential facet influencing enterprises across sectors. Businesses striving for growth, sustainability, and resilience must adeptly navigate the challenges of these turbulent times.
The success and sustainability of SMEs not only drive a country's economic progress but also reflect the efficacy of government policies fostering entrepreneurial culture. SMEs, constituting 99% of EU enterprises and significantly contributing to private sector jobs and business benefits, are key to global economic performance. Therefore, enhancing SME sustainability is vital for the broader economy. (Ližbetinová et al. 2020)

Risks permeate every facet of an enterprise's operation, and their impacts are most acutely felt by SMEs - the backbone of global economic growth. The dynamic and unpredictable nature of the business environment complicates decision-making for enterprise leaders. While entrepreneurs often recognize risks, they don't always integrate risk management into their business processes to effectively manage and mitigate these hazards. (Melnyk et al. 2017)

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Individual perceptions and assessments of risk shape risk management approaches and influence their efficacy. An effective risk management process involves risk identification, analysis, assessment, and the development of risk response strategies, which entail the selection and implementation of measures to reduce risk and soften the impact of adverse events. (Rehman, Anwar 2019)

Particularly for SMEs, an effective strategy is paramount as their competitive advantage and performance hinge on it. Enhancing competitive advantage is also tied to the organization's management system, and the performance and effective risk management of SMEs are pivotal to the business strategy. SMEs, due to their limited resources and size, face amplified risks in a globalized context. (Buganová et al. 2023)

1. RISK MANAGEMENT AND RISK CONTROLLING

Effective risk management, a process of risk identification, assessment, and reduction, plays a significant role in achieving competitiveness and sustainability. Despite the inherent unpredictability of future events, systematic risk management enables organizations to understand, assess, and control risks, guiding decision-makers to estimate probabilities and plan preventive measures accordingly. (Buganová et al. 2023)
In view of the numerous corporate crises and insolvency cases, it is clear that many companies do not have adequate risk awareness and in many cases no control over existing uncertainties. With increasing globalization, numerous international partnerships are emerging, which inevitably makes companies interdependent. Thus, political or economic uncertainties abroad can pose a risk to a local company. Similarly, the rapidly changing business environment poses many risks to a company. As more and more international competitors enter an increasingly globalizing market, risks arise for many companies that need to be weighed in time and brought under control appropriately. (Keitsch 2004) This is where controlling comes in. Controlling fundamentally supports management with information and attempts to make recommendations for action based on statistical data. (Schultz 2015)

Especially due to the high cost factors associated with the implementation of innovative and disruptive technologies, the controller is in a position to perform a full-scale upgrade of the IT infrastructure to provide data to the systems for evaluation (through data mining, big data and artificial intelligence [AI], among others). Implementation in controlling is at risk of stagnation due to lack of know-how, competence and ability, low risk appetite or inadequate IT standards, which can lead to failure. Due to the comprehensive transformation of work steps and processes, it is particularly relevant to assess the technology acceptance of controllers in order to factor in their motivation and also exploit the new potentials. Hulla (2019) mentions the risk of cyber attacks and data protection. (Hulla 2019)
Just as controlling is responsible for supporting the management level in achieving the set goals and checking the implementation of the measures introduced, this function can also be transferred to risk controlling, with the only difference that risk controlling fulfils these tasks in relation to risk management. (Wolke 2008) Accordingly, risk controlling supports risk management in achieving the set goals. In addition, it acts as an advisor and supporter of the management levels in all topics related to risks. Accordingly, risk controlling has the task of preparing the company for risks, but it does not take over steering and control decisions. (Winter 2007)

There are many reasons for establishing adequate risk management or risk controlling in a company. It should be mentioned in detail that it is not sufficient to limit risk management to a single staff unit.

2. RISK IDENTIFICATION, ASSESSMENT AND CONTROL

Risk controlling supports risk management by providing selected and suitable instruments. In the following table, some of these instruments can be viewed, whereby a distinction is made between instruments that can be assigned to a specific phase and those that can be used across phases. In the following chart, the risk control phase is not listed, which is due to the fact that this phase is the responsibility of the management and risk controlling "merely" fulfils a supporting function in this phase, e.g. by providing information. (Pedell 2004)

Phase-specific risk controlling instruments		
Risk identification	**Risk assessment**	**Risk monitoring**
Brainstorming Risk checklists Early warning systems Scenario analyses Process chain analyses	Risk portfolio Sensitivity analyses Scoring models Correlation matrices Risk simulation Value at risk Cash flow at risk	Risk reporting Risk recording sheets Risk variance analysis
Cross-phase risk controlling instruments		
Risk-oriented budgeting Risk-oriented performance measures as well as key figures and target systems Risk-oriented balanced scorecard		

Figure 1: Phase-specific and cross-phase instruments (Pedell 2004)

Risk controlling originated from controlling, which is why the instruments were largely adopted from there and adapted to risk management. (Pedell 2004) Depending on the size of the company, the industry, the risk culture and information preferences, different instruments are used. For example, small and medium-sized enterprises (SMEs) tend to use integrated instruments for recording and assessment, while larger companies use separate recording and assessment instruments. The coordination effort is higher here, as the instruments have to be coordinated with each other. Which instruments are actually used also depends on the risk culture of the company or the managers. (Pedell 2004) Some instruments are explained below. In order to remain within the scope of the work, other instruments are excluded from closer consideration.

3. INSTRUMENTS FOR RISK IDENTIFICATION

Within the realm of risk identification, an array of phase-specific tools exists, each vital to the process of identifying potential risks. This exploration will delve into three such instruments: risk checklists, early warning systems, and scenario analyses, to illuminate their distinctive attributes and applications. (Pedell 2004, Diederichs 2010, Diederichs 2010, Diederichs 2010) The concept of risk checklists draws on the idea of a tailored questionnaire - a tool that is at once standardized, yet adaptable over time. By incorporating standardized test grids, diverse facets can be examined and factual information can be systematically verified. The format of the questions posed can be tailored to specific needs, offering flexibility between open and closed types, with the depth of inquiry adjusted as per situational demands.

Early warning systems, another integral tool in the armamentarium of risk identification, are employed to detect both internal and external developments posing risks to the business at the earliest possible stage. (Pedell 2004) The utility of these systems lies in their capacity to gather, process, and convey information about future corporate and environmental developments in a timely manner. These systems are characterized by two primary requisites: the information must be of high quality, revealing cause-and-effect relationships, and it must be up-to-date, ensuring there is ample time to initiate mitigation measures. In the evolution of early detection instruments, a differentiation has emerged, leading to three distinct generations: early detection, early warning, and early action. (Diederichs 2010) While early detection systems identify opportunities, early warning systems highlight potential threats. Early action systems are called upon when detection and warning necessitate countermeasures.

Scenario analyses offer another instrument for risk identification. They simulate varying scenarios of environmental or corporate development, providing an anticipatory outlook on potential future occurrences. This tool is especially useful for preparation in the face of worst-case scenarios. In its application, the scenario analysis often assumes the shape of a funnel. As the projected time moves further into the future, the funnel expands, symbolizing a wider array of possible scenarios or developmental variations. Consequently, the level of uncertainty increases with the temporal distance from the starting point. The range of scenarios spans from best-case to worst-case, with the trend scenario representing the continuation of the observable trend from the starting point. (Klempien 2019)

4. INDUSTRY 4.0 IN RELATION TO RISK CONTROLLING

In the contemporary digital age shaped by Industry 4.0, risk management and control have undergone transformative changes with the advent of influential technologies such as Big Data, Business Analytics (BA), and Artificial Intelligence (AI). (Abée et al. 2020, Heimel, Müller 2019, ICV 2014) Together, these technologies have significantly reshaped our approaches to risk control, fostering a strategic framework that seamlessly merges diverse corporate operations.
Big Data, as defined by ICV, empowers real-time processing and analysis of voluminous, unstructured, and ever-changing data. (Obermaier, Grottke2017)The insights extracted from a multitude of internal and external sources serve as a credible basis for value-driven decision-

making. The orchestration of different data formats helps in statistically comparing various facets of data, thus contributing to inform corporate planning and risk control. (Schön 2018)
Amalgamated with this, Business Analytics (BA) and Artificial Intelligence (AI) provide an integrated system that bolsters the forecasting and evaluation capabilities integral to risk control. BA, with its diverse set of analytical forms—descriptive, diagnostic, real-time, predictive, and prescriptive—proffers accelerated and accurate results. These results prove beneficial for making informed decisions in complex situations, and thus, help in anticipating and controlling risks. (Martins et al. 2020, ICV 2016, Mehanna et al. 2016, Lanquillon, Mallow 2015)
AI, on the other hand, presents a paradigm shift in our approach to risk control. The technology simulates the cognitive processes and actions of the human nervous system, providing a flexible spectrum ranging from assisted intelligence, which automates simple tasks, to autonomous intelligence, capable of making decisions independently. (Treitz, Seufert 2019, Rice 2020) AI's capabilities of unsupervised learning bring forth a wealth of opportunities, thereby enhancing efficiency and precision in risk control.

Simultaneously, the combined applications of these technologies also present an array of automated analytical methods like regression analyses, structural equation models, contingency models, variance analyses, and more. This ensures quick access to statistical results that are invaluable in identifying and controlling potential uncertainties and risks.
Risk control processes have also become more dynamic with the implementation of strategic functions such as Analysis, Forecast, Optimisation, Simulation, and Radar Analyses. The Analysis stage leverages BA methods to evaluate the relevance and complexities of data, while the Forecast function, through predictive analytics, machine learning, and data mining, creates accurate predictions of future risks. (Mehanna et al. 2016, Gentsch, Kulpa 2016, Mehanna et al. 2016, Buschbacher (2016)
The Optimisation phase taps into real-time data and intelligent machine learning for continuous risk mitigation, whereas Simulation uses Industry 4.0 technologies to generate driver models, studying the impacts of various scenarios on company operations. Lastly, Radar Analyses offer a detailed understanding of the competitive environment and market trends, forming a critical part of long-term risk control.
In essence, the convergent applications of key technologies of Industry 4.0 have revolutionized risk control, enhancing the ability to identify, manage, and coordinate uncertainties. This integrated approach, pivoting on data-driven insights and digital innovation, has simplified management advice, improved decision-making, and robustly fortified risk control.

5. RESEARCH AND METHODOLOGY

The core objective of this research was to comparatively examine the approaches to risk management and risk controlling between Small and Medium-sized Enterprises (SMEs) and larger corporations.
Recruitment of these experts was conducted through the professional social networking site LinkedIn, within the period of 1 January 2021 to 30 April 2021. Eligibility as an expert was ascertained based on the information available on their LinkedIn profiles. From the pool of 33 managers that were initially contacted, 22 expressed interest in participating in this empirical study. Further screening was then applied, leading to the exclusion of four participants who, despite their initial interest, did not demonstrate the necessary level of professional expertise or requisite background knowledge on the topic. Additionally, seven interviews were deemed

to be of insufficient quality and thus excluded. Consequently, a final total of 11 interviews were deemed appropriate for inclusion in this research.
In order to ensure the credibility of the research, a predefined selection criterion was employed in the recruitment of participants.

The research methodology employed the use of MAXQDA analytics software to execute a thorough qualitative content analysis of the expert interviews. This allowed us to extract pivotal themes and insights from the data, distilling the essence of the expert perspectives into an accessible summary. The findings from this analysis thus inform our understanding and inform the conclusions drawn in this research.

Regarding the use of management techniques and tools to identify, assess and control entrepreneurial risks, the interviewed managers from large companies said the following:

Experts	**Identification, assessment and control of entrepreneurial risks - large companies**
E2, E4, E5, E6	Risk management department and culture
E6, E9, E10	Risk analysis and analysis tools

Table 1: Dealing with risks - large companies

In the context of management techniques and tools that can be used in an SME to identify, access and manage entrepreneurial risks, the following was stated.

Experts	**Identification, assessment and management of entrepreneurial risks - SMEs**
E1 E11	External network structures
E7	Further training for employees
E7	Briefings with staff
E11	Digital analysis tools indeterminate
E12	No risk management

Table 21: Dealing with risks - SMEs

6. DISCUSSION AND CONCLUSIONS

Upon comparing risk management approaches between large companies and Small and Medium Enterprises (SMEs), distinct differences were observed. Typically, large companies have specialized risk management departments bolstered by risk controlling, a luxury often not afforded by SMEs. Instead, in SMEs, risk handling is commonly the prerogative of the management team as a whole. This fundamental difference in approach speaks to the varying structures and capacities between the two categories of enterprises.

Furthermore, the information flow structure in large corporations often relies on decentralized managers, the risk owners, who serve as critical nodes of communication between departments and executive management. This system of information exchange provides a robust framework for identifying, assessing, and managing risks.
Contrasting this, the approach to risk analysis also varies between these businesses. All companies, regardless of size, employ statistical analysis tools; however, large corporations typically adapt these tools to their specific needs, a practice seldom found in SMEs. That said, employee involvement in the risk management process through brainstorming sessions and discussions is a common practice across all types of companies.

In an era characterized by rapid technological change and high uncertainty, risk management has become even more crucial. Standards such as ISO: 31000 have been designed to operationalize the management of uncertainties, thereby integrating them into strategic planning and operational execution. Yet, as illustrated by the case of Lufthansa during the 2020 Covid-19 pandemic, good risk management does not necessarily equate to complete protection for a company. Even with the most robust risk management strategies and digital technologies for risk identification, assessment, and control, companies can find themselves facing scenarios that completely upend their business models. Risk controlling complements risk management by providing statistical analyses that underpin decision-making. Nonetheless, it's important to recognize that even the most comprehensive risk management and risk controlling strategies cannot guarantee entrepreneurial security. Unpredictable external influences can still pose significant threats, reiterating the necessity of a robust and adaptable risk management strategy.

In today's data-driven economy, the massive influx of structured and unstructured data available for SMEs paves the way for more informed decision-making processes. This, in turn, enhances operational efficiency and reduces risks. The real-time analysis and predictive capabilities offered by AI and BA facilitate a dynamic risk assessment, enabling SMEs to anticipate and mitigate potential threats. This could range from market trends to competition and even internal operational risks. It can also help them avoid human errors and enhance the efficiency of their operations, thereby decreasing operational risks. Further, AI's predictive capabilities could enable SMEs to foresee and prepare for market trends, ensuring they aren't caught off-guard. The affordability and accessibility of these technologies are continually improving, allowing SMEs to tap into capabilities that were previously available only to large enterprises. As such, the gap in risk management capabilities between SMEs and larger companies is expected to decrease, further leveling the competitive field.

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REFERENCES

Abée, S., Andrae, S., Schlemminger, R. B. (2020): Strategisches Control-ling 4.0 - Wie der digitaleWandelgelingen, Wiesbaden.

Buganová, Katarína, MáriaHudáková, Jana Šimíčková, and Erika Mošková. (2023) Disparities in the Implementation of Risk Management in the SMEs. Systems 11, no. 2: 71

Buschbacher, F. (2016): Wertschöpfungmit Big Data Analytics, publis-hed in: Schäffer, U., Weber, J. (eds.): Big Data - Zeitwende für den Controller, Wiesbaden, pp. 40-45.

Diederichs, M. (2010): Risikomanagement und Risikocontrolling, Risk Controlling - einintegrierterBestandteileinermodernenRisi-komanagement-Konzeption, 2nd edition, Munich.

Gentsch, P., Kulpa, A. (2016): Unlocking new opportunities with external Big Data, published in: Schäffer, U., Weber, J. (eds.): Big Data - Zeitwende für den Controller, Wiesbaden.

Heimel, J., Müller, M. (2019): Controlling 4.0 - Wie veränderteDatenver-fügbarkeit und Analysemöglichkeiten das Controlling erneuern, published in: Erner, M. (ed.): Management 4.0 - Unternehmens-führungimdigitalenZeitalter, Wiesbaden, pp. 389-430.

Hulla, C. (2019): Digitale Transformation - 3 Implementierungsrisiken, die Vorstand und Aufsichtsratkennensollten, available online at: https://diligent.com/de/blog/digitale-transformation-3-implementierungsrisiken/ (30.04.2021).

ICV (2014): Big Data - Potential for the Controller. In: Dream Car of the Ideas Workshop at the ICV 2014, Wörthsee.

ICV (2016): Business Analytics - The path to data-driven corporate ma-nagement. In: Dream Car of the ICV Ideas Workshop 2016, Wörthsee.

Keitsch D. (2004): Risikomanagement, 2nd edition, Stuttgart.

Klempien, D. (2019): Scenario analyses, retrieved on: 08.08.2018, available at: http://www.controllingportal.de/Fachinfo/Grundlagen/Szenario-Analyse.html (30.04.2021).
Klingbein-Döring, W. (2020): Techni-scherFortschritt und Industrie 4.0, available online at: https://www.bpb.de/politik/innenpolitik/arbeitsmarktpolitik/315869/technischer-fortschritt-und-industrie-4-0 (30.04.2021).

Lanquillon, C., Mallow, H. (2015): Advanced Analytics mit Big Data, published in: Dorschel, J. (ed.): Praxishandbuch Big Data - Wirt-schaft - Recht - Technik, Wiesbaden.Martins, A., Silva, A. P., Fontes, A. (2020): A Paradigm Shift in Account-ing and Auditing in the Era of Big Data, Boca Raton.

Ližbetinová, L.; Štarchoň, P.; Weberová, D.; Nedeliaková, E.; Juříková, M. The approach of SMEs to using the customer databases and CRM: Empirical study in the slovak republic. Sustainability 2020, 12, 227

Mehanna, W., Tatzel, J., Vogel, P. (2016): Business Analytics in Control-ling - Five Fields of Application, published in: Controlling, 28, pp. 502-508.

Melnyk, O.; Sroka, W.; Adamiv, M.; Shpak, Y. 2017. Information Diagnostic Support of Enterprise Under the Conditions of Uncertainty. J. Mendel. Univ. Agric. For. Brunn. 2017, 65, 1403–1414.

Obermaier, R., Grottke, M. (2017): Controlling in an "Industrie 4.0" - New opportunities and new limits for the management of compa-nies, published in: Seiter, M. et al. (eds.): BetriebswirtschaftlicheAspekte von Industrie 4.0., Wiesbaden, pp. 111-148.

Pedell B. (2004): RisikointerdependenzenalsAnsatzpunkt für Aufgaben und Instrumente des Risikocontrollings, published in: Control-ling und Management, 48th Jrg, Wiesbaden.

Rehman, A.U.; Anwar, M. 2019 Mediating role of enterprise risk management practices between business strategy and SME performance. Small Enterp. Res. 2019, 26, 207–227.

Rice, D. (2020): Assisted Intelligence vs. Augmented Intelligence and Auto-nomous Intelligence, available online at: https://fedtechmagazine.com/article/2020/01/assisted-intelligence-vs-augmented-intelligence-and-autonomous-intelligence-perfcon (30.04.2021).

Schön, D. (2018): Planning and reporting in BI-supported controlling. 3rd edition, Wiesbaden.

Schultz, V. (2015): Controlling - Das Basiswissen für die Praxis, 2nd edi-tion, Wiesbaden.

Treitz, R., Seufert, A. (2019): Artificial intelligence for controlling - a forward-looking solution?, published in: isreport, pp. 28-31

Winter, P. (2007): Risikocontrolling in Nicht-Finanzunternehmen, Ent-wicklungeinertragfähigenRisikocontrolling-Konzeption und VorschlagzurGestaltungeinerRisikorechnung, published in: Lingnau, V., Becker, A. (eds.): Controlling, Cologne.

Wolke, T. (2008): Risk Management, 2nd edition, Munich.

A GREEN ECONOMY AND SUSTAINABLE DEVELOPMENT PERSPECTIVE OF AGRICULTURE IN WESTERN BALKANS[1]

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Abstract: Agriculture is a crucial sector for economic growth and development in the Western Balkans and it plays a significant role in the economy of this region, providing livelihoods for a significant portion of the population and contributing to the region's overall economic development. However, the sector is facing a range of challenges that threaten its long-term sustainability, including environmental degradation, climate change, and social and economic inequality. To address these challenges, a green economy and sustainable development perspective can provide a framework for promoting agricultural development while preserving the region's natural resources and improving social equity. This perspective emphasizes the importance of environmentally friendly and socially responsible agricultural practices, as well as the need for sustainable resource management and the development of renewable energy sources.

In this paper, it will be explored the challenges and opportunities for implementing a green economy and sustainable development perspective in the agricultural sector in the Western Balkans. It will be examined the potential for developing sustainable agricultural practices, promoting renewable energy sources, improving resource efficiency and enhancing social equity in the sector. Analysis will draw on a range of literature sources, including case studies, policy papers and academic research. It will be examined best practices and successful examples from other regions and countries, as well as the unique challenges and opportunities that exist in the Western Balkans. Ultimately, the aim is to provide insights and recommendations for policymakers, agricultural practitioners and other stakeholders on how to promote sustainable agricultural development in the region. By leveraging the principles of a green economy and sustainable development, it can be ensured that agriculture in the Western Balkans continues to be a vital and sustainable source of economic growth and development for generations to come.

Key words: agriculture, green economy, sustainable development, environmental degradation, resource efficiency, social equity, renewable energy sources.

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INTRODUCTION

In the Western Balkans, agriculture and related sectors account for an average of about 10% of GDP, while in some countries the number of employees in agriculture, forestry and fishing accounts for about 20% of the total workforce. In the case of Albania, that share is 40%. However, despite the very high potential of natural resources, the agricultural sector in this countries faces with numerous challenges, so large farms are very rare, and labor productivity and yields of agricultural crops are at a very low level due to the application of inadequate technology, insufficient technical equipment, production processes with the absence of modern standards and the like. At the same time, the demand for food is growing, both in terms of quality and quantity. Bearing in mind the growing tourist market and the great export potential of these countries, the Green agenda emphasizes the importance of applying European Union standards in the agri-food and primary production sector, especially in the part related to food safety, plant and animal health, improving the biological safety of livestock farms, prevention and care of animals and improvement of facilities for agricultural production. What is also necessary to do in this field is the strengthening of sanitary controls along the entire food production chain, as well as the establishment and maintenance of an electronic food certification system in order to ensure its safety. The Agenda also indicated that more intensive work should be done on raising consumer awareness and promoting the concept of sustainable nutrition. Therefore, more work should be done to promote food whose production is safe for the environment and organically grown, as well as to reduce the use of synthetic chemical substances during food production: pesticides, veterinary drugs and mineral fertilizers.
The Agenda also emphasizes the need to strengthen cooperation between scientific and educational institutions with producers and processors in the agri-food sector in order to facilitate the transition to innovative and environmentally friendly technologies and farming methods.

This concept paper aims to explore the current state of agriculture in the Western Balkans from a green economy and sustainable development perspective.

MATERIALS AND METHODS

This paper used a literature review approach to examine the current state of agriculture in the Western Balkans from a green economy and sustainable development perspective. The review included published articles, reports and case studies from various sources, including international organizations, academic publications and government reports. The paper also analyzed the methodologies used in existing studies to understand how researchers have examined the issues of sustainable agriculture in the Western Balkans. Kajikawa and Takeda (2020) used a literature review to examine the current situation of agriculture in the Balkans, and conducted interviews with stakeholders to understand the challenges and opportunities for promoting sustainable agriculture practices. Teixeira and Santos used a literature review and qualitative analysis of policy documents to examine the role of sustainable agriculture practices in rural development in the Western Balkans. Schipanski and Drinkwater (2020) used a literature review and case studies to explore opportunities and obstacles for agricultural diversification in the Western Balkans, and to identify successful examples of agroecological

practices. Ivanov and Kroumova (2019) used a literature review and stakeholder interviews to examine the current status and prospects of green agriculture in the Western Balkans.
The second part of the data was collected using the focus group methodology. The focus group method refers to qualitative methods of information gathering and is based on the use of the effect of group dynamics. The application of this method involved a group discussion led by a moderator. The main advantage of this method is the possibility of quickly obtaining so-called in-depth information in a small group of respondents. The essence of the method is that the attention of the participants is directed to the problem under study in order to determine the attitude towards the problem and to find out the motivation for certain actions.
In this case, two online focus group sessions were organized. In the focus group, the methods of in-depth group interviews are used, which allow "extracting" information from the respondents that is not on the surface and shows a wide range of attitudes towards the problem. Five respondents participated from each of the six Western Balkan countries. The participants were selected based on their importance in solving problems related to the green economy and the perspective of sustainable development in this region. Thus, in each country, a group of the five main stakeholders participated in the online sessions: representatives of agricultural producers, representatives of the state sector, representatives of non-governmental organizations, representatives of the banking sector, and representatives of the legislative authority. The method of a structured focus group was used, taking over the work of the moderator based on a prepared agenda with specifically defined questions on the topic. Nela and Beqiraj (2021) used a qualitative case study approach to examine the role of eco-agriculture practices in promoting sustainable rural development in the Western Balkans, using interviews with farmers and other stakeholders.

RESULTS AND DISCUSSION

Agriculture is an important sector in the Western Balkans, with around 25% of the population engaged in farming (data for each country individually are given in Table 1). The region produces a variety of crops, including cereals, fruits, vegetables, and livestock. On the other hand, agriculture is a significant contributor to greenhouse gas emissions in the Western Balkans, accounting for around 13% of total emissions. Methane emissions from livestock and nitrous oxide emissions from fertilizer use are the main sources of emissions in the sector (United Nations Environment Programme, 2020).

The value of agricultural production expressed as a percentage of the total GDP ranges from 20, which is for Albania, to 7, which is in Montenegro (Table 1). Bogdanov et al. (2017) obtained similar data for the countries of the Western Balkans. In the Republic of Serbia, the total gross value of agricultural production in 2019 was 5.5 billion USD; in Albania, agricultural production represents the basis of the social welfare of the population and the unemployment protection system, while in Bosnia and Herzegovina 20% of the population is employed in the agricultural sector. Montenegro has a significant participation of the agricultural sector in its GDP (8%), while in the Republic of North Macedonia agriculture participates with 13% of GDP (Petrović and Ćirić, 2021). The percentage of the population employed in agriculture is the highest in Albania, 40%, while the lowest is in Montenegro, where it is 14% (Table 1). In research from 2017, Nikolić et al. came to similar percentages, which indicate that the number of employees in the agricultural sector has not significantly decreased in the last few years.

The Western Balkans region has significant potential for renewable energy, particularly hydropower and wind power (Trendov and Vasa, 2015). Several countries in the region have set targets to increase the share of renewable energy in their energy mix, which could provide opportunities for renewable energy in agriculture. This region also has significant potential for organic farming, which could provide environmental and economic benefits. Organic farming is very important for achieving the Sustainable Development Goals in this sector in the Western Balkans region, as it aims to change the design of the entire food system to achieve environmental, economic and social sustainability (Djokic et al., 2022). However, the adoption of organic farming practices is currently low in the region, with only a small percentage of agricultural land under organic production. Forests cover around 40% of the Western Balkans region, providing important environmental and economic benefits. However, deforestation and forest degradation are significant challenges, with around 80% of forests in the region facing some form of degradation. Qineti and Gruda (2021) discuss about agroecological practices that can be used to promote sustainable agriculture in the Western Balkans, and suggest that these practices can improve soil health, increase crop productivity, and reduce environmental impacts.

The Western Balkans is a biodiversity hotspot, with a rich variety of plant and animal species. However, agricultural intensification, habitat loss and climate change are all threats to biodiversity in the region.

Table 1. Country-specific data on agriculture and green economy in the Western Balkans

COUNTRY	AGRICULTURAL LAND (% OF THE TOTAL LAND AREA)	VALUE OF AGRICULTURAL PRODUCTION (% OF GDP)	EMPLOYEES IN AGRICULTURE (% OF THE POPULATION)
Albania	56	20	40
Bosnia and Herzegovina	54	10	20
Kosovo*	56	12	40
Montenegro	37	7	14
North Macedonia	43	11	18
Serbia	55	10	20

*All references to Kosovo, whether to territory, institutions or population, in this text shall be understood in full compliance with United Nations Security Council resolution 1244 and without prejudice to the status of Kosovo.

Albania has set a target to increase the share of renewable energy in its energy mix to 38% by 2020. Bosnia and Herzegovina has significant hydropower potential, with around 40% of its electricity generated from hydropower. Kosovo* has significant potential for solar and wind power, but the development of renewable energy sources is still in its early stages. Montenegro has set a target to increase the share of renewable energy in its energy mix to 33% by 2020. North Macedonia has significant potential for hydropower and wind power, and has set a target to increase the share of renewable energy in its energy mix to 28% by 2020. It's important to note that these data can vary depending on the source and the year of the

data, and there may be other factors and nuances to consider when analyzing the agriculture and green economy in each country.

The following table summarizes data on agriculture and greenhouse gas emissions in the Western Balkans:

Table 2. Agricultural land area, agricultural productivity, greenhouse gas emissions from agriculture

COUNTRY	AGRICULTURAL LAND AREA (HECTARES)	AGRICULTURAL PRODUCTIVITY (TONNES PER HECTARE)	GREENHOUSE GAS EMISSIONS FROM AGRICULTURE ($MTCO_2E$/YEAR)
Albania	786,000	3.74	3.62
Bosnia and Herzegovina	2,784,000	2.66	8.20
Kosovo*	388,000	3.23	1.42
Montenegro	100,000	2.31	0.51
North Macedonia	1,079,000	3.38	3.13
Serbia	5,065,000	2.92	17.54
Total	**10,202,000**	**3.04**	**34.42**

Source: Data on agricultural land area and productivity are from the World Bank (2021), while data on greenhouse gas emissions from agriculture are from the FAO (2017).

Table 2 shows that Bosnia and Herzegovina has the largest agricultural area, while Serbia has the highest GHG emissions from agriculture. Albania, however, has the highest agricultural productivity, suggesting that agricultural practices there may be more efficient. These data can serve as a starting point for further analysis and research on the state of agriculture and the green economy in the Western Balkans. Also, it is very important to emphasize investments in agriculture. According to the data obtained by Erjavec et al. (2021), the most pronounced increase in the real value of total support was recorded in Kosovo*, where between 2010-17. increased by 337%. They are followed by Montenegro (57%), North Macedonia (50%), Albania (48%), Serbia (11%) and Bosnia and Herzegovina (3%).

Tables 3 and 4 present some other statistical data that may be useful for understanding the state of agriculture and the green economy in the Western Balkans.

Table 3. Top agricultural products produced in Western Balkans countries

COUNTRY	TOP AGRICULTURAL PRODUCTS
Albania	Grains, Vegetables, Fruits
Bosnia and Herzegovina	Cattle, Wheat, Corn
Kosovo*	Wheat, Maize, Vegetables
Montenegro	Grapes, Olives, Cattle
North Macedonia	Grapes, Apples, Peppers
Serbia	Maize, Wheat, Sunflower

Source: Data on agricultural land area and productivity are from the World Bank (2021), while data on greenhouse gas emissions from agriculture are from the FAO (2017).

Table 4. Renewable energy production in Western Balkans countries

COUNTRY	RENEWABLE ENERGY PRODUCTION (GWH)
Albania	3,288
Bosnia and Herzegovina	2,310
Kosovo*	0
Montenegro	1,090
North Macedonia	380
Serbia	1,964

Source: Data on agricultural land area and productivity are from the World Bank (2021), while data on greenhouse gas emissions from agriculture are from the FAO (2017).

As shown in Table 3, most countries in this region produce cereals, fruits, and vegetables, with the exception of Bosnia and Herzegovina, where cattle production ranks first. In terms of renewable energy production (Table 4), Albania ranks first with 3,288 GWh, followed by Bosnia and Herzegovina, Serbia, Montenegro, and Northern Macedonia.

Table 5. showing the agricultural land use in the Western Balkans countries based on data from the World Bank.

Table 5. Agricultural land use in the Western Balkans countries

COUNTRY	AGRICULTURAL LAND (% OF LAND AREA)
Albania	44.9
Bosnia and Hercegovina	41.7
Kosovo*	53.9
Montenegro	37.6
North Macedonia	53.3
Serbia	56.9

Source: World Bank (2021). Agriculture, forestry, and fishing, value added (% of GDP). Retrieved from https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS

Serbia has the highest percentage of agricultural land in relation to the total area - 56.9, while Montenegro has the lowest percentage - 37.6 (Table 5).

Various data are available that shed light on the impact of environmental factors on farms in the Western Balkans. An example is a Table 6 showing the percentage of farmland affected by soil degradation in the Western Balkans.

Table 6. Percentage of agricultural land affected by soil degradation in the Western Balkans countries

COUNTRY	PERCENTAGE OF AGRICULTURAL LAND AFFECTED BY SOIL DEGRADATION
Albania	40%
Bosnia and Herzegovina	31%
Kosovo*	38%
Montenegro	34%
North Macedonia	28%
Serbia	23%

Source: Data on agricultural land area and productivity are from the World Bank (2021), while data on greenhouse gas emissions from agriculture are from the FAO (2017).

This table provides information on the extent of soil degradation in the region, which can have a significant impact on agricultural productivity and the sustainability of agricultural practices.

Data from Tables 7 to 10 indicates the impacts of agriculture on the environment and the economy in the Western Balkans countries.

Table 7: Land use in the Western Balkans (in thousands of hectares)

COUNTRY	AGRICULTURAL LAND	FOREST LAND	OTHER LAND	TOTAL LAND
Albania	770	660	1,450	2,880
Bosnia and Herzegovina	1,252	2,726	1,758	5,736
Kosovo*	361	296	1,055	1,712
Montenegro	113	435	244	792
North Macedonia	725	1,650	1,075	3,450
Serbia	5,467	2,819	2,652	10,938

Source: FAO, 2016.

Table 8: Greenhouse gas emissions from agriculture in the Western Balkans (in Mt CO_2 equivalent)

COUNTRY	2010	2015	2020
Albania	2.5	2.7	2.8
Bosnia and Herzegovina	5.5	5.6	5.7
Kosovo*	1.1	1.2	1.3
Montenegro	0.4	0.4	0.4
North Macedonia	3.3	3.6	3.9
Serbia	14.6	14.9	15.2

Source: World Bank, 2021.

Table 9. Agricultural exports in the Western Balkans (in US$ millions)

COUNTRY	2016	2017	2018
Albania	263	294	337
Bosnia and Herzegovina	903	974	1,102
Kosovo*	49	59	60
Montenegro	41	37	33
North Macedonia	405	486	499
Serbia	2,964	3,408	3,614

Source: International Trade Centre, 2021.

Table 10. Agricultural imports in the Western Balkans countries

COUNTRY	AGRICULTURAL IMPORTS (IN MILLIONS OF USD)
ALBANIA	815
BOSNIA AND HERZEGOVINA	2,522
KOSOVO*	467
MONTENEGRO	140
NORTH MACEDONIA	586
SERBIA	4,498

Source: UN Com trade Database (2021)

In terms of forest area, Bosnia and Herzegovina ranks first with 2,726 thousand hectares, while Kosovo* ranks last with 296 thousand hectares (Table 7). At the same time, Serbia is in the first place in terms of greenhouse gas emissions from agriculture with one tonne of CO_2-equivalent. It is followed by Bosnia and Herzegovina, Northern Macedonia, Albania, Kosovo* and Montenegro, where gas emissions amount to 0.4 million tonnes of CO_2 (Table 8). However, Serbia ranks first in terms of the value of agricultural products. According to 2018 data, the value of exports in this sector in Serbia amounted to $3,614 million (Table 9).

Serbia ranks first in terms of the value of imported agricultural products (Table 10). According to Matkovski et al. (2018), the regional structure of the export of agricultural and food products indicates that the largest part of the export of agricultural and food products of the countries of the Western Balkans was placed on the EU market: for the period 2005 - 2015, in Serbia it was on average 50.2% of exports, Bosnia and Herzegovina 61.0%, North Macedonia 50.2% and Albania 73.1%. In Montenegro, only about 11.6% of agricultural and food products were exported to the EU market.

During focus group meetings, clearly defined questions were asked to all participants in the session in a specific order. Also, all stakeholders discussed with each other and reached conclusions about crucial problems and their solutions in the field of green economy and the perspective of sustainable development of agriculture in this region. Moderators were guided by the following questions:

1. What is the current state of agriculture in the Western Balkans?
2. What are the key challenges facing agriculture in the Western Balkans in terms of sustainability and green economy?
3. How have agricultural practices in the Western Balkans evolved over time, and what are the implications for sustainability and green economy?
4. What are the economic, social, and environmental impacts of agriculture in the Western Balkans?
5. How do policies and regulations in the Western Balkans affect sustainable agriculture practices and green economy?
6. What are the best practices for promoting green economy and sustainable development in agriculture in the Western Balkans?
7. What are the roles of different stakeholders, such as farmers, policymakers, and civil society organizations, in promoting sustainable agriculture practices in the Western Balkans?
8. What is the potential for innovative technologies and practices, such as precision agriculture and agroforestry, to promote sustainability and green economy in agriculture in the Western Balkans?
9. How can the private sector contribute to promoting green economy and sustainable development in agriculture in the Western Balkans?
10. What are the opportunities and challenges for promoting sustainable agriculture practices and green economy in the context of climate change in the Western Balkans?
11. How can international cooperation and partnerships contribute to promoting green economy and sustainable development in agriculture in the Western Balkans?
12. How can sustainable agriculture practices be integrated into broader rural development strategies in the Western Balkans?
13. How can education and awareness-raising initiatives help promote green economy and sustainable development in agriculture in the Western Balkans?
14. How can gender considerations be integrated into efforts to promote sustainable agriculture practices and green economy in the Western Balkans?
15. What are the prospects for scaling up successful sustainable agriculture initiatives in the Western Balkans to achieve broader impact and transformation?

Based on the discussions, the following conclusions were reached:

- There is a need for more comprehensive and up-to-date data on agricultural productivity, greenhouse gas emissions and other indicators of sustainability and green economy in the Western Balkans;
- There is a need for in-depth analysis of the economic, social and environmental impacts of agriculture in the Western Balkans and their implications for sustainable development and green economy;
- There is a need for identification of best practices for promoting sustainable agriculture practices and green economy in the Western Balkans and their scalability and replicability;
- There is a need for analysis of the roles and perspectives of different stakeholders, such as farmers, policymakers, civil society organizations and the private sector, in promoting sustainable agriculture practices and green economy in the Western Balkans;
- There is a need for assessment of the potential of innovative technologies and practices, such as precision agriculture and agroforestry, to promote sustainable agriculture practices and green economy in the Western Balkans;
- There is a need for examination of the opportunities and challenges for promoting sustainable agriculture practices and green economy in the context of climate change in the Western Balkans;
- There is a need for analysis of the policy and institutional frameworks needed to support sustainable agriculture practices and green economy in the Western Balkans;
- There is a need for Identification of the education and awareness-raising needs for promoting sustainable agriculture practices and green economy among farmers, policymakers, and the general public in the Western Balkans.

CONCLUSIONS

A green economy and sustainable development perspective of agriculture in Western Balkans is of paramount importance, as the region has great potential to contribute to the sustainable development goals through its agricultural sector. The agriculture sector is one of the largest employers in the Western Balkans, and it has significant untapped potential for increased productivity and profitability.

In this research we find out and it is evident that the Western Balkans region faces numerous challenges in its agricultural sector, including land degradation, water scarcity, and low productivity. These challenges are compounded by climate change, which further exacerbates the negative impacts on agriculture. Therefore, it is critical to adopt a green economy and sustainable development perspective to address these challenges and achieve sustainable agricultural development in the Western Balkans.

To achieve a green economy and sustainable development perspective of agriculture in the Western Balkans, policymakers and stakeholders must prioritize sustainable land management practices. This includes implementing measures to reduce land degradation and improve soil health. Policies that promote soil conservation, such as reduced tillage, conservation agriculture, and cover crops, should be encouraged. Additionally, investment in water management systems, including irrigation and drainage systems can help address water scarcity in the region.

The adoption of climate-smart agriculture practices is also crucial for sustainable agricultural development in the Western Balkans. This includes using climate-resilient crops and livestock breeds and implementing measures to reduce greenhouse gas emissions from the agricultural sector. Innovative technologies such as precision agriculture, which uses data to optimize farming practices, should be promoted to improve productivity and reduce environmental impacts.

Another essential aspect of sustainable agricultural development is promoting value chains that enhance the value of agricultural products, reduce post-harvest losses, and create opportunities for small-scale farmers. This includes promoting local markets, encouraging investment in processing facilities, and supporting farmers in the production of high-value crops. To achieve sustainable agricultural development in the Western Balkans, it is also essential to prioritize the inclusion of marginalized groups, including women, youth, and small-scale farmers, in agricultural value chains. This can be achieved by providing access to finance, training, and markets. Such inclusion can enhance their income-generating opportunities, reduce poverty, and contribute to the achievement of sustainable development goals.

In conclusion, a green economy and sustainable development perspective of agriculture in Western Balkans is essential for sustainable agricultural development in the region. The adoption of sustainable land management practices, climate-smart agriculture, promotion of value chains, and inclusion of marginalized groups are critical to achieving sustainable agricultural development. Policymakers, stakeholders, and development partners must prioritize these areas to ensure that the agricultural sector in the Western Balkans contributes to sustainable development goals. Agriculture plays a crucial role in the economy of Western Balkans, as it accounts for a significant portion of employment and exports. However, it is also a major contributor to environmental degradation, including deforestation, soil degradation, and water pollution. Therefore, there is a growing need for a transition towards a green economy and sustainable development perspective of agriculture in the region.

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REFERENCES

1. Bogdanov, N., Rodić, V., Vittuari, M. (2017). Structural change and transition in the agricultural sector: Experience of Serbia. Communist Post Communist Stud. 50, 319–330.
2. Đokić, D., Novaković, T., Tekić, D., Matkovski, B., Zekić, S., Milić, D. (2022). Technical Efficiency of Agriculture in the European Union and Western Balkans: SFA Method. Agriculture 2022, 12, 1992.
3. Erjavec, E., Volk, T., Rednak, M., Ciaian, P., Lazdinis, M. (2021). Agricultural policies and European Union accession processes in the Western Balkans: Aspirations versus reality. Eurasian Geogr. Econ. 62, 46–75.
4. Ivanov, B., & Kroumova, S. (2019). Green agriculture in the Western Balkans: status and prospects. Renewable Agriculture and Food Systems, 34(4), 309-318.

5. Kajikawa, Y., & Takeda, Y. (2020). Sustainable agriculture in the Balkans: current situation and future prospects. Sustainability Science, 15(6), 1665-1679.
6. Matkovski, B., Radovanov, B., Zekić, S. (2018). The Effects of Foreign Agri-food trade Liberalization in South East Europe. Econ. Cas. 66, 945–966.
7. Nela, L. & Beqiraj, A. (2021). The role of eco-agriculture practices in rural sustainable development in Western Balkans. Sustainability, 13(7), 3694.
8. Nikolić, R., Fedajev, A., Stefanović, V. & Ilić, S. (2017). The agriculture sector in Western Balkans: some characteristics of development. Economics of Agriculture, 64(1), 275-293. doi: https://doi.org/10.5937/ekoPolj1701275N
9. Petrović, P. & Ćirić, M. (2021). Environmental Sustainability in Agriculture: Western Balkans Case Study. Sustainability, 13(7), 3789.
10. Qineti, A. & Gruda, N. (2021). Agroecological Practices for Sustainable Agricultural Systems in the Western Balkans. Sustainability, 13(9), 5181.
11. Schipanski, M. E. & Drinkwater, L. E. (2020). Toward sustainable agroecosystems in the Western Balkans: exploring opportunities and obstacles for agricultural diversification. Sustainability Science, 15(6), 1553-1567.
12. Teixeira, R. F. & Santos, L. G. (2019). Sustainable agriculture and rural development in the Western Balkans. Journal of Cleaner Production, 219, 624-632.
13. Trendov, M. N. & Vasa, L. (2015). Pathway to EU integration: Rural Development Policies of the Western Balkan countries. Case study of Macedonia, Montenegro and Serbia. KKI Studies T-2015/5. Budapest: Institute for Foreign Affairs and Trade. Retrieved from http://kki.hu/assets/upload/5_KKI-Studies_Balkan_NT-LV_20150618.pdf.
14. United Nations Environment Programme (2020). Green Economy Assessment Report for the Western Balkans: Investing in a Greener and More Sustainable Future. United Nations Environment Programme, Geneva.
15. World Bank. (2020). Western Balkans Regular Economic Report No. 18: Agriculture and Food Systems in the Western Balkans. World Bank, Washington, DC.
16. https://neighbourhood-enlargement.ec.europa.eu/system/files/2020-10/green_agenda_for_the_western_balkans_en.pdf

THE PRICE OF BASIC INDUSTRIAL PRODUCTS FROM SUNFLOWER SEEDS, OIL AND MEAL FROM SUNFLOWER SEEDS, ON THE INTERNATIONAL MARKET UNDER CHANGED MARKET CONDITIONS[1]

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Abstract: Oil and meal from sunflower seeds are very common and important in the internationalmarket of leading industrial products from oilseeds, oil and meal.
Ukraine and Russia are leaders in the world production and processing of sunflower seeds, as well as industrially produced sunflower seed oil and meal, therefore the war conflicts between Ukraine and Russia cause large fluctuations in the production and supply of these products on the world market, and consequently large price fluctuations of these products at the international level. Therefore, using scientific methods, research was carried out on the current state and price trends of industrially produced oil and sunflower seed meal on the international market in the past twelve-month period, from April 2022 to March 2023, that is, during the six-month period of the past 2021/2022 economic year (from April 2022 to September 2022) and during the past six-month period of the current 2022/2023 economic year (from October 2022 to March 2023), the results of which are presented in this paper.

Keywords: international market in changed market conditions; the price of sunflower seed oil; the price of sunflower seed meal

INTRODUCTION

In addition to supply and demand, defining the cost price of a certain product at the world level is largely influenced by global socio-economic events. Thus, for example, the global financial crisis had a serious impact on the production and industrial processing of sunflower seeds, as well as many other agricultural and food products, through lower liquidity and an increase in financing costs (Gajdobranski et al., 2017; Gajdobranski, 2020).
Sunflower seed oil and meal are very common and significant in the world market of leading industrial products from oilseeds, edible oil and meal (Oštrić-Matijašević and Turkulov, 1980; Gupta, 2002; Vlahović, 2015; Premović, 2014; 2022). Ukraine and Russia are the leaders in

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the world production of sunflower seeds and industrially produced sunflower seed oil and meal, therefore the ongoing war conflicts between these actors cause changes in the volume of production and supply of these products on the world market, and thus, consequently, in the variation in prices of these products at the international level. Therefore, by applying scientific methods, research was carried out on the price trends of industrially produced oil and sunflower seed meal on the international market, in the past twelve-month period, from April 2022 to March 2023, that is, during the six-month period of the past 2021/22 economic year (from April 2022 to September 2022) and during the past six-month period of the current 2022/23 economic year (from October 2022 to March 2023), the results of which are presented in this paper.

1. The price of sunflower seed oil for industrial processing on the international market under changed market conditions in the period from April 2022. to March 2023.

1.1. The price of sunflower seed oil for industrial processing on the international market under changed market conditions for the period from April 2022. to September 2022. the past 2021/22. economic years

From April 2022 to September 2022, the past 2021/22. economic years, the prices of sunflower seed oil on the world market varied and amounted to (Table 1):

A) At "Minneapolis FOB; USDA": from 1,724 U.S.$/mt (in July 2022, past 2021/22 economic year) to 2,654 U.S.$/mt (in April 2022, past 2021/22 economic year), with the first determined value of the price of sunflower seed oil in the observed time period, the price value for the month of April 2022, the past 2021/22 economic year, also represented the maximum value of the price of sunflower seed oil for the observed time period (2,654 U.S.$/mt). From April 2022 to July 2022, sunflower seed oil price values on "Minneapolis FOB; USDA" recorded a steady decline, so that the minimum sunflower seed oil price value was recorded in July 2022 (1,724 U.S.$/mt). In the month of August, an increase in the value of sunflower seed oil prices was achieved at "Minneapolis FOB; USDA" compared to the month of July, so in August 2022, the price of sunflower seed oil at "Minneapolis FOB; USDA" reached a value of 2,028 U.S.$/mt. In September 2022, the price of sunflower seed oil then fell to a value of 1,949 U.S.$/mt. At “Minneapolis FOB; USDA", the average price of sunflower seed oil for the entire past 2021/22 economic year (from October 2021 to September 2022) was 2,456 U.S.$/mt, while for the previously examined period from October 2021 to March 2022 (also the past 2021/22 economic year), the average value of the price defined in the April 2022 USDA Report, was 2,743 U.S.$/mt. The average value of the price of sunflower seed oil for the analyzed time period from April 2022 to September 2022, the past 2021/22 economic year, was 2,169 U.S.$/mt (Table 1).

B) To "EU FOB NW Euro; Oil World": from 1,306 U.S.$/mt (in September 2022, past 2021/22 economic year) to 2,126 U.S.$/mt (in April 2022, past 2021/22 economic year), whereby the first established price value in the observed time period, the price value for the month of April 2022, the past 2021/22 economic year, also represented the maximum price value for the observed time period (2,126 U.S.$/mt).Sunflower seed oil price values were on "EU FOB NW Euro; Oil World" after April 2022, in the observed time period, recorded a permanent decline, therefore the minimum value of the price of sunflower seed oil on "EU FOB NW Euro; Oil World" (1,306 U.S.$/mt) was realized in September 2022, the past 2021/22 economic year. At "EU FOB NW Euro; Oil World" the average value of the price of

sunflower seed oil for the entire past 2021/22. economic year (from October 2021 to September 2022) was 1,676 U.S.$/mt, while for the previously examined period from October 2021 to March 2022 (also the past 2021/22 economic year), the average value prices defined in the April 2022 USDA Report, amounted to 1,628 U.S.$/mt. The average value of the price of sunflower seed oil for the analyzed time period from April 2022 to September 2022, the past 2021/22. economic year, was 1,724 U.S.$/mt (Table 1).

C) When analyzing and comparing data on the value of sunflower seed oil prices at "Minneapolis FOB; USDA" and on the "EU FOB NW Euro; Oil World" markets/stock exchanges in the observed time period, from April 2022 to September 2022, the past 2021/22. economic year (Table 1), it is established that the prices of sunflower seed oil on the world market were variable, which was expected, considering the changed and specific conditions and circumstances prevailing on the market, and it can be concluded that there are certain differences in the value of sunflower seed oil prices that were achieved in the observed time period (from April 2022 to September 2022, the past 2021/22 economic year), on the two observed world markets/world exchanges, since the values sunflower seed oil prices ranged from 1,724U.S.$/mt to 2,654U.S.$/mt at Minneapolis FOB; USDA" and from 1,306 U.S.$/mt to 2,126 U.S.$/mt on "EU FOB NW Euro; Oil World", with the average value of the price of sunflower seed oil for the analyzed time period (from April 2022 to September 2022, the past 2021/22 economic year), amounted to "Minneapolis FOB; USDA", 2,169 U.S.$/mt, and at "EU FOB NW Euro; Oil World", 1,724 U.S.$/mt. On both observed world markets/world stock exchanges, sunflower seed oil prices recorded a decline, so the first listed price values from the analysis carried out in April 2022 are from the past 2021/22. economic year, sunflower seed oil price values for the month of April 2022, past 2021/22. economic year, also amounted to the maximum values of sunflower seed oil prices in the observed time period (from April 2022 to September 2022, the past 2021/22 economic year) (Table 1).

Table 1. Sunflower seed oil price: April 2022-September 2022 (economic year 2021/22) (U.S.$/mt)

Stock market/Market	***Time period***					
	April 2022. - September 2022., 2021/22. economic year					
	April	**May**	**June**	**July**	**August**	**September**
„Minneapolis FOB; USDA"(U.S.$/mt)	2,654	2,502	2,155	1,724	2,028	1,949
	Min-Max: 1,724-2,654			Average (April-September 2022.): 2,169		
„EU FOB NW Euro; Oil World"(U.S.$/mt)	2,126	2,055	1,777	1,557	1,522	1,306
	Min-Max: 1,306-2,126			Average (April-September 2022.): 1,724		

Source: UCDA Report, April 2023, www.fas.usda.gov/data/oilseeds-world-markets-and-trade

1.2. The price of sunflower seed oil for industrial processing on the international market under changed market conditions for the period from October 2022. to March 2023 current 2022/23 economic years

From October 2022 to March 2023., current 2022/23 economic year, the prices of sunflower seed oil on the world market varied in the value interval (Table 2):

A) At "Minneapolis FOB; USDA": from 1,791 U.S.$/mt (in February 2023, current economic year 2022/23), i.e. from 1,689 U.S.$/mt (preliminary price of sunflower seed oil for March 2023, current 2022/23 economic year) to 2,337 U.S.$/mt (in November 2022, the current economic year 2022/23), whereby the last mentioned price information, until the analysis carried out in the month of April 2023, the current economic year 2022/23, the preliminary price value for the month of March 2023, the current 2022/23 economic year, had a minimum value of 1,689 U.S.$/mt, while the average value of the price of sunflower seed oil for the analyzed time period

from October 2022 to March 2023, the current 2022/23 economic year, at "Minneapolis FOB; USDA" was 1,968U.S.$/mt (Table 2).

B) To "EU FOB NW Euro; Oil World": from 1,168 U.S.$/mt (in February 2022, current economic year 2022/23), i.e. from 1,056 U.S.$/mt (preliminary sunflower seed oil price for March 2023, current 2022/23 economic year) to 1,353 U.S.$/mt (in October 2022, the current 2022/23 economic year), whereby the last value of the price of sunflower seed oil, until the analysis carried out in April 2023, the current in the 2022/23 economic year, the preliminary value of the price of sunflower seed oil for the month of March 2023., the current 2022/23. economic year, was 1,056 U.S.$/mt, which is also the minimum value of the price of sunflower seed oil for the analyzed time period, the period from October 2022 to March 2023, the current economic year 2022/23. The average value of the price of sunflower seed oil, for the analyzed time period, from October 2022 to March 2023, the current economic year 2022/23, at "EU FOB NW Euro; Oil World" amounted to 1,230 U.S.$/mt (Table 2).

C) When analyzing and comparing data on the value of sunflower seed oil prices at "Minneapolis FOB; USDA" and on "EU FOB NW Euro; Oil World", in the observed time period, from October 2022 to March 2023, current 2022/23 economic year (Table 2), it can be observed that the prices of sunflower seed oil on the world market were very variable, which was to be expected, considering the changed and specific conditions and circumstances prevailing on the market, and it can be concluded that there are significant differences in the value of sunflower seed oil prices, which were reached from October 2022 to March 2023, current 2022/23 economic year, on the two observed world markets/world stock exchanges, which is confirmed by the achieved average values of sunflower seed oil prices, which amount to 1,968 U.S.$/mt, at "Minneapolis FOB; USDA" and 1,230 U.S.$/mt on "EU FOB NW Euro; Oil World". On both observed world markets/world stock exchanges, the values of sunflower seed oil prices in the analyzed time period, from October 2022 to March 2023., are current in 2022/23 economic years, recorded a decline, so that the last values of the price of sunflower seed oil, until the analysis carried out in April 2023., are current in 2022/23 economic year, preliminary values of sunflower seed oil prices for the month of March 2023, current 2022/23 economic year, also amounted to the minimum prices of sunflower seed oil in the observed time period, from October 2022 to March 2023, current 2022/23 economic years (Table 2).

For the sake of comparison, the average value of the price of oil from seeds of other important oilseeds on the world market in the analyzed time period, from October 2022 to March 2023, current 2022/23 economic year, such as soybean seed, cotton seed, peanut seed and corn seed oils, was, respectively: from 1,214 U.S.$/mt to 1,499 U.S.$/mt; 2,318 U.S.$/mt; from 2,062 U.S.$/mt to 2,159 U.S.$/mt and 1,412 U.S.$/mt.

Table 2. Sunflower seed oil price: October 2022 - March 2023 (economic year 2022/23) (U.S.$/mt)

Stock market/Market	***Time period***					
	October 2022-March 2023, 2022/23 economic year					
	October	**November**	**December**	**January**	**February**	**March***
„Minneapolis FOB; USDA" (U.S.$/mt)	2,067	2,337	2,035	1,890	1,791	1,689
	Min-Max: (1,689*) 1,791-2,337			Average (October 2022.-March 2023.*):1,968		
„EU FOB NW Euro; Oil World"(U.S.$/mt)	1,353	1,337	1,244	1,220	1,168	1,056
	Min-Max: (1,056*) 1,168-1,353			Average (October 2022-March 2023*): 1,230		

* Preliminary
Source: UCDA Report, April 2023,www.fas.usda.gov/data/oilseeds-world-markets-and-trade

2. The price of sunflower seed meal for industrial processing on the international market under changed market conditions in the period from April 2022 to March 2023.

2.1.The price of sunflower seed meal for industrial processing on the international market under changed market conditions in the period from April 2022 to September 2022 past 2021/22 economic years

From April 2022 to September 2022, the past 2021/22 economic year, the prices of sunflower seed meal on the world market varied and recorded a constant decline (Table 3):

A) At "Minneapolis FOB; 32% Protein; USDA" the price of sunflower seed meal in April 2022, the past 2021/22 economic year, was a maximum of 354 U.S.$/mt, while in September 2022, the past 2021/22 economic year, it was a minimum of 248 U.S.$/mt (Table 3). At "Minneapolis FOB; 32% Protein; USDA" the average price of sunflower seed meal for the entire past 2021/22 economic year (from October 2021. to September 2022) was 309 U.S.$/mt, while for the previously examined period from October 2021. to March 2022 (also

the past 2021/22 economic year), the average value prices defined in the April 2022. USDA Report, amounted to 317 U.S.$/mt. The average value of the price of sunflower seed meal for the analyzed time period from April 2022 to September 2022, the past 2021/22 economic year, was 301 U.S.$/mt (Table 3).

B) At "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld", the price of sunflower seed meal in April 2022, the past 2021/22 economic year, amounted to a maximum of 352 U.S.$/mt, while in September 2022., the past 2021/22. economic year, it amounted to a minimum of 210 U.S.$/mt (Table 3). At "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld", the average price of sunflower seed meal for the entire past 2021/22 economic year (from October 2021 to September 2022) was 281 U.S.$/mt, while for the previously examined period, from October 2021 to March 2022. (also the past 2021/22 economic year), the average value prices defined in the April 2022. USDA Report, amounted to 287 U.S.$/mt. The average value of the price of sunflower seed meal for the analyzed time period, from April 2022. to September 2022., the past 2021/22. economic year, was 276 U.S.$/mt (Table 3).

C) When the data on the price value of sunflower seed meal at "Minneapolis FOB; 32% Protein; USDA" and at "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld", analyzed and compared with each other, in the observed time period, from April 2022 to September 2022, the past 2021/22 economic years (Table 3), it can be seen that the prices of sunflower seed meal on the world market were variable, which was to be expected, given the changed and specific conditions and circumstances prevailing on the market, and it can be concluded that there are certain minor differences in the value of sunflower seed meal prices that were achieved in the observed time period, from April 2022 to September 2022, the past 2021/22 economic year, in the two observed world markets/world exchanges, since the sunflower seed meal price values varied in the interval from 248 U.S.$/mt to 354 U.S.$/mt, at "Minneapolis FOB; 32% Protein; USDA" and from 210 U.S.$/mt to 352 U.S.$/mt on "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld", with the average value of the sunflower seed meal price for the analyzed time period, from April 2022 to September 2022., the past 2021/22 economic year, amounted to "Minneapolis FOB; 32% Protein; USDA", 301 U.S.$/mt, and on "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012), 276 U.S.$/mt (Table 3).

On both observed world markets/world stock market values of the price of sunflower seed meal, for the analyzed time period, from April 2022 to September 2022, the past 2021/22 economic year, recorded a permanent decline, so that the first established values of the price of sunflower seed meal in the aforementioned time interval, from April 2022 to September 2022, in the past 2021/22 economic year, the values of the price of sunflower seed meal for the month of April 2022, were also the maximum values of the sunflower seed meal price, while the last sunflower seed meal price values in the analyzed time interval, sunflower seed meal price values for the month of September 2022, the past 2021/22 economic year, also amounted to the minimum sunflower seed meal price values in the analyzed time period, from April 2022 until September 2022, the past 2021/22 economic year, on both observed world markets/world stock exchanges (Table 3).

Table 3. Sunflower seed meal price: April 2022-September 2022 (economic year 2021/22) (U.S.$/mt)

Stock market/Market	***Time period***					
	April 2022 - September 2022, 2021/22 economic year					
	April	**May**	**June**	**July**	**August**	**September**
„Minneapolis FOB; 32% Protein; USDA" (U.S.$/mt)	354	315	311	296	281	248
	Min-Max: 248-354			Average (April-September 2022): 301		
„HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld" (U.S.$/mt)	352	348	304	228	215	210
	Min-Max: 210-352			Average (April-September 2022): 276		

Source: USDA Report, April 2023, www.fas.usda.gov/data/oilseeds-world-markets-and-trade

2.2. The price of sunflower seed meal for industrial processing on the international market under changed market conditions in the period from October 2022 to March 2023 current 2022/23 economic years

From October 2022 to March 2023, current 2022/23 economic years, the prices of sunflower seed meal on the world market varied and amounted to (Table 4):

A) At "Minneapolis FOB; 32% Protein; USDA": from 220 U.S. $/mt (in December 2022, current economic year 2022/23) to 391 U.S.$/mt (in January 2023., current economic year 2022/23), the latter being the above information on the price of sunflower seed meal in the analyzed time period, until the analysis conducted in April 2023., the current 2022/23 economic year, the preliminary value of the price of sunflower seed meal for the month of March 2023, the current 2022/23 economic year, amounted to 340 U.S.$/mt, while the average value of the price of sunflower seed meal for the analyzed time period, from October 2022 to March 2023, the current 2022/23 economic year, at "Minneapolis FOB; 32% Protein; USDA" amounted to 331 U.S.$/mt (Table 4).

B) At "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld": from 195 U.S.$/mt (in October 2022, current economic year 2022/23) to 279 U.S.$/mt (in February 2023, current economic year 2022/23), the latter being the above information on the price of sunflower seed meal, in the analyzed time period, until the analysis carried out in April 2023 the current 2022/23 economic year, the preliminary value of the price of sunflower seed meal for the month of March 2023, the current 2022/23 economic year, amounted to 271 U.S.$/mt, while the average value of the price of sunflower seed meal for the analyzed time period, from October 2022 to March 2023, the current 2022/23 economic year, at "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld" was 240U.S.$/mt (Table 4).

C) When analyzing and comparing data on the prices of sunflower seed meal at "Minneapolis FOB; 32% Protein; USDA" and on "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld" in the analyzed time period, from October 2022 to March 2023, current 2022/23 economic year (Table 4), it can be seen that the prices of sunflower seed meal on the world market were variable, which was to be expected, given the changed and specific conditions prevailing on the market, and it can be concluded that there are certain differences in the prices of sunflower seed meal that were achieved from October 2022 to March 2023, current in 2022/23 economic year, on the two observed world markets/world stock exchanges, which is also confirmed by the average prices of sunflower seed meal, which in the analyzed time period, from October 2022. to March 2023, current 2022/23 economic year, were achieved, which amounted to 331 U.S.$/mt, at "Minneapolis FOB; 32% Protein; USDA" and 240 U.S.$/mt on "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld" (Table 4).

The price of sunflower seed meal recorded in the month of February 2023, current 2022/23. economic year, on both analyzed world markets/world stock exchanges it achieved a high value, namely at "Minneapolis FOB; 32% Protein; USDA", a value in the amount of 371 U.S.$/mt, which represents the value of the price of sunflower seed meal immediately after the maximum value of the price of sunflower seed meal for the observed time interval, from October 2022 to March 2023, current 2022/23 economic year (the maximum value of sunflower seed meal at "Minneapolis FOB; 32% Protein; USDA", in the amount of 391 U.S.$/mt, was reached in the

month of January 2023., the current economic year 2022/23), and at "HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld" value in the amount of 279 U.S.$/mt, which represents the maximum value of sunflower seed meal prices in the observed time period, from October 2022 to March 2023, the current 2022/23 economic year (Table 4).

For the sake of comparison, the average value of the price of meal from seeds of other important oilseeds on the world market in the analyzed time period, from October 2022 to March 2023, current 2022/23 economic year, such as seed meal: soybean, cotton and canola, was, respectively: from 521 U.S.$/mt to 565 U.S.$/mt; 443 U.S.$/mt and 377 U.S.$/mt.

Table 4. Sunflower seed meal price: October 2022.-March 2023 (economic year 2022/23) (U.S.$/mt)

Stock market/Market	***Time period***					
	October 2022.-March 2023, 2022/23. economic year					
	October	**November**	**December**	**January**	**February**	**March***
„Minneapolis FOB; 32% Protein; USDA" (U.S.$/mt)	N/A	N/A	220	391	371	340
	Min-Max: 220-391			Average (October 2022-March 2023*): 331		
„HiPro a.o. cif France or Ukraine DAF; Argentina Pellet 37-38% (Prior to Aug 2012); Oilworld" (U.S.$/mt)	195	209	223	261	279	271
	Min-Max: 195-279			Average (October 2022 - March 2023*): 240		

* Preliminary
Source: UCDA Report, April 2023, www.fas.usda.gov/data/oilseeds-world-markets-and-trade

INSTEAD OF CONCLUSION

War events in the Black Sea region caused changes in the available quantities of sunflower seeds on the world market, which caused changes in the available quantities of sunflower seed oil and sunflower seed meal, which also caused changes in prices on the world stock exchanges/world oil market and meal market, as well as their partial substitution with industrial products from other oilseeds.

However, despite the current war conflicts on the territory of Ukraine, in April 2023, the current 2022/23 economic year, increased export of the main industrial products from sunflower seeds, oil and meal from sunflower seeds, compared to the previous 2021/22 economic year. Thus, the export of sunflower seed oil from Ukraine in April 2023, current 2022/23 economic year, compared to the previous period, was increased by 150000 metric tons (from 3,950 thousand metric tons in the previous period, to the current 4,100 thousand metric tons), which contributed to a significant increase in the import of sunflower seed oil to the member states of the European Union, which is in April 2023., current 2022/23 economic year amounted to 200000 metric tons (from 900 000 metric tons in the previous period, to the current value of 1,100 000 metric tons). The export of sunflower seed meal from Ukraine is in April 2023, current 2022/23. economic year, compared to the previous period, was increased by 150 000 metric tons (from 3,300 thousand metric tons in the previous period, to the current 3,450 thousand metric tons), which contributed to a significant increase in the import of sunflower seed meal to the member states of the European Union, which is in April 2023, current 2022/23 economic year, amounted to 250 000 metric tons (from 2,250 000 metric tons in the previous period, to the current value of 2,500 000 metric tons). In China, it is April 2023, current year 2022/23 economic year, there was also an increase in the import of sunflower seed meal, in the amount of 200 000 metric tons (from 2,500 000 metric tons in the previous period, to the current value of 2,700 000 metric tons).

LITERATURE

1. Gajdobranski, A., Krmpot, V., Babić, V. (2017). Produktivnost i troškovi kao važni društveno-ekonomski apsekti privređivanja, 5th International Conference–Law, Economy and Management in Modern Ambience, LE-MiMA2017, Zbornik radova, Univerzitet Union–NikolaTesla, Beograd (FPSPiFSOM).
2. Gajdobranski, A. (2020). Obračunske kalkulacije u ratarskoj proizvodnji kod malih i srednjih gazdinstava na području AP Vojvodine, Monografija, Fakultet za poslovne studije i pravo i Fakultet za informacione tehnologije i inženjerstvo, Univerzitet UNION Nikola Tesla,Beograd.
3. Gupta, M. K. (2002). Sunflower oil. In: Vegetable oils in food technology: Composition, properties and uses, Editor, F. D. Gunstone, CRC Press LLC.
4. Oštrić-Matijašević, B., J., Turkulov (1980). Tehnologija ulja i masti, I deo, Univerzitet u Novom Sadu, Tehnološki fakultet, Novi Sad.
5. Premović, T. (2014). Uticaj vremena skladištenja, sadržaja nečistoće i ljuske semena na senzorni kvalitet, bioaktivne komponente i oksidativnu stabilnost hladno presovanog ulja suncokreta, Univerzitet u Novom Sadu, Tehnološki fakultet Novi Sad.

6. Premović, T. (2022). Nerafinisana ulja suncokreta – ekološki, tehnološki, nutritivni i ekonomski aspekti, Ekonomski institut a.d. Beograd, ISBN 978-86-904242-0-7.
7. Vlahović, B. (2015). Tržište agroindustrijskih proizvoda, Univerzitet u Novom Sadu, Poljoprivredni fakultet.
8. www.fas.usda.gov/data/oilseeds-world-markets-and-trade(pristupljneno01.04.2023. godine)

TRENDS OF GLOBAL WINE MARKET[1]

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Abstract: There is a huge number of producers and consumers of wine in the world. Quality wines are made on all continents of the world. Recently, globalization processes more and more influence world's winemaking and viticulture. Global wine industry creates a considerable part of the economy of many countries, and it brings the faster growth of the production capacity and the export value. Recently, world's wine consumption has been growing constantly and forecasts say that it will grow also in the following years. Tourism has a big influence on wine industry as well as on the economy of many countries. Global wine consumption has been growing in recent years and forecasts say that it will also grow in the following years.

Key words: wine, winery, market, consumer, production.

INTRODUCTION

Today, wine market ais widespread all around the world. Global wine markets as well as other markets are directed by the market power. The wine production also belongs into global market, that is connected to the area of vineyards and its consumption. Globalization has led to increased competition and changes in wine production and consumption. For market positioning and in the context of emphasized environmental responsibilities, wineries must adapt their strategies and performance to these market challenges (Faria S. et al. 2021). The biggest change in the world's production happened in the last 20 years and it was caused by its changes and development. Moreover, globalization paved the way for significant changes in the wine industry worldwide. New World countries, such as the US, Australia, Argentina, Chile, and South Africa, entered the market 40 years ago, benefiting from the availability of inputs and economies of scale, which determined an increase in their market share and a "catch up" process (Morrison A. 2017). This threatened the industry's dominance by the traditional countries (Cusmano L., et al. 2010), who faced rising challenges due to increased

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competition, changes in consumer behaviour, and growing environmental and public health concerns. According to the production, wine world can be divided into areas: Europe, New World where Australia, North and South America, South Africa belong and the newest world (China, India, Brazil, North Africa, and Eastern Europe).

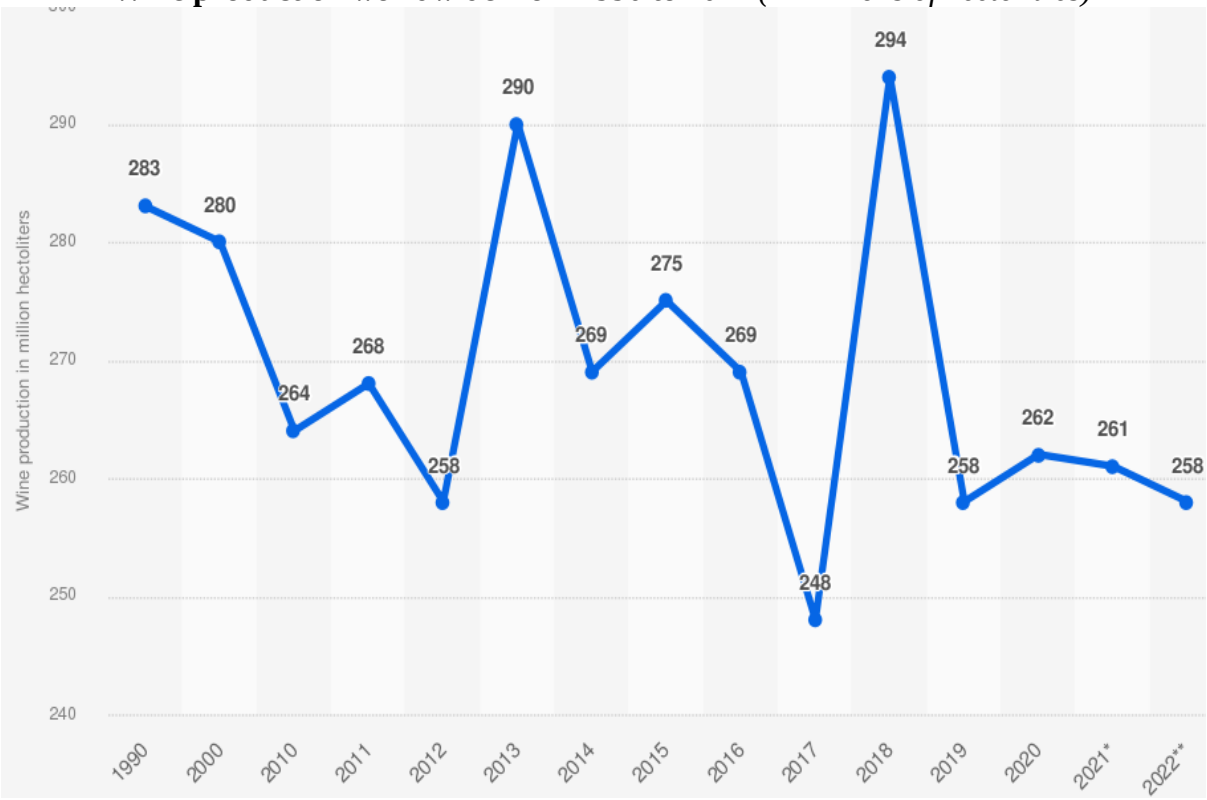
METHODOLOGY

The research is based on a review of scientific and professional literature and uses general scientific methods, while as specific methods and tools we emphasize statistical and economic indicators and the composite world production, sale, and consumption of wine. We will discuss the question of competition, the reasons for the international success of companies in certain continents and countries. The research used a database on international trade in wine. The data were taken from database the Statista and include data series, starting in 1990-2025.

WINE PRODUCTION IN THE WORLD

In Europe there has been a decrease of production of wine, the reason of this decrease was compensated by the increase of production of other countries. The production of wine on the American continent increased to 16%, Oceania increased its production from 1.6% to 5.1%, Africa from 3% to 4.1% and finally Asia from 1.5% to 5.1%.
The following graph shows the total production of wine in years 1990 to 2020 in the world. Figures are expressed *in millions of hectolitres.*

Wine production worldwide from 1990 to 2022 *(in millions of hectolitres)*



Source: OIV. (April 20, 2023). Wine production worldwide from 1990 to 2022 (in million hectoliters) [Graph]. In Statista. Retrieved June 27, 2023, from https://www.statista.com/statistics/397870/global-wine-production/

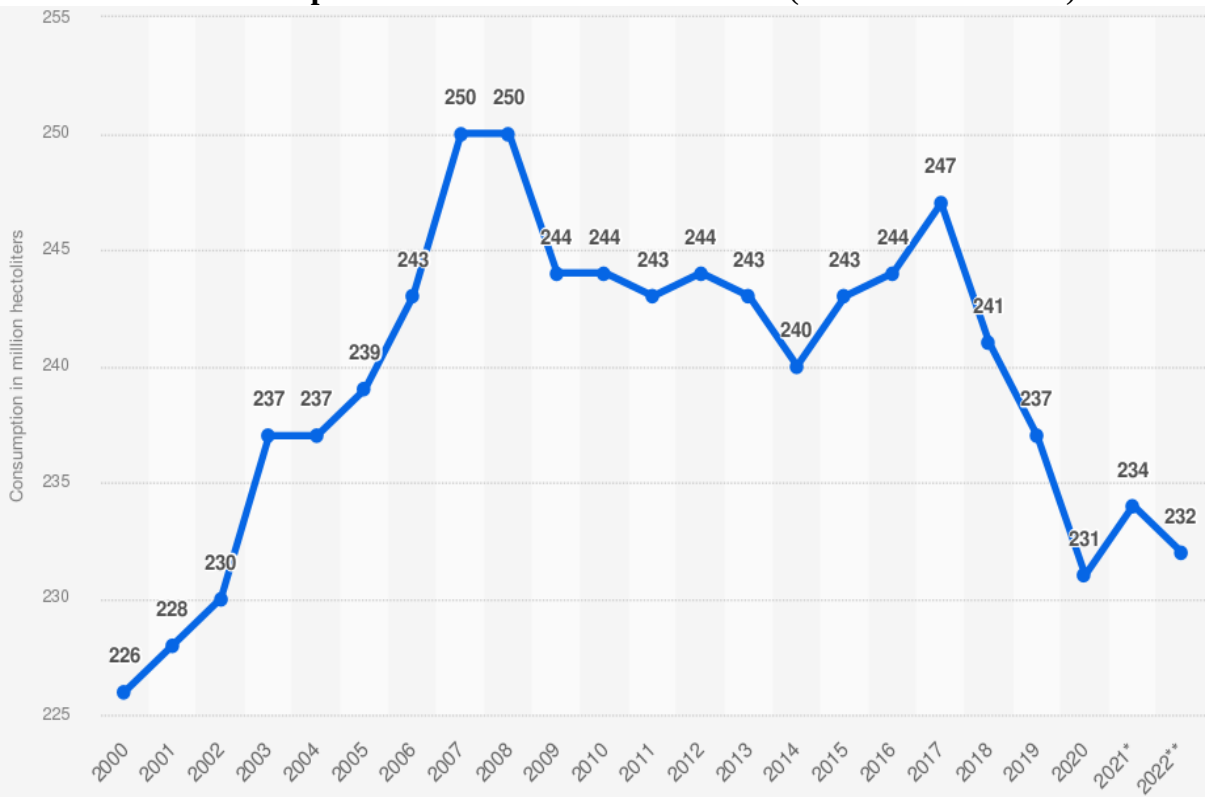
This statistic shows the trend in global wine production from 1990 to 2022. In 2022, global wine production amounted to about 258 million hectoliters. We can see from the following graph that the highest production of wine was recorded in 2018, when it had the value of 294 000 hl. On the contrary, the lowest value was reached in the previous year (2017) when it was 248 000 hl. It means, that the year 2018 had in comparison with the year 2017 the higher production of wine by 46 000 hl. Year 2019 had also decreased character, when from 2018 the value of production of wine decreased by 36 000 hl.

WINE CONSUMPTION

From 2000 to2022 wine consumption decreased due to the changes of lifestyle of families and generally world's society. Main reasons are change of lifestyle caused by economic, social, cultural factors. It is suitable for wine tourism to create various hiking wine paths where participants could get to know wine tradition, current wine producers, ways of cultivating vineyards and running of wine cellars as well as to taste wine and get familiar with vineyards' habits and traditions (Kerekeš 2019).

The following graph will provide us with information about the total wine consumption in the world in years 2000 – 2020.

Wine consumption worldwide from 2000 to 2022(in million hectoliters)



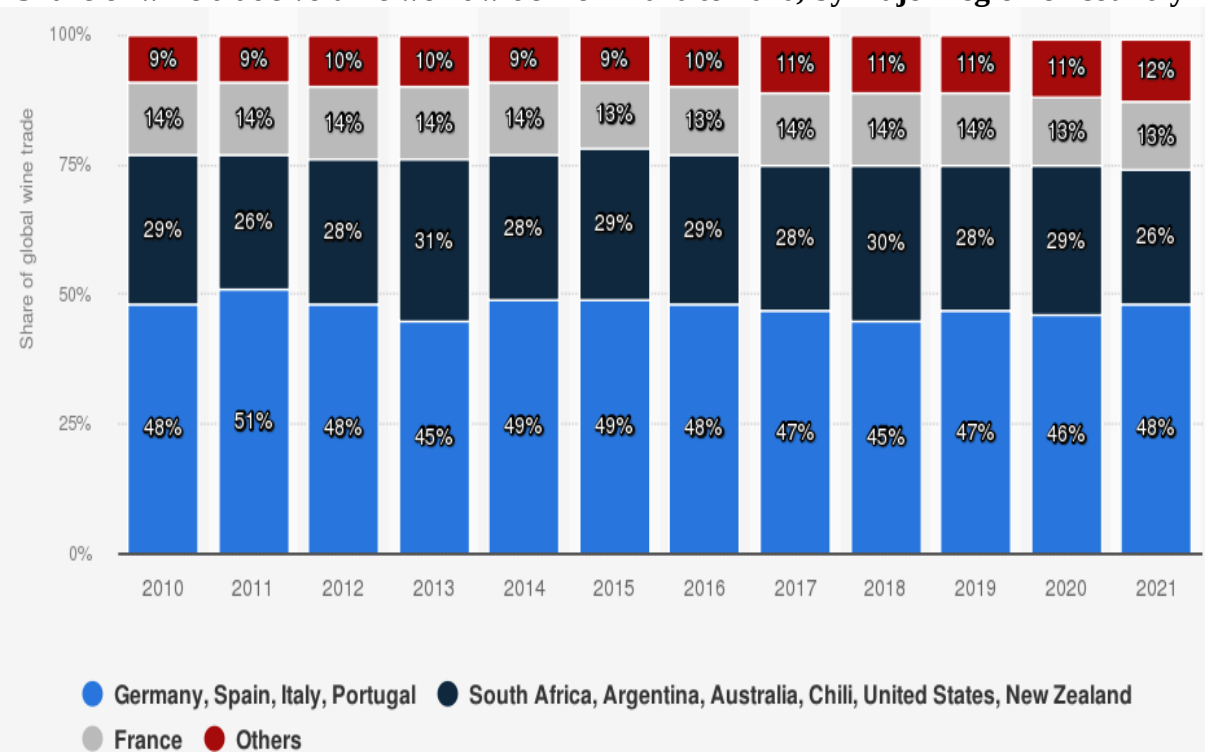
Source: OIV. (April 20, 2023). Wine consumption worldwide from 2000 to 2022 (in million hectoliters) [Graph]. In *Statista*. Retrieved June 27, 2023, from https://www.statista.com/statistics/232937/volume-of-global-wine-consumption/

In 2022, wine consumption worldwide was estimated to amount to 232 million hectoliters, down from 247 million hectoliters in 2017. Wine is an alcoholic drink commonly made from fermented grapes. Wines not made from grapes involve the fermentation of several other sources such as rice, plum, cherry, pomegranate, and elderberry (Statista 2023).

THE GLOBAL WINE MARKET

Global wine industry creates the significant part of the economy of many countries, and this brings faster growth of volume of production and value of export. Consumers can not fill themselves with wine despite Covid-19 crisis. World's wine consumption has been growing in recent years and forecasts say that it will also grow in the following years. The biggest world's production of wine is in Italy, France and Spain, these countries produce together almost 50% of the world's production. Fast developing countries follow as countries of new world, USA, Argentina, Chile, or Australia.

Share of wine trade volume worldwide from 2010 to 2020, by major region or country

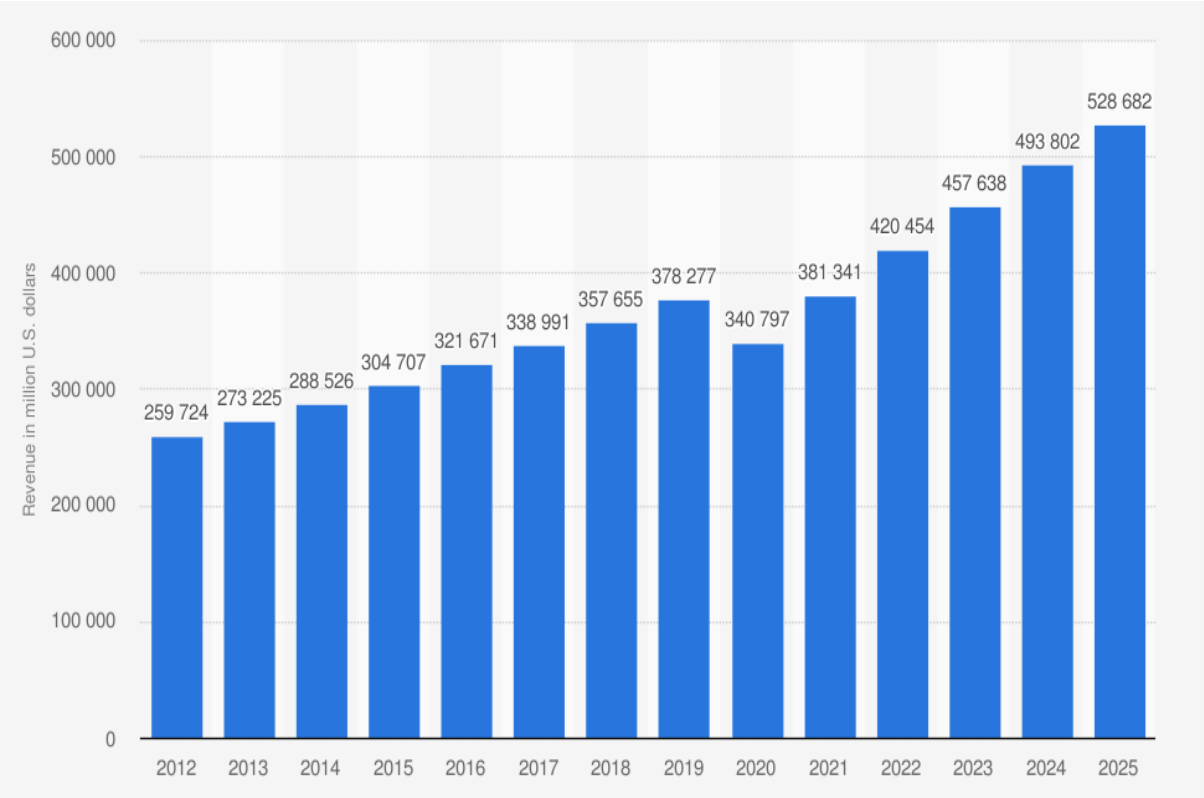


Source: FranceAgriMer. (August 17, 2022). Share of wine trade volume worldwide from 2010 to 2021, by major region or country [Graph]. In *Statista*. Retrieved June 27, 2023, from https://www.statista.com/statistics/1150624/global-wine-trade-share-by-region/

The regions of wine production in the world have largely maintained their share of the market over the years. France has fluctuated at around 13 to 14 percent while the other major European producers Germany, Spain, Italy, and Portugal peaked at 51 percent of the market and have since declined to 48 percent in 2021 (Satista 2023).

There is a huge number of producers and consumers of wine in the world, so we can talk about the competitive market. This huge number of participants on the market ensures, that every individual has only a little influence on the market price. Economic aspect of wine production is remarkable and therefore it is the main reason why governments support strong research programs in the field of development and improvement of wine industry. (Bisson a kol. 2002). Economically active and rich countries are active in international trade with wine. Increased tourism that accompanies discoveries of new wine regions is for many countries economically important.

Wine market revenue worldwide from 2012 to 2025

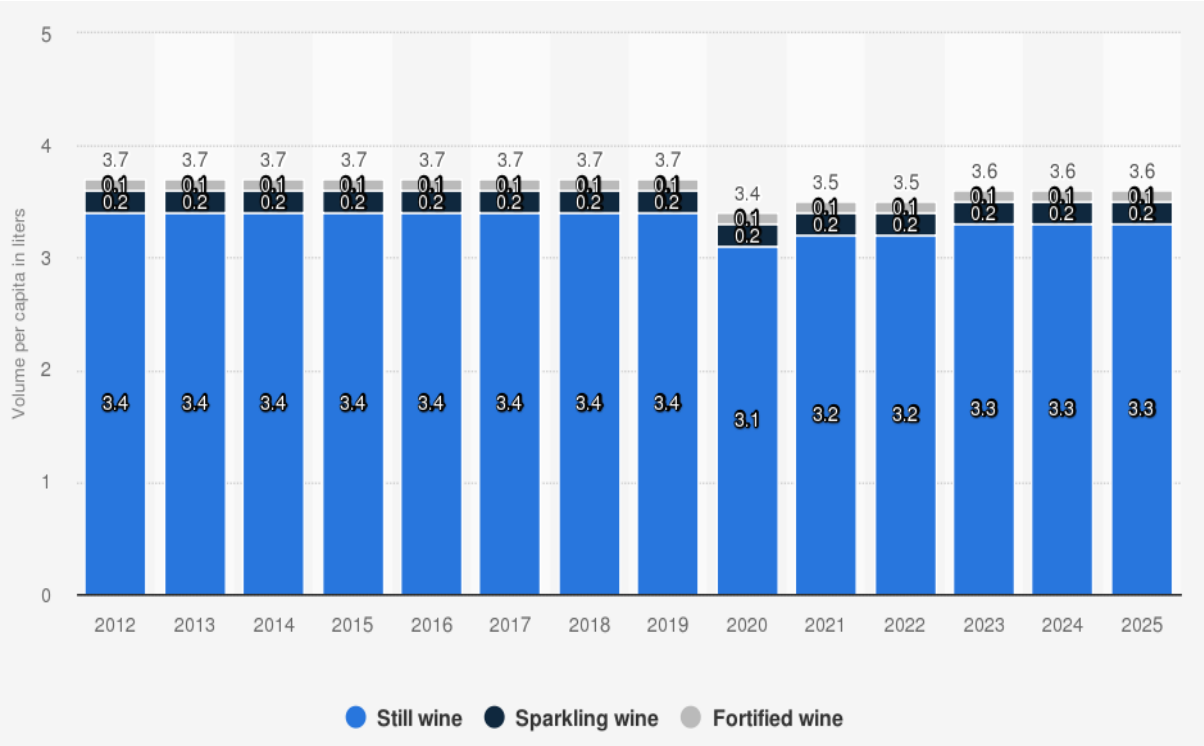


Source: Statista. (April 23, 2022). Wine market revenue worldwide from 2012 to 2025 (in million U.S. dollars) [Graph]. In *Statista*. Retrieved December 01, 2022, from https://www.statista.com/statistics/922403/global-wine-market-size/

Revenue from the global wine market stood at 340.8 billion U.S. dollars in 2020.He estimates that by 2025, revenues in this segment will increase to 528.7 billion dollars.

Traditional forms of selling of wine are supermarkets, wine shops and directly from wine-makers. Today, we have already an access to relatively big number of on-line wine shops. The global wine market is segmented by color; most notably red, rose, and white wine. Product types include still, sparkling, dessert, and fortified wine. Wine is sold and distributed by supermarkets, specialty stores, convenience stores, and online channels (Statista 2023).

Volume per capita of the wine market worldwide from 2012 to 2025, by segment
(in liters)



Source: Statista Consumer Market Outlook. (March 17, 2021). Volume per capita of the wine market worldwide from 2012 to 2025, by segment (in liters) [Graph]. In *Statista*. Retrieved December 01, 2022, from https://www.statista.com/forecasts/1222549/global-wine-market-per-capita-volume-by-segment

Total per capita volume in the global wine market stood at 3.4 liters in 2020. Still wine accounted for most of this volume at 3.1 liters per capita.

CONCLUSION

Globalization has brought on the world market increasingly more wine producers who are prepared to introduce millions of hectolitres of wine. From the point of view of production and sale of wine, we can see sharp increase in recent years. China has the biggest growth potential whose sale of wines should grow another 20 to 30 years. The Internet creates new possibilities in how to impress directly customer market segments with new market participants and new screenplays from the point of view of production and consumption.

ACKNOWLEDGEMENTS

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REFERENCES

1. Faria, S.; Gouveia, S.; Guedes, A.; Rebelo, J. Transient and Persistent Efficiency and Spatial Spillovers. (2021). Evidence from the Portuguese Wine Industry. *Economies.* 9, 116.
2. Morrison, Andrea, and Roberta Rabellotti. (2017). Gradual catch up and enduring leadership in the global wine industry. Research Policy 46: 417–430.
3. Cusmano, Lucia, Andrea Morrison, and Roberta Rabellotti. (2010). Catching up trajectories in the wine sector: A comparative study of Chile, Italy, and South Africa. World Development 38: 1588–1602.
4. KEREKEŠ, J. (2019). Vidieckyturizmusaagroturizmus v regiónochturizmu. Bratislava: 1000 kníh. 2019. 243 s. ISBN 978-80-570-1032-6
5. BISSON, Linda a kolektív. (2002). Thepresen and future of the international wine industry. In Nature publishing group [online], vol. 418, no. 1, pp. 696 – 699 [cit. 2021-04-19]. ISSN 00280836
6. Statista - The Statistics Portal (2023). Retrieved, from https://www.statista.com/statistics/232937/volume-of-global-wine-consumption/
7. Statista - The Statistics Portal (2023).Retrieved, from https://www.statista.com/statistics/1150624/global-wine-trade-share-by-region/
8. Statista - The Statistics Portal (2022).Retrieved, from https://www.statista.com/statistics/922403/global-wine-market-size/

SUSTAINABLE PROCESSES AND THEIR APPLICATION IN MODERN ADVANCED CUTTING TECHNOLOGIES[1]

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Abstract: Many scientists agree that the years ahead are crucial for the survival of our planet. The development of science has enabled the emergence of many technologies, bringing with it unprecedented opportunities but also dangers. Unfortunately, the development of human consciousness and morality is in great disagreement with technological development, which was primarily put into the service of acquiring superprofits, even at the cost of irrational consumption of natural resources and energy, with growing environmental and health problems. Sustainable development in the metalworking industry imposes the search for new technologies that could be used with minor consequences for nature and man. Introducing sustainable production into practical application in the metalworking industry requires, in addition to new engineering knowledge, and knowledge in the fields of economics, ecology and the social sciences. Using the integrated process concept, which takes into account economic, environmental and social aspects, as well as relevant variables that affect the improvement of the efficiency and stability of production processes, opportunities for improvements in the sustainability of the cutting process can be identified.

This paper presents an example of the implementation of a sustainable advanced production process in the form of cryogenic processing. The advantages brought by this type of advanced production during the turning process of modern difficult-to-process materials are analyzed.

Keywords: modern materials, advanced processing, sustainability, cutting processes

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1. INTRODUCTION

The concept of sustainable development comes from forestry and refers to the extent to which afforestation with new saplings and forest cutting are in direct dependence - new growth of the forest is constantly enabled, without at the same time destroying living habitats. In general terms, the basic principle of sustainable development was defined in 1987 by the United Nations Commission, under the leadership of Gro Harlem Brundtland, the former Prime Minister of Norway, but this is the definition that is still accepted today: " Respond to the demands of today's generation without destroying the opportunities for future generations to respond to their demands ". All international policy efforts related to environmental protection are based on this definition.

In the promotion of sustainable production, the role of education, culture and social sciences is very important. Sustainability is a matter of education and thinking. If people do not know what sustainability is or do not work in accordance with the principles of sustainability, i.e. do not understand the consequences of their own behavior, it is difficult to achieve improved sustainability. Therefore, a change in the way of thinking is needed, both in society and in industry, which will enable much closer cooperation between technical and social sciences.

Sustainable production will not come to life in practice unless innovative programs of education and training of technicians, engineers and scientists of the new generation are introduced. This fact should be a motivation to achieve excellence in education and training programs in the field of sustainable production. Education no longer has to be seen as a goal, but as a means to create sustainable values. The need to spread knowledge and skills, in order to enable the application of patterns of sustainable production, as well as sustainable consumption, is one of the basic requirements for redefining educational needs not only in developed regions of the world, but also in developing countries such as our country. New curricula for sustainable production must be based on the strength of partnerships between the main actors: technical schools, universities, industry and government institutions. Traditional educational programs have mainly evolved around the needs of technicians, engineers and scientists in basic knowledge in the fields of physical and natural sciences, engineering materials, engineering design and manufacturing technologies. Unfortunately, the knowledge gained from these disciplines is often isolated in relation to the real world, which includes both social sciences and humanities.

New educational programs must focus on multidisciplinary, interconnected subjects (courses) that will deal with both the environment and society, with the aim of creating something that can be considered "sustainable production". These educational programs at the university level should also include marketing, innovation, management, ethics, regulations, policy, etc..., in order to provide a much broader knowledge base for the next generation of engineers and scientists who will learn the principles of sustainability and later apply them in production. Courses for manufacturing engineers should include knowledge of process performance improvement, sustainable quality, health and safety improvement along with knowledge of cleaner manufacturing processes.

In addition to education and training programs on the topic of sustainable production in school and university environments, this concept needs to be extended to engineers already working in industry. This can be achieved through certified programs that can be conducted through short courses or online programs based on the Internet.

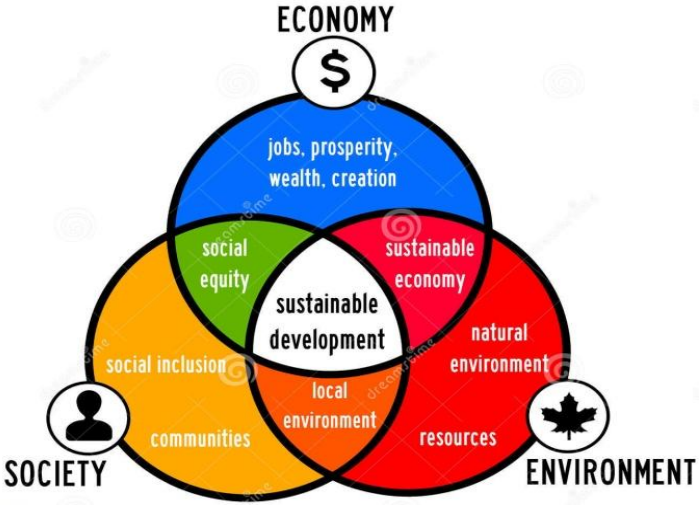
New product design methodologies and innovative manufacturing techniques must be developed to simultaneously address overall life cycle issues, which include: reducing production costs, shortening new product development time, reducing material use, reducing energy consumption, reducing industrial waste, repair, reuse, recovery, recycling of used products/materials, protection of the environment and society. These paradigm shifts in product design and manufacturing require optimized methods that include environmentally conscious and energy efficient manufacturing processes. This requires finding new design methodologies, production processes and resource planning processes in order to simultaneously achieve multiple goals to improve the company's profitability, which include quickly bringing new products to market while conserving natural resources and taking care of the environment at the same time.
Innovative sustainable production can become an engine for sustainable growth not only by promoting economic growth, but by enabling social well-being and environmentally conscious practices. Creating value through sustainable manufacturing will require product, process and system level innovation throughout the entire life cycle and across multiple life cycles.

More than ten years ago, the Faculty of Technical Sciences, more precisely the Department for Materials Removal Processes, recognized the need to introduce the basic principles of sustainability into the teaching subjects covered by this Department. Therefore, the courses in the subject Design and functionality of products, Production design, and especially in the subject Innovation technology, have been significantly innovated with the aim of educating production engineering students in the field of sustainable design and sustainable cutting technologies. In the continuation of this work, the basic principles of their education in the field of sustainable cutting processing processes, which are studied within the subject of Innovation Technologies in basic academic studies, will be presented.

2. CONCEPT OF SUSTAINABLE DEVELOPMENT

Today, the need to achieve the overall sustainability of industrial activities is well recognized, arising from several reasons: the reduction of non-renewable resources, stricter regulations related to the environment and safety and health at work, increasing consumer preferences for products that are not harmful to the environment, etc. Global environmental problems caused by the consumption of natural resources and pollution, which are the result of technical products, have led to increased political pressures and stronger legal regulations in developed industrial countries. Therefore, industrial production is under additional economic pressure and is trying to offset increased costs and create additional value for its products. Adopting sustainable development in manufacturing offers industry a cost-effective way to improve economic, environmental and social performance, i.e. three pillars of sustainability, Figure 1.

Figure 1. Foundations of sustainable development, three pillars of sustainability



Today, in the 21st century, the concept of sustainability is becoming a reality in the field of product development. The old "cradle-to-grave" production concept, which represents an open-loop life cycle, is now being transformed into a new "cradle-to-cradle" concept with a closed loop for multiple life cycles. This is a very powerful and growing concept in the manufacturing world, taking and refining the natural flow, allowing it to evolve. Sustainable development is the process of transitioning human activities to a pattern that can last forever. It is an approach to issues of environmental protection and development, in a way to harmonize human needs with the capacity of our planet. Added to this is today's awareness and need for eco-efficiency and environmental protection, which is associated with minimum toxic emissions into air, water and land, production of minimum amount of useless waste and minimum energy consumption at all levels.

After the Conference on Environment and Development, held in Rio de Janeiro in the summer of 1992, the term "sustainable development" became a leading term in the field of environmental policy. It certainly represents progress for environmental policy, because it explains the connection between ecological, economic and social directions, which represent the three pillars (carriers) of sustainability, Figure 1. Sustainability is the driver of innovation, and innovation promotes accelerated growth in production. On the other hand, production is the engine for wealth creation and social well-being, while social development and economic growth largely depend on the level and quality of education and training.

Within these three pillars (carriers) of sustainability, concepts of environmental protection must be established, in order to be solved professionally and in a socially acceptable way. Major changes are needed in the economic, social and political fields. In the field of economics, new ways of doing business must be introduced, which take into account the concept of nature as a concept of further production when calculating the price. In the social field, completely new challenges are being posed to the principles and practice of fair distribution from the point of view of creating equal opportunities for development. The decisive question, however, concerns society's willingness to influence the economy and each individual in terms of changing behavior, consumption and lifestyle and production style. This again means that the biggest change is expected in the field of politics.

The initiative on sustainable development has been established at the political level within the UN, OECD, EU and at the national level. This initiative is well positioned and promoted at the macro level, but there are serious shortcomings in its implementation in practice, in plants dealing with cutting processes. By implementing sustainability principles at the level of the cutting process, the industry has the potential to save money and improve its own environmental and social performance.

Sustainability requires a comprehensive view of the multi-life cycle of a product. Of course, industrialized countries have made some progress in applying green products with the use of materials, but the amount of waste still continues to grow. Numerous studies have shown that in one year more than 75% of the material resources used for the production of goods is returned to the environment as waste. This waste of potential resources is disturbing now, but in the next 50 years, as the demand for resources increases tenfold and the total amount of waste increases by a comparable amount, this waste of resources will also be seen as a great tragedy. This is why the coming years are crucial for the survival of planet Earth.

3. EVOLUTION OF THE CONCEPT OF SUSTAINABLE PRODUCTION

Over the past decade, there have been significant changes in the way business views sustainability. Companies strive for sustainable production for six main reasons [1]:

1. The economic gain that is realized as a result of their initiatives.
2. The social commitment they show to their community and stakeholders.
3. To meet regulatory requirements and use fewer resources and hazardous chemicals.
4. To meet customer expectations.
5. Awards and media attention.
6. Profit from employment in successful sustainable manufacturing companies.

Sustainable production uses technological and non-technological solutions, from the selection of materials and production processes to the organization, structure and performance of reporting. It shifts the focus from solving the problem at the end, when questions are raised about waste disposal, recycling, etc., to the very beginning, in the design phase of products and processes, where there are more possible approaches to solve potential problems.

Although there is no universally accepted definition for the term "sustainable production", numerous efforts have been made both in the recent past and in the present to arrive at the right definition. For example: The US Department of Commerce identifies sustainable manufacturing as a high-priority goal and defines it as: "creating industrial products that use processes that minimize negative environmental impact, conserve energy and natural resources, are safe for employees, the community and consumers, and are cost-effective" [2].
In order to reach the concept of sustainable production, it was necessary to go a long way from the concept of traditional production, through the concept of lean production and the concept of green production, Figure 2. [3]. The concept of promoting "green technologies", known under the name 3R (*Reduce, Reuse, Recucle),* is not enough to realize the concept of sustainable production. It was necessary to move on, to a new concept called 6R (*Reduce, Reuse, Recover, Redesign, Remanufacture, Recucle*) because it enables the transformation from one paradigm of the open life cycle to the theoretical paradigm of the closed loop of the life cycle.

In the new concept, 6R, each element has a specific role and meaning:

- ***Reduce*** mainly focuses on the first three phases of the life cycle and refers to reducing the use of resources in pre-production, reducing the use of energy and materials during production and reducing waste during the use phase.
- ***Reuse*** refers to the reuse of a product or its components, after the first life cycle, for a later life cycle to reduce the use of new raw materials for the production of such products and components.
- ***Recycle*** includes the processes of converting materials that may be considered waste into a new material or product.
- ***Recover*** is defined as the process of collecting products at the end of the use phase, disassembling, sorting and cleaning for use in the next life cycle.
- ***Redesign*** simplifies the future use of the product through the application of techniques such as "design for the environment" to create a product that is more sustainable and is called redesigned.
- ***Remanufacture*** includes the reprocessing of already used products in order to restore as many parts as possible to their original state without losing their functionality.

Figure 2. Evolution of sustainable production

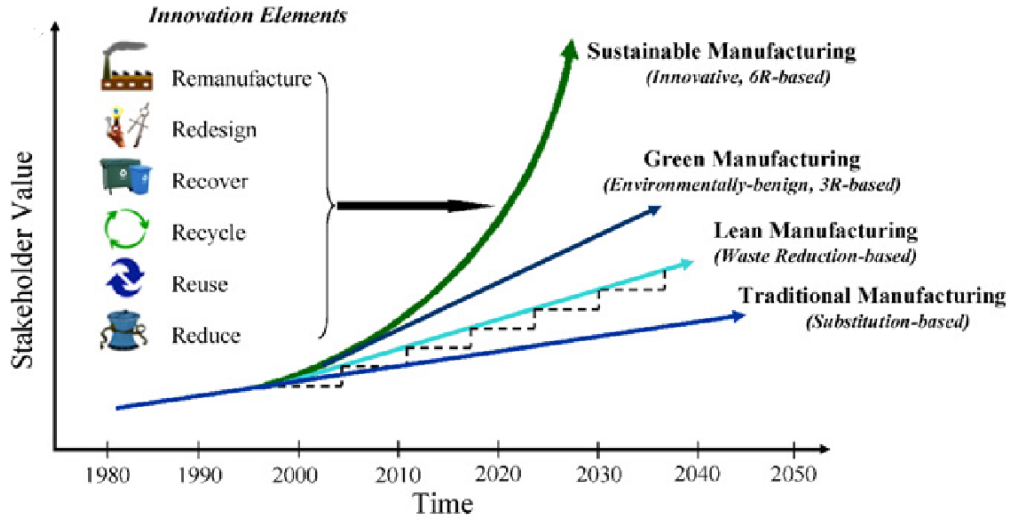
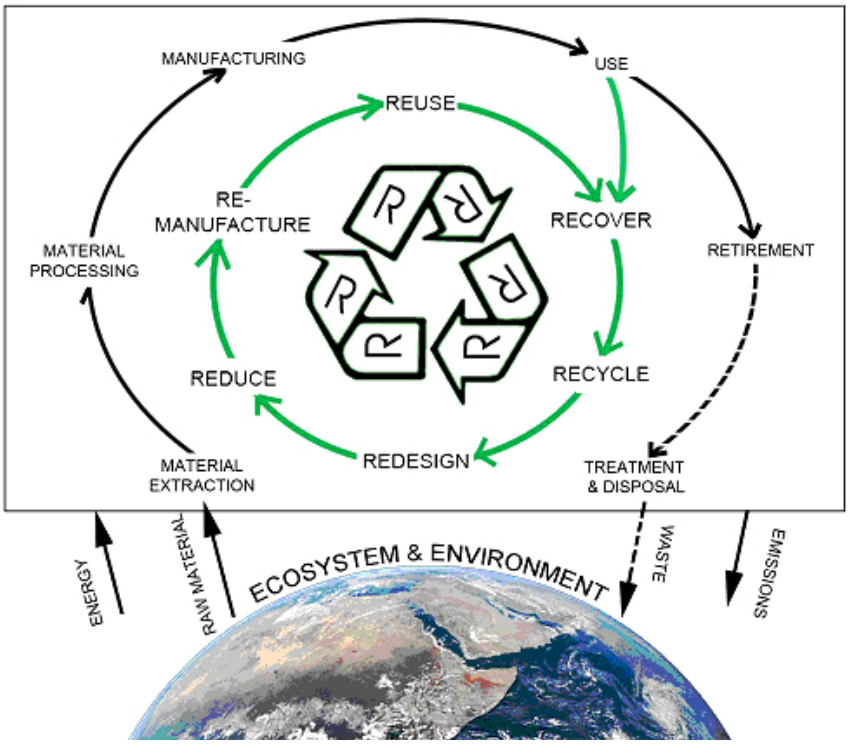


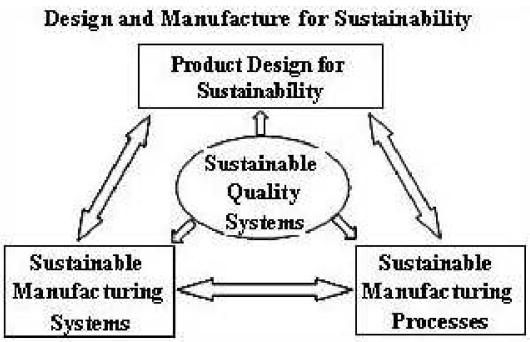
Figure 3 [4] shows the product life cycle with a closed loop ("cradle to cradle"). In order to move towards a closed-loop system, at least three sustainable product development criteria must be met. These are: a) minimization of material and energy resources needed to satisfy product function and customer demand, b) maximization of consumption of already used resources and c) minimization/removal of harmful impact of waste and gas emissions. The closed loop product system, from Figure 3, must meet at least the first two criteria (a and b). In this type of product system, reuse, remanufacturing and recycling activities enable the circulation of materials within the product system. These activities reduce the need for new extraction of raw materials to supply the system, thereby reducing the total energy input and emissions per unit of product.

Figure 3. Closed loop product life cycle system



Three integral elements of sustainable production are shown in Figure 4 [5].

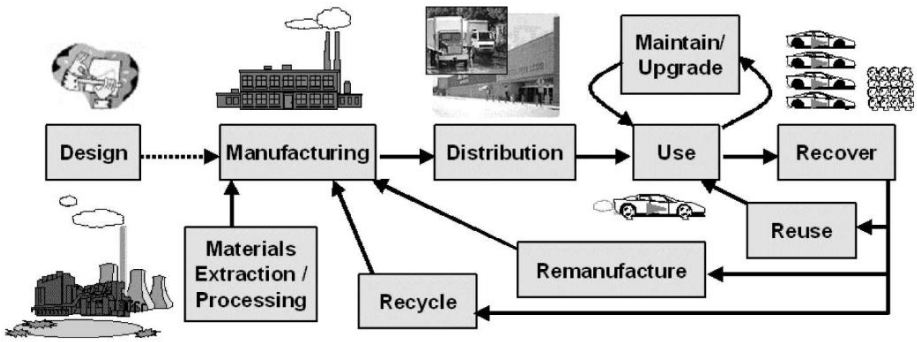
Figure 4. Three integral elements of sustainable production



Efforts to make production more sustainable must include consideration of issues at all relevant levels—product, process, and system-not just one or more levels in isolation. For example: at the process level, there is a need for process optimization in order to achieve technological process improvements, reduction of energy and resource consumption, reduction of toxic waste, reduction of occupational hazards and increase of product life cycle. At the system level, there is a need to consider all aspects of the supply chain, taking into account all the major stages of the life cycle - pre-production, during production, use and post-use. At the product level, one should start from sustainable product design, which includes the entire range of economic, environmental and social issues that define the general quality of life.

The basic premise is that, using the principles of manufacturing sustainability, all manufactured products can be designed, manufactured, assembled, distributed, used and serviced/maintained/improved and at the end of their life cycle these products can be efficiently disassembled, recycled, reused and that way they can start a new life cycle, Figure 5 [6].

Figure 5. Material flow in a sustainable product life cycle



In recent years, the concept of the Circular Economy (CE) has gained significant momentum around the world, compared to the traditionally known Linear Economy model, which is based on the principle of "take - make - sell - spend - throw". The goal of the circular economy model is to produce goods and services in a sustainable way, by limiting the consumption and wastage of resources (raw materials, water, energy), as well as by reducing waste. The circular flow of materials precisely includes recovery, reuse, recycling and remanufacturing (processing) of products. Thus, the circular economy becomes a necessary option for continued economic prosperity and an ecological balance to maintain biodiversity with human life and economic growth. The circular economy model fits directly into the general framework of sustainable development.

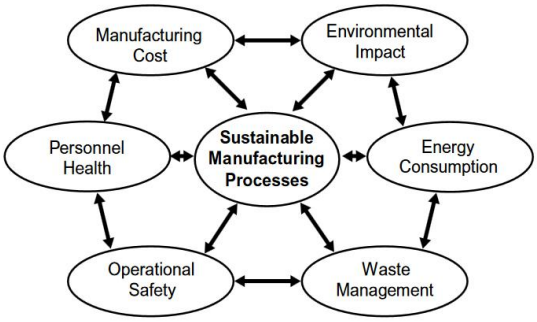
4. SUSTAINABLE PRODUCTION PROCESSES

The production processes are numerous and depending on the products being made, the way they are made and their key characteristics, these processes vary widely. For example, the manufacturing process of a simple screw includes several clearly defined stages: screw design, type of tooling and workpiece material, metal removal/shaping, finishing, packaging, transportation, storage, etc. It is difficult to take into account all these stages in the evaluation of the sustainability of the production process, although all these stages directly or indirectly contribute to the sustainability of the production process. Also, process costs are highly dependent on the methods used to manufacture the part/component and the type of workpiece selected.

With a constant effort to reduce production costs, industrial organizations strive to maintain product quality, machine and operator safety, and reduce energy consumption. If the process involves the use of coolants and lubricants or the emission of toxic substances or harmful chemicals, then this presents additional problems that affect the environment, safety and health of employees.

In principle, among a large number of influential factors, the following six factors can be considered significant in the design of sustainable production processes: energy consumption, production costs, environmental impact, operational safety, employee health, waste management, Figure 6 [5].
The choice and primary importance of these six parameters in the preliminary phase of sustainability assessment does not exclude the possibility of including other significant parameters, such as product functionality requirements, etc., which influence the decision-making process, and are related to processing costs and energy consumption, but expects them to remain as a secondary influence on sustainability.

Figure 6. Factors affecting sustainability in machine processes



For all six parameters, there is a different level of expectation, as shown in Table 1. But there is a clear fact that all these factors cannot achieve their best levels due to technological and production costs. Also, there are strong interactions between these factors, which often require trade-offs. Therefore, the only optimized solution would be a practical one, which would include combinations of minimum and maximum achievable levels within the constraints imposed. The attainable level is again a very relative and specific case.

Table 1. Sustainability factors in material stripping processes and their desired level

Factors	Željeni nivo
Energy consumption	Minimum
Environmental impact	Maximum
Manifacturing costs	Minimum
Operational sefety	Maximum
Personnel health	Maximum
Waste management	Maximum

4.1 Energy consumption

During production operations, the level of energy consumption can be observed and evaluated in relation to theoretical values in order to calculate the efficiency of energy use during the operation. Saving energy in production processes is the most necessary factor of sustainability, which should be taken into account during the entire operating time of the machine, thus achieving significant savings in the long run. For each production operation, energy consumption can be measured in real time. If the same task/operation is performed on two different machines, the energy consumption may vary due to the differences in the

machines and the conditions used in the production processes. Namely, the application of appropriate means for cooling and lubrication, the choice of cutting tools, cutting conditions, combinations of the type of tool and workpiece material, and improved tribological conditions can reduce energy consumption in the processing process. Also, the functional characteristics of the designed cutting tool can contribute to energy savings in machine operations. According to data from the Energy Information Administration, in the USA the broom processing industry annually consumes 47 billion kWh, which represents 5% of industrial electricity consumption [7]. This is roughly equivalent to the emission of 35 million tons of carbon dioxide into the atmosphere.
In the case of cutting, there is an achievable minimum energy level for each machining operation. In assessing the sustainability of energy, that is, the power that is consumed, it is generally expected that the desired energy source is ecological - a renewable source.

4.2 Manifacturing costs

Manufacturing costs include a range of costs, starting with the activity planning process until the part is sent to the next workstation. In the context of assessing the viability of production systems, our interest is only in the production costs involved in and during the performance of operations, including tooling costs. For example, in a machining operation, the material removal rate (throughput) depends on the machining modes selected, the capabilities of the machine tool, and the cutting tools used. Numerous software tools are available to optimize machining costs through the use of appropriate cutting conditions and the use of analytical, experimental, and hybrid methods to optimize machining performance and select cutting tools based on tool durability criteria, including minimum cost. In addition, there are several other direct and indirect factors that come from environmental effects, operator health and safety aspects.
Due to the increase in costs related to materials and energy, the total costs of production will further increase and put more and more pressure on manufacturing companies. This is the reason why companies in the metal processing industry are looking for ways to improve production processes in order to increase profitability, and in accordance with the requirements of sustainable development.

The results of the energy analysis show that the largest part of the electricity costs during metal cutting operations fall on filtering systems, i.e. on the use and treatment of cooling and lubricating agents. It is obvious that the application of cooling and lubricating agents is directly related to the considerable consumption of electricity during metal cutting operations.
Otherwise, coolants and lubricants are used in more than a million machine tools in e.g. Germany, that is, in 1.8 million machine tools in the USA [8]. The German coolant market has an annual volume of more than 100,000.00 tons, of which 72,000.00 tons are mineral oils. Taking into account other products based on mineral oils (e.g. hydraulic oils), the German metalworking industry annually consumes 1.15 million tons of these products, the procurement and subsequent disposal of which costs approx. 3.0 billion euros per year (source: The Federal Office for Economic Affairs and Export Control Germany-BAFA, 2007). It is estimated that the disposal of SHP after use costs approx. 250 euros per ton.
The metalworking industry uses large quantities of cutting fluids that are applied for lubrication and cooling. The cutting fluid market is estimated to be worth $10.75 billion in 2018, and the global cutting fluid market value will reach $14.54 billion by 2025 (source: *https://www.grandviewresearch.com/industry-analysis/metalworking-fluids-market, 01.11.2019.*). In terms of volume, the size of the global cutting fluids market is expected to reach 3.66 million tons by 2025, with a Compound Annual Growth Rate (CAGR) of 4.0%.

4.3 Personnel health

Cooling and lubricating agents are very harmful to human health when they come into contact with body parts or enter the body by inhalation. Health hazards can be acute, even due to short exposure, or chronic caused by prolonged or repeated exposure to hazardous coolants and lubricants. The US and some European countries, especially Germany, France and the UK, are very active in reducing the amount of coolants and lubricants used in manufacturing operations by enforcing strict legal provisions. Excessive use of coolants and lubricants is also undesirable given the significant costs associated with procurement, maintenance, recycling and disposal. Reported data indicate that 80% of occupational skin diseases are caused by cutting fluids [9], and also a large number of respiratory diseases [10].
The toxicological assessment of coolants and lubricants depends on their composition and the properties of the components, which differ significantly depending on the application. In the working space of the machine tool, on the blade of the tool, high temperatures occur, which can lead to the conversion of the cooling and lubricating agent into vapor (mist) and its mixing with the air at the workplace. There are few findings from animal experiments or epidemiological studies regarding the long-term effects of their absorption into the lungs of workers. However, the toxic profiles of individual components indicate systemic toxic reactions after pulmonary or dermal absorption. Reactions in the respiratory tract and lungs can be irritating or toxic.

In general, occupational exposure to cooling and lubricating mists, if mineral oils are used, should be < 3 mg/m^3 (based on 8 working hours), or < 1 mg/m^3 when emulsions are used [11]. These values of coolant mist concentration in the air breathed by the machine tool operator do not necessarily represent best practice, but are achievable and representative of the industry. On the other hand, the American National Institute for Occupational Safety and Health (NIOSH) adopted recommended standards for working conditions in the mechanical industry as far back as 1998, and it was proposed that exposure to coolant mist and lubrication be limited to 5 mg/m^3 of air (based on 8 working hours) [12].

Today, manufacturers of coolants and lubricants have to face a large number of guidelines and legal requirements, which affect their development. However, modern water-based coolants and lubricants still contain between 15 and 60 different substances. Boric acid, amines and chlorinated products are components that must no longer be used in the production of coolants and lubricants, because they cause health problems, such as cancer of the skin, testicles, larynx, pancreas, bladder and the like. Furthermore, it was discovered that the specific combination of substances used is the cause of chronic dermatological diseases. According to German data on occupational diseases, 23% of patients who were in contact with coolants and lubricants had toxic, toxic-degenerative and allergic eczema. Over time, the containers themselves for storing coolants and lubricants become an ideal place for the development of harmful bacteria. There are certain ways to solve these problems, but unfortunately they are still poorly applied in practice due to insufficient and inadequate knowledge.

4.4 Operational sefety

Compliance with regulatory security requirements is mandatory. Safety assessment statistics and specific corrective measures are regularly checked and updated. In principle, safety aspects related to production processes can be divided into two broad categories: personal safety and work equipment safety. The safety of operators and other employees is considered a more important category. Some examples of this category are safety fences, screen

protectors, safety training, hard hats, goggles, gloves and coats, availability of fire equipment, first aid equipment, etc. In addition to routine operational safety and security inspections, special training programs are implemented that promote precautionary measures.
The amount of human interaction during the production operation and the precautions provided to prevent possible accidents are taken as the primary focus in the assessment of operational safety as a sustainability parameter. The ergonomic design of the human interface with the work environment is also an important factor in safety assessments, as is the compliance and proper application of regulatory safety requirements.

4.5 Environmental impact

The main factors that contribute to environmental pollution, such as emissions from various liquids, dust and the use of toxic, flammable or explosive materials, contribute to this factor. The use of large amounts of coolants and lubricants in machine operations creates enormous problems for human health and the environment. Taking care of containers for disposing of used liquids, preventing them from leaking into the environment and developing harmful bacteria, etc., are just some of the important aspects that should be taken into account when assessing environmental protection.
All measures designed to prevent environmental pollution, such as for example the use of suitable filters, appropriate steps in the disposal of liquids, etc..., are essential and, as the regulations require, must be regularly controlled by the competent organizations and institutions . The ISO 14000 series of standards is designed to facilitate the management of environmental protection. A management system includes setting goals and priorities, assigning responsibilities for achieving these goals, measuring and reporting on goals, and externally verifying claims. Because the standards are designed to be voluntary, the decision to implement them is a business decision. The motivation may come from the need to achieve better compliance with environmental regulations, from the search for more efficient processes, from user requests, from community or group environmental campaign pressure, or simply from the desire for company owners to be good cooperative citizens.

4.6 Waste management

Recycling and disposal of all types of production waste, during and after the end of the production process, are calculated in this category. The basic prerequisite for the successful implementation and functioning of an integral waste management system is a certain hierarchical development of activities (minimizing the amount of waste at the source, recycling waste, processing waste, depositing waste).
Economical and energy-efficient recycling of metal parts, shavings, etc., contributes to a sustainable processing process. Breaking chips into small, manageable sizes and shapes and depositing them for recycling and/or reuse becomes a basic requirement for automatic processing.
Scientific principles continue to emerge alongside powerful techniques. Eliminating waste generation and processes without harmful emissions into the environment is the ideal condition to be hoped for, although it is still not technologically feasible. However, efforts to find ways to reduce and eliminate waste generation continue. For example, some liquids may be biologically degraded before being disposed of. The same technology can be used to control the growth of bacteria in the aforementioned containers, etc.

5. ADVANTAGES OF APPLICATION OF SUSTAINABLE TECHNOLOGIES OF CUTTING

The sustainability strategy, as can be seen from all of the above, offers metalworking companies a positive long-term vision that will ensure a more prosperous, cleaner, safer and healthier environment, contributing to a better quality of life for all of us, both today and for future generations. It is a process of transition of human activities to a pattern that can last forever. It is an approach to issues of environmental protection and development, in a way to harmonize human needs with the capacity of our planet.

Some of the advantages that the implementation of the sustainability principle brings to companies are: lower operating costs, improved competitiveness, generation of less waste, a greater amount of waste is recycled and reused, reduction of energy and water consumption, improvement of the environment, improvement of working conditions, better health and safety performance, adoption of best practices in processing, improved public profile or image for the company, improvement in the skill level of the workforce, greater readiness for future changes in health, safety and environmental legislation.

Sustainability offers all companies the opportunity to ensure economic prosperity while respecting the environment and its resources, as well as its employees. This will help them ensure the long-term security of their business. Many companies are facing the problem of declining demand. Therefore, they need to adopt the concept of sustainability and use all its advantages in order to improve their performance and thus their competitiveness in the market.

In order to minimize the impact of cutting processing technologies on health, the environment, as well as to reduce energy consumption, processing costs and waste, it is absolutely necessary to adopt innovative processing processes and systems [13].

Some of the processing strategies with high performance, which can minimize the negative impact of cooling and lubricating agents on the environment, are shown by the so-called "ring of sustainable processing", Figure 7 [14]. This ring consists of currently widely applied machining techniques, with a relatively low environmental impact, such as: dry machining without cooling and lubricating agents, machining methods that use minimal amounts of cooling and lubricating agents, low-temperature cooling and high-pressure jet cooling pressure of cooling and lubricating agents, application of biodegradable oils as cooling and lubricating fluids, etc.

Figure 7. Ring of sustainable cutting operations

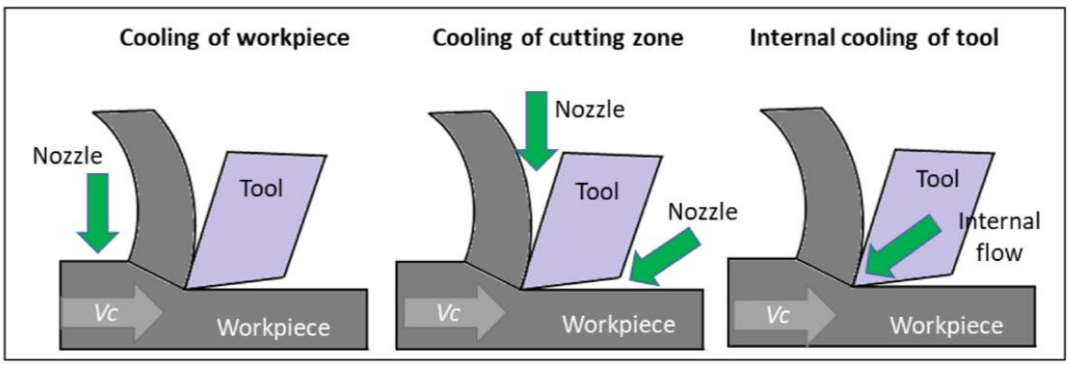
6. EXAMPLE OF THE IMPLEMENTATION OF A SUSTAINABLE ADVANCED PRODUCTION PROCESS - CRYOGENIC PROCESSING

Cryogenic machining is an advanced manufacturing process that uses extremely low temperatures to enhance cutting performance and material quality. This process involves the use of liquid nitrogen or other cryogenic fluids to cool the cutting tool and workpiece during machining, which helps reduce friction and heat generated during cutting.
Research and development in the field of tool-workpiece-machine interactions results in innovations that improve both the productivity of the machining operation and the quality of the workpiece.
The current trend in terms of increasing productivity and high-speed machining leads to an increase in the temperature of the workpiece and the cutting tool. Management of thermal phenomena in machining operations in order to increase tool durability and processing quality is not new. However, the development of new cooling techniques and process temperature management is still new and leaves room for further studies. The metalworking industry makes extensive use of conventional cooling and lubrication media (such as air, oils, and pressure emulsions) to reduce the very high temperatures generated in the cutting zone. However, the increase in environmental protection requirements during processing identifies conventional means for cooling and lubrication as the largest unsustainable elements in the processing process. This leads to research to find alternative cooling mechanisms. Added to this are requirements for more efficient processing of old and new hard-to-process materials (titanium, etc.). One of the alternatives that meets such requirements is the application of cryogenic fluids.
Several cryogenic fluids are available, but for cutting processes, CO_2 and N_2 are used almost exclusively [15].

6.1. Machining operations

There are different implementations of bringing liquid N_2 or CO_2 into the cutting zone, shown in Figure 8.

Figure 8. Different executions of coolant supply [16]

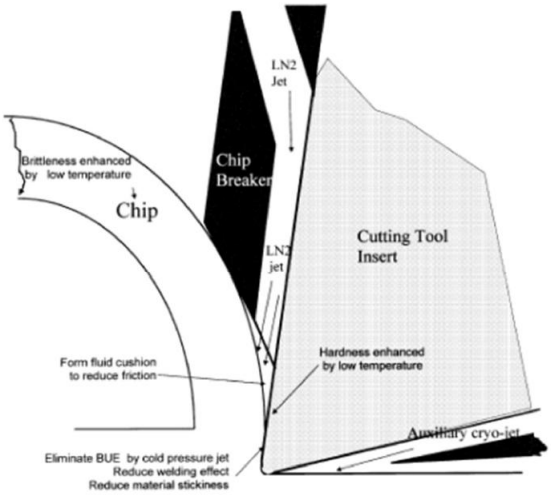


In recent times, the main trend is to bring the cooling fluid through the tool, because with this method we directly affect the cutting zone.

6.2. Cryogenic turning operations

Most research work on cryogenic machining has been done on turning operations. One of the reasons for this is the easier delivery of cryogenic media to the cutting zone, Figure 9.

Figure 9. Cutting zone during cryogenic turning



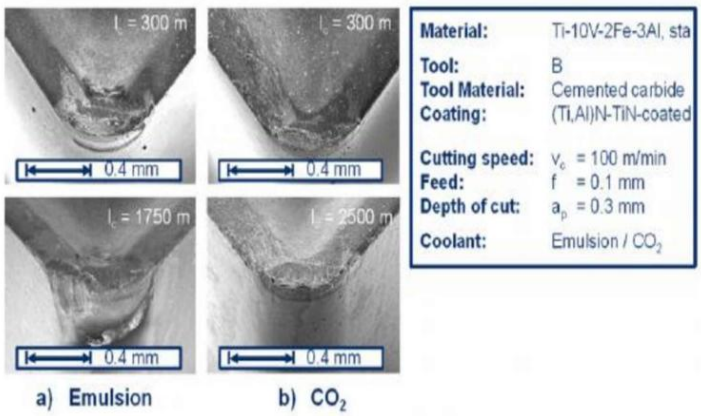
6.3. Turning of titanium alloys

Pusavec [17] made a study as part of research into cleaner production. They compared cryogenic LN_2 cooling with water jet processing and with conventional emulsion. They compared the projected lifetime of the product and their study gives indications that cryogenic processing significantly reduces the impact of the processing process on the environment and the health of workers.

Machai [18] published 3 articles on the machining of b-titanium alloys which are known to be more difficult to machine than all other titanium alloys. TI-10V2FE-3AL was used for the workpiece material, which offers the best combination of strength, toughness and fatigue resistance among all aluminum alloys.

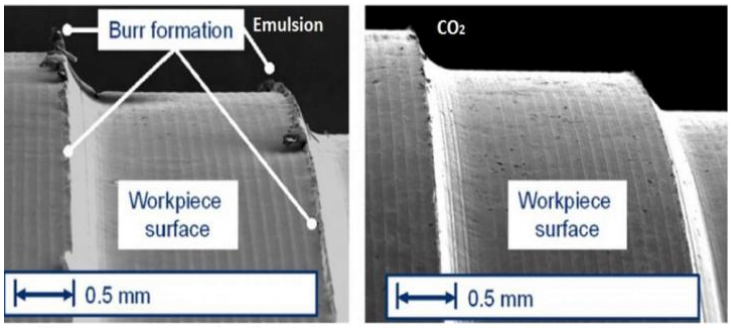
Tests were performed on a CNC lathe with cemented carbide tools, both with (TI, Al) N-TiN coatings and without coatings. CO_2 is applied through the tool holder via a nozzle integrated above the cutting insert. The obtained results are shown in Figure 10.

Figure 10. Tool with coating in conventional emulsion and CO_2 cooling [15]



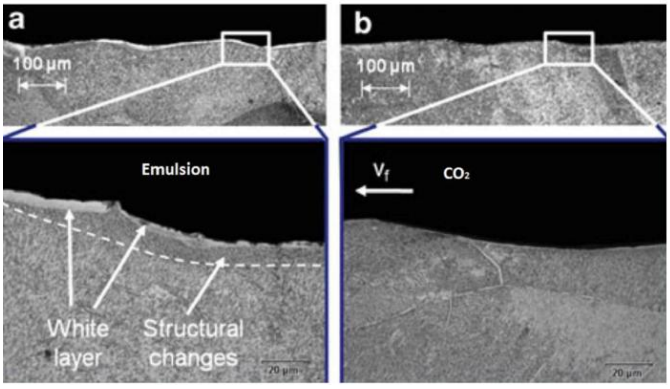
The images on the left reveal tool wear on the side surface when turning with conventional coolant and lubrication. With both cooling methods, the phenomenon of welding can be observed, another complicating factor in cutting processing, which means that in this case CO_2 did not completely manage to penetrate the cutting zone and prevent the chemical reaction of the tool with the workpiece.
However, CO_2 cooling maintained tool hardness and reduced tool face friction. The development of side and back surface wear on coated tools is greatly reduced. Analyzes showed that the coating was removed on the main and auxiliary cutting edges, but this happened more slowly with cryogenic processing than with the classic application of cooling and lubricating agents.
The best results in terms of tool stability during machining were given by coated tools with a sharp edge. Figure 11 shows the appearance of the processed surface during cryogenic and conventional cooling.

Figure 11. Workpiece surface during cryogenic and conventional cooling [15]



CO_2 cooling offered greater tool durability probably due to the lower temperature in the tool and workpiece. The formation of white layers and microstructural changes is prevented due to these advantages of cryogenic cooling (Figure 12).

Figure 12. The surface area of the workpiece after the turning operation [15]



In the conclusion of this study, it is stated that tool durability is largely dependent on the parameters of the processing regime and the microstructure of the workpiece material. Also, the heat treatment strongly influences which wear mechanism will occur in the tool.
It can also be summarized that although the technique of using cryogenic liquids for machining has been developed for over 70 years, the industry has not yet fully accepted and

adapted it. As many have reported, cryogenic refrigeration has great technological and economic potential. Some report that the technique is cost-effective compared to conventional cooling methods while others are skeptical. Each case is individual and must be analyzed individually in each case.

7. CONCLUSION

Socio-economic and technological drivers present various challenges for production in the future, especially in the metalworking industry. Industry and policy makers need to align policies and approaches towards sustainable development goals, in order to proactively and timely respond to these challenges. Industry becomes an active partner in sustainable development, working closely with governments and civil society. Adopting new paradigms of sustainable production, the industry is looking for workers and engineers who have knowledge of the basic principles of sustainability, that is, of technologies that meet the requirements of sustainable development. The role of educational institutions, at the high school and university level, therefore becomes more and more important. The task of these educational institutions is to offer the market personnel capable of implementing the principles and requirements of sustainable production in industrial plants. The role of universities that educate engineers of various professions is especially responsible. It is necessary that universities, ie technical faculties, constantly work on innovating and accrediting new study programs and courses, which will provide students with the necessary knowledge needed to respond to the demands of the present, that is, the near future, from the aspect of sustainable development.

Also, one conclusion that emerges from the example is that if one takes into account the growing number of scientific papers dealing with the energy consumption of cutting processes, and the tendency of companies to advertise themselves as "environmentally friendly", it can be said that they are talking about "green production ” is increasingly breaking through to manufacturers. The story of Industry 5.0, which also takes the environment into account, has already begun. New cooling techniques such as cryogenics will definitely still be researched. Combining cryogenic cooling with processing optimization aimed at optimal productivity, economic profit, and minimized energy consumption may prove to be a worthwhile investment in the future.

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LITERATURE

[1] Carley, S., Jasinowski, J., Glassley, G., Strahan, P., Attari, S., Shackelford, S. (2014). Success Paths to Sustainable Manufacturing, School of Public and Environmental Affairs, Indiana University

[2] US Department of Commerce (2011). Sustainable Manufacturing Initiative website, http://trade.gov/competitiveness/sustainablemanufacturing/index.asp, accessed 27 April 2011.

[3] Jayal, A. D., Badurdeen, F., Dillon, Jr. O. W., Jawahir, I. S. (2010). Sustainable manufacturing: Modeling and optimization challenges at the product, process and system levels, CIRP Journal of Manufacturing Science and Technology, Vol. 2, pp. 144-152.

[4] Jawahir, I. S., Rouch, K. E., Dillon, Jr O.W., Joshi, K. J., Venkatachalam, A., Jaafar, I. H. (2006). Total Life-cycle considerations in product design for manufacture: a framework for comprehensive evaluation, (Keynote paper). In: Proceedingss TMT 2006, Lloret de Mar, Barcelona, pp. 1–10.

[5] Jawahir, I. S., Wanigarathne, P. C., Wang, X. (2006). Product design and manufacturing processes for sustainability, Mechanical Engineers' Handbook: Manufacturing and Management, Vol. 3, Chapter 12, Third Edition, Edited by Myer Kutz, Copyright John Wiley & Sons, Inc.

[6] Sutherland, J. W., Gunter, K., Allen, D., Bras, B., Gutowski, T., Murphy, C., Piwonka, T., Sheng, P., Thurston, D., Wolff, E. (2004). A Global Perspective on the Environmental Challenges Facing the Automotive Industry: State-of-the-Art and Directions for the Future, International Journal of Vehicle Design, Vol. 35 (1/2), pp. 86-102.

[7] Devoldere, T., Dewulf, W., Deprez, W., Willems, B., Duflou, J.R. (2007). Improvement Potential for Energy Consumption in Discrete Part Production Machines"; in Proceedings of the 14th CIRP Conference on Life Cycle Engineering, ed. by Takata, S., Umeda, Y., Tokyo, Japan, Springer, London, pp. 311-316.

[8] Dahmus, J. B. (2007). Applications of Industrial Ecology: Manufacturing, Recycling and Efficiency, Massachusetts Institute of Technology, pp. 15-42.

[9] Lawal, S.A., Choudhury, I.A., Nukman, Y. (2012). Application of vegetable oil-based metalworking fluids in machining ferrous metals - A review. Int. J. Mach. Tools Manuf., Vol. 52, pp. 1-12.

[10] Marksberry, P.W. (2007). Micro-flood (MF) technology for sustainable manufacturing operations that are coolant less and occupationally friendly, J. Clean. Prod., Vol. 15, pp. 958-971.

[11] Simpson, A.T., Stear, M., Groves, J. A., Piney, M., Bradley, S. D., Stagg, S., Crook, B. (2003). Occupational Exposure to Metalworking Fluid Mist and Sump Fluid Contaminants, Ann. occup. Hyg., Vol. 47, No. 1, pp. 17–30.

[12] National Institute for Occupational Safety and Health (1998), Criteria for a Recommended Standard–Occupational Exposure to Metalworking Fluids, U.S. Department of health and human services, pp. 21-24.

[13] Haider, J., Hashmi, M.S.J. (2014). Health and Environmental Impacts in Metal Machining Processes, Comprehensive Materials Processing, Volume 8, pp. 8-31.

[14] Krolczyk, G. M., Maruda, R.W., Krolczyk, J.B., Wojciechowski, S., Mia M., Nieslony, P., Budzik, G. (2019). Ecological trends in machining as a key factor in sustainable production: A review, Journal of Cleaner Production, Vol. 218, pp. 601-615.

[15] Stefánsson, T. (2014). Application of Cryogenic Coolants in Machining Processes: State-of-the-art Literature Study and Experimental Work on Metal Matrix Composite. Masters Thesis.

[16] Navneet Khanna, Chetan Agrawal , Danil Yu Pimenov, Anil Kumar Singla, Alisson Rocha Machado, Leonardo Rosa, Ribeiro da Silva , Munish Kumar Gupta, Murat Sarikaya, Grzegorz M. Krolczyk. “Review on design and development of cryogenic machining setups for heat resistant alloys and composites”.

[17] Pusavec, Franci, Krajnik, Peter and Kopac, Janez. 2009, Transitioning to sustainable production - Part I: application on machining technologies. Journal of Cleaner Production, pp. 174-184.

[18] Machai, Christian and Biermann, Dirk. 2011, Machining of β-titanium-alloy Ti-10V-2Fe-3Al under cryogenic conditions: Cooling with carbon dioxide snow Journal of Material Processing technology, pp. 1175-1183.

ENERGY EFFICIENCY THROUGH THE USE OF SOLAR ENERGY IN THE REPUBLIC OF SERBIA

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Abstract: Renewable energy sources today make up only a small part of the total world energy production and consumption. In the future, that share should be significantly increased, because there are fewer and fewer non-renewable energy sources and their reserves are running out, while their harmful influence has become more and more pronounced in the last few years. The sun, without which there is no life on our planet, gives the Earth several thousand times more energy than humanity manages to consume at the current stage of its development. Everything speaks in favor of the fact that renewable sources can and must be better utilized and that if we work smart we need no longer worry about energy after the fossil fuels are depleted. Our relationship with solar energy today is far more complex. Providing appropriate government policies and technology development, the sun will take a major role in the functioning of modern society—this time, through the production of clean and renewable electricity. The intensity of solar radiation in Serbia is among the highest in Europe, the average intensity ranges from 1.1 kWh/m²/day in the north to 1.7 kWh/m²/day in the south during January, and from 5.9 to 6.6 kWh/m²/day during July. By 2050, solar energy could be a source of a quarter of the energy in the world's electrical network according to the forecast by the International Energy Agency (IEA). The aim of this paper is to indicate energy efficiency through the use of solar energy in the Republic of Serbia.

Keywords: solar energy, energy efficiency, climate conditions, sustainable development.

INTRODUCTION

Solving the energy crisis is one of the most important undertakings of the 21st century. Perfect solutions are difficult to come by, not only because of the drastic differences in political and public support for sustainable energy around the world, but also because of the vast knowledge required to solve the many challenges associated with the global energy landscape. The aim of this paper is to emphasize the importance of rational management of renewable energy sources, especially today when most countries in the world, under the influence of the crisis in Ukraine and the coronavirus, are facing shortages of electricity and natural energy sources due to environmental pollution. We live in a time when the population

is explicitly growing, which requires larger arable land, more factories and buildings, but results with increased waste.
In cities, it is impossible to control the huge amounts of waste material and fossil fuels, especially if there are no adequate laws to regulate it. This is the case in our country. It should be emphasized that with the appearance of increasingly large industrial centers and cities, as well as with one's own behavior, man disrupts the natural balance, also known as anthropogenic factors (Благојевић, 2012). With its development, man has also developed an awareness of how he should behave in order to live better and protect his habitat, thus the concept of environmental protection was born. The modern world is already faced with a common responsibility and the necessity to harmonize its development with the needs of people and nature and with the awareness that the Earth must be preserved both for the current generation and for future generations of people. The obligation of today's generation is to leave posterity at least as many chances and opportunities for development as it has, arising from the fundamental principle of moral justice, which is that all people have equal rights to the broadest basic freedoms that do not threaten the freedom of others. The current generation has the right to natural resources and a healthy environment, but it must not jeopardize the same right for future generations. In recent years, renewable energy sources have played an increasingly important role in energy production. The increased use of renewable energy sources contributes to the reduction of negative impacts on the environment, increasing the reliability of energy supply, enabling the establishment of sustainable energy development and improving the standard of living, especially in rural regions. The development of production and distribution capacities of energy from renewable sources requires strong political will and great financial support in order to ensure the competitiveness of ecological and sustainable sources on the energy market as well as affordable prices (Матијевић, 2011, p. 6).

1. RENEWABLE ENERGY SOURCES - STATE AND PERSPECTIVE

Energy is all around us. Our task is to find the most efficient way for production, storage, distribution, and application. Energy is a natural force that, transformed into some form, serves to perform industrial and other processes and works. Energy is necessary for the movement of nutrients in the ecosystem. Its flow is unidirectional: it starts with the sun rays, then plants follow, then herbivores, carnivores, and finally a man. Energy is consumed all the time, but sunlight constantly compensates for it (Благојевић, 2012, p. 19).

The use of renewable energy sources (RES) limits climate change. Technologies related to renewable energy sources also play a role in achieving better employment in Europe, primarily thanks to the increase in production and consumption of local energy. However, renewable energy sources make up a small part of the European energy mix because they still cost more than traditional energy sources (Матијевић, 2011, p. 1). With the roadmap for renewable energy sources, the European Union had set itself the goal of increasing the share of renewable energy sources in the energy mix to 20% by 2020. This goal required progress in the three main sectors in which renewable energy sources can be used: electricity, biofuels, which should represent 10% of vehicle fuel by 2020, and finally, heating and cooling systems. The roadmap set out the European Commission's long-term strategy for renewable energy sources in the European Union. The task of this strategy was to enable the EU to meet the dual objective of increasing the reliability of the energy supply and reducing greenhouse gas

emissions. The assessment of the share of renewable energy sources in the energy mix and the progress achieved in the last 10 years show that they can be used more and better. It also proposed the creation of a new legislative framework for the improvement and promotion of the use of renewable energy sources (Матијевић, 2011, p. 2).

Natural (primary) forms of energy can be (Shin & Choi , 2000, pp. 167–180):

- non-renewable energy sources and
- renewable energy.

Non-renewable forms of energy are:

- fossil fuels (coal, oil, natural gas, oil shale); and
- nuclear fuels.

Renewable forms of energy:

- water power (energy of watercourses, sea currents, waves, tides);
- biomass (and biogas, including wood and waste);
- solar radiation energy;
- wind energy;
- Earth's internal heat (geothermal energy);
- tidal energy; and
- wave energy.

Renewable energy sources can be divided into two main categories (https://www.industrija.rs/vesti/clanak/oie-energija-buducnosti Retrieved July 15, 2023): traditional renewable energy sources such as biomass and energy from large hydroelectric plants, 'new renewable energy sources' such as solar energy, wind energy, geothermal energy and the like. We can freely say that man has used energy forever, starting from the prehistoric times when energy was used in the form of food to meet the basic physiological needs, through the physical strength and the so-called human energy, which represents the initial form of energy. After the First Energy Crisis in 1973, the importance of energy and the necessity of switching to renewable energy sources became more than clear. Increased energy saving is a short-term solution, so it remains that for a long-term solution it is necessary to switch from non-renewable to renewable energy sources. According to some authors (Перовић, 2008, pp. 348–362), companies are motivated to be socially active because being a good corporate citizen has positive implications for stakeholders, consumers, and competitors. The main goal of modern business is to achieve business excellence.

According to projections, despite the increase in raw material costs, the number of renewable energy facilities were expected to grow by 8% in 2022. About 60% of the expected increase in global renewable energy capacity this year will come from solar energy. It is estimated that a large part of the mentioned increase will be a consequence of large projects implemented in China and the European Union. Looking ahead, the solar industry shares its expectation that solar costs will be cut in half by 2030. For example, there is currently a move toward higher efficiency modules that can generate 1.5 times more power than similarly sized modules. This development is expected to have a very positive impact.

In addition, the sector announces product innovations that will reduce the cost of expensive materials such as silver and silicon used in the production of solar panels and double-surface modules that allow the panels to capture solar energy from both sides. Especially after the Russian invasion of Ukraine, it was seen how fragile food chains are and that this situation can cause a food crisis in the world. This situation has prompted countries to look for ways to increase their agricultural productivity. In terms of land use, until recently the creation of a solar farm consisting of solar panels meant giving up the use of land for agricultural purposes.

However, thanks to technological developments, especially agrovoltaic systems, it has become possible to use land for both agriculture and solar panels, and the first examples can be seen in African countries. This method, which makes it possible to increase the efficiency of the harvest by using the shade panels and their capacity to collect rainwater, is just one of the innovations that we will see in the coming period. Another important innovation is expected to occur with the use of digital technologies to best integrate solar energy into residences, workplaces, and power systems. In this way, we want the energy obtained from solar energy to be more efficient, timely, and sustainable. As a result of this development, it seems possible to expect solar energy to reach a price advantage that will make it unrivaled in many parts of the world compared to fossil fuels. However, today it seems that, in the context of technological development, there is still a long way to go to increase the efficiency of solar energy.

The most important strategic documents of the Republic of Serbia in this segment (Energy Development Strategy until 2025 with projections until 2030 and the National Strategy for the Sustainable Use of Natural Resources and Goods) unequivocally indicate the necessity of promoting greater use of renewable energy sources, but the results so far are unsatisfactory. In Serbia, during 2020 and 2021, there were no commissioning of large power plants that produce electricity from renewable energy sources. A large number of small solar power plants have been built. The current production of solar energy is still negligibly smal-in 2021, its share in the total production of electricity was 0.04 percent. On the other hand, switching to solar energy is the fastest, easiest, and cheapest form of using renewable energy sources, both for the economy and for citizens.

Table 1. Estimated budget for financing projects of common interest in the European Union (in millions of euros)

Years	**2014.**	**2015.**	**2016.**	**2017.**	**2018.**	**2019.**	**2020.**	**In total**
Grants	365.7	436.8	664.5	766.8	826.2	960.0	1,192.4	**5,212.4**
Financial instruments	40.6	48.5	73.8	85.2	91.8	106.7	132.5	**579.2**

Source: Norton Rose Fulbright (2014) European energy infrastructure opportunities - Projects of Common Interest, стр. 25

2. EFFICIENCY OF SOLAR ENERGY

Humans have used solar energy as one of the primary sources in the past. However, when the industrial revolution occurred in the second half of the 18th century, fossil fuels became the main source of energy. Their negative impact on the environment and climate is great. Moreover, the speed of their renewal is so low that they are considered a non-renewable

source of energy. In moments of oil crises, their limitations came to the fore. Thus, in the 70s of the 20th century, as a result of the scarcity of resources, the price of fossil fuels rose so much that people suddenly began to search for alternative sources of energy. Then the potential of the Sun's energy was recognized and the redevelopment of the use of solar energy began. Today, industries and companies engaged in the production of solar systems are increasingly rising and represent the fastest growing sector of the economy (https://www.novosti.rs/c/odrzivi-razvoj/zelena-buducnost/1228979/solarna-energija-njen-znacaj Retreived on July 20, 2023). The most common form of human use of solar energy are photovoltaic solar panels which absorb sunlight to create electricity. They can be used as primary or secondary sources of electricity in households.

Water heating, especially in closed tanks and pools, or the operation of small devices, i.e., machines that are valid for small consumers, are just some examples of smart exploitation of solar energy. The use of solar energy contributes to the reduction of greenhouse gas emissions. Greenhouse gases absorb the Sun's energy and Earth's heat and trap it in the atmosphere. This way, the greenhouse effect is created. Many of these gases are naturally available in the atmosphere, but human activity increases their concentration, especially carbon dioxide (SO2), methane (SN4), nitrogen oxide (N2O) and freon (fluorinated gases), which cause climate changes. Apart from electricity generation, solar energy is also used in other sectors, such as heating and cooling buildings, heating water for households and irrigation in agriculture. Overall, solar energy is of great importance in reducing greenhouse gas emissions, ensuring a long-term sustainable source of energy, reducing dependence on energy imports and improving the economy.

The main advantages of solar energy are:

- It has an inexhaustible and natural source which is the Sun;
- The environmental impact is minimal, compared to other renewable energies such as wind (where the impact of wind turbines on birds is questioned) or hydro (where there is an impact on the aquatic ecosystem); and
- It can be adapted to the domestic environment, with the installation of solar panels that provide energy to homes.

In contrast, the disadvantages of this type of energy is (https://sr.economy-pedia.com/11040640-solar-energy Retreived July 20, 2023) that it requires a constant flow of sunlight for its operation. However, not all regions of the planet can capture solar radiation in the same way. Like all renewable energies, solar energy depends on the climate factor and does not guarantee a permanent supply. Namely, it would be problematic for the community to depend only on sunlight, because it does not have a regular flow. Faced with this shortcoming, technology has advanced and it is possible to store energy from sunlight, but only through solar thermal energy systems. However, photovoltaic solar energy cannot be stored. The question arises, what does the use of solar energy depend on? The efficiency of solar systems depends on geographical parameters, i.e., sunshine, cloudiness, object shadows, terrain configuration, and air pollution, but it also depends on the socio-political situation at the local and national level, as well as on the economic and social characteristics of society. The socio-political situation can encourage the development of solar systems. On the other hand, low environmental awareness and undefined state policy influence greater investments in non-renewable energy sources.

The number of hours of solar radiation on the territory of Serbia is between 1,500 and 2,200 hours per year. The average intensity of solar radiation is from 1.1 kWh/m2/day in the north to 1.7 kWh/m2/day in the south during January, and from 5.9 to 6.6 kWh/m2/day during July (https://www.scee.rs/sr/energetska-efikasnost/aktuelne-teme/solarna-energija-i-solarni-paneli.html Retrieved July 18, 2023). The average value of radiation energy is from 1,200 kWh/m2/year in northwestern Serbia to 1,550 kWh/m2/year in southeastern Serbia, while in the central part it is about 1,400 kWh/m2/year. Serbia has a significantly higher number of hours of solar radiation than most European countries with the best conditions in the southeastern part of our country. For the first time, the Government of the Republic of Serbia provided the opportunity for the construction of solar power plants in Serbia through subsidies with the Regulation on incentive measures for the production of electricity from renewable sources and from highly efficient combined production of electricity and heat from 2009. After that, the Government further increased the capacity and reduced the subsidized price through two new Regulations from 2013 and 2016. You can view the multi-year overview of electricity production in solar systems in Serbia on the website of the International Renewable Energy Agency (IRENA).

On the World RES Atlas page, you can view various maps (https://esolargroup.biz/kalkulator.html Retreived on Juy 15, 2023), including a map of our country marked by the degree of representation of all types of renewable energy sources. In March 2021, the new Law on the Use of Renewable Energy Sources was adopted, as well as the Law on Energy Efficiency and Rational Use of Energy, with which the Government of the Republic of Serbia seeks to encourage new investments in clean energy. The construction of thermal power plants on solar energy are significant investments, this type of thermal power plant is basically no different from other power plants that convert thermal energy into electricity. Given that they have no harmful products during the production of electricity and have relatively good efficiency (20–40%), they definitely have a bright future. Thermal energy is used to heat the fluid, the products of which are used to generate electricity through a generator. Solar thermal power plants consist of a mirror and a reservoir of fluid that is heated and passes through the turbines of the generator. We can divide them into the following categories: parabolic collectors (highest potential for commercial use), solar towers, and solar plates. We will also mention Fresnel reflectors as one of the youngest technologies of this type. All these thermal power plants use primarily the direct component of solar radiation and to be efficient they must follow the movement of the sun. The efficiency of these power plants is increased by installing energy storage capacity, which also increases reliability. Thermal energy is stored in a material of high energy density. Molten salt is now used because of sodium, which has the appropriate density, and in the coming period, the use of other elements, for example graphite, can be expected. The greatest potential for using solar energy is in the south of Serbia, the cities with the greatest potential are Niš, Kuršumlija, and Vranje.

The application of solar systems in households is conditioned not only by the awareness of the importance of their application, but also by the economic standard. The use of solar energy helps reduce these emissions, which is the key to combating climate change. The largest solar power plant in Serbia opened in Lapovo The solar power plant DeLasol was built by the MT-KOME X company and covers 12.5 hectares. This power plant is the largest in Serbia in terms of size and power and it will produce 15,000 megawatt-hours of electricity annually, enough for about 2,100 households. An oil company in Serbia has also started implementing

projects in the field of solar energy. The company NIS started installation of solar panels for the production of electricity at its gas stations. As part of the first phase of this project, solar panels will be installed at eight NIS Petrol and GAZPROM retail outlets throughout Serbia.

Most of the electricity produced will be used for the needs of gas stations and exchanged with the distribution grid. In periods when the production of the power plant exceeds the needs of the gas station, the surplus will be delivered to the distribution network. By the same principle, when production is insufficient, electricity will be taken from the grid. The company decided to take this step based on the principles of sustainable development and the realization of its green agenda, which includes investing in renewable energy sources in order to reduce carbon dioxide emissions and global warming. In this pilot project, NIS invested more than 22 million dinars; this way, in eight locations, annual savings in the procurement of electricity of almost 300 MWh will be achieved, with the delivery of about 40 MWh to the distribution network and with an annual reduction in carbon dioxide emissions of 375 tons.

The implementation of energy efficiency measures, the use of renewable energy sources, environmental protection, and the reduction of the impact on climate change are key elements of the transition towards sustainable energy development in the Republic of Serbia. Bearing in mind the current situation in the efficiency of energy production, transformation, transport, and consumption in the Republic of Serbia, the implementation of measures and procedures to increase energy efficiency has the capacity of a ‘new, domestic energy source’ and is imposed as a long-term element of functioning and the basis of development of all energy sectors. Achieving sustainable energy development in the Republic of Serbia in the period up to 2030 in accordance with the needs and possibilities of the economy and the society will require that the further development of the energy sector in the Republic of Serbia be based on activities that include (Стратегија развоја енергетике Републике Србије до 2025. године са пројекцијама до 2030. године „Службени гласник РС“, број 101 од 8. децембра 2015):

- more intensive research of energy potentials;
- development of the energy market, with the application of the principles of competition, transparency, and non-discrimination;
- construction of new energy capacities, i.e., revitalization and modernization of the existing ones;
- a comprehensive and coordinated approach to the rationalization of energy consumption and the overall increase in energy efficiency;
- creation of adequate regulatory and organizational conditions and simplification and acceleration of procedures for obtaining consent and permits;
- intensive use of renewable energy sources, whereby the promotion of renewable energy sources should be included in the energy plans of cities and local communities as part of local energy strategies;
- reorganization and restructuring of companies in the energy sector; and
- further harmonization of existing regulations with EU regulations and standards.

CONCLUSION

Solar energy has been reaching the Earth since its inception and since the inception of humanity. As such, it represents the basic energy source and the source of life. Solar energy has captured the attention of science and the public in the last few decades, especially its environmentally conscious part. Namely, solar energy is an immediately usable, clean, and renewable ecological resource, which is a great advantage over fossil fuels. Therefore, more and more work is being done on systems that convert solar energy into electricity, both for small-scale domestic and large commercial fields of solar panels so as to make a great contribution to the stability of the operation of public power grids. It is true that the global solar picture is constantly changing and that the countries that were until recently unequivocally in the lead when it came to the number of installed solar units are today somewhat lower on the general scale, but it seems that Serbia is clearly and continuously lagging behind the world. Energy efficiency is becoming an increasingly important topic in the business world, both because of financial savings and because of the increasing demands for sustainable business practices. Solar energy is no longer an 'alternative' energy, as it was wrongly considered in our country until recently. Given the variable price of classic energy sources, of which oil and gas are not renewable and whose prices tend to rise permanently, the use of this most efficient renewable energy source becomes an absolute imperative. The Sun sends us every hour as much energy as the entire population of the Earth consumes in one year, therefore it is an investment in a permanent heating solution whose price, which is absolutely free, cannot be changed by any taxes or global economic and political crisis.

LITERATURE

1. Благојевић, Љ. (2012). Животна средина и здравље, Факултет заштите на раду, Универзитет Нишу.
2. Јовановић, М. (2016). Обновљиви извори енергије као фактор економског развоја и унапређења енергетске сигурности земаља Западног Балкана, докторска дисертација, Универзитет у Нишу, Економски факултет.
3. Матијевић А. (2011). Обновљиви извори енергије стање перспектива у Србији и свету, Факултет техничких наука, Крагујевац, стр.1-6.
4. Shin D., Choi S. (2000). The Combustion of Simulated Waste Particles in a Fixed Bed. Combust Flame, 121, pp. 167-180.
5. https://www.industrija.rs/vesti/clanak/oie-energija-buducnosti Retrieved July 15, 2023
6. Перовић, Н. (2008). *Друштвена одговорност компаније – изазов савремене економије,* зборник радова, Морал и економија, Институт друштвених наука, Центар за економска истраживања, Београд, стр. 348-362.
7. Norton Rose Fulbright (2014). European energy infrastructure opportunities - Projects of Common Interest, стр. 25
8. https://www.novosti.rs/c/odrzivi-razvoj/zelena-buducnost/1228979/solarna-energija-njen-znacaj Retreived on July 20, 2023
9. https://sr.economy-pedia.com/11040640-solar-energy Retreived July 20, 2023
10. https://www.scee.rs/sr/energetska-efikasnost/aktuelne-teme/solarna-energija-i-solarni-paneli.html Retrieved July 18, 2023
11. https://esolargroup.biz/kalkulator.html Retreived on Juy 15, 2023

12. Стратегија развоја енергетике Републике Србије до 2025. године са пројекцијама до 2030. године „Службени гласник РС“, број 101 од 8. децембра 2015
13. Закон о енергетици („Службени гласник РС”, бр. 145/14 и 95/18 - др. закон)
14. Закон о изменама и допунама Закона о енергетици (Службени гласник РС бр. 40/2021)
15. Закон о енергетици („Службени гласник РС”, бр. 145/14 и 95/18 - др. закон и 40/21) - интерно пречишћен текст.

CIRCULAR ECONOMY AND PACKAGING WASTE MANAGEMENT IN BOSNIA AND HERZEGOVINA

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Abstract: Circular economy and packaging waste management are closely related terms. The circular economy represents a model that implies that materials and resources are used in such a way that they are maximally used and recycled, while waste is not reduced to a minimum. Packaging waste management is one of the key aspects of the circular economy, given that a large part of the waste produced in Bosnia and Herzegovina is related to packaging waste. Packaging waste in Bosnia and Herzegovina represents a significant environmental problem, as in many other countries of the world. In the last few years, the country has started to work on improving the packaging waste management system, but there are still challenges that need to be solved.

In accordance with legal and by-laws in BiH on packaging and packaging waste, manufacturers and importers of goods are obliged to organize and finance the collection, transport and recycling of packaging waste generated after the use of their products. However, this is still not fully implemented, and a large part of packaging waste is still disposed of inappropriately. Several companies in Bosnia and Herzegovina deal with the collection and recycling of packaging waste, but the capacities are still limited. One of the leading facilities for mechanical recycling of waste PET amalgam in Bosnia and Herzegovina is "Omorika reciklaža", Doboj, with a capacity of 400 t/month. However, there is a lack of adequate infrastructure for the collection and processing of waste, as well as the strong will and support of society and the government to solve the problem. Also, there is a lack of adequate infrastructure for the collection and processing of waste, as well as the strong will and support of society and the government to solve the problem. Although there are legal frameworks for packaging waste management in Bosnia and Herzegovina, there are still challenges that must be addressed in order to create a sustainable and efficient waste management system. In order for the circular economy and packaging waste management to be successfully implemented in Bosnia and Herzegovina, it is necessary to develop adequate legal frameworks, to increase the awareness of citizens and companies about this issue and to provide resources for its effective application.

Keywords: circular economy, packaging waste, waste management, resources, recycling

INTRODUCTION

Waste is defined by the Waste Framework Directive (75/442/EEC), as "any substance or object which the holder disposes of or is required to dispose of". The increase in the rate of waste production during the last decades has had strong implications in the European waste management policy. It was estimated that 2.01 billion tons of municipal solid waste were generated in 2016, and this number is expected to increase to 3.40 billion tons by 2050 (Kaza et al., 2018). The amounts of waste generation, as well as its morphological composition, are mostly related to income levels and urbanization rates (Pešević, 2022). In countries with high

incomes, the share of organic waste is lower compared to countries with lower incomes, due to larger amounts of packaging waste and other inorganic waste. European statistics show that as a result of income growth, the share of secondary raw materials (mainly packaging) in waste grows about 50 percent faster (1.5%x1.8=2.7%/year) than the growth of the amount of total waste (1.8%/year) per inhabitant, while the amount of organic waste is decreasing. In addition, the United Nations Environment Program (UNEP, 2011) in its publication on the green economy indicates that packaging waste increases with the growth of gross domestic product (GDP) and income growth, while the share of organic waste decreases in parallel. The turnover of the packaging industry in Western Europe represents around 2% of GDP and the food industry is the main user of packaging with almost 60% of total packaging production (Coelho et al., 2020).
Packaging waste represents one of the fastest growing types of waste in the EU. The problem of packaging waste has been highlighted due to the growing fees for landfilling, the environmental impact of disposing of this type of material (e.g. a significant part of packaging waste is not biodegradable), and the possibility of using this waste as a resource (da Cruz et al., 2014).

Since the publication of Directive 94/62/EC on packaging and packaging waste, practically all Member States have been undertaking major investments in their recycling systems (e.g. in selective collection and sorting equipment and infrastructure). The transition towards a circular economy, with the aim of extending the useful lifetime of materials by promoting recycling whilst lowering resource use, has become a priority in the European Union (EU) vision of sustainable economic growth and global competitiveness (Milios, 2018; Tisserant et al., 2017).
In March 2019, the European Commission adopted a comprehensive report on the implementation of the Circular economy action plan. The report presents the main achievements of the Action Plan and points to future challenges in shaping the economy and points towards a neutral, circular economy where the pressure on natural and freshwater resources, as well as ecosystems, is minimized. The circular economy was seen as a way to tackle its pressing problems of environmental pollution and resource scarcity. It represents a systemic shift towards building long-term stability, new business and economic opportunities, and social benefits for the environment. The concept of circular economy (CE) is gaining traction as an alternative to the "use-dispose" paradigm. The CE concept aims to extend the life of materials and promote recycling to maximize material service per resource investment while reducing environmental impact and resource use. The concept of CE is closely related to the 3R principles: reduce, reuse and recycle (Ghisellini et al. 2015; Lieder and Rashid 2015). The circular economy is a concept that is often associated with sustainable development and the green economy. The circular economy legislative package include a common EU target of recycling 70% of packaging waste by 2030, as well as mandatory extended producer responsibility programs to market more environmentally friendly products and encourage treatment and recycling programs.

Packaging is any product, regardless of the nature of the material from which it is made, from its purpose for containing, storing, protecting, handling, delivering and presenting goods, from raw materials to finished products, on the way from the producer to the user or consumer.

Packaging can be:

- Primary or sales packaging as the smallest packaging unit in which the product is sold to the final customer (glasses, bags, cans, bottles, jars, boxes, bowls, tubes and other similar packaging).
- Secondary or collective packaging includes films, boxes and similar wrappings and other packaging with component parts, which surround or connect several basic sales units of the same or different types at the point of purchase, regardless of whether they are sold to the final user or consumer together with the goods or is removed at the point of purchase.
- Tertiary or transport packaging includes barrels, crates, buckets, sacks, pallets, boxes and other packaging, the components of which contain or connect large quantities of basic sales units of goods in primary or secondary packaging, with the purpose of facilitating the handling and transportation of products and protecting goods from damage on the way from the manufacturer to the retailer or from the retailer to the end user or consumer.

Packaging waste is any packaging or packaging material that cannot be used for its original purpose, with the exception of material residues created in the production of packaging (production residues) that are not considered packaging waste. Packaging waste consists of products made of different materials - glass, plastic, paper, cardboard, wood, metal, multi-layer mixed materials, etc.

• Metal packaging – cans, cans, deodorant packages, sprays, buckets, metal barrels, aluminum foils, aluminum lids, etc.
• Plastic packaging – PET packaging, crates, plastic barrels, lids, plastic detergent bottles, etc.
• Glass packaging - glass beverage glasses, all glass bottles and food jars, etc.
• Cardboard - cardboard bags, boxes, cardboard packaging for drinks, etc.
• Paper - wrapping paper, laminated paper (used in butchers and shops), bread bags, paper bags, etc.
• Wood – wooden pallets, wooden crates, etc.

Stipanelov Vrandečić (2010) states the following as the most important functions of packaging: protective function (preserves the quality of the product), storage and transport function (ensures easier manipulation of the product during storage and transport), sales function (the appearance and design of the packaging are often very important when choosing a product by the customer), use function (packaging should enable the product to be used as easily as possible), ecological function (ensures that the packaging is treated in a way that will be most acceptable for the environment after using the product), informative function (provides the consumer with appropriate information). Therefore, the packaging, by its function, gives the appropriate characteristics to each product. However, packaging loses its purpose and ceases to be needed often even before the product is consumed (Grum, 2013).
Directive 94/62/EC and 2004/12/EC define the handling of packaging and packaging waste. This directive aims to harmonize national legislation with the intention of reducing the negative impact that packaging waste has on the environment and to regulate the internal market. The content of the directive focuses on the prevention of packaging waste, the reuse of packaging and finally the recycling and recovery of packaging waste, which is one of the bases of sustainable management of natural resources and the protection and improvement of the environment. Directive 2018/852 introduced more ambitious goals in the rate of recycling of municipal waste, but also of total packaging waste and specific materials in packaging. Regarding packaging waste, the common EU target for recycling is 65% by 2025, 70% by

2030, with separate targets for specific materials (plastic 55%, wood 30%, iron 80%, glass 75%, paper and cardboard 85%), therefore EU member states as well as those that wish to join, must establish a system for managing packaging waste in accordance with this directive. In the process of integration of Bosnia and Herzegovina into the EU, our country decided to harmonize its legislation with the Acquis Communitaire, i.e. legal acquis of the European Union. EU directives and laws, and above all Directive 94/62/EC on packaging and packaging waste, establish the principle of "producer's extended responsibility", i.e. an obligation to all entities in the packaging life chain, from packaging manufacturers, fillers (manufacturers of the finished product), through importers, distributors to retailers, to recycle and use the packaging waste generated on the market after the consumption of their products in percentages determined by the state, while do not achieve the goals of the EU Directive.

Extended Producer Responsibility (EPR) is an effective resource management tool, where producers take responsibility for managing the waste generated after product use. This may include the collection, sorting and treatment of such waste for recycling and recovery purposes. This policy first appeared in the early nineties in several European member states, especially for packaging waste, and later spread throughout the EU and beyond. In one variant of this instrument, only the collection of used products is carried out, while in the other, there is the possibility of paying certain compensation to the consumer. This variant is often combined with the practice of giving a discount for a new product, provided that the old, used one is handed in.
The Extended Producer Responsibility scheme can provide funding for containers, public awareness activities and sorting activities to increase the level of separation/quality of packaging waste.
Directive 2019/904EU54 of June 5, 2019 on reducing the impact of certain plastic products on the environment (Directive on single-use plastics) prescribes various measures for certain plastic products, including single-use plastic bags, all with the aim of reducing waste in seas, as well as the impact of plastic waste on the environment and human health. Plastic is the most common type of material used in the packaging industry. The packaging sector consumes 40.5% of all produced plastic, which is the largest sector for plastic consumption in the EU (Jacobsen et al., 2022). However, the recycling rate is still low, at 34.6%, and a worrying 23% of plastic waste is still sent to landfill (Plastics Europe, 2022).

With the support of UNDP, a special report "Transposition of the Directive on single-use plastics and its impact on the economy of Bosnia and Herzegovina" was prepared, the purpose of which is to identify the current status of the EU Directive on single-use plastics, analyze the plans for adapting those industries that in their business they use single-use plastic, which is the subject of the Directive, and the possibility of its transposition into BiH legislation. Although there are two significant regulatory policy instruments in FBiH and RS (extended producer responsibility scheme and measures for separate collection), they focus on plastic packaging as a whole and do not specifically regulate single-use plastic products that are subject to the Single-Use Plastics Directive. In FBiH, the Regulation on fees for plastic suspender bags was adopted. According to this Regulation, a mandatory fee is paid for plastic suspender bags, excluding thin bags in which fruit, vegetables, bulk and other loose products are packed. The regulation does not define whether retailers should charge for plastic bags, but in practice most major retail chains charge for them (0.10 KM per bag). In the Republic of Srpska, amendments to the law regulating this area have been adopted, while the by-law on plastic bags is still in the preparation phase. The Law on Amendments and Supplements to the Law on Waste Management of the RS defines that a fee must be paid for manufactured or

imported products that become waste after use, and where plastic carrier bags are classified as well. This change obliges retailers to charge for lightweight bags, while very light bags used for bulk products are not charged.

In BiH, waste management policy is under the jurisdiction of the entities (FBiH and RS) and the tasks are performed by entity ministries responsible for environmental protection. The implementation of the directive on packaging and packaging waste into the national legislation, i.e. into the legislation of the entities, is part of the process of stabilization and accession of BiH to the EU. Legislative procedures should ensure that economic entities organize the management of packaging waste themselves or through a third party.
Systems of extended producer responsibility have been established in both entities, based on entity laws on waste management and by-laws on packaging. Manufacturers, importers, fillers, packers, distributors and suppliers are obliged to join the packaging waste management system. They can either transfer their obligations directly to the system operators by signing a contract and paying a fee to the operator or pay a prescribed (higher) fee to environmental funds (Environmental Protection Fund of the Federation of Bosnia and Herzegovina and Environmental Protection and Energy Efficiency Fundof the Republic of Srpska).
Recently, initiatives to increase recycling and better management of packaging waste have appeared in Bosnia and Herzegovina. There is a legal regulation in Bosnia and Herzegovina concerning the management of packaging waste, but it is not applied adequately in practice. In addition, there is a lack of education of the population about the importance of proper management of packaging waste.

BASIC CHARACTERISTICS OF WASTE MANAGEMENT IN BOSNIA AND HERZEGOVINA

Packaging waste management should be considered within the broader framework of municipal waste management. The existing arrangement for waste management in BiH is inadequate in most municipalities, both from the aspect of waste collection and disposal. Waste collection is not comprehensive, especially in semi-urban and rural areas where service coverage is 68-80% (World Bank, 2017).
Capacities for waste collection and disposal remain insufficient in view of the rapidly growing volume of waste production; essentially all waste is landfilled and there is no waste separation, recycling or treatment (with some minor exceptions). There are no reliable data on the composition of the municipal waste stream, because data on waste generation are not based on actual measurements. Also, there is no detailed and comprehensive information on the quantities of separately collected and recycled waste in BiH. The BiH Agency for Statistics (BHAS) annually publishes data on the collection and disposal of municipal waste, but there are numerous problems with the quality of the data. According to BHAS data, only a few business entities submitted data on waste quantities obtained by direct measurement, considering that only a small number of landfills have measurement equipment. In cases where direct measurements are not available, estimates are made based on the number of vehicles and their capacity. Currently, there are no specialized statistical surveys on the amount of packaging placed on the market.

According to the data of the BiH Statistics Agency (2019), in 2018, the estimated amount of municipal waste produced is 1,243,973 tons, that is, 355 kg per inhabitant per year, or 0.97 kg per inhabitant per day. Public collection collected 920,540 tons of municipal waste, of which

mixed municipal waste accounted for 90.9%, separately collected municipal waste 4.0%, waste from gardens and parks 3.1% and packaging waste 2.0% (BHAS, 2019).
The large amount of packaging waste that is produced every day represents a great challenge for local communities and authorities. Packaging waste is mostly disposed of in landfills, many of which are improperly constructed and do not meet prescribed standards.

Solid waste management is regulated by laws on waste management in the entities (FBiH and RS) and Brčko District (BD), which promote the principle of waste hierarchy, the "polluter pays" principle and the principle of producer responsibility. Waste management strategies were drawn up in both entities and BD, for the period up to 2018 (FBiH) and 2026 (RS and BD). These strategies promote further harmonization of legislation with EU directives, regionalization of waste disposal, introduction of waste separation at source and creation of sustainable waste management systems. The main actors in the solid waste management sector are municipalities, which are responsible for waste management, setting tariffs and making all decisions on regionalization, separation, waste treatment and necessary investments. The exception is the Canton of Sarajevo, where communal services are organized at the cantonal level.
The practice of waste separation at the source and separate collection in BiH is currently not well developed and is still far below the goals defined in the entity's waste management strategies. The total separate amount is estimated at around 5%, of which 3% is directly purchased from the commercial, institutional and industrial sectors and 2% is collected from households (World Bank, 2017). The collection of recyclable waste from large supermarkets and other commercial establishments is relatively well developed in large cities. In principle, the collection of industrial and commercial packaging is organized independently of the system operator. The collection is focused on materials whose income covers the costs of collection and preparation, such as metal, paper and cardboard, foil, PET bottles, large objects made of rigid plastic. According to the Waste Materials Market Study - Bosnia and Herzegovina (IFC, 2004), informal waste collectors exist in practically all cities. They mainly collect scrap metal and, to a lesser extent, scrap cardboard, as these materials tend to have a higher market value. Informal waste collectors collect materials from local landfills, roadside containers and directly from households (in the form of door-to-door collection).
There is no reliable data on the amount of packaging that is placed on the market and the amount of recyclable waste that is separately collected, recycled or exported. According to estimates, in 2013, over 200,000 tons of packaging were placed on the BiH market (World Bank, 2017).

According to the data of the BiH Statistics Agency (2023), the total amount of processed and disposed of waste in 2021 in BiH was 807,855 tons. Of the total amount of collected waste, 84.9% was collected from the territory of Bosnia and Herzegovina, imports from other countries amounted to 2.4%, and the stored amount was 9.3%. According to the method of waste management, 10.6% was temporarily stored, 21.8% processed and 67.2% handed over to another business entity for further processing and disposal (BHAS, 2023). Observing the period 2014-2021. the trend shows an increase in the total amount of collected waste, as well as the amount handed over to others for management. Significant amounts of waste materials were also imported and processed.
In Bosnia and Herzegovina, there is very limited separate collection for recycling, and there is almost no data on the amount of separately collected and recycled waste. The total separate amount is estimated at around 5%, of which 3% is directly purchased from the commercial, institutional and industrial sectors and 2% is collected from households (World Bank, 2017).

According to several studies conducted in different cities of Bosnia and Herzegovina, the amount of dry recyclable fraction (plastic, glass, paper, metal, aluminum cans, PET) makes up 24-38% of the total waste. Taking into account the recyclable fraction in the residual waste and the recyclable materials collected through the system of extended producer responsibility (which are not disposed of in containers but collected directly from commercial/institutional entities), the total amount of dry recyclable fraction is estimated at about 210,000 t. According to World Bank estimates (2017), packaging waste accounts for about 160,000 t of this amount. On the other hand, according to the estimates stated in the Federal Waste Management Plan 2012-2017, the annual amount of packaging waste in the territory of FBiH amounts to about 170,000 t, that is, about 68 kg/flat. The estimate of BHAS (2023) is that in Bosnia and Herzegovina, between 43 kg and 55 kg of packaging per inhabitant is sold annually. Due to the lack of reliable data on waste producers, quantities, composition, recovery, recycling, disposal, interest groups, etc., planning and implementation of effective and efficient waste management systems are difficult.

Tab. 1 Recycling rate of packaging waste, Bosnia and Herzegovina, 2012-2017 (BHAS, 2020)

	2012	**2013**	**2014**	**2015**	**2016**	**2017**
Placed on the market (t)	194214	200040	206041	212223	218589	225147
Submitted for recycling - operators (t)	3050	7053	16241	19169	29889	30583
Recycling rate (t)	2%	4%	8%	9%	14%	14%

	Composition, %	**2017, tons**
Glass	21.4	48 21
Metal	6.7	15 179
Paper	31.2	70 162
Plastic	25.0	56 187
Wood	8.3	18 636
Multilayer	7.2	16 155
Dangerous PW	0.1	293
Other	0.1	317
Total marketed	100.0	225 147

Based on the quantities shown in Tab. 1, the amount of packaging registered in the operator's system, the amount of packaging that is outside the system, the amount of packaging waste submitted for recycling by system operators is calculated. At the end, the % of recycled packaging waste was calculated in relation to the total packaging waste placed.
Secondary raw materials are separated in different ways:
• by direct purchase from the commercial/institutional/industrial sector by small private companies;
• using additional municipal containers, followed by sorting in a sorting plant;
• separation from mixed waste on separation lines;
• removal from the container by the collector of secondary raw materials;
• separation at a landfill (e.g. Sarajevo, Zenica, Goražde)

For now, separate waste collection systems are applied in a limited number of municipalities where part of the waste is taken to sorting facilities. In some settlements, a limited number of containers have been installed for the selective collection of dry recyclable fraction (mainly paper and cardboard, PET packaging and other plastics). In FBiH, sorting plants for pre-separated secondary raw materials exist at the regional landfill in Sarajevo and the municipal landfill in Konjic with a capacity of 5 t/h. Two lines for separating mixed waste have been installed at the regional landfill in Mostar and the municipal landfill in Tuzla. In the RS, there is only one sorting plant for the previously separated dry recyclable fraction in Doboj, which was temporarily suspended due to high financial costs, while there is one simple sorting plant with a smaller capacity (1.5 t/hour) at the landfill in Banja Luka. All lines operate at a financial loss due to insufficient incoming quantities and poor-quality manual sorting. Separated recyclable material at sorting stations makes up about 50% of incoming quantities, and at sorting stations for separating mixed waste it makes up 2-3% of incoming quantities (World Bank, 2017).

The waste management strategy of the RS envisages the separation of 50% of packaging or 23% of total waste in 2026, and the FBiH Strategy envisages the separation of 35% of packaging or 10% of total waste in 2017. Specific recycling targets are defined for paper and cardboard, plastic, glass, metal, wood and composite packaging. These goals are quite ambitious, considering the results achieved so far.
In the packaging and packaging waste management system, the obligations of all business entities (manufacturers, importers, exporters, packers, fillers, carriers, final suppliers) and operators are clearly defined. In the system of collection, selection and recycling of packaging and packaging waste, the system operator has a key role for general socially responsible behavior in which the system of selective waste collection will take place in a sustainable and harmonized manner and in which all actors will have the opportunity to develop and strengthen the material and technical basis of the system. Also, the system operator has a key role in promotional and educational activities for the successful functioning of the system. The system operator must obtain a permit issued by the competent ministry. Legislation adopted at the entity level determines the conditions and procedures for submitting a request for a permit, issuing, revoking, revising, renewing and extending a permit. The Federal Ministry of Environment and Tourism has issued a license for two system operators in FBiH for packaging waste and two operators for EE waste. In the RS, there is only one operator authorized for packaging waste.

System obligees (producer, importer, packer, filler, etc.) are obliged to submit to the Fund reports on packaging waste management for the previous calendar year, as well as evidence confirming the accuracy of the data specified in the report. In the RS, a packaging specification is submitted with the report, which especially contains data on the weight of the product and the weight of the packaging in which the product is packed, as well as the type, weight and percentage of packaging material per piece of packaging. In the event that manufacturers, importers, fillers, packers, distributors and suppliers do not transfer their obligations to the system operator, they are obliged to pay fees for burdening the environment with packaging waste to the Entity Fund. These fees are practically a penalty for not meeting general and specific recovery and recycling targets.
However, in practice, numerous problems occur in the management of packaging waste. Most of the packaging that is placed on the market is not reported by the taxpayers of the system and therefore does not contribute financially to the collection system (through EPR schemes or the Environmental Protection Fund) (World Bank, 2017). This limits the available

resources in the system and does not allow significant improvements in waste management practices. There is no regular supervision of products placed on the market, identification of system obligees and inspection of identified entities, and the quantities of packaging reported by entities to EPR organizations are not subject to audit (World Bank, 2017).
The recycling industry in BiH is not well developed mainly due to the limited size of the market. In such a situation, recycling relies on the export of waste, which leads to additional costs and efforts.

According to legal acts in Bosnia and Herzegovina, all manufacturers of packaging are obliged to keep records of the amount of packaging produced and sold, as well as the amount returned and recycled. However, despite legal obligations, there is still a lack of infrastructure and technology for the proper management of packaging waste in Bosnia and Herzegovina. Also, there are plans to establish new waste processing and recycling facilities in Bosnia and Herzegovina. However, the implementation of those plans and projects depends on the cooperation and financial support of the government, the community and the private sector.

MANAGEMENT OF PACKAGING WASTE IN THE FEDERATION OF BIH

In the last ten years in the Federation of Bosnia and Herzegovina, the issue of packaging waste management, electrical and electronic (EE) waste, and the placement and use of plastic suspender bags has been legally and institutionally regulated. The management of packaging and EE waste is entrusted to system operators operating within the extended producer responsibility system.
Based on the provisions on Article 58, paragraph 8 of the Law on Waste Management ("Official Gazette of the Federation of BiH", no.: 33/03 and 72/09), the Rulebook on the Management of Packaging and Packaging Waste was adopted in FBiH, which prescribes rules of packaging management in the production, circulation and use of packaging and rules of conduct and other conditions of collection, reuse, restoration and disposal, in accordance with the priorities and basic principles of the Law on Waste Management.

Since 2014, the FBiH Environmental Protection Fund has started collecting the so-called "general fee" paid to the Fund by all system payers, regardless of whether they are part of an organized system or not. The fee serves the Fund to cover the administrative costs of monitoring the entire system of packaging and packaging waste, processing reports of all payers and all operators, as well as the establishment and maintenance of databases, i.e. of the register of payers and the amount of materials and waste. The general fee is 0.002 KM per 1 kg of packaging and is calculated on the basis of the annual report on quantities and types of packaging that authorized operators and payers who have not joined the organized system submit to the Fund (World Bank, 2017).

System operators are obliged to organize the management of packaging waste on behalf of entities that have transferred their obligations to the operator. Operators are obliged to:
• Ensures that the collector of packaging waste regularly collects municipal packaging waste and performs its selective separation;
• Regularly pick up and collect non-municipal packaging waste from end users;
• Ensure reuse of packaging waste and recycling in authorized facilities;
• Ensure disposal of the unused part of packaging waste at regional or municipal landfills.

All flows of packaging and electronic waste are regulated by adopted regulations in these areas, and for each separate flow, a fee is provided by the manufacturer, importer, distributor, which is directed to the Environmental Protection Fund/authorized operator, and from there to 1) construction of the plant, 2) improvement of organization, 3) encouragement of separate collection, 4) market of secondary raw materials, 5) implementation of regional plans, 6) development of information system, 7) application of new technologies for treatment, remediation of long-term pollution, 8) cleaning projects, 9) education programs and Fig.
Rulebook on packaging and packaging waste management (no. 88/11), which entered into force on February 29, 2011. year, the following are prescribed:

1) packaging management rules in: production, circulation and use of packaging,
2) rules of procedure and other conditions for collection, reuse, restoration and disposal of packaging waste generated in industry, trade, retail, service and other activities and households.

The basic rules of packaging and packaging waste management in terms of this Ordinance are:

1) division of responsibilities of all business entities in accordance with the principle of integrated approach and "extended producer responsibility" during the life cycle of the packaging,
2) reducing the amount of packaging waste,
3) reuse of packaging, recycling and other forms of renewal or reuse of packaging waste.

In accordance with the provisions of the Law on Waste Management in the Federation of BiH, the Federal Ministry on April 10, 2023. adopted a new Rulebook on the Management of Packaging and Packaging Waste in the Federation of BiH. The rulebook prescribes new, higher goals for recycling and utilization of packaging waste, which will increase from 37% to 45% in the period 2023 - 2027.

The manufacturer, importer, filler, packer, distributor and final supplier is obliged to join the packaging waste management system and is responsible for achieving the prescribed goals. There is also a significant increase in specific targets for all packaging materials, except for multi-layered ones. Namely, the category of multi-layer materials has been abolished, and taxpayers will report this material in the category of the dominant material: if cardboard dominates, it will be reported under cardboard, if metal dominates, under metal and the like. There is also a prescribed obligation that 5% of the total prescribed general goal of packaging waste must be separated from municipal waste. The obligation of cantons and public utility companies to establish separate collection of packaging waste was introduced. However, packaging waste recycling is still not fully developed, and many people are still not sufficiently aware of the problems that packaging waste represents for the environment.

The Federal Environmental Protection Strategy 2022-2032. aims to reduce the amount of waste and increase the amount of reused materials.One of the priorities of this strategy implies the improvement of the management system for special categories of waste, which will be achieved by strengthening the extended producer responsibility scheme for packaging and EE waste and creating conditions for adequate collection and disposal (Tab. 2). Under this priority, efforts will be made to strengthen the waste market intended for recycling and to include informal collectors in the recycling system. One of the measures is the introduction of additional economic and financial instruments and mechanisms in the field of waste management, which will support the transition to a circular economy.

Tab. 2. Development goal/measures for packaging waste
(Federal Environmental Strategy 2022 – 2032)

Indicators (output and final result)	**Baseline value (2021)**	**Target value**
Packaging waste recycling rate (%)	The general goal for the utilization and recycling of packaging waste is 35% of the packaging placed on the market. Minimum quantity (%) to be used or recycled: - Glass12% - Metal10% - Paper30% - Plastic16% - Wood12% (2016)	Targets for packaging waste: - 30 % minimum (by weight of packaging waste) will be processed or incinerated in an incineration plant with energy recovery - 55% (by weight of packaging waste) will be recycled. The following targets for the recycling of materials contained in packaging waste must be achieved in phases by 2032: - 20% by weight for glass - 45% by weight for paper and cardboard - 20% by weight for metals - 19% by weight for plastic - 13% by weight for wood

There are two system operators in FBiH: “Ekopak” (based in Sarajevo) and “Ekoživot” (based in Tuzla). The company “Ekopak”, the first authorized operator of packaging and packaging waste management in Bosnia and Herzegovina, has cumulatively submitted for recycling close to 120000 tons of packaging waste for the previous 10 years of operational work. According to the Annual Report on Packaging and Packaging Waste Management, in 2022, “Ekopak” sent more than 15000 tons of packaging waste for recycling through its network of collectors. 1900 tons of glass, 453 tons of metal, 10387 tons of paper, 2045 tons of plastic, 715 tons of wooden packaging, and 138 tons of multi-layer packaging were sent for recycling. According to current estimates of the FBiH Environmental Protection Fund, only 15% of packaging waste is recovered from the packaging placed on the FBiH market (World Bank, 2017).

In addition to them, there is another operator of the system, “Ekoživot”, to which the packaging is reported, and a significant part of the packaging is outside the system, which is not reported to anyone, due to the avoidance of this legal obligation, even though it has existed since 2012.

Therefore, the situation has not changed significantly with the introduction of EPR schemes for packaging waste organized by “Ekopak” and “Ekoživot”. Both organizations have implemented several smaller projects through the provision of separate collection containers to public utility companies in more than 20 municipalities (World Bank, 2017). These are projects of limited size, and the number of containers is not sufficient to efficiently organize the provision of services in a given area.

In the Federation of BiH, since 2020, the first factory for the production and processing of PET-packaging and hard plastic "Bosna - Plastik", Goražde, has been in operation, which buys PET-packaging from both legal and natural persons.

MANAGEMENT OF PACKAGING WASTE IN THE REPUBLIC OF SERBIA

In the Republika Srpska, the 2015 Amendment to the Law on Waste Management provides for the establishment of a packaging waste management system. With the mentioned change, a step was made in the transition from a linear to a circular economy, because the mentioned system is based on the principle of extended producer responsibility (EPR). Extended producer responsibility is a principle that implies that the producer is responsible for the entire life cycle of the product and packaging it puts on the market. In practice, this principle works because the manufacturer incorporates the costs of environmental protection into the price of the product, collects them from the end consumer, and then invests these funds in the disposal of waste generated by using the product in an environmentally friendly way.
The producer can transfer this responsibility to the producer responsibility organization (Producer Responsibility Organization - PRO), which in the legislation of Republika Srpska is called Operators of the packaging waste management system. They are obliged to invest the funds collected from clients specifically in the collection of packaging waste and on their behalf ensure the reuse and recycling of packaging waste in accordance with the goals, and influence the raising of public awareness of problems in the field of waste management through various campaigns.

One of the priorities of the Environmental Strategy of Republic of Srpska for the period 2022-2032. year in the field of waste management is to strengthen the public's awareness of the proper separation, collection and disposal of waste, which will be achieved by implementing modern educational and informational awareness campaigns at all levels.
In the Republic of Srpska, a waste management strategy and plan were adopted, including a waste prevention program. The system for special waste is arranged in accordance with the EPR rules and includes the vehicle, tires, batteries, oil, electrical and electronic waste, packaging.
Management of packaging and packaging waste is carried out in accordance with the Law on Waste Management and the Regulation on Management of Packaging and Packaging Waste ("Official Gazette of the Republic of Srpska", number 24/21), which implies the division of responsibilities of all economic entities in accordance with the principle of "polluter pay" and the principle of responsibility during the life cycle of packaging, reduction of the amount of packaging waste generated, reuse of packaging, recycling and other forms of reuse, and reduction of the final disposal of packaging waste. This regulation prescribes the conditions for the design, production and use of packaging, management of packaging and packaging waste, special conditions for issuing a license for the operator and report forms on the management of packaging and packaging waste. A legal entity or an entrepreneur who places a packaged product on the market is obliged to ensure the prescribed management of packaging waste through an operator in accordance with the Law on Waste Management and by-laws. If the packaging that becomes packaging waste after use is not disposed of by the operator, the legal entity or entrepreneur is obliged to pay compensation for the packaging waste for that packaging. The collected fee is distributed to the account of the Environmental Protection and Energy Efficiency Fund of the Republic of Srpska and is spent specifically for the management of packaging and packaging waste. One operator operates on the territory of Republika Srpska for the management of packaging and packaging waste, which includes

collection, transport, storage, reuse, treatment and disposal of packaging waste, namely "Euro Beta", Banja Luka.
Based on the reports on the amounts of packaging waste submitted by taxpayers and operators, the types and amounts of packaging waste reported for 2017 are shown in Tab. 3.

Tab. 3 Reported amounts of packaging waste by type of packaging for 2017.
(WMP RS, 2020)

Reported amounts of packaging waste for 2017 (t)				
Type of packaging material	**Obligors based in the Republic of Srpska**	**Obligers based in the Federation of BiH**	**Obligers based in Brčko District**	**Obligers who have transferred their obligation to the operator**
Plastic	560.39	156.02	0.17	6030.18
Glass	990.21	15.62	0.01	5489.19
Metal	104.12	9.27	0.02	1351.96
Paper	533.49	75.69	1.62	7179.68
Wood	70.00	23.86	-	2046.52
Other	7.71	6.28	-	-
Packaging of contamination with dangerous substances	2.88	2.80	0.02	-
TOTAL	**2268.80**	**289.54**	**1.84**	**22097.53**

Tab. 4 Amounts of collected and reused packaging waste for 2017 according to the operator
(WMP RS, 2020)

Amounts of collected and reused packaging waste for 2017		
Type of packaging material	**Collected quantity (t)**	**Reused (t)**
Plastic	4720.56	1135.60
Glass	3740.81	451.22
Metal	1006.27	101.00
Paper	6813.21	4474.68
Wood	1676.22	238.60
TOTAL	**17957.08**	**6401.10**

Based on the data in Tab.4, it can be seen that the amount of recycled packaging waste is 35% of the collected amount of packaging waste for 2017.

According to the data of the Republika Srpska Institute of Statistics (RSIS), the amount of municipal waste produced in the Republic of Srpska in 2021 was 397182 tons. Out of the total amount, most was collected mixed municipal waste, 277 139 t or 96.2%. 1324 t of packaging waste was collected, the share of which in the total collected waste is 0.5%. In terms of waste management, only 2189 t of waste is classified as processed waste, i.e. waste submitted for processing with the aim of recovering components, i.e. reuse or recycling (RSIS, 2022).

The need to introduce a circular economy is recognized by the Waste Management Plan for the Republika Srpska for the period 2019-2029 (WMP RS, 2020), which recognizes as one of the goals the achievement of the rational use and preservation of natural resources, the reduction of the total amount of waste that is disposed of, the reduction of emissions and the reduction of risks to human health and the environment. However, the recycling industry is not developed in RS. There is only one recycling plant in operation, and most of the collected recyclable waste is delivered to other plants in BiH or exported abroad. "OmorikaReciklaža" is a factory that recycles PET packaging. The company was founded in 2007 and is located in Doboj. Waste PET is used as raw material and recycled in a modern recycling facility with an installed capacity of 400 t per month. Waste packaging is used for the production of high-purity crushed PET, which is then used for the production of PET regranulate (rPET).

RECOMMENDATIONS FOR TRANSITION TO CIRCULAR ECONOMY IN BIH IN THE PACKAGING WASTE MANAGEMENT SECTOR

The organizational model for the production of goods and services in society is predominantly linear: resources are extracted, passed through the production process, used by society, and then discarded, ignoring external effects. As a result, we extract more natural resources than the planet can provide, and we throw away materials in the production chain, also wasting their inherent energy. The linear economy is wasteful: most of the value in the materials we use is lost in landfills, and the things we produce are constantly underutilized.
Unlike the linear model, the circular economy starts from the aspiration to minimize all these disadvantages. The circular economy aims to decouple growth from the final consumption of resources. The circular economy is a concept of sustainable development based on the principle that products, materials and resources should be used in a way that reduces their consumption and waste production, and maximize their use through reuse, repair, recycling and renewal. According to the CE definition proposed by Kirchherr et al. (2017), the goal of CE is to achieve sustainable development, and circularity should be simultaneously sustainable for the environment, economy and society (Corona et al., 2019). The circular economy model is based on the principle of circulating materials and products as long as possible. In contrast to traditional recycling, the practical policy and business-oriented circular economy approach emphasizes the reuse of products, components and materials, remanufacturing, renovation, repair, upgrading, as well as the use of solar, wind, biomass and waste energy throughout the production chain and life cycle. from cradle to cradle (Rashid et al., 2013; Braungart et al., 2007).

Instead of using products once and then throwing them away as waste, the circular economy implies the use of resources in a way that maximizes their use and recycling, while reducing waste to a minimum. The circular economy is a turn towards sustainable development that proposes a closed system of production in which resources are reused and recycled, thereby reducing the need for new materials. Moving towards a more circular economy could provide various opportunities, including reduced pressure on the environment, increased security of supply of raw materials, increased competitiveness, innovation, growth and new jobs. However, this change also poses challenges such as financing, key economic factors, consumer behavioral skills and business models.

Due to the nature of packaging materials and intended uses, the packaging industry is built on a linear model where packaging is designed, produced, consumed and disposed of (Zhu et al., 2022). This creates a significant amount of waste, which is becoming an increasing concern

for the environment. Adequate management of packaging waste and its reduction through reuse or recycling contributes to the preservation and protection of the environment, but also balance with the economic development of society (Matijašević-Obradović&Milojević, 2018). Prevention of waste generation is probably the most important link in proper waste management, and by developing consumer awareness and changing consumer habits, we can reduce the amount of packaging and other waste generated.
The concept of adequate waste management in general, including packaging waste, as a special category of waste, is inextricably linked with the concept of cleaner production, which is based on new methods that should be cleaner, that use much less energy and do not produce harmful by-products. Through the transition to a circular economy, the necessity of changing the business model of the national industry that promotes an ecologically sustainable way of doing business through the application and introduction of standards in production processes, eco-design, the promotion of ecological new materials and technologies in the context of new market "requirements" and needs will be increasingly emphasized (Arsić&Premović, 2021).
The management system for special categories of waste, which represents one of the foundations of the transition from a linear to a circular economy, needs to be significantly improved. As mentioned, Bosnia and Herzegovina has a recycling rate of only 2%, which means that a large amount of packaging waste ends up in landfills or is improperly disposed of in the environment. The fact that waste is still allowed to be dumped in landfills that do not comply with the Directive poses a threat to the environment and undermines the economics of all other alternatives for waste management. The political appeal of low-cost disposal is that it relieves the pressure to increase household charges to recover costs.

In order to improve packaging waste management in local self-government units, it is necessary to implement the following measures:
• Stimulation of consumers through appropriate compensation for the return of primary packaging,
• Support packaging waste prevention projects,
• Implementation of educational campaigns on the topic of reducing the use of packaging waste.

Waste management in the Republic of Srpska (WMP RS, 2020)for special waste streams (including packaging waste) recommends waste prevention, separation at the point of origin, separate collection, storage and preparation for reuse, recycling and treatment, and fees for special categories of waste in accordance with the principles of circular economy.
In all local self-government units, it is necessary to organize a system of separate collection of municipal waste components through green islands, waste collection centers, and enable direct collection from waste producers. In addition, it is necessary to strengthen the market of recyclable materials, and thus to improve the management of special categories of waste.

This process requires additional efforts and financial resources for a just transition in order to contribute to environmental protection, among other things, by significantly minimizing the amount of waste produced in the region (Vasilkov et al., 2021). One of the problems on the way to the establishment of a circular economy system is essentially the underdeveloped recycling industry, which, in addition to the lack of incentives, is limited by the relatively small market for raw materials. At the World Bank, there is significant scope for moving from a linear to a green and circular economy model and turning environmental challenges into business opportunities. This would, especially for SMEs, represent a new source of income, cost savings, job creation and, consequently, increased productivity.

The introduction of the extended producer responsibility system for packaging and packaging waste in Bosnia and Herzegovina represents the first step in the transition to a circular economy. In the Federal Environmental Strategy 2022-2032, the connection with the public utility sector is cited as a key shortcoming of the current system. Although there are individual cases of cooperation between system operators and municipalities, cooperation is not legally required. Therefore, the utility sector is not motivated to work on separate collection, and thus a significant part of this waste is lost, which is disposed of in landfills. In addition, the recycling targets set are rated as low and easy to achieve by collecting waste only from the commercial sector.

In order to improve environmental management, the Environmental Strategy of the Republic of Srpska for the period 2022-2032. states as one of the measures "Transition towards circular economy". The aim of this measure is to integrate the concept of circular economy in the Republic of Srpska, primarily focusing on waste management - waste selection and recycling, which will enable sufficient amounts of recyclable materials for sustainable production in various sectors (industry, agriculture, etc.) and efficient use of resources.The basis for action in this direction is the Green Agenda for the Western Balkans, as well as ongoing activities on the creation of the Roadmap for the circular economy of BiH - as the first step towards the integration of the circular economy concept.

In accordance with the Agenda for the Western Balkans, intersectoral action is required to develop a clear policy for the introduction of a circular economy (sustainable production and consumption). In Bosnia and Herzegovina, policy makers and authorities at all administrative levels are not sufficiently engaged in this area, and therefore the economy of Bosnia and Herzegovina is still based on the linear principle. In addition, there is no adequate cooperation between the industry and the environmental sector, and there is a lack of innovations in production aimed at developing the circular economy. Multisectoral cooperation under the leadership of the economic and environmental sectors is needed in order to prepare a clear policy in the area of the environment with an emphasis on creating conditions for the introduction of a circular economy.

Without the support of the public and businessmen, and the will for positive action, the improvement of technical and operational capacities will not be enough for a complete turnaround and transition from a linear to a circular economy. Waste producers – households should separate and hand over waste intended for recovery of valuable properties (eg packaging made of glass, plastic, metal or paper/cardboard), through appropriate containers, green islands or collection centers or other appropriate ways or places. In addition, they should buy products that contain recycled materials, and buy products and use services that generate less packaging waste (adhere to the basic principles of sustainable development).

It is necessary to build modern facilities for sorting waste and obtaining high-quality monofraction from separated waste suitable for recycling. Waste sorting enables the production of compost and/or biogas from organic waste in composting and fermentation plants. The remaining waste can be used in energy recovery in incinerators or processed in mechanical-biological treatment (MBT) plants. MBT extracts recyclable materials, delivers high-calorie fractions for energy production and controls the breakdown of organic substances, which are mainly responsible for emissions from landfills - especially landfill gas and leachate. This achieves a significant reduction in greenhouse gas emissions.

In the territory of Bosnia and Herzegovina, 72 examples of companies that carry out some type of circular activities have been identified. In most of the analyzed companies, circular activities are carried out as additional processes, i.e. it is not about integral business models of the circular economy. Certain companies have recognized CE as a primary business model (e.g. Lucius, Kudces.ba, the BioDizajn project), other companies with CE complement their existing complementary business (e.g. Aida Commerce, NextBike), while certain companies due to their connection with international markets and owners they follow advanced models, including in terms of CE (e.g. Natron-Hayat, Lukavac Cement) (Dragnić et al. 2022).
In order for the circular economy to fully develop in Bosnia and Herzegovina, it is necessary to improve the existing legal framework and provide support and resources for its implementation. It is also important to increase the awareness of citizens and companies about the importance of the circular economy and to encourage their participation in this process.

CONCLUSION

Packaging waste in Bosnia and Herzegovina represents a significant environmental problem, given that a large part of that waste is not disposed of in the prescribed manner. The circular economy is a concept that is increasingly being applied around the world as a sustainable solution for waste management and conservation of natural resources.
By improving the packaging waste management system, a more efficient use of resources is established and waste disposal at landfills is reduced, which directly affects the extension of the life of landfills and leads to more environmentally friendly waste management, thus achieving a greater degree of protection of the environment and human health. This implies the improvement of the process of collecting and sorting packaging waste, as well as the development of a system for recycling this waste. More efforts are needed to reduce the amount of packaging waste, as well as to ensure proper management and disposal of existing waste. The diversity of laws and restrictions does not help the process of implementing the circular model, therefore, in addition to the necessary time, the cooperation of institutions at different levels is also needed.
In Bosnia and Herzegovina, there is a specific system for managing packaging waste, which is implemented through public utility companies and other organizations. However, this system often does not work as it should, because there is a lack of funds and capacity for its effective application. Also, in Bosnia and Herzegovina there is a problem of illegal disposal of waste, including packaging waste. This represents a serious problem for the environment and requires serious measures to suppress and prevent this form of pollution. In order to protect the environment and transition the industry to a green and circular economy, it is necessary to improve the waste management system, especially the management system for special categories of waste, which includes packaging waste. In order to reduce the impact of packaging waste on the environment in Bosnia and Herzegovina, it is necessary to apply appropriate measures for waste management, including improving the existing system, strengthening capacities and raising public awareness of the importance of recycling and environmental protection. It is necessary that all citizens, companies and institutions in Bosnia and Herzegovina take responsibility for waste management, including packaging waste, in order to reduce its negative impact on the environment. In addition, it is important to improve the legal frameworks that regulate waste management and to provide adequate resources for its efficient processing and recycling. In Bosnia and Herzegovina, there are also numerous companies engaged in the production of recycled materials, such as paper, plastic and metal, which represents a positive step in the development of the circular economy.

Bosnia and Herzegovina is in the initial phase of considering the concept of circular economy. In order to successfully develop the circular economy in Bosnia and Herzegovina, it is necessary to invest in infrastructure, technology and education, as well as the adoption of adequate legal frameworks and policies that encourage sustainable development and reduce the impact on the environment. The introduction of a deposit system could be a more effective option to achieve a greater degree of separate collection of packaging waste, especially PET bottles, than through extended producer responsibility, which is the current way of regulating this area.

A circular economy can bring numerous benefits, including reducing the environmental burden, creating new jobs and promoting sustainable development. Therefore, it is important to take measures to effectively manage packaging waste and promote sustainable practices in Bosnia and Herzegovina.

REFERENCES

1. Arsić, L., & Premović, J. (2021). Institucionalni okvir za razvoj modela cirkularne ekonomije u Srbiji. Zbornik radova: Ekonomska politika u Srbiji i svetu u 2021: u susret globalnim šokovima I rastućoj neizvesnosti, 155-167.
2. BHAS (2019). Environment. Public transportation and disposal of municipal waste, 2018. Agency for Statistics of Bosnia and Herzegovina, https://bhas.gov.ba/data/Publikacije/Saopstenja/2019/ENV_01_2018_Y1_0_BS.pdf
3. BHAS (2020). Chemicals and Waste in the 2030 Agenda - Capacity Building for Monitoring and Reviewing the Sustainable Development Goals (SDGs) in Developing Countries. https://bhas.gov.ba/data/Publikacije/Metodologije/ENV_00_2020_MD_0_EN.pdf
4. BHAS (2023). Environment. Waste recovery and disposal. https://bhas.gov.ba/data/Publikacije/Saopstenja/2023/ENV_05_2021_Y1_1_SR.pdf
5. Braungart, M., McDonough, W., & Bollinger, A. (2007). Cradle-to-cradle design: creating healthy emissions–a strategy for eco-effective product and system design. *Journal of cleaner production*, *15*(13-14), 1337-1348.
6. Coelho, P. M., Corona, B., ten Klooster, R., & Worrell, E. (2020). Sustainability of reusable packaging–Current situation and trends. Resources, Conservation & Recycling: X, 6, 100037.
7. Corona, B., Shen, L., Reike, D., Carreón, J. R., & Worrell, E. (2019). Towards sustainable development through the circular economy—A review and critical assessment on current circularity metrics. Resources, Conservation and Recycling, 151, 104498.
8. da Cruz, N. F., Ferreira, S., Cabral, M., Simoes, P., & Marques, R. C. (2014). Packaging waste recycling in Europe: is the industry paying for it? Waste management, 34(2), 298-308.
9. Dragnić i dr. (2022). Studija slučajeva primjene poslovnih modela cirkularne ekonomije u BiH, Centar za politike i upravljanje.
10. Government of Federation of Bosnia and Herzegovina (2022). Federal Environmental Strategy 2022 – 2032. https://www.fmoit.gov.ba/upload/file/2020/Eday/Federalna%20strategija%20za%C5%A1tite%20okoli%C5%A1a%202022-2032..pdf
11. Ghisellini, P., Cialani, C., &Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. Journal of Cleaner production, 114, 11-32.

12. Grum, Đ., (2013). Gospodarenje ambalažnim otpadom izaštita okoliša, *Sigurnost* 55 (1), str. 57.
13. IFC (2004.) Studija tržišta otpadnih materijala – Bosna i Hercegovina, International Finance Corporation.
14. Jacobsen, L. F., Pedersen, S., & Thøgersen, J. (2022). Drivers of and barriers to consumers' plastic packaging waste avoidance and recycling–A systematic literature review. Waste Management, 141, 63-78.
15. Kaza, S., Yao, L., Bhada−Tata, P., & Van Woerden, F. (2018). What a waste 2.0: A global snapshot of solid waste management to 2050. The World Bank.
16. Kirchherr, J., Reike, D., Hekkert, M. (2017). Conceptualizing the circular economy: an analysis of 114 definitions. Resour. Conserv. Recycl 127, 221-232.
17. Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. Journal of cleaner production, 115, 36-51.
18. Matijašević-Obradović, J., &Milojević, G. (2018). Upravljanje otpadom-aktuelni strategijski pristup i analiza rada ovlašćenih operatera u domenu recikliranja ambalažnog otpada. *Pravo-teorija i praksa*, *35*(7-9), 1-14.
19. Milios, L. (2018). Advancing to a Circular Economy: three essential ingredients for a comprehensive policy mix. Sustainability science, 13(3), 861-878.
20. Pešević, D. (2022). Upravljanje otpadom. Prirodno-matematički fakultet, Univerzitet u Banjoj Luci. 1-384.
21. Plastics Europe Plastics - The Facts (2021). An Analysis of European Plastics Production, Demand and Waste Data
22. Rashid, A., Asif, F. M., Krajnik, P., &Nicolescu, C. M. (2013). Resource conservative manufacturing: An essential change in business and technology paradigm for sustainable manufacturing. *Journal of Cleaner production*, *57*, 166-177.
23. Republika Srpska Government (2022). Environmental Strategy of the Republic of Srpska for the period 2022-2032.https://www.vladars.net/sr-SP-Cyrl/Vlada/Ministarstva/mgr/Documents/ENVIRONMENTAL%20STRATEGY%20OF%20REPUBLIKA%20SRPSKA%202022%20to%202032_462217192.pdf
24. RSIS (2022). Environmental statistics, Annual report, 2021. Generated, collected and disposed of waste, no. 281/22.
25. Stipanelov Vrandečić, N., (2010). Ambalaža, Split, Kemijsko-tehnološki fakultet.
26. World Bank (2017). Bosnia i Herzegovina: Municipal Solid Waste Management Sector Review: Review of the Extended Producer Responsibility in Bosnia and Herzegovina for Packaging and Packaging Waste and WEEE. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/834281562138748942/municipal-solid-waste-management-sector-review-review-of-the-extended-producer-responsibility-in-bosnia-and-herzegovina-for-packaging-and-packaging-waste-and-weee
27. Tisserant, A., Pauliuk, S., Merciai, S., Schmidt, J., Fry, J., Wood, R., &Tukker, A. (2017). Solid waste and the circular economy: a global analysis of waste treatment and waste footprints. Journal of Industrial Ecology, 21(3), 628-640.
28. UNEP (2011). Towards a GREEN economy. Pathways to Sustainable Development and Poverty Eradication. A Synthesis for Policy Makers. http://www.unep.org/greeneconomy/Portals/88/documents/ger/GER_synthesis_en.pdf
29. Vasilkov, Z., Petrović, S., Vuković, J., Lazić, D., & Damnjanović, A. (2021). Zeleni dogovor Evropske unije i Zelena agenda za Zapadni Balkan: nove smernice za suočavanje sa izazovima zaštite životne sredine. Ecologica, 28(104), 494-502.

30. WMP RS (2020). Republički plan upravljanja otpadom u Republici Srpskoj, Ministarstvo za prostorno uređenje, građevinarstvo i ekologiju Republike Srpske, Vlada Republike Srpske.
31. Zhu, Z., Liu, W., Ye, S., & Batista, L. (2022). Packaging design for the circular economy: A systematic review. Sustainable production and consumption, 32, 817-832.

MANAGEMENT OF THE ECONOMY IN THE CONDITIONS OF THE GREEN AGENDA

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SUMMARY: One of the directions of today's economic science includes the understanding of the essence and importance of the „green" economy for today's humanity and for future development trends. There is a trend to define the „green" economy as a segment of economic science that takes into account the simultaneous preservation and development of the biosphere and civilization as part of the way of doing business.
The goal is to improve people's well-being without risking the biosphere. The essential goal of the „green" economy theory is to find the key to the problem of the possibility of meeting ever-growing needs in conditions of limited resources. The directions for determining the system of „green" economy are: the introduction of renewable energy sources; improvement of the waste management system; improvement of the water resource management system; development of „clean" transport; organic production in agriculture; energy efficiency in the housing sector; preservation and efficient management of ecosystems.
The currently known characteristics and principles of the „green" economy represent its multiplier and anti-crisis potential. The essence of the goals of "green" technologies implies working not with the consequences, but with the causes of environmental problems. Tools for „greening" the economy are discussed — subsidies, preferential tax rates, grants, adequate control over „green" companies.
Taking into account the „green" experience of developed countries, recommendations can be formed for the „greening" of the domestic economy: work on the quality of state management of the state of the environment; adjusting the taxation system to shift the focus to pollution taxes; encouraging the production of environmentally friendly products and the use of production methods in accordance with the principles of sustainable development; publication of information on the impact of business entities on the environment and data on corporate environmental control.
In this paper, the „green" economy is seen as a new trend in the economy, which can help stabilize modern economic systems and balance the interests of man and nature based on the efficient use of resources. The paper highlighted the recognition of the need for investment, whereby the state should be the coordinator and partner for the transition of the economy to the principles of the green economy.

Keywords: green economy, economy, biosphere, management

INTRODUCTION

Today, the term "green" economy is being used more and more often. Therefore, there is a need to explain this concept. Someone believes that it is a new type of industry that will help improve the state of nature, which is threatened by the current industrial methods. Some experts are of the opinion that the "green" economy should be based on new technologies that will benefit nature, i.e. protect it from destruction. Others see it as creating new

environmentally friendly products. Everyone is right to some extent, but there is a more precise definition of a "green" economy. This is an economy that is focused on sustainable development, conservation of natural resources and ensuring the reuse of final products or their parts (in other words, waste). In the "green" economy, everything is aimed at using exhaustible resources as rationally as possible. If the traditional economy combines labor, technology and resources to produce goods, one of the tasks of the green economy should be to return waste back into the production cycle, while causing minimal damage to nature.

According to the definition of the United Nations Environment Program, a green economy is an economy that improves human well-being and ensures social justice, while significantly reducing environmental risks and the depletion of nature.[1] In a narrower interpretation, the "green" economy is understood as the development, production and operation of technologies and equipment to control and reduce the emission of pollutants and greenhouse gases, monitoring and forecasting climate change, as well as saving energy and resources and renewable energy, technology. In other words, the "green" economy includes those types and results of economic activity that, along with modernization and increasing the efficiency of production, contribute to improving the quality of life and the environment.[2] From this it should be understood that the green sector of the economy includes areas whose activities are aimed at transforming resources without causing damage, as far as possible, to the environment and climate - green energy, transport, recycling and waste disposal, etc.

In the transformation of the economy from "brown" (i.e. old) to "green" (i.e. new), the key role is played by the state, which directs the economy in the intended direction with its policy. Management within the green economy therefore implies not only economic/corporate management, but also management of the state, its legal regulations and economic functions. Certain economic measures of the state (grants, subsidies, tax breaks...) can play a decisive role in the ultimate goal of achieving a green economy and sustainable development.

1. THE TERM OF "GREEN" ECONOMY

Before reviewing the way of managing the economy in the conditions of the so-called green agenda, it is necessary to look at the very concept of green economy. Despite the fact that different experts define this term in various ways, it can be sublimated defined that "green" economy is a segment of economic science that, apart from the effectiveness and efficiency of the economy, takes into account the simultaneous preservation and development of the biosphere and civilization as part of the way of doing business.

The goal is to improve people's well-being without risking the biosphere. The essential goal of the "green" economy theory is to find the key to the problem of the ability to meet ever-growing needs in conditions of limited resources, in other words, sustainability.

In economic science, there is a different approach to the term green economy.

[1] Зеленая экономика: здравоохранение / United Nations Environmental Programme: GreenEconomy. //http://www.unep.org/greeneconomy/Portals/88/documents/research_products/briefingpapers/Ru_GE_HEALTH.pdf/

[2] Кучеров А.В., Шибилева О.В. Концепция «зеленой» экономики: основные положения и перспективы развития // Молодой учёный, 2014. № 4. С. 561-563.

One point of view is that the green economy represents a new form of industry that will help improve the general state of nature, i.e. that the "green" economy is represented by technologies that will benefit nature conservation.
Another point of view is that the green economy represents the creation of new environmentally friendly products.
It can be said that both points of view are correct, but there is a more precise definition of the "green" economy. This is an economy that is focused on preserving society, natural resources and ensuring the reuse of final products (or their parts, i.e. waste). In the "green" economy, everything is aimed at using scarce and expendable resources as rationally as possible.

2. THE CONCEPT AND PRINCIPLES OF THE GREEN ECONOMY

The concept of "green" economy causes a lot of discussion, but the analysis showed that now the level of mistrust has significantly decreased and almost all countries – both developed and developing countries – recognize the importance of this concept. Almost all countries consider the "green economy" to be an important tool for achieving sustainable development.

According to Russian researchers Kucherov and Shibileva,[3] the "green" economy implies changes not only in the relationship between the economy and the environment. Ecological transformation requires the improvement of human consciousness and the spread of democracy. Therefore, in the concept of green economy, social, economic and environmental transformation must go together. This vision of development states that all three sectors must be transformed so that markets are oriented towards social and ecological values, and the state must closely cooperate with public organizations on innovative transformation. For this to happen, new economic processes must be designed and new economic rules developed that develop incentives for environmental behavior and integrate them into everyday economics.
At the same time, the state should function not as a rigid regulator, but as a partner and coordinator. Therefore, the development of the "green" economy requires the intervention of the state in the existing "rules of the game", which implies the creation of a regime of state regulation that encourages the development of ecological industries, technologies, etc. In this sense, the most important role is played by a strong political will that is able to shift the emphasis towards the "green" transformation of the national economy.

At the same time, in the materials of developed countries, a significant emphasis is placed on the efficiency of resource use, the creation of new jobs and increasing competitiveness. Developing countries emphasized that the outcome of a green economy should be poverty eradication, equity, investment and greater opportunities to access new markets. The BRICS countries believe that the transition to a green economy should mean changing consumption and production patterns in industrialized countries, as well as the fight against poverty.[4]

[3] Кучеров А.В., Шибилева О.В. Концепция «зеленой» экономики: основные положения и перспективы развития // Молодой учёный, 2014. № 4.
[4] «Зеленые» технологии для «Зеленой России», 2013. № 7. [Электронный ресурс]. Режим доступа: http://www. gosrf.ru/joumal/209/

Looking at several points of view, the principles of green economy policy can be sublimated as follows:

- Economical, efficient and rational use of resources
- Policy development and planning, according to the concept of green development
- Support for advanced technologies
- Ensuring citizens' participation in "green" development
- Formation of procedures and skills that are acceptable for nature conservation
- Openness and responsibility of all social and economic entities.

3. EUROPEAN AND ASIAN EXAMPLES OF WASTE MANAGEMENT

One of the most important aspects of the green agenda is the attitude towards waste. By looking at the attitude towards waste in different parts of the world, it is possible to look at the attitude towards the green agenda as a whole, which is proven by examples from practice.

In Europe, on average, about 40% of solid waste is recycled and used as secondary raw material, 20% of waste is used as energy, and the remaining 40% is sent to landfill. Germany, Belgium, Sweden and the Netherlands are leading here.[5] However, in other parts of the world the picture is quite different. The example of Mongolia speaks in favor of this.

Data on the situation in remote parts of Asia speak of a very high degree of pollution, much higher than that in developed countries. It is not only pollution, but also the efficiency of the use of energy resources and the attitude towards waste. The example of Mongolia from several years ago is striking. About 1.4 million people live in the capital of this country, Ulaanbaatar, of which 54% live in apartments, and 46% live in yurts. Every year, about 488,000 tons of various waste are buried, for which more than one billion hours of transportation were spent. Almost 50% of the total waste is ash produced by burning coal in the yurts from September to June. According to statistical data, the burning of 1.1–1.3 million tons of coal annually produces 198–230 thousand tons of ash and a huge, but undetermined amount of so-called "greenhouse gases", primarily carbon dioxide.[6] On the other hand, it is a positive fact that in 2012, about 11,300 tons (3.1 billion truckloads) of secondary raw materials were collected and exported to China.

In recent years, the ecological situation in Mongolia has significantly worsened due to the fact that people in search of profit have completely forgotten about the environment. The growth in consumption has led to a significant increase in the generation of various wastes. One million tons of various types of waste are generated annually in Mongolia, of which more than 500 thousand tons are in Ulaanbaatar. According to the data of the city authorities, about 80 percent of the total generated waste is consumer waste, and about 20 percent is construction waste. Unfortunately, all generated waste practically does not undergo mechanical processing and is sent to a landfill or buried. In order to solve this problem, the project "Master plan for improving solid waste management in Ulaanbaatar until 2020" was launched a few years ago, which was developed by the Japanese organization for international cooperation "Žaika". Within this project, the so-called 3R principle for waste processing.[7] The

[5] Переработка отходов: анализ мировых тенденций / Июль, 2012. www.geo.albo06.ru/
[6] Олзвойбаатар Л., Дорлигсурэн Ч. Современное состояние менеджмента отходов г. Уланбатора и их перпективы. // Материалы межрегиональной конференции с международным участием. Барнаул. 22-24 окт. 2015 г.
[7] Ibid.

"Green Development Policy of Mongolia" was approved by the Decree of the Great State Herald No. 43 dated June 13, 2014. In general, the policy is aimed at ensuring a balanced environment: efficient, rational and economical use of natural resources, supporting ecosystem services, reducing waste and reducing greenhouse gas emissions, creating a system that stimulates the green economy in order to improve people's well-being, social equality and accessibility. Mongolia's green development policy directly reflects the Rio de Janeiro Declaration (1992). In Mongolia, as in other countries of the world, there are still current problems related to society, the economy and the natural environment.

Currently, there are 5 hydropower plants in Mongolia with a total capacity of about 1141 MW. In 2015, the State Electricity Policy (2015—2030) was published, which includes the law on electricity and the law on renewable energy. This sector of the economy requires significant investments, while it needs special attention from the state for additional support, because at the moment mechanisms for subsidizing this industry have not been developed. The transition to a green development model in Mongolia will ensure the security of the main "fundamentals" and, accordingly, especially important aspects of the functioning of the state and each of its citizens, such as energy security; environmental safety and protection of the population from harmful effects, etc.

4. CONDITIONS FOR THE TRANSITION TO A GREEN ECONOMY AND THE ESSENCE OF GOALS

Although the transition to a green economy is much more difficult than it seems at the beginning, the processing and use of natural resources are aligned with the principles of green development policies over time. In order to achieve the goal, it is first of all a priority to abandon the technologies used in the "brown" (traditional) economy. However, the transition to a "green" model of the economy is not possible without a significant amount of investment, which implies the collection of large sums of money.

Investors in the green economy can be commercial (corporate) structures (investment funds, banking sector, large companies) and the state. Investment in the energy industry plays an important role in reducing the burden on the environment. Prospects for the "green" development of industry and the economy as a whole are connected to a large extent with progress in the energy sector, primarily with the development of alternative energy. In a green economy, income and employment growth is driven by public and private investments that reduce carbon dioxide emissions and other forms of pollution, improve energy and resource efficiency, and prevent loss of biodiversity and ecosystem benefits.

The currently known characteristics and principles of the "green" economy represent its multiplier and anti-crisis potential. The essence of the goals of "green" technologies implies working not with the consequences, but with the causes of environmental problems.

5. PRINCIPLES OF GREEN DEVELOPMENT POLICY

In summary, it can be said that the policy of green development implemented by the countries of the world today and in the future is reflected in five essential points, namely:

- Economical, efficient and rational use of resources
- Policy development and planning, according to the concept of green development
- Support for advanced technologies
- Ensuring citizens' participation in achieving "green goals"
- Formation of approaches and skills that are acceptable to nature
- Openness and responsibility.

In order to implement the policy of green development determined through these six points, it is necessary to look at the directions of determining the system of green economy, as well as the methods ("tools" in colloquial terms) applied by the state for its implementation.
As directions for determining the "green" economy system, i.e. guidelines for achieving the ultimate goal can be taken:

- introduction of renewable energy sources
- improvement of the waste management system
- improvement of the water resources management system
- development of "clean" transport
- organic production in agriculture
- energy efficiency in the housing sector
- preservation and efficient management of ecosystems.

The role of the state in implementing the green agenda is crucial. The state has methods of encouragement and punishment in various segments of society, including the economy. Some of the methods that the state possesses can be called "tools for achieving goals". Such tools of "greening" of the economy are reflected in the following actions of the state:

- Subsidies to business entities that implement measures to "green" the economy
- Preferential tax rates for business entities that implement measures to "green" the economy
- Grants to business entities that implement measures to "green" the economy
- Adequate control over "green" companies for the purpose of preventing manipulations and circumvention of state regulations
- Adjusting the taxation system to shift the focus to pollution taxes
- Encouraging the production of environmentally friendly products
- Using production methods in accordance with the principles of sustainable development
- Publication of information on the impact of business entities on the environment and data on corporate environmental control.

6. CONCLUSION

As a conclusion, it can be said that the main directions of green development include three goals:

1. Economic — ensuring sustainable rates of long-term economic growth, forming an energy system that actively uses renewable energy sources;
2. Ecological — reduction of harmful effects on the environment (reduction of emissions of greenhouse gases and other pollutants, prevention of emergency situations (breakdowns) of power facilities, etc.);
3. Social — creation of new adequate permanent jobs, improvement of the environment and quality of life.

"Green" economy is a new trend that helps to avoid the ecological crisis and preserve society, natural resources and ensure the reuse of parts of finished products. Green growth is characterized by the increasing use of green technologies in all sectors of the economy, an increase in the number of green jobs, the production and use of environmentally friendly goods and services.

The role of the state in implementing the "green agenda" is crucial. It is the state that determines the guidelines for the implementation of the transformation, legislation, stimulation and punishment within the framework of the development process. Its role is very important in informing about the achievement of goals and building social awareness about the necessity of implementing the "green agenda" within the framework of sustainable development.

LITERATURE

1. «Зеленые» технологии для «Зеленой России», 2013. № 7. [Электронный ресурс]. Режим доступа: http://www. gosrf.ru/joumal/209/ (дата обращения: 23.05.2014).
2. Зеленая экономика: здравоохранение / United Nations Environmental Programme: GreenEconomy. [Электронный ресурс]. //http://www.unep.org/greeneconomy/Portals/88/documents/research_products/briefingpapers/Ru_GE_HEALTH.pdf/
3. Кучеров А.В., Шибилева О.В. Концепция «зеленой» экономики: основные положения и перспективы развития // Молодой учёный, 2014. № 4.
4. Нэргуй Д., Цэдэв Н.Х., Баярхуу С. Политика зеленой развитии Монголии // Материалы межрегиональной конференции с международным участием. Барнаул. 22 - 24 окт. 2015 г.
5. Олзвойбаатар Л., Дорлигсурэн Ч. Современное состояние менеджмента отходов г. Уланбатора и их перпективы. // Материалы межрегиональной конференции с международным участием. Барнаул. 22-24 окт. 2015 г.
6. Переработка отходов: анализ мировых тенденций / Июль, 2012. www.geo.albo06.ru/

INNOVATION-BASED BUSINESS MODELS AS THE ROUTE TO THE GREEN TRANSITION IN THE REPUBLIC OF SERBIA

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Abstract: The green economy is certainly the economy of the future. We can reach it step by step with well-designed policies, strategies, actions, and initiatives. It is inclusive and requires a complete transformation of our thinking, acting, and doing business. A systemic and profound transformation of the economy as we know it today is needed to make it green and inclusive and to achieve the goals of sustainable development. Green transition implies economic, investment, and energy transition, which are based on sustainable use of resources and energy, reduction of negative impact on the environment, application of innovations and digital tools, knowledge, added value, and greater competitiveness of the economy. In order to achieve a green transition in the economy, it is necessary to develop adequate business models, based on innovations, which will respond to the future demands of consumers and users of services on the domestic and international market, such as the application of circular product design, extended product life, reuse and product repair, the possibility of material recycling, etc. Also, such models must first of all enable the economy and enterprises to achieve their primary goal—profit generation and increased competitiveness. For the development of the Republic of Serbia in recent years, the circular economy has been recognized high on the priority list as an important tool for realizing the green transition. The aim of the paper is to point out the importance of applying innovation-based models as a basis for a successful green transition.

Keywords: green transition, circular economy, innovations, business models.

INTRODUCTION

The Republic of Serbia is in the group of less developed European countries whose development is not driven by knowledge and innovation. The role and importance of knowledge and innovation in the development of the Serbian economy is small, the innovativeness of domestic small and medium-sized enterprises (SMEs) is at a relatively low level; only a small number of SMEs innovate. The increase in the number of SMEs is not accompanied by the growth of innovation that would provide them with a sustainable

competitive advantage on the domestic and global market. The institutional framework in the Republic of Serbia is not efficient and fully rounded, and the business environment is not sufficiently adapted to the development of innovations and innovative SMEs. Innovations are at the basis of the development of the knowledge-based economy and play a key role in the growth and survival of companies. Knowledge-based economies are characterized by the creation, dissemination and use of knowledge, and innovation. The creation, exchange, and successful commercialization of knowledge through innovation is a source of growth in productivity, added value, competitiveness, economic growth, creation of new jobs, and well-being in a society. Innovations occupy a central place because they significantly affect all aspects of the knowledge-based economy (Николић, 2014, p. 1).

Innovative SMEs are faced with numerous problems and obstacles, primarily in terms of financing, availability of the results of the activities of research institutions, access to the international market, administrative barriers, and the possibility of hiring qualified staff. All this creates the need for systemic, well-designed policies and concrete support programs that should enable small and medium-sized enterprises to use their development and innovation potential. Also, there is an uneven distribution of innovations within the SME sector between a small number of highly innovative SMEs with great potential for growth and a large number of small and medium-sized enterprises that do not have a pronounced innovative orientation and great innovation potential. Therefore, within the policy of encouraging innovation, there should be a clear difference between these two groups of small and medium-sized enterprises, that is, it is necessary to understand and appreciate their diversity in business conditions, methods, and motives for innovation. The increase in the number of small and medium-sized enterprises in the Republic of Serbia is not accompanied by the growth of innovation that would ensure a sustainable competitive position of the SME sector. Due to the level of development of our economy, small and medium-sized enterprises have not fully utilized their developmental potential. The majority of small and medium-sized companies do not base their operations and competitive advantage on innovation and continuous improvement of business efficiency. That is why there is a need to improve the current model of economic development, and above all, the role, place, and way of encouraging small and medium-sized enterprises, in order to increase their innovation and competitive power and the economy as a whole. Accordingly, the main goal of this paper is to show the importance of innovations of innovative SMEs, the SME sector and the economy as a whole. Based on appropriate methods and analysis techniques, the paper examines the development of the SME sector in the Republic of Serbia, the impact of innovations on development.

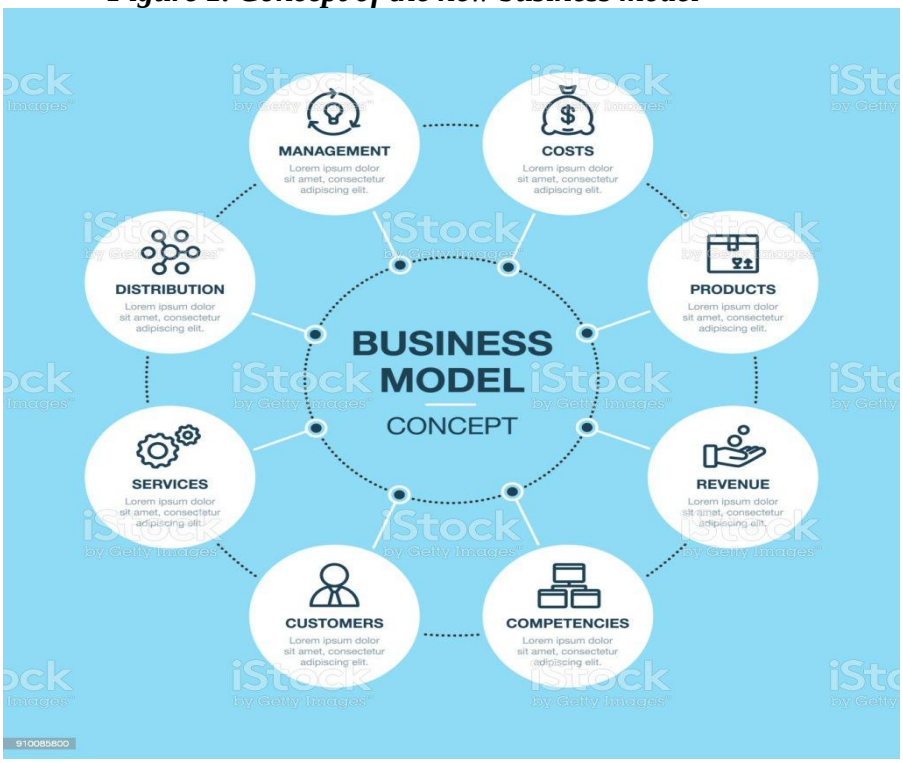
1. BUSINESS MODEL DEVELOPMENT

The business model shows the current operations of the company and its behavior in the future, including vision, mission, strategy and goals, business culture, organizational system, technological equipment, processes and activities, products and services, human resources and markets where the company performs (Николић, 2014, p. 63). Chesbrough (2006), defines a business model as a way of doing business for a company. According to him, the business model has two basic roles: a) to enable the creation of new value and to formalize the newly created value, i.e. integrate it into the existing business model in order to enable constant development; and b) to create new added value. By the creation of new value, Chesbrout means undertaking a set of activities from the idea, through development, selection of

technology, placement of new products and services on the market, to the realization of income by their placement on the market.

According to Pourdehnad (2007), the business model represents a comprehensive system for creating products and providing services that satisfy the needs and demands of consumers and enables the realization of profits. According to a broader explanation, a business model is a system that shows how a company chooses its customers, defines and adjusts its activities, classifies the jobs that should be performed within the company and which should be procured from outside the company, optimizes its resources, performs on the market, creates products and services for consumers and makes a profit. The traditional business model implied a closed innovation system. The company's innovative activities were limited by the knowledge and technology available to the company. The companies were not very motivated to change the successful way of doing business, the production program, the range of products and services, the appearance on the market and the relationship with consumers. Intellectual property is kept as a trade secret within the company. Companies tried to optimize the time when they will introduce new products that will create new value for consumers and thus achieve a competitive advantage in the market. The new, open business model promotes and improves cooperation with the external environment, the exchange of ideas, knowledge, resources and technology, intensifies the innovative activities of the company and better meets the needs of consumers. The modern open model of business implies the abandonment of the closed model of innovation and the acceptance and development of the openness. The open innovation model was developed so that the company could respond to current requirements regarding innovative activities, development of new products, services, markets, new ways of satisfying consumers and protection and use of the company's intellectual property.

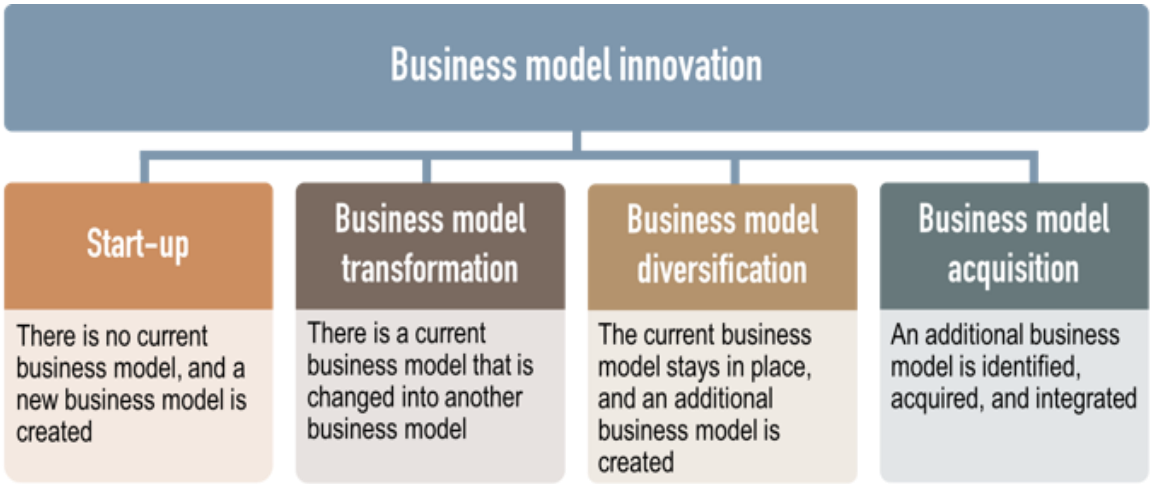
Figure 1. Concept of the new business model



Source: https://www.istockphoto.com/se/vektor/enkla-vektor-infografik-f%C3%B6r-business-modell-mall-gm910085800-250647642

The new model of innovation abandons the old paradigm and accepts the need for interconnections and cooperation (horizontal and vertical) between different companies in order to reduce the potential risks and costs of innovative activities and the entire business on the one hand, and on the other hand, simultaneously increases the efficiency of the innovation process and profitability of the new products and services (Николић, 2014, p. 65). The development of a new business model, which is based on an open model of innovation, enabled the significant development of new small and medium-sized enterprises that, by pooling ideas and the necessary means for their realization, can now significantly influence the events on the market as shown in Figure 2.

Figure 2. Classification of innovative business models

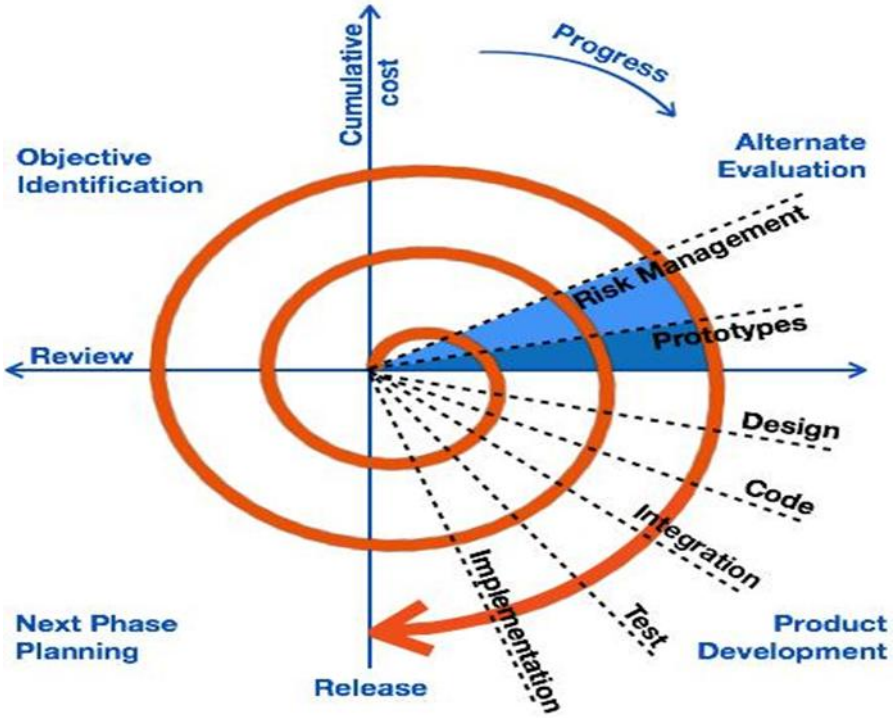


Source: https :// commons . wikimedia . org / wiki / File : Business _ model _ innovation _ classification . png Retrieved on December 8, 2023

Small and medium-sized enterprises, with their flexibility and high speed of response, shorten the time needed to develop and offer a new product on the market, which fundamentally changes the traditional order on the market (the best example is the field of ICT, where small and medium-sized enterprises very significantly influence the pace of development). The new way of doing business implies not only competition between different companies, but also cooperation through various forms of strategic partnership, but also the creation of other more or less formalized cooperation networks. Establishing cooperation on new bases is especially important in the innovation field, where the exchange of knowledge and innovation results has become the basis of a successful innovation process. The proposed business model highlights two levels of relationships: the first, between the most significant partners in the network, and the second, between less significant partners in the network, whereby these relationships should not be isolated from each other. All partners need to be active participants of the group. In order for the whole system to be sustainable, all members of the group must act on the broadest basis to effectively implement and disseminate the strategy open innovation that promotes economic value and profit for all group members.

In the literature, the triple spiral model (Figure 3) is often mentioned, in which the spiral of innovation includes the government (state), universities, and the economy in multiple relationships, in order to create a flexible overlapping innovation system (Crespell & Hansen, 2008) .

Figure 3. Triple spiral model



Source: https://docplayer.rs/199468481-Softversko-in%C5%BEenjerstvo-softverski-procesi-i-metodologije-razvoja-softvera.html Retrieved on August 16, 2023

Companies today have much greater opportunities to commercialize innovations outside the company. In the past, ideas, knowledge, technologies, and innovations that cannot be commercialized by the company were most often internally stored and collected in the company's internal databases, and if the company had no interest or opportunity to directly commercialize them, they remained forgotten and unused. Small and medium-sized enterprises play an important role in the open innovation model and often represent the most significant part of innovative efforts in an economy, unlike large companies that often act only as an integrator of the entire innovation system. As SMEs operate in a global environment, it is necessary to establish cooperation with larger companies in order to create better opportunities and greater utilization of their capacities, as well as with other SMEs from the same or different activities, as well as with research centers, institutes, laboratories, independent researchers, universities and all others entities that can contribute to their innovative development. According to the features of innovation, manufacturing small and medium-sized enterprises can be grouped into several categories: from low-tech SMEs, through SMEs that have a minimum of technological capabilities, technologically competent SMEs, and up to SMEs that can independently successfully carry out research aimed at creating a new innovation.

Table 1. Types of companies according to technological intensity

Research performance	➢ Research Department or equivalent ➢ Capable of long-term technological development innovation
Technological competence	➢ More researchers ➢ Some budgetary discretionary rights ➢ Ability to participate in technological networks
Minimum abilities SMEs	➢ One researcher ➢ They can adopt/adapt ready-made solutions ➢ They need help with implementation
Low-tech SMEs	➢ They do not have significant technological capabilities ➢ They think that innovation is not necessary for them ➢ Maybe they really don't need innovation

Source: Arnold, E., Thuriaux, B., (1997), Supporting Companies' Technological Capabilities, Technopolis report to the OECD.

For the purposes of statistical monitoring within Eurostat (http://europa.eu/documents/comm/green_papers/pdf/com 95_688_en.pdf Retrieved on June 15, 2023), companies can be divided into three groups according to their innovation activities: 1) companies that innovate products and/or processes (without innovation in the field of organization and/or marketing); 2) companies that innovate in organization and/or marketing (without product and/or process innovation); and 3) innovative companies that have developed and product/process innovation and organization/marketing innovation. In innovation leader countries, the share of companies developing both product/process innovations and organizational/marketing innovations is higher than in other less innovative countries. Small and medium-sized enterprises represent a large and very heterogeneous group of enterprises in terms of innovation capacities, motives for innovation, innovation activities, and innovation results. Accordingly, small and medium-sized enterprises can be classified into four large groups: innovation leaders, leading users of innovation, potential innovators, and non-innovative SMEs (Table 2).

Table 2. Two-dimensional matrix of SMEs according to their innovation capacities

I **Innovation leaders** 1-3% of all SMEs (less than 5 employees)	II **Leading users of innovation** 10-15% of all SMEs (less than 5 employees)
III **Potential innovators** about 40% of all SMEs (less than 5 employees)	IV **Non-innovative small and medium** Companies about 40-45% of all SMEs (less than 5 employees)

Source: OECD, (2000), Enhancing the competitiveness of SMEs in the global economy: Strategies and policies, Workshop 1, Enhancing the competitiveness of SMEs through innovation, Conference for Ministers responsible for SMEs and Industry Ministers, Bologna, Italy, 14-15 June 2000.

2. INNOVATIONS TO THE GREEN TRANSITION OF THE ECONOMY AND COMPANIES

The green transition, after the pandemic and the energy crisis, is not only a determination, but also the only possible way of sustainable development. Therefore, it is important to define how to implement it in the most efficient way and in the shortest possible time, and not endanger economic processes at any point (Drakić, https://www.antenam.net/ekonomija/286587-drakic-zelena-tranzicija-jedini- path-to-sustainable-economic-systems Retrieved August 15, 2023). The task of policymakers is to create an environment that will be stimulating for businesses that are ready for the green transition. We should certainly find an adequate measure for those who show an irresponsible attitude towards the environment. Additionally, it is necessary to provide financial and technical support for companies that have decided to meet new technologies and business models.

In the recovery phase after COVID-19, the role of SMEs in ensuring the supply of critical raw materials has become very significant, even crucial. The emergence of the pandemic caused by the COVID-19 had and continues to have a negative impact on the public health of the population of all countries, consequently affecting both developed markets and developing economies, to which the market of the Republic of Serbia belongs. In this sense, in the Republic of Serbia, micro, small, and medium-sized enterprises (MSMEs) are the most affected, which is very important for its economy because MSMEs represent over 99% of active companies. These companies generate over 30% of GDP, contribute 40% to total exports, and provide opportunities for employment in the country, with a share of over 67%. All these elements indicate that the key to the recovery of Serbia's economy, after the pandemic caused by the COVID-19 virus, actually lies in the recovery of the MSME sector, which has lost about a third of its income and is financed mainly from external sources. The total measures in 2020 amounted to about 13% of the GDP in Serbia and an additional package of measures in the amount of 4.3% in 2021, which includes four programs of

financial support by the Ministry of Economy to small and medium-sized enterprises for which two billion dinars were set aside. These are programs for the purchase of equipment, the encouragement of entrepreneurship through development projects, the support program for start-up businesses, and the program for young and female entrepreneurs. The Center for Digital Transformation (CDT) of the Serbian Chamber of Commerce, in cooperation with the Ministry of Economy, issued a public invitation to companies to participate in the new project *Digital Transformation Support Program for Micro, Small and Medium Enterprises 2021* (https://pks.rs/vesti/ grant-up-to-6000-euros-for-digital-transformation-mmsp-4982 Retrieved on August 1, 2023). Therefore, it is evident that the MSME sector will have the opportunity to improve business with the help of certified consultants by introducing modern digital tools.

The published *Map of the Register of Measures and Incentives for Regional Development*, which shows information on state investments, economic development and economic potential, with half-yearly data for 2021, shows that the implementers of regional development incentives realized a significant amount of incentive funds and that the support of the state was primarily intended for the economy. The strategy for supporting the development of SMEs, entrepreneurship, and competitiveness for the period from 2015 to 2020 defines six strategic goals, namely: improving the business environment; improving access to funding sources; continuous development of human resources; strengthening the sustainability and competitiveness of SMEs; improving the access to new markets; and development and promotion of entrepreneurial spirit and encouragement of entrepreneurship of women, youth and social entrepreneurship. The strategy of the industrial policy of the Republic of Serbia from 2021 to 2030 (https://privreda.gov.rs/sites/default/files/documents/2021-08/Industrijska-Strategija-Vlade-Srbije-F01.pdf) includes a wide a variety of economic activities, with a focus on the processing industry. Improving the competitiveness of the national economy is a high priority and in this sense the general goal of the Strategy is defined as raising the competitiveness of industry in the Republic of Serbia.

The Board of Executive Directors of the World Bank approved it in March 2023 the first *Program Development Loan for the Green Transition to the Republic of Serbia*, which provided EUR 149.9 million (equivalent to USD 160 million) to support Serbia's increased efforts to improve its public sector institutions on the path to achieving more resilient, greener, and more inclusive economic growth that will remain sustainable for future generations. "The Government of Serbia has taken a big step forward on the way to making the green transition a reality and this activity, which provides support to its budget, is aimed at strengthening those efforts," said Nikola Pontara, director of the World Bank Office in Serbia. "Creating new and preserving existing opportunities for business, as well as introducing innovations with the aim of ecologically cleaner and more resilient economic growth, can be challenging but also has numerous advantages," added Pontara (https://www.worldbank.org/sr/news /press-release/2023/03/09/world-bank-supports-serbia-s-transition-to-a-greener-economy). Its goal is to speed up the transition to clean energy through energy market reforms in order to ensure the sustainability of the public enterprise *Elektroprivreda Srbije (EPS)* and enable faster introduction of renewable energy sources, but at the same time protect energy vulnerable customers. Through this activity, Serbia is also supported to harmonize its regulations with European Union standards on climate and environmental protection, with a special emphasis on waste management and air quality. Today, it is almost impossible to analyze the effects of digital technology, i.e. Industry 4.0, on

society outside the context of the green economy and the principles of sustainable development. In this respect, it seems more and more that the green economy and digital transformation are becoming interdependent and in some segments even inseparable. In terms of environmental protection, it is up to all stakeholders to use the potential that Industry 4.0 possesses in order to transform the way in which the human population affects the environment, which is in contradiction with the IPAT identity (Дашић et al., 2020). This is supported by the fact that for the last few years, the concept of sustainability in manufacturing companies has been seen as one of the identifying elements of the industrial revolution. This is one of the reasons why a large number of companies make efforts to promote their commitment to environmental protection and the introduction of environmentally friendly, i.e. green processes in production, such as energy efficiency, carbon emission reduction, waste management and intelligent use of resources. Guided by the United Nations Sustainable Development Goals, it is clear that sustainability is the right business strategy for the future. The impact of digital technology on the green economy is a complex and layered process. The meeting of green economy and digital technology takes place on three levels: technological, process, and development. In the context of digital transformation, technology is the driving force or engine of innovation, even when it comes to sustainability. In order to successfully achieve a green economy in industry, it is necessary to use technologies capable of maximizing production efficiency (Stojković & Vasiljević, 2021).

CONCLUSION

Green economy can be the answer to announced climate change and global warming, as it promotes sustainable economic and social development. However, if there is no technology support, that is, if current technological solutions are not in in accordance with the principles of sustainable development, green economy is threatened. Digital technology, by itself, does not contribute to green development economy. The synergy of green and digital transformation can offer a solution with long-term effects. The challenge caused by climate change and ensuring sustainable development conditioned the development of the European Green Plan, which, among other things, includes the application of digital technologies in order to introduce a green economy. Initiatives for key changes must be accompanied by strong support from the (executive) government through the defined priorities of the Government, as well as the adoption of strategic documents that provide guidelines for further legal regulation of norms and topics that are the focus of a specific strategic document. In the transition period, it will be necessary to redefine priorities, harmonize legal norms that have already been transposed to a greater or lesser extent with EU norms, so that further transition towards the EU can be started. It is necessary to actively follow regulations from the EU policy area in the context of the circular economy.

LITERATURE

1. Arnold, E., Thuriaux, B. (1997). Supporting Companies' Technological Capabilities, Technopolis report to the OECD.
2. Chesbrough, H. (2006). Open business models, Harward business school press, Boston, Massachusetts.
3. Dašić, G., Anufrijev, A. (2022), *Zelena економija кroz prizmu digitalne transformacije,* Green economy through the prism of digital transformation, ECOLOGICA, Vol. 29, No 107 (2022), 331-336 https://doi.org/10.18485/ecologica.2022.29.107.5
4. Dašić, G., Popov-Locke, J., Đervida, R., Radosavac, A. (2020). *Zaštita životne sredine u Industriji 4.0 – potencijal korporativne društvene odgovornosti,* Ecologica, 27(98), 319-325.
5. http://europa.eu/documents/comm/green_papers/pdf/com 95_688_en.pdf Retrieved on June 15, 2023
6. https://commons.wikimedia.org/wiki/File:Business_model_innovation_classification.png accessed 12.08.2023
7. https://docplayer.rs/199468481-Softversko-in%C5%BEenjerstvo-softverski-procesi-i-metodologije-razvoja-softvera.html accessed 12.08.2023
8. https://pks.rs/vesti/ grant-up-to-6000-euros-for-digital-transformation-mmsp-4982 Retrieved on August 1, 2023
9. https://pks.rs/vesti/bespovratna-pomoc-do-6000-evra-za-digitalnu-transformaciju-mmsp-4982 приступљено 1.08.2023
10. https://privreda.gov.rs/sites/default/files/documents/2021-08/Industrijska-Strategija-Vlade-Srbije-F01.pdf
11. https://www.istockphoto.com/se/vektor/enkla-vektor-infografik-f%C3%B6r-business-modell-mall-gm910085800-250647642
12. https://www.osce.org/files/f/documents/7/8/479681.pdf
13. https://www.worldbank.org/sr/news /press-release/2023/03/09/world-bank-supports-serbia-s-transition-to-a-greener-economy
14. OECD, (2000), Enhancing the competitiveness of SMEs in the global economy: Strategies and policies, Workshop 1, Enhancing the competitiveness of SMEs through innovation, Conference for Ministers responsible for SMEs and Industry Ministers, Bologna, Italy, 14-15 June 2000.
15. Pourdehnad, J., (2007), Idealized design - An open innovation process, a presentation from the Annual W. Edwards Deming Annual Conference, Purdue University, West Lafayette, Indiana.
16. Stojković, R., Vasiljević, D. (2021). *Praktični aspekti Zelene ekonomije*, Ecologica, 28(103), 378-386.
17. Дракић, https://www.antenam.net/ekonomija/286587-drakic-zelena-tranzicija-jedini-path-to-sustainable-economic-systems Retrieved August 15, 2023)
18. Николић, М. (2014). *Иновативност малих и средњих предузећа као фактор привредног развоја Србије*, докторска дисертација, Универзитет у Нишу, Економски факултет.
19. Програм развоја циркуларне економије у Републици Србији за период 2022–2024. године"Службени гласник РС", број 137 од 9. децембра 2022.

20. Стратегија за подршку развоја малих и средњих предузећа, предузетништва и конкурентности за период од 2015. до 2020. године и Акциони план за спровођење стратегије за подршку развоја малих и средњих предузећа, предузетништва и конкурентности за 2015. са пројекцијом за 2016. годину, https://privreda.gov.rs/sites/default/files/documents/2021-08/Strategija-I-Plan.pdf
21. Стратегија индустријске политике Републике Србије од 2021. до 2030. године, https://privreda.gov.rs/sites/default/files/documents/2021-08/Industrijska-Strategija-Vlade-Srbije-F01.pdf
22. "Смернице и најбоље праксе за ММСП како би се обезбедила отпорност и напредак ка кружној економији у одрживом управљању ресурсима и решења за ланац снабдевања критичним сировинама у Србији" https://unece.org/sites/default/files/2022-06/Guidelines%20and%20Best%20Practices%20for%20MSMEs%20Serbia%20AD.pdf

HEALTHCARE SYSTEM REFORM IN WESTERN BALKANS WITH SPECIAL REFERENCE TO MONTENEGRO

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Abstract: The healthcare system, as a part of the general social system, has developed over time under the influence of multiple factors, mostly without significant study and systematic planning. It is about a subsystem whose structure, organisation, goals, and way of functioning are determined by the economic potential of the country, political structure, the health status of the nation, culture, tradition, etc.
The issuesthat the healthcare systems face in Western Balkans, such as the fact that most health institutions are primarily focused on providing curative protection, and much less concentrated on preventive protection of the whole population; the existence of disparity between entrenched rights from health insurance and the financial abilities to meet the unrealistic expectations of citizens and employees in healthcare; the inconsistent manner of allocating funds with the priorities and levels of healthcare, as well as the application of an inadequate payment method for health services and the unclear way of financing health institutions, inevitably impose the reform of healthcare system as a priority.
The process of structured reforms in the healthcare system of Montenegro began in 2005. The reform of primary health care continued with the reform of hospital healthcare in the years 2009-2012. However, this process of reform has never been achieved. The desire for political promotion has led to irrational and populist reforms that did not follow the modern medical trends, hence avoiding politically and socially painful reform cuts that were necessary. The sequence of necessary actions to initiate fundamental healthcare system reforms has never been done. Processes such as healthcare system mapping, prioritisation, action plan, determination of Hospital Safety Index, development of appropriate strategy and legal legislation (Law on Health Care, Law on Health Insurance and Law on Patients' Rights) are the order which must be followed to implement comprehensive and quality reforms of each national healthcare system.

Keywords: healthcare, healthcare system, healthcare system reform, the healthcare system of Montenegro

INTRODUCTION

The healthcare system, as a part of the general social system, has been developing over time under the influence of an abundance of factors, usually without more significant study and systematic planning. It is about a subsystem whose structure, organisation, goals, and way of functioning are predetermined by the economic potential of the country, its political structure, and the state of health of the nation, culture, tradition, etc.

When you talk about the healthcare system of Montenegro, it must be said that it is a system with inherited characteristics and problems of the state union of which it was a part, as is the case with other former Yugoslav republics. The value premises of that system were social self-management, while the distinctive characteristics of the healthcare system were:

- Absence of all state control mechanisms in the management of health policy
- Social principles which enabled the largest possible scope of citizens' rights to health care and
- Social property did not oblige participants in the health care system to be efficient, which in turn caused a long-term funding crisis.

The above-mentionedproblems with which the healthcare system faced left inevitable consequences for the healthcare system of Montenegro. In the period of post-socialist transition, with societal change, all social institutions became state, and private practice was introduced. Healthcare financing has mostly remained in the domain of public financing and citizen participation. In addition, healthcare was exposed to additional difficulties (war and sanctions).

The healthcare system of Montenegro was grounded on the principles of social justice, equality, and accessibility which ensured universal accessibility, parity, and the right to health care for all citizens, financed from public funds. Such an approach has caused high expectations from the healthcare system in the eyes of the people, which led to an increase in costs above realistic possibilities.

THE REFORM OF THE HEALTHCARE SYSTEM IN MONTENEGRO

The healthcare system of Montenegro with inherited problems required comprehensive reform. The decisive reasons for the healthcare system reform were:

- Growing costs for health care, which are conditioned by the aging of the population, the increase in chronic diseases, increased demands for better quality services, the economic situation, and the real decrease in funds for health care,
- The inability to provide the needs for health services in the scope established by the law,
- Exacerbation of the indicators of the health conditions caused primarily by the deterioration of the quality of life, standard of living, and poverty,
- Underdevelopment of economic relations in healthcare and financing of healthcare activities with a particularly pronounced low professional satisfaction and motivation for the work of healthcare workers,
- Excessive spending and obligations of the Health Care Fund,
- Insufficiently regulated work of the private sector in healthcare, without objective parameters on the effects of privatisation,

- Underdeveloped information system to support management and
- Inadequate planning and management of the health system, which does not correspond to the modern conception of the healthcare system.

Additionally, the absence of clear goals and a strategy of development enabled the concentration of resources and capacities on a secondary level (hospital care), where the users used the highest percentage of services because the healthcare at a primary level failed to solve the greatest number of health problems. To this should be added the following facts that support the initiation of the reform process (Strategy of Development of Healthcare of Montenegro, 2003):

- The healthcare system, although organised based on primary healthcare, does not function in a coordinated and integrated manner,
- Healthcare institutions are primarily focused on providing curative protection to the citizens, but much less on preventive work for the entire population,
- There is a discrepancy between established rights from health insurance and financial abilities to satisfy unrealistic expectations of citizens and healthcare workers from the healthcare system,
- Inadequate manner of allocating the funds with priorities and levels of healthcare,
- Deficient payment methods for health services and ambiguous methods of financing healthcare institutions,
- Healthcare is not tailored to the needs, priorities, and specifics, especially at the local level,
- Many non-medical workers and inadequate structure of healthcare workers, notably in certain segments of the healthcare system,
- Absence of a national medication policy and irrational consumption of medication,
- The records and reporting system prescribed by law are of poor quality and quite outdated.

The process of structural reforms in the healthcare system of Montenegro began in 2004 with the reform of primary healthcare and continued with the reform of hospital healthcare in 2009-2012. This type of reform in the healthcare system includes the amelioration and advancement in the areas of recognized weaknesses of the system, which aims to achieve a financially sustainable healthcare system, which, along with efficiency, provides appropriate quality for all service users. The reform aims to eliminate those weaknesses and reorganize the system through new processes, thus achieving economic and financial results (Structural Reforms in the Healthcare System with an Action Plan for the period 2015-2017, 2015)

The healthcare reform at the primary level began in 2004 with the implementation of the Healthcare System Improvement Project in Montenegro with the support of a World Bank loan in the amount of $7.5 million, and continued with additional funding of the same project, in the amount of $7.2 million or 5.10 million euros.

The first phase of the project ended on December 31, 2009, and during the five years within this project, significant results were achieved, namely:

- Primary Health Care Centre has been established as the basic unit of primary health care (PHC) within which there is a category of a selected doctor, a support centre, anda support unit. The citizen and his needs are placed at the centre of the entire system of reformed primary care, which rests on the selected doctor as the bearer of

health care provision at the primary level. From April 1st, 2008, the process of registration with the selected doctor began in all municipalities of Montenegro. The level of registration of insured persons to date is 94.6%.

- The material and spatial provision and equalisation of conditions for the provision of primary health care in the entire territory of Montenegro have been carried out,
- The Basic Package of Health Services for the Primary Level of Healthcare has been defined,
- The primary healthcare payment model has been transformed (based on 50% capitation and 50% service),
- Personnel reorganization of employees in primary health care was implemented (dentists were privatized, the number of non-medical personnel was reduced to a minimum, and the problem of excess medical personnel was solved through a social program),
- The integration of the private and public sectors at the level of primary health care was realised,
- Further education of the teams of selected doctors was accomplished (all teams in Podgorica and 28% of teams outside Podgorica, in cooperation with the Faculty of Medicine),
- The integral Information System was introduced on the entire territory of Montenegro, as well as the ICPC-2 as a standard coding system for health services (recommended by the EU). Bilateral financial assistance from the Government of Austria was secured as a sign of support for an Integrated Hospital Information System (IHIS) of the Clinical Center of Montenegro. It should be noted that in that period, despite numerous problems, the basic health resources were preserved, the material basis of work was significantly improved, and accordingly the health service provided health care to the population of the Republic and numerous displaced persons. However, the lack of adequate mechanisms for managing the healthcare system, primarily institutional mechanisms, affected the disparity between sources of funds and healthcare needs.

The primary health care reform was accompanied by a change in the financing model through:

- Conceptualisation, preparation, and implementation of efficient, effective, fair, and sustainable payment mechanisms for primary health care in Montenegro
- Definition of methodology for determining the value of capitation and the prices of health services in primary health care.

The ultimate effects of the health care reform on a primary level were:

- Reduced expenditure on prescription medication
- Improved distribution of the funds
- 74% of selected doctors receive a higher salary according to the new methodology compared to the previous method of calculation,
- Quality and up-to-date data on the patient's health condition,
- Quality reports on the scope and structure of the services provided,
- Data that enables comprehensive control
- Management makes decisions based on real and timely data.

During the reform, the total number of doctors employed in primary health care has reduced by 5%, while the number of nurses has decreased by 35%. Simultaneously, the number of General Practice doctors increased (selected doctors for adults) which improved their availability (54.4 in 2015 compared to 36.3 in 2004, per 100,000) (Šćepanović, L., 2003).
The other part of the healthcare system reform continued with the reform of hospital healthcare between the years 2009 and 2012 to further upgrade it. The goal of the continuation of the reform was to eliminate the recognised weaknesses of the healthcare system to achieve a financially sustainable health system, which provides efficiency and appropriate quality for all users of services.

Further development of the healthcare system of Montenegro at that time was based on the Master Plan 2010-2013. adopted by the Ministry of Health. The Master Plan continues to guide the development of the healthcare system based on the guidelines of that document as well as the health strategy of the European Union "Together for Health": the strategic approach of the EU for the period 2008-2013. and World Health Organization guidelines. The Master Plan providesthe main settings for the development of the Secondary and Tertiary Health Care Strategy. The more significant objectives stated in this document are (http://www.mzdravlja.gov.me):

- Continuation of harmonisation of legal frame in healthcare with EU regulations. The reform of the legal framework. Reform of the legal framework has the task of transferring financial responsibility from the Health Insurance Fund (HIF) to executors on secondary and tertiary levels, which will result in better hospital management, an increase in positive competition as well and an increase in the quality of healthcare services.
- Preparation for introducing a new payment system on a secondary level of health care (DRG payment model by diagnosis group). DRG system, as a globally recognised standard for comparing efficiency and costs in healthcare, enables the creation of appropriate economic analyses, that should determine further steps, and ensures comparability of data between hospitals in the country, as well as with hospitals in the EU and beyond,
- Establishing a system for quality control in health care, and development of a quality control strategy in health care, which includes the development of professional standards (protocols and clinical guidelines) that will define the procedures and levels of knowledge and skills that health workers should master,
- Establishing a National Health Account
- Building a legal framework for private-public partnership in healthcare, based on the analysis of the positive EU practice in the field of inclusion of private institutions in the healthcare system, granting concessions, the status of a client, direct joint investments, leasing equipment and space in public institutions, and finding optimal models for Montenegro,
- Defining of Basic Package of Health Services for Secondary and Tertiary Levels of Healthcare,
- Establishment of the Network of Healthcare Institutions, Norms, and Standards for Secondary and Tertiary Levels of Healthcare,
- Development of the Health Information System, including the development and integration of the information system of the Agency for Medicines and Medical Devices and the information system of general hospitals

- Introduction of voluntary financing of healthcare services to increase the share of private funds in the healthcare system, in a public and transparent manner. The Health Insurance Fund (HIF) will provide financing for the basic package of healthcare services, while all other services, as well as the price difference paid by the insured through the co-payment system, will be subject to voluntary health insurance,
- Introducing modern information and communication solutions and technologies, to reduce equipment procurement and maintenance costs, address the issue of medical personnel shortage in certain areas of Montenegro, and most importantly, elevate the quality of diagnostics across the entire region of Montenegro.
- Development of an appropriate payment model for tertiary-level healthcare, based on EU model analysis,

As part of the implementation, the reforms were intended to encompass all segments of the healthcare system, from the organization and operation of the Ministry of Health, the network of healthcare institutions and their functioning, the private healthcare sector, the operation and organization of the Health Fund, methods of healthcare financing, payment methods, monitoring, and control.

The carriers of the healthcare and health insurance system reform were the Ministry of Health of Montenegro, the Health Insurance Fund, and the Institute of Public Health of Montenegro, with active participation from all other healthcare and various institutions. To implement the reform, it is necessary to involve international institutions and organizations, especially the IMF, World Bank, World Health Organization, and others.

The implementation of the reform involves the execution of short-term and long-term measures that will be based on projects. Through health policy instruments, the Ministry of Health aims to Provide conditions for:

- Strengthening of primary healthcare
- Funding sources and development of a new health insurance system
- Improvement Improvement of the payment system for healthcare services and programs through service contracting based on capitation, budgeting, and other payment methods,
- Privatisation within the healthcare system – regulating the private sector,
- Defining the role of the state in shaping health policy: Government, Health Council, and Ministry of Health,
- Rationalisation of public health, and
- Integration of the private sector into the healthcare system.

The directions of reform encompass (Health Development Strategy of Montenegro, 2003):

- Institutional reform,
- Reform of economic relationships in healthcare, and
- Reform of attitudes towards health.

The institutional reform aims to enable the health administration, national-level healthcare institutions, and primary-level healthcare institutions to manage the healthcare system more effectively. The tasks within this domain are summarized as follows:

- Defining legal instruments that should provide conditions for improving health protection and stable functioning of the healthcare system. This entails enacting the Health Law, Health Insurance Law, and Medicines and Medical Devices Law.
- Defining sub-legal regulations that regulate the functioning of institutions and entities within the healthcare system in an objective and standardised manner, to ensure equal rights in accessing healthcare, optimal working conditions, and an appropriate quality control system in healthcare.
- Defining professional standards which serve as instruments to establish a division of labour, a catalog of knowledge and skills that various profiles of healthcare workers should achieve, all to provide higher quality healthcare services.

The reform of economic relations in healthcare aims to establish stable sources of financing for healthcare, equal forms of ownership, abolish monopolies, and affirm market principles in specific segments of the system by introducing, alongside mandatory and voluntary health insurance, new methods of payment for healthcare services.

The reform of economic relations in healthcare entails accomplishing the following tasks:

- An analysis of economic relations and financial flows in healthcare should indicate the availability of total resources for health protections, problems in acquiring funds, and efficiency in their utilisation,
- The project to improve payment for healthcare services should bring about a change in the system of economic relationships and rational healthcare provision, while providing incentives for quality and affirming the medical profession.
- The master plan for healthcare resources should ensure regionalisation and planned development of overall healthcare capacities required to achieve healthcare development goals.
- The project to enhance the structural organisation of healthcare should provide improvements in primary healthcare, allocation of resources, and the reorientation of the healthcare system, towards greater utilisation of the service potential of the primary level of healthcare.
- The project for the development of the healthcare information system will enable the standardisation of information, its utilisation, and better management at all levels of the healthcare system.

The reform of attitudes towards health involves changing the approach towards health as a fundamental human right and promoting health by establishing ethical and civic relationships through the affirmation of the medical profession and enhancing citizens' awareness of health. This also includes increasing the professionalism and competence of healthcare staff.

The fundamental legislation for this reform compromises the Health Protection Law (2012) and the Health Insurance Law (2012), which establishes the institutional foundations of a modern and efficient healthcare system.

The Health Development Strategy in Montenegro is based on healthcare policies to make healthcare more efficient and of higher quality while integrating Montenegro's healthcare system into European and global healthcare development processes.

AREAS OF FURTHER REFORM INTERVENTIONS

The analysis of Montenegro's healthcare system, conducted by the Ministry of Health in June 2015 (Structural Reforms in the Healthcare System with an Action Plan for the Period 2015-2017,2015) revealed that the existing healthcare system is costly, extensive, dispersed, inadequate interconnected, with too many smaller expensive and closed systems. The only consistently maintained link within the system is the connection to the Budget, in terms of providing funds for its regular functioning. The financial models used to address problems within the system showed that despite all funding sources, it did not become more functional, financially sustainable, or result in improved service quality. Instead, it produced a financially unsustainable system while simultaneously reducing the quality of healthcare, which manifested through the expansion of the Service Delivery Network resulting in increasing financial obligations.
In that way, a vicious circle was created that resulted in poorer healthcare and increased costs. This situation indicates that within the existing system, generators of irrational consumption must be identified and eliminated as the root causes of the problem, only then transitioning to alternative organisational and functional forms with new models of rational consumption. Although certain health-related indicators in the healthcare system have improved since the start of the reform, the costs in the healthcare system are significant, accounting for 6.5% of GDP, and the total debt of the Health Insurance Fund at the end of 2014 was around 46 million euros, approximately 10 million euros more than at the end of 2013. Based on this, it is evident that structural reforms should continue to enhance the efficiency and quality of the healthcare system, with a particular focus on specific priority areas.

The analysis of the functioning of all levels of healthcare and the healthcare system revealed that:

1. The primary level of healthcare and the concept of selected doctors have largely become administrative services for the secondary and tertiary levels, primarily involving referrals for further specialised treatment, diagnostics, and prescription issuance. This resulted in the unnecessary referral of a significant number of patients to the secondary and tertiary levels.

2. At the secondary level, a considerable number of patients were referred to the Clinical Center of Montenegro without actual necessity. This led to the outcome where the Clinical Center provided services of a general hospital with insufficient bed and personnel capacities, while within the system, there were around 700 available beds each day.

The measures that the Ministry of Health suggests to solve this problem are as follows:

- Development of a continuous education program at all levels of healthcare.
- Reducing the bed capacity by around 30% (to 600 beds) by repurposing specific hospital capacities, converting them into day clinics with a minimal number of beds, primarily for treating urgent conditions daily, while other patients would be referred to the nearest general hospital.

- Reduction of hospital capacities, accompanied by a decrease in the length of stay (no more than 5 days) and higher utilisation of capacities (80-85%).
- Organising hospital infrastructure while adhering to the principles of territorial distance and geographic distribution of hospitals.
- Reviewing the basic package of services for primary, secondary, and tertiary levels, and prescribing a new adequate package of services offered to the insured on an annual basis.

The implemented measures would lead to financial savings (which would be used for education, technology, and improving the material status of employees), reduction of unnecessary referral of patients to the Clinical Center of Montenegro, and improvement of the level of health services in hospital facilities.

3. Human resources are at a satisfactory level but there are waiting lists for certain specialist and subspecialist healthcare services that have rendered the system ineffective and may represent a significant source of corruption. To overcome this issue, the Health Insurance Fund has entered contracts with private healthcare institutions in Montenegro, which has further burdened the system financially. Through these contracts and additional funding, a certain lack of organization and inefficiency within the public healthcare system has been revealed.

A suggested set of measures aimed at solving the problem of uneven utilisation of personnel capacities includes:

- Education at all levels of health care;
- Redistribution of working time;
- Increasing the number of doctors at the primary level of health care while raising the level of knowledge through continuous education.

The effects of the proposed measures would be selected doctors with higher competence; relievingthe secondary and tertiary level of health care while reducing the number of curative medicine services as the most expensive type of medical services; significant reduction of costs for services provided in the public health system (Basic package of services) and uniformity in the provision of quality medical services.

4. Hospital healthcare represents the most expensive segment of the healthcare system where the most complex health issues of the population are addressed, involving numerous specialised personnel and the use of costly medical equipment. Hospital activities are costly, and this reflects on healthcare expenses and the efficiency of financial resource utilization. Even though the bed coverage relative to the population in Montenegro is satisfactory (3.9 beds per 1000 inhabitants), there is evident underutilisation of hospital beds, requiring a balanced and rational redistribution of capacities within the system. Bed occupancy is around 76%, which is not satisfactory (according to European standards, it should be 85%).

The redistribution of hospital capacities in terms of reduction, repurposing for medical or other purposes, and division into acute and chronic patient treatment should result in the following:

- Financing of services rather than unnecessary hospital capacities;
- Rational and profitable utilisation of hospital capacities;
- Shorter patient hospitalisations and increased number of therapeutic and diagnostic services;

- Reinvestment of achieved savings into equipment, education, and material standards of employees.

5. High-quality management is a significant precondition of an efficient and quality functioning healthcare system; hence it is necessary to accentuate the education of management staff at all levels. The process of healthcare system reform necessitates a new approach to the management of the healthcare system and the need to apply methods and models of modern healthcare management. The healthcare system and healthcare institutions require newly educated professionals who completely understand the processes in healthcare and organisational problems and have the knowledge and the skills that enable them to manage healthcare institutions. Having in mind that the healthcare system is only partially based on market principles, whilst most of it is based on taking funds from the budget, health managers are mainly oriented towards bridging the discrepancy between the needs of health institutions and financial possibilities without the ability to find new ways of obtaining funds to maintain the quality of business in conditions of reduced cash flow.

The application of contemporary management which implies the implementation of a system of hierarchical responsibility and decision-making, the education of managers to improve the development of their own potential and professional management of resources, as a result, should produce appropriate financial savings, better and better-quality health services and the sustainability of the health care system.

6. Introducing the case-based payment system (DRG model- Diagnostically related groups). Considering the magnitude of hospital expenditure in the total healthcare budget, the payment method in hospitals significantly affects the performance of the overall health system. The introduction of a payment system based on the DRG model aims to promote spending control in the hospital sector. In addition, the introduction of this payment system aims to improve the management and use of resources, to ensure the redirection of costs to cost-effective services, and to improve equity in financing. The payment system contributes to the achievement of health policy goals in a way that promotes access to necessary health services, better quality of health care, and equality in the provision of health care, while at the same time promoting effective and efficient use of resources and, when necessary, cost control.

HEALTH POLICY OF MONTENEGRO ON THE WAY TO THE EUROPEANUNION

Health policy represents the basis for legislation and national healthcare programs. By adopting strategic documents, Montenegro set as its main goal in healthcare the construction of a sustainable and integrated healthcare system based on the principles of solidarity, equality, availability, and quality, which gives the needs of citizens a central place.
The health condition of the population of Montenegro, measured by health indicators, lags behind most EU countries, which is a consequence of the poor economic situation prevailing in the country. Even if the general situation has been slightly improving recently, no significant improvement in basic health indicators can be expected.

The main problems that have a more significant influence on the status of health indicators and that should be set as priorities for solving are the fact that capacities and resources dominate at the secondary and tertiary levels, while the efficiency and quality of health care are not priorities.This is also the reason that the system cannot function in a coordinated and integrated manner.
Even though a lot of goals of health policy have been achieved, it is necessary to constantly improve the quality improvement process, the resource management process, the transparency of funding, and the functional connection of public and private health services as a means of ensuring the financial sustainability of the health care system.
As explained earlier, the healthcare system of Montenegro is financed through contributions for mandatory health insurance. The negative impact of the financial crisis on filling the health budget led to a change (in 2010) in the contribution rate for health insurance from 10.5% to 12.3% for employees, while the contribution rate for pensioners was reduced from 19% to only 1 %.
To ensure a greater number of tax and contribution payers as well as to improve the efficiency of public revenue collection, the Law on Unified Registration was adopted, the implementation of which began in 2011. The goal of this law is to increase public revenue, which would directly ensure an increase in healthcare financing.

In order to ensure and secure the financial sustainability of the healthcare system, it is necessary to:

- Limit the growth of health costs,
- Identify the basic generators of those costs and act on them with appropriate measures,
- Promote the quality and efficiency of service provision,
- Improve the efficiency and rationality of resource use,
- Redefine the roles of the key bearers of health and financial policy (Ministry of Finance, Ministry of Health, and Health Insurance Fund),
- Define the financial arrangement, which implies the introduction of a new payment model based on the DRG model.

Efficient cost control in healthcare requires identifying their generators. International experience shows that health technologies are the main generator of costs and the cause of their growth. Namely, practice has shown that new technologies and pharmaceutical products are responsible for a 30-40% increase in costs. The reason for this is not only their high cost but the fact that they are often included in the work without first examining their effectiveness from a clinical or financial point of view. On the other hand, the number and salaries of healthcare workers can also be interpreted as one of the cost generators in healthcare. However, their control by the Ministry of Finance cannot maximise the health production function or realise the opportunity for savings.
Effective cost control requires looking at their structure from both a static and a dynamic aspect.

The strategy for controlling consumption in health care should promote (Strategy for the Optimisation of the Secondary and Tertiary Level of Healthcare with an Action Plan for Implementation, 2011):

- Basic principles of technical effectiveness, i.e., the autonomy of the healthcare sector at the macro, meso, and micro level in the reallocation of resources;
- Service-based payment model, instead of capacity financing;

- Introduction of contracting for the purchase of services in order to define the conditions for payment of the effects and results of the provision of health care and to regulate the relationship between a single-payer (HIF) and the provider of health services;
- Rationality in the provision of healthcare through the incentive policy of rewarding the employee for quality and efficiently provided healthcare services;
- Consistent application of clinical protocols and guidelines in the provision of healthcare, as well as the introduction of new technologies when justified from a clinical and financial point of view;
- Fiscal stability of the healthcare sector through the adoption of a long-term fiscal plan for the stabilisation of the healthcare system, which will include the annual forecast of healthcare spending and public revenues in the healthcare sector to reduce the fiscal deficit to zero.

Having in mind the role of the Ministry of Finance in ensuring and controlling costs intended for health care financing, the participation of its representative in the management structure of the Health Insurance Fund is necessary.

The assessment of the competent institutions of the EU and the WHO on the level of reforms achieved is an important indicator of the quality of policy and the level of reforms implemented in the health system of Montenegro. The research on the reached level of health system reform, which was conducted by the Ministry of Health in cooperation with the WHO and UNDP (Assessment of the Integrity of the HealthcareSystem in Montenegro, 2011) covered all levels of the health system of Montenegro and gave the following results.

Regarding the success of the healthcare system reform, patients on the primary level have a positive opinion. Namely, 40.6% of respondents consider that the healthcare system reform is successful, while approximately 39.3% consider it to be partially successful. According to the opinion of every other citizen (50.6%), during the implementation of the healthcare reform, the quality of healthcare services improved. On the other hand, 30.2% of respondents believe that the quality of services has remained the same.

There is a high degree of agreement between respondents' answers about the current reform and changes in the quality of health services. This means that the respondents who positively evaluated the results of the implemented reform also spoke positively about the change in the quality of health services compared to the period before the implementation of the reform (Assessment of the Integrity of the HealthcareSystem in Montenegro, 2011).

As characteristics of the healthcare system that have improved compared to the period before the implementation of the reform, the respondents identified in the largest percentage: a better relationship with the doctor, which results in better familiarity with the patient's health condition and disease history (61.6%) and waiting time for an examination (53 .5%) which was reduced by the introduction of the obligation to schedule examinations in advance.

Based on the obtained data, it can be concluded that the reform of the healthcare system at the primary level, which has been implemented since 2003, has resulted in positive changes, as some of the defined goals have been achieved. On the other hand, with the implementation of the reform, according to the opinion of primary healthcare patients, changes did not occur when it came to expertise (64.8%) motivation of doctors (60.1%), and equipment of institutions (55.3%).

When it comes to the main advantages of the reform, patients single out less waiting in lines (18.6%), better monitoring of patients/better insight into their health condition (16.0%), scheduling examinations in advance (12.1%) and the concept of "Selected doctor" (12.0%) who contributed to "increasing discipline in health centers". Out of the total number of respondents, 14.5% believe that there were no changes for the better due to the implementation of the reform because "in practice, it was poorly implemented."

According to citizens, due to the obligation to schedule examinations in advance, the reform of the health system "made" doctors unavailable when patients needed them the most (41.8%), which was a feature of the previous health care provision system. In addition, as the main drawback of the reform, patients state the overload of certain doctors with a large number of patients (23.0%) and difficult access to doctorspecialists (10.0%) compared to the period before the implementation of the reform.

CONCLUSION

The problems of the Montenegrin healthcare system, partly inherited from the previous system, as well as the indicators of health capacity and quality of health services, which are constantly lagging behind developed European countries, were the main reason for initiating a comprehensive reform.

The first phase of the system reform was related to primary health care and aimed to increase the availability of healthcare to every individual, ensure the quality of the service, improve the health infrastructure, and reduce the costs of that system.

The second part of the reform of the health system continued with the reform of hospital health care in 2009-2012. to further upgrade it. The goal of the continuation of the reform is to eliminate the recognised weaknesses of the health system with the intention of achieving a financially sustainable health system, which provides efficiency and appropriate quality for all users of services.

Unfortunately, the reform was started but was never nearly completed because there was no political will to do the same.

The changes on the political scene that took place in 2020 also brought news in the field of financing health spending. The Europe Now program abolished the contribution category for health insurance, which included the financing of health expenditure from employees' wages. This transition from Bismarck's to Beveridge's system implies the financing of health spending from the budget (mainly from taxes). The question arises whether the application of the system used by Great Britain is good, bearing in mind that Montenegro does not have their economy nor the strength of their economy and, accordingly, neither their budget.

On the other hand, with the abolition of contributions and the transition to budget financing, the autonomy and independence as well as the stability of the healthcare system's income formation were abolished and everything is related to the budget and consumption, which means that the decision on the distribution of funds is based on political and not general interests.

In accordance with that, all further reforms of the healthcare system would have to go in the direction of further development of primary healthcare, integration of the private and public sectors, the introduction of appropriate systems of voluntary and additional health insurance, the development of the health information system, as well as the construction of such a system that will be in accordance with the needs, characteristics, and goals of the development of Montenegro.

LITERATURE

1. Dunn, R., 2002, *Healthcare Management*, Seventh edition, Chicago, Health Administration Press.
2. *European Commission, Report on the progress of Montenegro for 2013, October 16, 2013*, Brussels, COM (2013)
3. *Law on Healthcare Protection of Montenegro*, Official Gazette of Montenegrono. 39/04 од 09.04.2004., 14/10 from 17.03.2010.
4. Lombardi, D.M., Schermerhorn, J.R., 2011, *Health Care Management*, John Willey & Sons.
5. Micovic P., 2008, HealthcareManagement - Management of the Healthcare System and Healthcare Institutions, Belgrade, Obelezja.
6. Micovic,P., Micovic I., 2013, *Healthcare system*, Belgrade, European Center for Peace, and Development.
7. Mihajlovic B., Kostic N., 2005, Management in healthcare, Belgrade, Cigoja stampa
8. Assessment of the integrity of the health system in Montenegro, Ministry of Health, UNDP, SZO, Podgorica, 2011.
9. Perisic N., 2011, Reforms in Serbian Healthcare, Social Reforms – Content and Results, Belgrade, Faculty of Political Sciences.
10. ПPlan of Human Resources in Healthcare for the Period 2013-2022, 2013,Podgorica, Ministry of Health of Montenegrолан
11. Ristic Z., Ristic K., Healthcare Management in Economic Theory and Practice, Business Studies, Journal for Business Theory and Practice, Year V, Issue 9-10, Banja Luka, 2013.
12. Strategy for Optimisation of Secondary and Tertiary Level of Healthcare with Action Plan for Implementation, Ministry of Health of Montenegro, Podgorica, 2011, page 61.
13. Healthcare Development Strategy of Montenegro, Ministry of Health of Montenegro, Podgorica, 2003, page 10.
14. *Structural Reforms in the Healthcare System with Action Plan for the Period 2015-2017*, Ministry of Health of Montenegro, Podgorica, 2015, page 3.
15. Swayne, L.E., Duncan, J.W" Ginter, P.M., 2006, Strategic Management of Health Care Organizations, 6th ed. John Willey & Sons.
16. Senkubuge, F., Modisenyane, M., Bishaw, T., 2014, Strengthening health systems by health sector reforms, Glob Health Action.
17. Scpeanovic, L., Шћепановић, Л., Healthcare Personnel and Primary Healthcare Reform in Montenegro, 2023, Serbian Medical Journal of the Medical Chamber, vol. 4, no. 1, pp. 27-40.
18. http://www.mzdravlja.gov.me

A PROSPECTIVE COHORT STUDY OF PSORIATIC ARTHRITIS PREVALENCE IN SERBIAN PATIENTS WITH PSORIASIS

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Abstract: The aim of this study was to determine the incidence and prevalence of psoriatic arthropathy and to point out the problem of their occurrence in a sample of patients diagnosed with psoriasis.
109 patients with diagnosed psoriasis and psoriatic arthropathy, took part in the survey. The average age of patients was 48,85±10,11 years. We analyzed the incidence and prevalence of the psoriatic arthropathy occurrence for the patients with psoriasis.
Psoriatic arthropathy registered with patients wer those with arthritic changes on: sacroiliac joints with 24 (22,02%) patients, 19 (79,17%) male and 5 (20,83%) female (p<0,001); spine with 11 (10,09%) patients, 6 (54,56%) male and 5 (45,45%) female (p=0,578); peripheral joints with 74 (67,89%) patients, 33 (44,59%) male and 41 (55,41%) female (p<0,01). When comparing the symptoms, most of the patients (63,30%) skin changes were represented before arthritis, for 27,52% patients arthritis preceded the skin changes, and for 9,17% patients the changes were simultaneous,
It can be concluded that psoriatic arthropathy occurs more often in median age (31 to 50 years old) and it is more common for men than women. For most patientspsoriatic skin changes preceded joints affection, with the most common ones being polyarthritis.
Keywords: psoriasis; psoriatic arthropathy; psoriasis and association.

INTRODUCTION

Psoriasis is a non-infectious, chronic proliferative and inflammatory skin disease that is an immune-mediated disease associated with many other medical conditions. Psoriasis is characterized by erythematous plaques covered with silvery scales particularly over theextensor surfaces, scalp, and lumbosacral region. [1,2] Psoriasis is caused by a combination of genetic and numerous other etiological factors,[3] it is a common disease among the white people, and approximately 2-3% of the world population has it.[4] Psoriatic arthropathy (PsA) is a chronic inflammatory seronegative disease associated with psoriasis. They affect peripheral and axial skeleton with erosive arthritis characteristics on peripheral joints, and ankylosing changes on sacroiliac joints and spine.[5] Research has shown that among the population with psoriasis, 5 to 10% people have some kind of PsA. [6] The strongest form of PsA occurs during the forth to sixth decade of life, with the same frequency for men and women[7]. Psoriatic formations can occur on every skin part, especially on the extensor extremities, scalp, lumbosacral, gluteal and genital areas. It often affects the penis glans, while it affects the mucosa of the oral cavity less often, and it rarely affects tongue. [8] Pustular psoriasis form, generalized or localized, occurs less often. Localized pustular psoriasis affects the palm and soles skin. Localized pustular psoriasis starts on fingertips and can be accompanied by a severe form of peripheral arthritis. A third of the patients with a generalized pustular psoriasis has arthritis, which usually has a severe clinical course and predominantly affects the spine. However, even patients with a severe arthritis clinical course can have a mild form of psoriasis that affects only one so called “hidden” area, such as scalp, armpits, umbilical cord, perineum, so it’s in fact an “inverse psoriasis”. Nail associated psoriatic changes are more common with PsA patients compared to the skin changes, and they occur in more than 80% of patients.[8] Nail changes, which include furrowing and onycholysis, are the only clinical psoriasis manifestations that are significantly associated with PsA development.[8,9] It affects eyes in about one third of PsA patients, including conjunctivitis, iritis, keratoconjunctivitissicca and episcleritis.[10] Common symptoms are increased fatigue, malaise, fever and, less frequently, morning stiffness. Psoriasis and psoriatic arthropathy have a significantly negative influence on many life quality areas related to health, including physical, professional, social, psychological and sexual wellbeing.[11-14]

The goal and purpose of this paper is to point out the rheumatological and orthopedic problems that are often encountered by physiatrists during the rehabilitation treatment of patients with psoriasis with consequences on the locomotor system, based on our experience treating the psoriatic arthropathies.

PATIENTS AND METHODS

A prospective cohort study was conducted. The monitored research sample includes 109 patients with a diagnosis of psoriasis and psoriatic arthropathy, aged 29-66 years. Patients were monitored on an outpatient basis and in inpatient treatment at the Special Hospital for Rehabilitation Agens and the Special Hospital for Progressive Muscular and Neuromuscular Diseases in Novi Pazar, in the period from 2010-2016. The diagnosis was made on the basis of anamnestic data, clinical examination and additional diagnostic findings of native radiography. The patients were divided into three groups, according to the manifestation of articular affections. In the first group there were 24 patients with a diagnosis of psoriatic

arthritis localized to the sacroiliac joints, the second group included 11 patients with changes in the spinal cord and in the third group were patients with affection of peripheral joints.

Regarding the specifics of the symptoms development, the order of the of symptoms occurrence was observed separately, i.e. whether the skin changes preceded the joint changes, or vice versa, or they occurred simultaneously; and the type of cutaneous manifestation of psoriasis, i.e. whether only individual changes were present, or only diffuse, then whether the changes were found only on the nails or only on the head. The clinical picture of sacroiliitis is often mixed with lumbalgia of another etiology, i.e. lumbosacral pain. This applied primarily in cases where sacroiliitis preceded cutaneous manifestations of the disease. The non-recognition of sacroiliitis as part of psoriatic syndrome by physicians is completely justified, although it would be expected that a careful history and clinical examination would establish a clear distinction between sacroiliac joint infection and lumbar syndrome even when degenerative change has not yet developed - a change that would be radiologically verified.

The ethics committees of the Special Hospital for Rehabilitation Agens and the Special Hospital for Progressive Muscular and Neuromuscular Diseases in Novi Pazar gave their consent for conducting the research.

In the analysis of the results, standard descriptive methods were used - determination of the mean value (X) and standard deviation (SD). The comparison of the mean values of the numerical features between the two groups of respondents was performed by Student's-T test or Mann-Whitney U test (Mann-Whitney U Test), depending on the type of data distribution. In all analyzes, an estimate error of 0.05 (5%) was assumed as the limit of statistical significance. The Excel program from the Microsoft Office 2016 software package was used to enter, rank, group, tabulate and graphically display data. The calculations were performed using the SPSS program Version 20.0 (IBM SPSS Statistics 20).

RESULTS

The study included 109 patients (78 men and 51 women). The average age of the patients included in the study was 45.88±8.58 years.
A review of the patients with sacroiliac joint affection
Anamnestic data on pain, which begins in the lumbosacral region with propagation towards the hips and flexors of the knee joint, and arthritic changes determined by native radiographs on the sacroiliac joints, were recorded in 24 (19 male and 5 female) patients ($\chi 2$ = 18.963 ip<0.001). The average age of patients with psoriasis with affection on the sacroiliac joints was 44.33 years. The youngest patient was 29 years old, and the oldest 66. The largest number of patients, 14 (58.33%), were in the range from 31 to 50 years of age (Table 1). Out of 24 examined patients, in 19 (79.17%) besides sacroilitis, polyarthritis was recorded, while in 5 (20.83%) oligoarthritis was found. Analysis of the native radiographs of the diseased subjects with symptoms of sacroiliac joint damage recorded radiological changes in terms of sclerosis of the joint edges on both sacral and iliac bone in 10 patients (41.67%), while ankylosis of the sacroiliac joints, where the joint ruptures were barely noticeable and which was fully present, was recorded in 7 patients (29.17%). In other subjects (29.17%) the changes that would be observed on X-rays were not fully developed, although there was a discrete marginal joint sclerosis with narrowing of the joint space. Analyzing the evident X-ray changes on the sacroiliac joints (a total of 17 patients with a positive X-ray finding), unilateral affect was detected in 3 patients (17.65%), symmetrical bilateral changes were

observed in 9 (52.94%) while in 5 (29.41%) of patients we found bilateral changes in the sacroiliac joints, although they were not symmetrical ($\chi 2 = 10.253$ and $p < 0.001$). This asymmetry could conditionally indicate two times of sacroiliac affections occurrence. This also coincides with the anamnestic data obtained from patients, which indicates two times of symptomatology occurrence related to the sacroiliac region on different sides.

A REVIEW OF THE PATIENTS WITH SPINAL CORD INJURY

Arthritic changes in the joints of the spine, terminologically included under the term arthritis (i.e. spondylitis), were manifested by the appearance of morning long-term stiffness accompanied by pain most often in the lumbar segment of the spine, and much less often in the neck. The objective finding indicated spasm of the paravertebral musculature with percussive sensitivity of the Valleix points, decreased flexion and extension movements, while in the neck segment stiffness was accompanied by morning headaches.

Of the total number of the analyzed psoriasis patients, the symptomatology localized on one of the spinal segments was represented in 10.09% (11 patients: 6 men and 5 women) ($\chi 2 = 1.498$ and $p = 0.683$). In 6 (54.55%) persons there was a long-term morning stiffness localized in the thoracolumbar and lumbar region, while muscle spasm with palpatory-percutaneous sensitivity of the cervical spine was present in 5 (45.45%) patients, of whom 3 had a headache localized in the occipital region at the same time. The age of the observed patients in whom the existence of clinical and radiological findings on the spinal column was ascertained was 49.9 years (from 32 to 66 years of age) (Table 1).

Analyzing the X-rays of the patients' spines, we found the presence of osteophytes with pronounced uncarthrosis on the cervical spine in 5 (45.45%) patients and on the thoracolumbar region in 6 (54.55%) patients. In 3 patients (27.27%) we noticed the existence of horizontal osteophytes on the XI and XII thoracic vertebrae that started from the lower plateau of the vertebral body, indirectly indicating the existence of instability of the spinal segment. We accepted these phenomena as concomitant findings without a direct consequential connection with psoriasis as the underlying disease. In the cervical segment of the spine, we noticed linear longitudinal ossifications on the profile native images, which were localized on the anterior longitudinal ligament in the projection of III, IV and V of the cervical vertebra. Analyzing the thoracic spine segment, also on the radiographs, ossification of the anterior longitudinal ligament was observed in two patients at the level of IX to XII vertebra. In these patients, there were no horizontal osteophytes registered in the three patients on the last two thoracic vertebrae. We considered that it was necessary to perform an analysis of the time of appearance of X-ray changes that accompany spondylitis. Nonspecific ailments that can be described as discomfort and that belong to atypical spondylitis without a clear localization of the painful sensation are usually not accompanied by radiological confirmation. Dyscartrotic or uncartrotic changes in the neck segment occur in one patient during the first ten years after the appearance of the cutaneous manifestation of psoriasis. Uncarthrosis with dysarthrosis in the area of the cervical spine occurs in four patients in the period from ten to twenty years from the beginning of psoriasis, as well as in six patients in the thoracolumbar segment. Occurrence of ossification of the anterior longitudinal spinal ligament was noted twenty years after the onset of psoriasis in two patients. In this group of patients, simultaneous damage to peripheral joints was registered, which was present in 8 patients.

A REVIEW OF THE PATIENTS WITH PERIPHERAL JOINT AFFECTION

Small joints (peripheral joints) arthritis was present in 74 (67.89%) patients, 33 (44.59%) males and 41 (55.41%) females ($\chi 2 = 10.390$ and $p < 0.05$). These were the patients in whom psoriasis affected the nail plates (9 patients) while arthritis was localized on the interphalangeal joints of the hands. In 4 patients with the appearance of psoriasis on the nails, the joint manifestation of the disease was in the sense of sacroiliitis (3 patients) and spondylitis (1 patient). Small joints arthritis was present in 47.29% of patients in whom the cutaneous form of the disease was single, while in generalized forms of psoriasis the presence of small joints arthritis was recorded in 13.51% of patients (10 patients).

Peripheral arthritis was also present in 20 patients (27.02%) in whom the psoriatic skin manifestation was localized exclusively on the hairy part of the head (capillary). The mean age of patients with peripheral joint affect was 50.16 ± 9.33 years. The youngest patient was 34 years old, and the oldest 68. The largest number of patients, 43 (58.11%), were in the range from 41 to 60 years of age (Table 1).

Table 1. Patients presentation by sex, age and findings relevant to joint affection

		Age						
Psoriatic arthropathy	Gender	21 – 30	31 – 40	41 – 50	51 - 60	61 – 70	Total	p value
Sacroiliac joints	M	1 (4.17%)	5 (20.83%)	6 (25%)	3 (12.5%)	4 (16.67%)	19 (79.17%)	<0.001
	F	-	2 (8.33%)	1 (4.17%)	1 (4.17%)	1 (4.17%)	5 (20.83%)	
Spine	M	-	1 (9.09%)	2 (18.18%)	2 (18.18%)	1 (9.09%)	6 (54.56%)	0.683
	F	-	2 (18.18%)	2 (18.18%)	1 (9.09%)	-	5 (45.45%)	
Peripheral joints	M	-	7 (9.46%)	9 (12.16%)	10 (13.51%)	7 (9.46%)	33 (44.59%)	<0.05
	F	-	8 (10.81%)	11 (14.86%)	13 (17.57%)	9 (12.16%)	41 (55.41%)	
Total		1 (0.92%)	25 (22.94%)	31 (28.44%)	30 (27.52%)	22 (20.18%)	109 (100%)	

PATIENTS PRESENTATION BY PRIORITY OF SYMPTOMATOLOGY AND LOCALIZATION OF SKIN CHANGES

Of the total number of observed patients (n = 109) in whom psoriasis with joint manifestation was found, and in relation to the analyzed course of the disease and the appearance of symptoms in terms of determining the priority of symptomatology (whether the cutaneous manifestation preceded joint symptomatology or joint disease "announced" psoriasis) Chi square test did not determine a statistically significant difference in the mode of onset of the disease between the group of patients with the presence of sacroiliac arthritis and psoriatic

spondylopathy on one side and patients with a picture of peripheral arthritis on the other side ($\chi 2 = 0.835$; $p = 0.659$) (Table 2).

Table 2. Time of psoriasis onset and joint manifestations of the disease

	Symptoms sequence				
Psoriatic arthropathy	Skin then articular	Articular then skin	Simultaneously	Total	p value
Sacroiliac joints	15 (62.50%)	7 (29.17%)	2 (8.33%)	24 (22.02%)	<0.001
Spine	7 (63.64%)	3 (27.27%)	1 (9.10%)	11 (10.09%)	
Peripheral joints	47 (63.15%)	20 (27.02%)	7 (9.46%)	74 (67.89%)	
Total	69 (63.30%)	30 (27.52%)	10 (9.17%)	109 (100%)	

The Mann Whitney test did not show a statistically significant difference between the group of patients with psoriasis with sacroiliac joint and spinal cord infection, and those in whom joint symptoms were absent despite psoriasis ($Z = 1.187$ and $p = 0.235$). There was no statistical significance in the difference between the onset of the disease between the group of patients with the manifestation on the spinal column (thoracolumbar and cervical segment of the spinal column) and the appearance of psoriatic arthritis on other joints. Using the Chi square test ($\chi 2 = 0.647$ and $p = 0.374$), the stated position of non-existence of a significant difference that referred to the very beginning of the disease in these two groups was confirmed.

If we approach the description of cutaneous psoriatic manifestations, ie verification of their presence (which is grouped by description as occasional occurrence of cutaneous manifestations, diffuse distribution, localization only on nail plates and appearance exclusively on the hairy part of the head), we were not able to notice a significant statistical difference between the localization of cutaneous manifestations and the types of occurrence of affected joints ($\chi 2 = 5.263$ and $p = 0.261$) (Table 3). Individual changes were present in most patients (45.87%); then only head related changes (24.77%); diffuse changes were present in 17.43% of the patients, and the least represented psoriatic changes were manifested only on the nails (11.93%) ($p < 0.001$).

Table 3.Types of skin manifestations of psoriasis

	Type of cutaneous manifestation of psoriasis					
Psoriatic arthropathy	Individual changes	Diffuse changes	Only on the nails	Only on the head	Total	p value
Sacroiliac joints	10 (41.67%)	7 (29.17%)	3 (12.5%)	4 (16.67%)	24 (22.02%)	0.261
Spine	5 (45.45%)	2 (18.18%)	1 (9.1%)	3 (27.27%)	11 (10.09%)	
Peripheral joints	35 (47.29%)	10 (13.51%)	9 (12.16%)	20 (27.02%)	74 (67.89%)	
Total	50 (45.87%)	19 (17.43%)	13 (11.93%)	27 (24.77%)	109 (100%)	

DISCUSSION

Our study aimed to determine the incidence and prevalence of psoriatic arthropathy in patients diagnosed with psoriasis. Psoriatic arthropathy is a manifestation of psoriatic disease that could affect up to 48% of patients with psoriasis. The data stated in the literature speaks in favor of the most common occurrence of arthritis at the age of 30 to 55 years of age,[15,16] while in our country in almost 80% of all patients it is at the age of 30 to 60 years of age. In the group of patients with arthritis as part of psoriasis, we had only one patient younger than thirty years, while the data from the literature indicates that the number of children or persons younger than twenty years is not negligible. [17,18]

Epidemiological studies cited by John Hopkins University School of Medicine[4] indicate that there is an equal number of men and women with arthritis as a part of psoriasis. In our group related to the existence of changes in the SI joint, there were significantly more men than women (79.16% of patients or 19 out of 24), while there were 5 women (20.84%).
The research of Šakić et al. (m-5: w-2) [19], as well as Jajić and Assadi (m-7: w-4) [20] agrees that men suffer more from PsA than women. In our study, the most common PsAs were on the peripheral joints (67.89%), followed by SIZ (22.02%) and finally spondylitis (10.09%).

Numerous studies indicate a prevalence of peripheral joint infection in patients with PsA of 60%.[21-26] The results of the Krawczyk-Wasielewska, Skorupska and Samborski studies indicate a prevalence of SI joint infection in patients with psoriatic arthritis from 34 to 78%, and in patients with psoriasis without joint manifestation from 14 to 23%.[27] The results of other authors speak in favor of a higher frequency of radiological changes in patients with polyarticular form of PsA, which was confirmed in our study.[28-30]
If we observe the duration of psoriatic disease with skin changes, it usually takes ten years for psoriatic arthritis and spondylitis to appear, and this is data identical to that of the published works.[17] Skin changes that precede the joint disease in psoriasis, regardless of which form of joint disease it refers to, were present in 69 of the observed patients or 63.30%; simultaneous occurrence of the disease on both skin and joints was recorded in 10 patients (9.17%), while the articular manifestation preceded the cutaneous manifestation in 30 patients (27.52%).

In a study conducted in Brazil, which aimed similarly to our study to determine the prevalence of psoriatic arthritis (PsA) in a sample of 524 patients with psoriasis, the diagnosis of PsA was documented in 175 patients (33%), 49% of whom were rheumatologists recently identified. Most people with PsA (72%) had peripheral involvement, 11% had isolated axial involvement, and 17% had both peripheral and axial involvement. Almost half of the respondents with PsA did not have a previous diagnosis.[31] This finding is consistent with the results of our study, but differs from the results of a study aimed at assessing the prevalence and clinical characteristics of PsA in the Chinese population of psoriasis patients, where out of 1928 psoriasis patients, 112 patients (5.8%) had PsA, of which 92% were newly diagnosed. Oligoarthritis (48.2%) was the most common pattern of manifestation, followed by spondylitis (26.8%), polyarthritis (19.6%) and classic distal interphalangeal (DIP) arthritis (5.4%). Compared to patients without PsA, patients with PsA had more severe skin disease, higher frequency of nail changes (46.4% vs. 21.0%) and scalp involvement (90.2% vs. 76.4%).[32] The results reported in the literature[15,33,34] indicate that in the group of patients with lifelong manifestations of the disease in 70% of the patients there is a skin form that precedes the joint one; in 15% of all the cases both skin and joint form appear at the same time; while in 15% of the cases the articular form occurs as an introduction to the clinical form of some sort of psoriasis, regardless of whether it occurs in the form of capillary psoriasis, nail plates, numismatics or geography. Recognizing the true physical, social, and emotional burden of psoriasis and psoriatic arthropathy, as well as their associated factors, is the first step to improving the prognosis for affected patients.[35]

CONCLUSION

Inflammatory processes on the sacroiliac joints, as a consequent condition within psoriasis, occur more often in middle age (from 31 to 50 years of age) and are more common in men with psoriasis than in females. In most patients, psoriasis skin changes were preceded by the appearance of joint symptoms, whether it was the joints of the spine or other affected joints. The appearance of skin changes is usually only local; forms of generalized psoriasis were present in 19 patients (17.43%), in the shape of psoriasis geographica.

Polyarthritis was the most common form of joint infection in psoriasis. If we observe exclusively sacroiliitis, we notice that it is most often present as bilateral and symmetrical, although there is a possibility of unilateral affectation or bilateral, but asymmetrical. Analyzing the radiological changes as part of the damage that occurs on the cervical and thoracolumbar segment of the spine, we can single out somewhat characteristic findings that would be described as ossification of the longitudinal anterior ligament. Changes of uncartrotic nature, as well as dysarthrotic elements, and the presence of claw osteophytes, are not exclusively related to psoriasis as the basic disease within which the described changes occur. Namely, these changes are common among the population in middle and old age, regardless of the presence of psoriasis.

CONFLICT OF INTEREST
Authors declare no conflict of interest.

ABBREVATIATION
PsA – Psoriatic arthropathy

REFERENCES

1. Griffiths CEM, Armstrong AW, Gudjonsson JE, et al. Psoriasis. Lancet. 2021; 397(10281): 1301–15.
2. Thorleifsdottir RH, Sigurdardottir SL, Sigurgeirsson B, et al. Patient-reported Outcomes and Clinical Response in Patients with Moderate-to-severe Plaque Psoriasis Treated with Tonsillectomy: A Randomized Controlled Trial. Acta Derm Venereol 2016 Nov 7. doi: 10.2340/00015555-2562
3. Elder J, Bruce A, Gudjonsson J, et al. Molecular dissection of psoriasis: integrating genetics and biology. J Invest Dermatol 2010; 130: 1213–26.
4. Gudjonsson JE, Elder JT. Psoriasis: epidemiology. Clin Dermatol 2007; 25: 535–46.
5. Moll JMH, Wright V. Psoriatic arthritis. Semin Arthritis Rheum 1973; 3: 55-78.
6. Musculoskeletal Problems and Functioning Limitations: The Great Public Health Challenge for the 21st Century. Geneva: World Health Organization. 2003.
7. Stucki B. International Classification of Functioning, Disability, and Health (ICF). A promising framework and classification for rehabilitation medicine. Am J Phys Med Rehabil 2005; 84: 733-40.
8. Andrew G. Franks, Jr. Psoriatic arthritis and Reiter syndrome. In: Sontheimer RD, Provst TT, eds. Cutaneous manifestations of rheumatic diseases. 2nd ed. Philadelphia. 2004; 197-204.
9. Gladman DD, Anhorn KB, Schachter RK, et al. HLA antigens in psoriatic arthritis. J Rheumatol 1986; 13: 586-64.
10. Banares A, Hernandez-Garcia C, Fernandez-Gutierrez B, et al. Eye involvement in the spondyloarthropathies. Rheum Dis Clin North Am 1998; 24: 771-84.
11. Krueger G, Koo J, Lebwohl M, et al. The impact of psoriasis on quality of life: results of a 1998 National Psoriasis Foundation patient-membership survey. Arch Dermatol 2001; 137: 280–4.
12. Langley RG, Krueger GG, Griffiths CE. Psoriasis: epidemiology, clinical features, and quality of life. Ann Rheum Dis 2005; 64 Suppl 2: ii18–23; discussion ii24–15.
13. Dalgard FJ, Gieler U, Tomas-Aragones L, et al. The psychological burden of skin diseases: a cross-sectional multicenter study among dermatological out-patients in 13 European countries. J Invest Dermatol 2015; 135: 984–91.
14. Schoels MM, Aletaha D, Alasti F, et al. Disease activity in psoriatic arthritis (PsA): defining remission and treatment success using the DAPSA score. Ann Rheum Dis 2016; 75: 811–8.
15. Psoriatic Arthritis. The Johns Hopkins University School of Medicine and the Johns Hopkins Arthritis Center, 2011.
16. Kavanaugh A, Gladman D, van der Heijde D, et al. Improvements in productivity at paid work and within the household, and increased participation in daily activities after 24 weeks of certolizumabpegol treatment of patients with psoriatic arthritis: results of a phase 3 double-blind randomised placebo-controlled study Ann Rheum Dis 2015; 74: 44–51.
17. Catanoso M, Pipitone N, Salvarani C. Epidemiology of Psoriatic Arthritis. Reumatismo, 2012; 64(2): 66-70.
18. Sieper J, Caron P, van den Bosch F. Spondylarthropathides: treatment. BMj group, eulAr textbook on rheumatic Diseases. First edition, 2012; 276-300.
19. Šakic D, Badovinac O, Delija A, et al. Psoriasis and psoriatic arthritis prevalence in two physiatric surgeries – Med Jad 2006; 36(3-4): 83-6.

20. Jajić Z, Assadi G. Učestalost psorijatičnog artritisa u populaciji bolesnika s psorijazom. Acta Med Croatica 2003; 57: 323-6.
21. Helliwell P, Marchesoni A, Peters M, et al. A re-evaluation of the osteoarticular manifestations of psoriasis. Br J Rheumatol 1991; 30: 339-45.
22. Jones SM, Armas JB, Cohen MG, et al. Psoriatic arthritis: outcome of disease subsets and relation- ship of joint disease to nail and skin disease. Br J Rheumatol 1994; 33: 834-9.
23. Veale D, Rogers S, Fitzgerald O. Classification of clinical subsets in psoriatic arthritis. Br J Rheumatol 1994; 33: 133-8.
24. Kane D. A prospective, clinical and radiological study of early psoriatic arthritis: an early synovitis clinic experience. Rheumatology 2003; 42: 1460-8.
25. Reich K, Krüger K, Mössner R, et al. Epidemiology and clinical pattern of psoriatic arthritis in Germany: a prospective interdisciplinary epidemiological study of 1511 patients with plaque-type psoriasis. Br J Dermatol 2009; 160: 1040-7.
26. Kumar R, Sharma A, Dogra S. Prevalence and clinical patterns of psoriatic arthritis in Indian patients with psoriasis. Indian J Dermatol Venereol Leprol 2014; 80: 15-23.
27. Krawczyk-Wasielewska A, Skorupska E, Samborski W. Sacroiliac joint pain as an important element of psoriatic arthritis diagnosis. Postepy Dermatol Alergol. 2013; 30(2): 108–12.
28. Laiho K, Kauppi M. The cervical spine in patients with psoriatic arthritis. Ann Rheum Dis 2002; 62: 650-2.
29. Jenkinson T, Armas J, Evison G, et al. The cervical spine in psoriatic arthritis: A clinical and radiological study. Brit J Rheumatol 1994; 33: 255-9.
30. Helliwell PS, Porter G, Toylor WJ. Polyartricular psoriatic arthritis is more like oligoarticular psoriatic arthritis, than rheumatoid arthritis. Ann Rheum Dis published online 13. July 2006.
31. Ranza R, Carneiro S, Qureshi AA, et al. Prevalence of psoriatic arthritis in a large cohort of Brazilian patients with psoriasis. J Rheumatol 2015; 42(5): 829–34.
32. Yang Q, Qu L, Tian H, et al. Prevalence and characteristics of psoriatic arthritis in Chinese patients with psoriasis. J Eur Acad Dermatol Venereol 2011; 25(12): 1409–14.
33. Mercieca C, Landewé R, Borg AA. Spondyloarthropathies: pathogenesis and clinical Features. u: textbook on rheumatic Diseases. BMJ group, eulAr, 2012; 255-75.
34. Ethimiou P, Markensonj A. Psoriatic arthritis. Manual of rheumatology and outpatient orthopedic Disorders, diagnosis and therapy. Fifth edition. Baltimore: Lippincott Williams & Wilkins, 2006; 318-24.
35. Menter A. Psoriasis and psoriatic arthritis overview. Am J Manag Care 2016; 22(8 Suppl): s216–24.

THE IMPACT OF CURRENT GEOPOLITICAL EVENTS ON BANKS AND ESG GOALS OF SUSTAINABLE DEVELOPMENT

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Abstract: The defined plan for the implementation of the green agenda in Europe aims to turn the European continent into the first climate-neutral continent by 2050, whereby the role of the financial sector in mentioned transition process is crucial. Clearly, climate changes imply new challenges for central banks, regulatory bodies, and supervisors. The ECB treats climate risks as key drivers of risk within the banking sector of EU countries. Within its jurisdiction, the EBA has an assessment of the impact of environmental, social and governance (ESG) risks on the risk of the financial system. Furthermore, the EBA disclosed the "Action Plan for Sustainable Finance" as a draft document which allows integration of ESG risks into the regulatory framework. Most of banks, which operate in the EU markets, have committed to net zero GHG emissions, thus joining the community of institutions that support climate action incentives and have begun the process of disclosing reports in this area. The current economic and political situation, due to the Russia-Ukraine conflict, largely dictates the strategic decisions of banks and affects the slowdown in the implementation of the green agenda. Banks have not changed their risk appetite, but the general attitude of the banking sector has changed due to sudden transformation in the economic positions of various sectors. Banks have shown their readiness to provide support to all clients who are willing to focus on transition to cleaner energy sources and significantly contribute to the reduction of GHG emissions in the process of realizing their transition plans. Despite the volatile geopolitical circumstances, banks currently make additional efforts in the direction of gradual decarbonization. The key conclusion of this paper is that achieving the goals of net zero GHG emissions will not be simple, nor will the process take place in a linear fashion. The established and measurable transition plans, with the support and engagement of all stakeholders in the process, represent vital items within the green agenda, from which realization depends the future quality of life.
Keywords: ESG, climate changes, green swans, volatility, banking sector.

1. INTRODUCTION

At the global level, since 2015 and the adoption of the Paris Agreement on climate changes as well as the United Nations Program for Sustainable Development until 2030, many countries have made a significant progress toward the concept of a low-carbon and circular economy. The European Green Plan sets the goal of turning the European continent into the first climate-neutral continent by 2050, whereby the role of the financial sector in the aforementioned transition process is a crucial. Climate change implies new challenges for: central banks, regulatory bodies and supervisors.
The European Central Bank (hereinafter: ECB) treats climate risks as one of the key risk drivers within the banking sector of EU countries. Furthermore, the ECB has transparent attitude regarding obligation for institutions to create a strategic, comprehensive approach which is directed towards the future (the so-called „*forward-looking approach*“). The traditional assessment approach based on historical data is not suitable for capturing the risks associated with climate changes (ECB, 2020). In this sense, in literature is recognized the risk of so-called „*green swans*“, a phenomenon which is similar to the well-known term of „black swans“, described by the famous mathematician and philosopher Nassim Nicholas Taleb. Using an analogy with Taleb's definition of the „black swans“ phenomenon, the term „green swans“ is related to potentially extreme financial events which have a devastating effect and may represent a prelude to a subsequent, systemic financial crisis (Swartzman et al, 2020).

Events marked as „black swans“ in the literature imply events with following three characteristics (Taleb, 2010):

1) unexpected and rare events that exceed regular expectations;
2) events that have an extreme and long term impact; and
3) the explanation of this phenomenon is possible only after it appears (*ex-post).*

Described events take into account uncertainty and generally show a high degree of skewness in relation to a normal and an exponential distributions. Fat tail of the probability distribution in financial markets suggests the need for regulation. „Green swans“ or „climate black swans“ contain different characteristics than classic black swans. Namely, both subtypes of risks associated with climate change (specifically, physical and transition risks) are characterized by a high degree of uncertainty and non-linearity, which means that the possibility of their occurrence could not be reflected through the understanding and analysis of historical data, and that the possibility of obtaining extreme values could not be excluded.

„Green swans“ differ from „black swans“ in three crucial aspects. First, although the general view is that the impact of climate change could be treated as a type of event with a very high degree of uncertainty, there is a high level of certainty regarding some combinations between physical and transition risks which may materialize in the near future (NGFS, 2019). There is a need for ambitious action despite the prevailing uncertainty about the timing and nature of climate change impacts. Second, climate disruptions are far more serious with very high influence globally observed than most systemic financial crises: they can pose an existential threat to all of humanity (Ripple et al, 2019). Third, the complexity of climate change is an element of a higher order than „black swans“: complex chain reactions and cascading effects related to physical and transition risks could fundamentally generate unpredictable ecological, geopolitical, social and economic dynamics.

2. INFLUENCE OF ESG RISKS ON RISK MANAGEMENT IN BANKS

Central banks have a very responsible role to avoid beforementioned outcome as much as possible, including the additional inclusion of central banks in the search for the development of adequate scenario analyzes for future events related to the risk of climate change. Additionally, central banks are not alone in those efforts, so it is necessary to emphasize that central banks have an important role which is reflected in the coordination of actions between different market participants (governments of countries, the private sector, the civilian population and the international community) and the measures taken in order to fight against climate change.

The European Banking Authority (hereinafter: EBA) in its jurisdiction has an assessment of the impact of environmental, social and management risks (hereinafter: ESG) on the overall risk of the banking sector, i.e. of the financial system as a whole. The EBA has disclosed the Action Plan for Sustainable Finance as a draft document to include ESG risks in the regulatory framework. Climate changes and deterioration of environmental conditions represent an important source of structural and social changes with an impact on economic activity and the financial system as a whole. Most often, in the context of climate risks, two basic risk drivers are mentioned, namely:

1) Physical risk - which refers to the financial impact of climate change, including more frequent extreme weather events and gradual climate change, as well as other conditions of environmental deterioration such as: air, water and soil pollution, loss of biological diversity (so-called *biodiversity*) or *deforestation*. Physical risk could be acute (if it results from extreme events such as: droughts, floods, earthquakes and other natural disasters), and chronic (if it results from events such as: global warming, land conversion, loss of biodiversity, destruction of natural habitats, etc.).
2) Transitional risk - refers to the financial loss of the institution resulting from the process of adjustment towards a low-carbon and sustainable economy. This risk could occur as a result of relatively sudden adoption of policies in the area of: climate change, technological progress, etc.

The mentioned two types of risks are the drivers of the most important types of banking risks, such as: credit, operational, market and liquidity risk, but also other types of risk, such as, for example: credit spread risk in the banking book and strategic risk. Physical risk affects individual risk types as follows (ECB, 2020):

1) *credit risk*: on the probability of default (*PD - probability to default*) and loss given default (*LGD - loss given default*) for exposures related to geographical areas significantly affected by climate change (e.g. lower valuations of collaterals in portfolios due to higher flood risk);
2) *market risk:* extreme physical events could lead to shifts in market expectations and result in sudden price changes, greater volatility and losses in asset value in certain markets;
3) *operational risk:* the continuity of the bank's operations might cease due to physical damage to the bank's assets and its branches as a result of extreme weather events; and

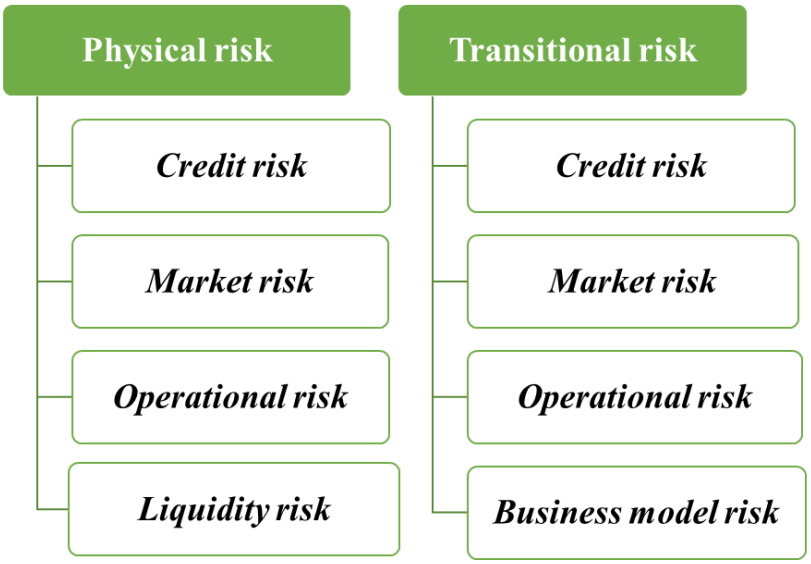
4) *liquidity risk:* the impact on liquidity risk is reflected in the withdrawal of clients' funds from their current accounts in order to finance and rehabilitate the consequences of damage caused by climate change.

Transition risk affects individual risk types as follows (ECB, 2020):

1) *credit risk:* energy efficiency standards could lead to an increase in adjustment costs and lower profitability, which consequently results in a higher level of PD and a lower value of collaterals;
2) *market risk:* there might be a sudden change in the prices of underlying securities and derived financial instruments (*derivatives*);
3) *operational risk:* changes in preferences of customers in relation to the climate change coulf affect the reputational risk and the risk of corporate social responsibility due to the media unacceptable activities of the bank connected with the financing of those activities which are marked as controversial from the perspective of ESG actions; and
4) *business model risk:* transition risk drivers could affect the sustainability of individual business lines and lead to strategic risks for the respective business models if certain adjustments are not made. For example, an unexpected change in the prices of securities can reduce the value of the bank's highly liquid assets and thus affect the liquidity buffers. This will consequently have a negative effect on the liquidity coverage ratio (hereinafter: LCR) and a difficulties to meet the regulatory requirements, i.e. maintaining it within the prescribed limits of 100%.

The effects of both, physical and transitional risk, on certain types of banking risks are shown on Figure 1.

Figure 1. Effects of physical and transitional risk on banking risks



Most of the banks that operate in the EU markets have committed to net zero emissions, thus joining the community of institutions which support initiatives related to climate actions and which initialized the process of disclosing reports related to this area. Also, some institutions have included climate risk in their processes and harmonized the credit portfolio with accepted obligations from the ESG area. Undoubtedly, the current economic and political situation as a result of the Russia-Ukraine conflict, largely dictates the strategic decisions of banks and affects the slowdown in the implementation of the „green agenda“. Banks have not changed their risk appetite, but the general attitude of the banking sector has changed due to sudden changes in the economic positions of various sectors. Specifically, the largest effect is inherent for the energy and transportation sector, which are overvalued, while on the other hand, the mining and precious metals sector, the service sector, and the manufacturing industry are among the sectors that are undervalued.

3. ECONOMIC AND GEOPOLITICAL ASPECTS OF BANKS' ORIENTATION TOWARDS SUSTAINABLE DEVELOPMENT

Despite the Russia-Ukraine conflict, which had a short-term negative impact on the green agenda, European banks remained fully committed to zero GHG emissions. Banks were faced with evident difficulties in the process of providing support to the real economy during the continuation of the decarbonization process (i.e. reduction of carbon dioxide emissions). On the other hand, many banks treat the current Russian-Ukraine war and crisis as a factor that will accelerate the long-term need for financing projects from clean energy sources as well as the reconstruction of infrastructure.
In this light, the actions of clients, governments and regulatory bodies will have a significant impact on banks regarding efficient and effective management of assets and liabilities in order to meet requirements of their stakeholders. By relying on a number of different inputs, not only on macroeconomic indicators, banks could be in a position to become more involved in areas that affect the environment and climate changey, primarily through a comprehensive collective approach based on the prudential principle. Careful measurement of banks' activities is recommended mainly due to the current geopolitical events that impose the need for European banks to commit for achieving the goals of zero GHG emission at a time when all countries are dramatically affected by the global crisis caused by the Russia-Ukraine conflict.

The COVID-19 pandemic and then the war in Ukraine have changed the entire picture in the business environment and everyday life. Europe is still gradually recovering from the effects of the COVID-19 pandemic and the supply chain disruptions. Bottlenecks in production, rising costs and reduced supply have affected individual sectors in different ways, and after emerging from the pandemic, companies are faced with a significant increase in debt levels and limited investment opportunities. The negative implications in the post-COVID-19 period have been reinforced by the war in Ukraine and accompanying problems such as: high prices of oil derivatives and gas, volatility of energy costs, significantly weakened demand and accelerated inflation, all of which together lead to a higher level of corporate indebtedness and intensifying financial distress. This new reality that European banks are facing at the same time entails a new approach when implementing climate strategies.

Present volatility in the financial markets, existing and growing inflationary pressures and rising trend of the interest rates at the global level directly affect the creditworthiness of companies, individuals and the public sector. Since the beginning of the conflict between Russia and Ukraine, according to the assessment of the European Investment Bank (hereinafter: EIB), companies have faced financial distress, which is reflected in the fact that the risk of going into default status has increased from 10% to 17% (Ernst Young, 2022). The conflict in Ukraine influenced the governments of certain countries to reassess all aspects of energy security, which slowed down the transition to green and sustainable development. Certain countries saw the above factors as elements that will accelerate the transition, as they were assessed as the last warning signal towards the necessary transition to cleaner environment. In the long run observed, net zero emissions remain at the top of priority goals, with overreliance on fossil fuels coupled with recent geopolitical changes bringing short-term economic and social harms that must be promptly addressed. The energy crisis has accelerated the long-term demand for new energy sources, such as: biogas and solar energy, which act in the direction of decarbonization, and greatly improves the energy picture at the global level. Orientation towards clean sources of energy as the cheapest sources (e.g. wind farms, solar panels) is present and generally accepted in many countries.

Banks have developed a high degree of corporate social responsibility: they have shown willingness to provide support for all clients who are willing to implement the transition to cleaner energy sources and contribute to the reduction of GHG emissions. Therefore, in addition to the fact that in the COVID-19 period banks significantly supported their clients in order to preserve their liquidity position, now additional efforts are being made by banks in the direction of the gradual decarbonization of the entire economy. In the mentioned process, there are several factors which carry a significant degree of uncertainty. One of the factors is the policies of the governments of individual countries related to individual plans for climate change, tariffs, initiatives and investments. In this sense, a clean sectoral transition becomes of the crucial importance, i.e. banks must decide which activities they will finance as part of the long-term decarbonization plan, as well as how long the aforementioned financing will last.

A large number of banks have joined initiatives that support efforts towards net zero emissions, such as: *Net Zero Banking Alliance (NZBA), Partnership for Carbon Accounting Financials (PCAF)* or *Collective Commitment to Climate Action*. According to research conducted by Ernst Young, 77% of banks globally disclose data related to climate change according to the recommendations of the *Task Force on Climate-related Financial Disclosure* (acronym: *TCFD*) and related to climate change (Ernst Young, 2022).

The share of companies which apply TCFD recommendations in financial or annual reports has increasing trend every year. Based on TCFD research, over 70% of companies have implemented TCFD recommendations when disclosing climate-related information in financial or annual reports for fiscal year 2021, that is a significant increase compared to 45% for fiscal year 2017 (TCFD, 2022). At the same time, an evident increase in the availability of financial data disclosed in connection with climate change has been observed since the publication of the TCFD recommendations. As part of the TCFD research, 88% of the respondents pointed out a more than significant improvement in the quality of disclosure, while 95% of respondents agree with the increase in the availability of financial disclosures (TCFD, 2022).

The most significant conclusions based on the TCFD research from 2022 are as follows (TCFD, 2022):

- In the area of disclosure, the European region leads in relation to other regions with a portion of 60%, followed by Asia Pacific with 36%, North America with 29%, Latin America with 28% and the Middle East and Africa with 25%; and
- Large companies are more committed to disclosure in accordance with TCFD recommendations, as evidenced by the fact that the largest contribution to disclosure is made by companies with a market capitalization above USD 12.2 billion (49%), followed by companies with a market capitalization in the range between USD 3.4 billion to USD 12.2 billion with a share of 37% and finally companies whose market capitalization is below USD 3.4 billion participating in the disclosure with 29%.

Lending activities still remain in the focus of banks, whereby the emphasis is increasingly shifting towards the financing of green activities with a significant reduction of those activities which mostly contribute to the environmental pollution. All participants have a long path to go before fully achieving the proclaimed goals, above all in the area of net zero GHG emissions. Achieving the goal of net zero GHG emissions is defined by the *Greenhouse Gas Protocol*, which refers to the coverage of three main scopes of gas emissions, namely (Net Zero Climate, 2023):

1) Scope 1 – emissions that are owned or directly controlled by the respective company;
2) Scope 2 – emissions related to energy production by a certain company; and
3) Scope 3 – indirect emissions that are associated with activities based on sources that are not owned or controlled by a particular company.

Additionally, the International Energy Agency (*IEA - International Energy Agency*) estimates that global investments in the field of energy on an annual level should increase from the current USD 2 trillion to about USD 5 trillion per year by the end of 2030 in order to meet the goals of net zero emissions. achieved within the stipulated period, until 2050 (IEA, 2023).

The process of „greening organizations“ has become a common feature of all modern organizations. In this sense, banks have introduced various processes (such as: *Kaizen, Six-sigma, Lean-Manufacturing* etc.) in order to act in the direction of reducing the GHG emissions. Building and nurturing of a "green" organizational culture which will have a stimulating and guiding effect on employees towards green forms of behavior becomes crucial for contemporary organizations. The main determinants of the new organizational culture should be supported and initiated by the banks' top management. Also, large organizations have an educational role to proactively act in the function of preserving the environment through various recommendations and guidelines (Lukić Nikolić, 2021).

Commercial banks have largely included elements of the environmental protection in their business plans, strategies and policies. Also, commercial banks in the Republic of Serbia have recognized the need for increased engagement in the domain of the circular economy, and certain results are visible in the concrete examples of individual commercial banks. In their research, Lukić Nikolić et al. (2023) unequivocally concluded that the inclusion of commercial banks in the area of circular economy during digital age significantly contributes to socially responsible business, as well as to the growing profitability and competitiveness of banks.

4. CONCLUSION

In addition to striving for the adequate positioning in the market, all organizations are increasingly turning to the preservation and protection of the environment, providing current and future generations with more acceptable living conditions. Not primarily striving to achieve their lucrative goals, commercial banks increasingly have an additional, educational role to contribute to the safeguarding of the environment and the realization of the green agenda by their example and action in the direction of „green“ behavior. The defined plan for the implementation of the green agenda in Europe aims to turn the European continent into the first climate-neutral continent by 2050.
There are numerous obstacles on the path for achieving goals of the green agenda, due to the existence of uncertain and unexpected events and their impact on the global level. The described events in the context of green behavior could be defined as „green swans“ analogously to the phenomenon of „black swans“, which the philosopher Taleb described as extraordinary and extremely unpredictable events that shape economic events and the reality of life. The current economic and political situation, due to the Russia-Ukraine conflict, largely dictates the strategic decisions of banks and affects the slowdown in the implementation of the green agenda. The present volatility in the markets around the world due to the conflict between Russia and Ukraine, and the prolonged effects of the COVID-19 crisis, necessarily influenced banks to partially change their plans regarding the implementation of the green agenda. However, the banks have not completely changed their risk appetite, only the pace of realization of the declared goals has changed. In this sense, the banks continued to provide support to all clients who showed a willingness to significantly contribute to the reduction of GHG emissions and ultimately create the conditions for reaching the net zero goal by 2050.

It is evident that the efforts of European banks towards achieving the goal of net zero GHG emission will not be simple at all, nor will the described process take place in a linear fashion. This is indicated not only by current geopolitical events (such as the Russia-Ukraine conflict), but also by many other events that make it difficult to achieve the net zero goal. The above does not mean that the set goal is unattainable in the long term, primarily bearing in mind that banks are profiled as market participants who define their goals in the long term, and that the set goals refer to a time period of almost 30 years. Precisely defined and measurable transition plans, with the support and engagement of all interested stakeholders in the process of realizing the green agenda, represent vital items whose implementation depends on the future quality of life.

REFERENCES:

ECB (2020). Guide on climate-related and environmental risks - Supervisory expectations relating to risk management and disclosure. Raspoloživo na: https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.en.pdf (pristup: 13.04.2023)

Ernst Young (2022). Are volatile geopolitics and macroeconomics disrupting the path to net zero. Raspoloživo na: https://www.ebf.eu/wp-content/uploads/2022/11/ey-ebf-report-net-zero-1122.pdf (pristup: 10.04.2023)

IEA (2023). Raspoloživo na: https://www.iea.org/data-and-statistics#data-tool-types (pristup: 14.04.2023)

Lukić Nikolić, J. (2021). Zeleno ponašanje zaposlenih i zeleni menadžment ljudskih resursa. Raspoloživo na: https://mbs.edu.rs/mbsblog/zeleno-ponasanje-zaposlenih-i-zeleni-menadzment-ljudskih-resursa/ (pristup: 10.04.2023)

Lukić Nikolić, J., Mirković, V., Brkljač, M. (2023). Circular Economy and Banking Industry in the Digital Age: Case Study of Erste Bank a.d. Novi Sad. Ecologica, Vol. 30 (2023), No. 109, pp. 157-164. https://doi.org/10.18485/ecologica.2023.30.109.22 (pristup: 14.04.2023)

Net Zero Climate (2023). Raspoloživo na: https://netzeroclimate.org/what-is-net-zero/ (pristup: 14.04.2023)

NGFS (2019). NGFS First Comprehensive Report: A Call for Action - Climate Change as a Source of Financial Risk. Raspoloživo na: https://www.ngfs.net/en/first-comprehensive-report-call-action (pristup: 13.04.2023)

Ripple, W. J., Wolf, C., Newsome, T, Barnard, P., Moomaw, W. (2019). World Scientists' Warning of a Climate Emergency. BioScience, https://doi.org/10.1093/biosci/biz088 (pristup: 13.04.2023)

Svartzman, R., Bolton, P., Despres, M., Pereira da Silva, L.A., Samama, F. (2020). The green swan - Central banking and financial stability in the age of climate change. Raspoloživo na: https://www.bis.org/publ/othp31.pdf (pristup: 13.04.2023)

Taleb, Nasim Nikolas (2010). Crni Labud - uticaj krajnje neverovatnih zbivanja (prevod drugog izdanja). Smederevo: Heliks

TCFD (2022). Task-force on climate related financial disclosures – 2022 Status Report. Raspoloživo na: https://www.fsb.org/2022/10/2022-tcfd-status-report-task-force-on-climate-related-financial-disclosures/ (pristup: 14.04.2023)

PRIVATIZATION AND FINANCIAL MARKET DEVELOPMENT. A CASE STUDY OF STOCK MARKET SIZE AND LIQUIDITY IN THE REPUBLIC OF SERBIA, 1989-2022

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Abstract: Privatization of social capital did not lead to the development of the capital market in the Republic of Serbia (RS). Today in Serbia, the largest number of companies operates outside the Belgrade Stock Exchange (BELEX). As companies in Serbia today do not raise capital by issuing shares, there is almost no primary capital market. The capital market is characterized by low-volume, low-depth trading, with few liquid securities, and securities' trading is expensive, prices are unstable, and risks are high.
The topic discussed in this work is the analysis of market size and liquidity of the Belgrade Stock Exchange (BELEX) in the period 1989-2022 when the privatization of socially-owned enterprises in the Republic of Serbia was carried out.
The importance of this research is reflected in the fact that the stock market is the indicator of the success of each individual company, as well as a reflection of the entire political-economic system. The stock market mechanism reflects the equality of market participants, respect for property rights, and the functioning of institutions. In the case of the RS, as we shall see, this is all quite devastating.

Keywords: financial market, privatization, BELEX, the Republic of Serbia

INTRODUCTION

In the wider perspective, financial market formation consists of the creation of a trading community regulated by both formal and informal mechanisms. Participants engage in a series of transactions enacted through a chain of trust. The chain of trust consists of the links that extend from the buyer of a security, to the intermediation by agents and other intermediaries that enact the transaction, to the seller; and vice versa. External to this community are market participants who accredit impersonal trust to financial market that rides upon the quality of personal trust among traders, brokers and financial entities. Financial markets are more than "intermediaries", as classically described by economic treatments, between savers and ultimately investors in physical capital. These are the arenas in which trust is so reutilized that verbal agreements are held to be binding.
The historical absence of financial markets in socialist economies is a fundamental starting point for the analysis of the formation of the new social and economic organization. Given the absence of exiting market institutions, the attempts to create impersonal financial markets were always subject to competing institutional solutions offered by powerful actors, e.g.

banks or investment funds, which were influenced by new opportunities created by the collapse of the socialist regimes. In this sense, the political efforts to establish Financial markets and the strategies by powerful social interests represent, competing conceptions of market control.

But the efficacy of these instruments is strongly impaired by the loss of credibility that should be infused in the market through government rule-settings and dominant market participant (Atanasov, Ciccotello and Gyoshev 2005; Naceur, Boubakri and Ghazouani 2008; Stringgham and Boettke; King 2001)

The capital market in Serbia began to develop with the enactment of the Law on the Circulation and Disposal of Social Capital ("*Official Gazette of the SFRY*", No's 84/89 and 46/90) and the adoption of the Law on the Money Market and the Capital Market ("*Official Gazette of the SFRY*", No 64/89) and the Law on Securities ("*Official Gazette of theSFRY*", No 64/89). The founding assembly of the Yugoslav Capital Market, established by the 34 largest banks from the territory of the Socialist Federative Republic of Yugoslavia (SFRJ), was held on December 27, 1989.

During the process of dissolution of the SFRY, the Republic of Serbia (RS) adopted in 1991 the Law on Conditions and Procedures for Converting Social Property into Other Forms of Property ("*Official Gazette of the RS*", No's 48/91 and 75/91). After the dissolution of the SFRY and the formation of the Federal Republic of Yugoslavia, in 1992 the Yugoslav Capital Market changed its name to the Belgrade Stock Exchange.The Federal Republic of Yugoslavia (SFRY) was the successor of the Socialist Federative Republic of Yugoslavia (SFRY) which disintegrated in 1991 after the secession of the Republic of Slovenia, the Republic of Croatia, the Republic of Bosnia and Herzegovina (B&H), and the Republic of Macedonia. It was constituted on April 27, 1992, by the decision of the Assembly of the SFRY as a joint state of the Republic of Serbia and the Republic of Montenegro. It existed until February 2003, when a state union named Serbia and Montenegro was established.

MATERIALS AND METHODS

The research aims to determine to what extent the mass privatization of social capital in the Republic of Serbia (RS) contributed to the development of the financial market and the Belgrade Stock Exchange in the period 1996-2022.

In order to achieve this research objective, it was imperative to analyze the available BELEX documentation and the legal acts related to the privatization of socially-owned enterprises and the development of the capital market in the RS.

The course of privatization and the development of the Belgrade Stock Exchange are reviewed in parallel.

As an opening, the legal framework from 1989 is presented, which set in motion the privatization of social capital in the Socialist Federal Republic of Yugoslavia (SFRY and the formation of the Belgrade Stock Exchange as a financial institution that did not exist in the system of socialist self-management and social ownership of the means of production.

This is followed by a digest of the course of the privatization process of the socially-owned enterprises and the development of the Belgrade Stock Exchange. The extent of privatization of social capital is collated with the number of companies on the Belgrade Stock Exchange and the volume of turnover from the trading to explore the correlation.

INSTITUTIONAL DEVELOPMENT OF THE BELGRADE STOCK EXCHANGE AND PRIVATIZATION

In the 1990s, the Belgrade Stock Exchange mostly traded short-term debt instruments of companies, government bonds, and the like, although the first share trade was carried out in 1991, namely shares in the companies "Sintelon", Bačka Palanka and "Auto kuća Kikinda" (*https://www.belex.rs/o_berzi/istorijat*). In 1994, the Federal Republic of Yugoslavia (FRY)

passed the Law on Stock Exchange, Stock Exchange Operation, and Stockbrokers ("*Official Gazette of the FRY*", No 90/94). In the Republic of Serbia, it was preceded by amendments to the Law on Conditions and Procedure for Converting Socially Owned Propertyinto Other Types of Property("*Official Gazette of the RS*", No's 48/94, 51/94). The Law on Stock Exchange, Stock Exchange Operation, and Stockbrokers laid down the basics of the operation of stock exchanges and stock brokers. It set out that the stock exchange would trade in deposit money, bills, checks, shares and other securities, foreign exchange, capital, gold and other precious metals, goods and financial derivatives, i.e. tradeables (Article 2). This Law stipulated that the stock exchange should be established as a joint-stock company and that it could be established by at least eight founders, and that the permit for its establishment should be issued by the competent federal authority. It envisioned the establishment of two types of exchanges, financial stock market and commodity market.

In terms of this Law, stock exchange operations meant: listing of tradeables traded on the stock exchange; fixing interest rates, exchange rates, and prices of tradeables; trading in tradeables; performance of obligations of participants on the stock exchange for transactions concluded on the stock exchange, publicizing of data on transactions on the stock exchange (Article 51). The Law provided that the financial stock market may trade in deposit money, bills, checks, foreign exchange, short-dated securities, gold and other precious metals, in foreign currency denominated securities, capital, shares and long-term securities, and financial derivatives (Article 52).
According to Article 53 of this Law, goods and financial derivatives could be traded on the commodity exchange.
Thus, the Belgrade Stock Exchange was formed as a mixed stock exchange that was established as a joint stock company founded by the Federal Republic of Yugoslavia and about fifty banks and insurance companies.
This Law was repealed in 2002 pursuant to the Law on the Market of Securities and Other Financial Instruments ("*Official Gazette of the FRY*", No 65/02)
A year later, a new Law on Ownership Transformation was enacted in the Republic of Serbia ("*Official Gazette of the RS"*, No's 32/97 and 10/2001). Pursuant to this Law, 777 of the best companies in Serbia were privatized by transferring 60% of the shares of those companies to employees and pensioners (Obradović 2017).
In 1996, commodity bills and commercial papers of the Directorate for Commodity Reserves backed by wheat, corn, sugar, and oil were traded on the Belgrade Stock Exchange, and the first municipal bonds were traded on the Belgrade Stock Exchange in 2000, when treasury bills of the National Bank of Yugoslavia (NBY) were also included in the trade. The introduction of bonds of the Republic of Serbia in 2001 to cover the state's debt based on old foreign currency savings contributed to the development of the domestic capital market (*https://www.belex.rs/o_berzi/istorijat*).

In 2001, a new Law on Privatization was adopted in the Republic of Serbia ("*Official Gazette of the RS*", No's 38/2001, 18/2003, 45/2005, 123/2007, 30/2010, 93/2012, 119/2012, and 51/2014). **This Law provided for the privatization of social capital through the sale and transfer of capital free of charge, and not through stock exchange mechanisms, that is, initial public offering**. Article 11 of this Law stipulated that the transfer of capital free of charge is carried out upon the sale of capital, namely by transferring shares to employees and transferring shares to citizens. Pursuant to this Law, privatization is carried out by the Privatization Agency.

This Law provided for the establishment of two registers. The Central Securities Depository, which was to have a unique database of issued shares (Article 7) and the Privatization Register, which was to record the part of the capital of the subject of privatization expressed in shares, which was transferred to citizens free of charge (Article 8).

In parallel with this Law, the Law on Share Fund ("*Official Gazette of the RS*", No 38/2001). In terms of this Law, the shares remaining after the sale of the capital in the privatization process according to the Law from 2001, as well as the stakes remaining until the date of entry into force of this Law regulating privatization in companies that have privatized part of the public, i.e. social capital, according to the provisions of the Law on Property Transformation, were transferred to the Share Fund. The Share Fund also included the stakes of shareholders who gave up the repayment of subscribed shares that were repaid on the basis of the Law on Social Capital from 1989, the Law on Conditions and Procedures for Converting Social Property into Other Types of Property from 1991, and the Law on Ownership Transformation from 1997. (Article 8).

From this it is evident that shares as securities on the capital market in Serbia derived exclusively from the privatization process, that is, from social capital.

According to Article 9, of this Law, the Share Fund sold shares, that is, stakes based on the order of the Privatization Agency, on the financial stock exchange through a public auction and outside the stock exchange by accepting a takeover bid. Concurrently with the offering for the sale of shares from the Share Fund, the shares of individual shareholders of the legal entity whose shares are offered for sale for the purpose of selling the majority share were also offered for sale. The Share Fund was obliged to sell the shares transferred to it no later than six years from the date of entry into force of the law regulating privatization. The Share Fund also sold shares that were transferred to the republic fund responsible for pension and disability insurance of employees (Article 10).
The companies whose shares were transferred to the Share Fund were obliged to submit a prospectus to the financial stock exchange at the request of the Share Fund within seven days from the date of receipt of the request and conclude an agreement with the financial stock exchange on listing and quotation, i.e. provide conditions for trading shares on the financial stock exchange (Article 11a).
In September 2002, trading bonds of the Republic of Serbia began on the Belgrade Stock Exchange, and in March 2003, the method of continuous trading was introduced for the bonds of the RS. In 2003 and 2004, the BELEX trading system was improved and international cooperation with foreign and Yugoslav stock exchanges was intensified. The first index of the Belgrade Stock Exchange BELEXfm was published at the end of 2004.
In September 2004 the Belgrade Stock Exchange was admitted to full membership of the Federation of Euro-Asian Stock Exchanges FEAS, and in February 2005 it became an

associate member of the Federation of European Securities Exchanges FESE. In April 2006, a Memorandum of Understanding was signed between the Belgrade Stock Exchange and the International Finance Corporation (IFC) and cooperation was established to promote and improve the level of corporate governance in the RS. In December 2007, a Memorandum of Agreement on Partnership was signed between the Belgrade Stock Exchange and the Macedonian Stock Exchange, the Zagreb Stock Exchange, and the Ljubljana Stock Exchange. In November 2010, a Letter of Cooperation was signed on exchanging of trading data between stock exchanges from Sofia, Skopje, and Belgrade. In March 2011, the Belgrade Stock Exchange became a member of the Vienna Stock Exchange Alliance for data distribution.

In 2005, the information and reporting process on the Belgrade Stock Exchange was improved, and the first information services for the distribution of trading data in real time were put into operation. The following year, the process of educating the broad public began, as well as the improvement of cooperation with issuers of securities, which in April 2007 led to the first listing of shares.

Since 2008, the Belgrade Stock Exchange has been participating in the organization of Roadshow conferences for domestic companies, and the shares of companies from Serbia are included in the increasing number of indexes of international agencies that cover the Yugoslav capital market. In the first half of 2008, the BELEX information system based on the FIX protocol was launched. In the early 2010, the improvement of the trading system was implemented through the BELEX FIX API module, which enabled members of the Belgrade Stock Exchange to use their own applications for trading, and thus greater liquidity and quality of the market.

In mid-2010, the first shares of public enterprises of the Republic of Serbia were included in trading on the Belgrade Stock Exchange, but this was short-lived, so that today not a single significant public enterprise is listed on the Belgrade Stock Exchange, such as "Telekom Srbija" or "Elektroprivreda Srbije". In August 2010, trading in the shares of "Naftna industrija Srbije (NIS)", Petroleum Refineries Company, started on the Belgrade Stock Exchange (*https://www.belex.rs/o_berzi/istorijat*).

In 2014, the Law on Privatization ("*Official Gazette of the RS*", No's 83/14, 46/15, 112/15, 20/16) was amended. In terms of this Law, privatization is no longer defined, as in the previous one, only as the sale of property and free distribution of shares to employees and citizens, but primarily as a sale of shares, i.e. stakes which, after the termination of the agreement on the sale of capital concluded in the privatization process, were transferred and listed in the Register of Shares and Stakes transferred after the termination of the agreement concluded in the privatization process. And also, as a sale of shares of the Shareholder Fund, as well as the Development Fund of the Republic of Serbia, and the Republic Fund for Pension and Disability Insurance (Article 2).

The operation of the Belgrade Stock Exchange is regulated by the Law on Securities and Other Financial Instruments Market ("*Official Gazette of the RS*", No 47/2006), the Law on the Capital Market ("*Official Gazette of the RS*", No's 31/11, 112/15, 108/16, 9/20, and 153/20) and the new Law on the Capital Market ("*Official Gazette of the RS*", No 129/21).

The Law on Securities and Other Financial Instruments Market governs the conditions and procedure for the securities carve-outs; trading securities on the regulated securities market; organization, structure, and operation of the regulated market in the RS; the concept and activity of the market operators; establishment and activities of participants in the regulated market; organization and powers of the Securities Commission; organization and competences of the Central Securities Depository and Clearing House. This Law defines the

concepts of securities, financial instruments, debt securities, standardized financial derivatives, and foreign securities.

In terms of the Law on the Capital Market, the stock exchange is defined as one of the market operators if it has a license issued by the Securities Commission. The market operator exercises the rights corresponding to the regulated market managed in accordance with this Law (Article 106).
In August 2021, the Athens Stock Exchange (ATHEX) received the consent of the RS Securities Commission for the acquisition of 10.24% of the total number of shares of the

Belgrade Stock Exchange. Thus, the owners of securities trading on the Belgrade Stock Exchange can offer capital to traders of the stock exchange in Athens and vice versa. This was the first time that a foreign stock exchange became the owner of part of the capital of the Belgrade Stock Exchange. In this way, BELEX became visible on the global investment map. This enabled the introduction of new financial instruments in the Republic of Serbia, as well as access to the Belgrade Stock Exchange for large international investors, banks and their clients.

The cooperation between the Belgrade Stock Exchange and the Athens Stock Exchange is based on two principles: the shared belief that the respective markets have a key role in ensuring sustainable development, can effectively solve the growing problems and better cater to the needs of issuers coming from the European Union (EU) and from the international environment.
At the same time, the Belgrade Stock Exchange, as a market operator, made a decision to upgrade its trading platform and migrate trading activities to the trading platform of the Athens Stock Exchange, thus improving the liquidity and the range of services of the joint trading platform (*www.athexgroup.gr*).

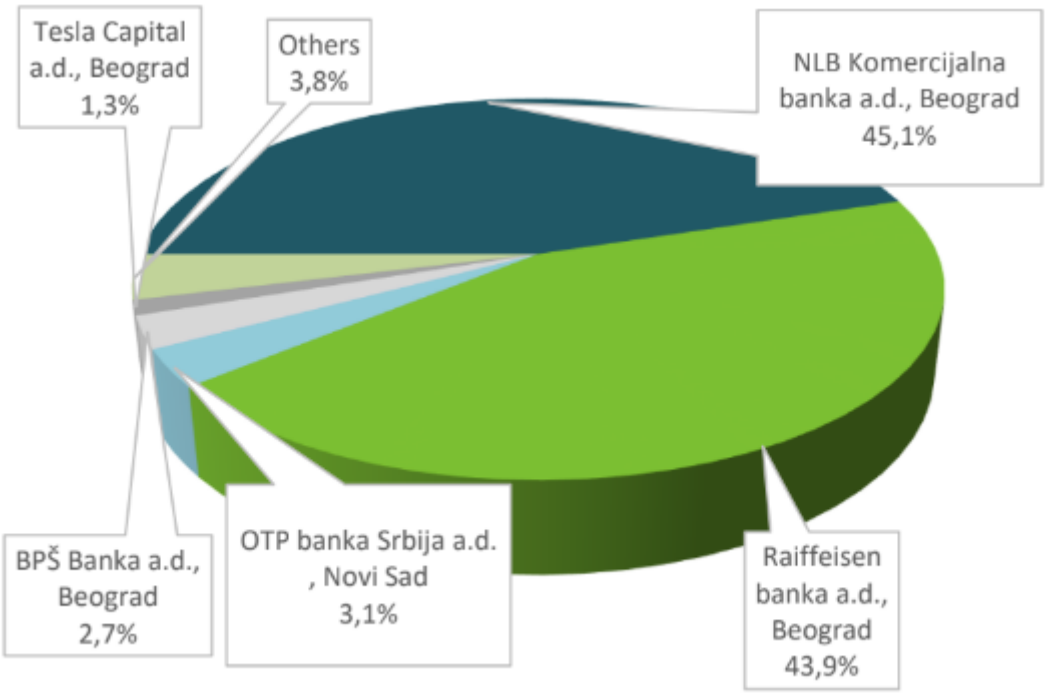
General indices of the Belgrade Stock Exchange j.s.c. Belgrade (BELEX) are the BELEX line and BELEX15 indices of the most liquid shares.

Table 1. *Members of the Belgrade Stock Exchange*

Member		Activity	Market Maker	FIXAPI
1.	ABC broker a.d., Beograd	Broker		
2.	Banka Intesa a.d., Beograd	Broker-Diler		+
3.	BPŠ Banka a.d., Beograd	Broker-Diler		+
4.	Convest a.d., Beograd	Broker		
5.	Dunav Stockbroker a.d., Beograd	Broker-Diler		+
6.	Erse Banka, a.d., Novi Sad	Broker-Diler		+
7.	Euro fineks broker a.d., Beograd	Broker		
8.	Eurobank Direktna a.d., Beograd	Broker-Diler		+
9.	Ilirika invesment a.d., Beograd	Broker		+
10.	Intercity broker a.d., Beograd	Broker-Diler		+
11.	M&V Invesments a.d., Beograd	Broker-Diler	MTLS, FINT	+
12.	Mediolanum invest a.d., Beograd	Broker-Diler		
13.	Momentum Securities a.d., Novi Sad	Broker-Diler		+
14.	NLB Komercijalna banka a.d., Beograd	Broker-Diler		+
15.	OTP banka Srbija a.d., Beograd	Broker-Diler		+
16.	Prudence Capital a.d., Beograd	Broker-Diler		
17.	Raiffeisen banka a.d., Beograd	Broker-Diler		+
18.	Tandem financial a.d., Novi Sad	Broker		
19.	Tesla Capital a.d., Beograd	Broker		+
20.	Tezoro broker a.d., Beograd	Broker-Diler		
21.	UniCredit Bank Srbija a.d., Beograd	Broker-Diler		

Source: *https://www. belex.rs/članovi/spisak_članova*

Chart 1. *Top Member Statistics. Members in Total Turnover, January 2023*



Source: *https://www. belex.rs*

TRADING ON THE BELGRADE STOCK EXCHANGE AND PRIVATIZATION

Until 2018, the Belgrade Stock Exchange, as the operator of the capital market, i.e. the place where the securities of companies that operate on it are traded in order to provide additional financing, traded exclusively in shares acquired in the privatization process of social capital in the RS.

The first initial public offering (IPO) on the Belgrade Stock Exchange was in 2018 by the joint stock company Fintel energija a.d., Belgrade. This is a company that produces electricity from wind and it is majority-owned by the Italian company Fintel Energia Group S.p.A. The process of the initial public offering of this Company was completed on October 30, 2018.

Towards the end of 2018, the value of the shares of 575 companies that were listed on the Belgrade Stock Exchange was 4.5 billion euros (*https://www. belex.rs/trzista_i_hartije/akcije*).

The main problem of capital market development in the RS is the lack of tradeables, so it can be assumed that owners of savings from Serbia invest abroad.

The capital market in the RS does not allocate capital efficiently, i.e. efficient channeling ofsurplus savings into the domestic economy, and the number of initial public offerings (IPO) for the sale of company shares is small.

Today, out of 136,490 registered companies in the RS, only 467 are on the Belgrade Stock Exchange (The Serbian Business Register Agency, *https://www.apr.gov.rs; https://www. belex.rs/trzista_i_hartije/akcije*).

The majority of companies on the Belgrade Stock Exchange are either inactive on the market or do not attract the attention of investors. The majority of companies that are on the Belgrade Stock Exchange today did not come to the stock market by choice, but by force of privatization laws, that is, the legal obligation to take shares from the Share Fund and go public on the Belgrade Stock Exchange, as we explained in the previous segment.
In August 2010, trading in the shares of "Naftna industrija Srbije (NIS)", Petroleum refineries company started on the Belgrade Stock Exchange (*https://www. belex.rs/trzista_i_hartije/akcije*).

NIS is one of the few state-owned enterprises in the RS that remained viable after privatization and it continues to perform well. This is generally because it listed the company's shares on the Belgrade Stock Exchange independently of transactional shares from privatization. It is the only privatized company that voluntarily entered the Belgrade Stock Exchange.
Since the Belgrade Stock Exchange is almost exclusively trading in the shares resulting from the privatization of social capital, it is evident that the majority of companies acquire additional capital for their business through bank loans or on the over-the-counter domestic and foreign capital markets.
At the time of the beginning of the process of privatization of social capital in the RS through the sale of capital and the free distribution of 30% of the shares of privatized companies to employees and citizens (Articles 42, 43, 44, 45, 46,48,49,50,52, of the Law on Privatization ,"*Official Gazette of the RS"*, No 38/2001, 18/2003, 45/2005, 123/2007, 30/2010, 93/2012, 119/2012, and 51/2014), the turnover in 2002 on the Belgrade Stock Exchange amounted to 100 billion dinars, while in 2004 the realized turnover amounted to only 32.9 billion dinars through more than 110,000 transactions. Free-float i.e. shares which are readily available for trading in the stock market accounted for about 59% or 19.5 billion dinars, realized in more than 51,000 transactions by October 31, 2004. At that time, there were 320 different shares of companies and banks on the free stock market (*https://www. belex.rs/trzista_i_hartije/akcije*).
Towards the end of 2004, the Share Fund, which had listed shares from privatization to be publicly traded on the Belgrade Stock Exchange, withdrew from the stock exchange after the introduction of the institute of public takeover bids with which the stock exchange was practically ousted from capital transactions.

The institute of public takeover bids was introduced by the Companies Act ("*Official Gazette of the RS"*, No 125/04), which was adopted by the National Assembly of the Republic of Serbia on November 15, 2004. This institute is also found in the new Companies Act ("*Official Gazette of the RS"*, No 36/2011,99/2011, 83/2014, 5/2015, 44/2018, 55/2018, 91/2019, and 109/2021).
Article 447 of the Act provided that a person in the process of a takeover bid buys in at least 95% of the shares of the target company in accordance with the law regulating the securities market in relation to the total number of shares has the right to also buy the shares to which the bid referred from shareholders who did not accept the sale of shares in that bid (dissenting shareholder), under the terms of the bid. This was basically a forced selling of shares. On the other hand, according to Article 448 of the Law, a shareholder who acquired 95% of the shares of another company (majority shareholder) is obliged to buy the shares of the remaining shareholders at their request (minority shareholder). This, in turn, was the forced buy-in of shares.

The restructuring of the ownership structure of the company through the technique of taking over the control block of shares put minority shareholders ("small shareholders"), workers of privatized companies in an unfavorable position. In this way, the state practically stopped the trading on the stock market by forcing a non-standard method of selling shares by bidding, which favored large investors and prevented small investors from buying shares. By October 2005, there were over 70 takeovers of rather large companies, which took place outside the Belgrade Stock Exchange. Firms were run by majority shareholders who extracted profits and reported operations with no profits or even losses, leading to a large decline in the value of minority shares. Thus, by 2016, the turnover at the Belgrade Stock Exchange decreased by more than four times compared to its first years of operation (Statement by Minister of Finance Dušan Vujović, http://www. nin.co.rs./pages/article.php?!d=105601).
The Belgrade Stock Exchange registered a significant decline in total transaction turnover from 2002 to 2005, while growth was registered from 2005 to 2006. The turnover at the Belgrade Stock Exchange decreased from 1.2 billion euros in 2002 to 400 million euros in 2004. In 2005, it was around 600 million euros, and in 2006 it grew to almost one billion euros.

In the period from 2002 to 2006, the number of daily traded shares was about 50. Of these, about twenty shares were on the so-called continuous trading. Shares of about 1,000 companies that were listed on the Belgrade Stock Exchange in the period 2002-2006 were not traded for months, and sometimes for more than a year.
Index the Belgrade Stock Exchange BELEXfm, created in May 2004, ranged from 1000 index points to 1716 points in the period 2004-2006, and then stagnated for more than a year. The second index BELEX 15 (for 15 companies in the RS with the most liquid securities), introduced at the beginning of 2005, with an initial value of 998.24, reached its maximum in April 2006 at 1149, and then began to stagnate, reaching 1240 in August 2006.
One of the major problems of the capital market in the period 2002-2006 was the small number of types of securities for trading. In addition to corporate shares, old savings bonds were also traded, but only between banks and outside the Belgrade Stock Exchange and the central bank bonds. Continuously, shares of 20 to 30 companies were traded in 2005 and 800 companies occasionally. In 2006, the number of shares on continuous trading was reduced to 15-20, and the number of shares of companies that were traded in general increased to 1,000. Of these 1,000, only the shares of less than 200 companies were actually traded. Primarily the shares of privatized companies were traded. The shares of some companies on the Belgrade Stock Exchange in the given period were not traded for more than a year. According to estimates in brokerage circles, only 5,000-6,000 individuals participated in the purchase of shares on the Belgrade Stock Exchange in the given period (Prokopijević 2006)
In the following years, the intensive mass privatization of social capital in the RS did not lead to further development of the primary capital market through the issue of shares. Thus, on February 3, 2023, the total trading turnover on BELEX amounted to only 100.2 million dinars, i.e. 0.9 billion euros, while the total number of transactions was only 156. Thus, the volume of trading on BELEX is practically smaller today compared to 2002, when mass privatization began with the sale of social capital. Nor did the BELEX indices grow compared to 2002. The value of the BELEX 15 index on February 3, 2023 was 865.76, and the BELEX line was 1,176.33 (*https://www. belex.rs/trzista_i_hartije/akcije*).

Table 2 *BELEX size and activity, 1996-2022*

Godina	Promet RSD	Promet EUR	Broj transakcija	BELEX15		BELEXline	
2023.	1.926.018.491	16.409.022	1.426	860,34 ▲	4,33%	1.765,65 ▲	1,48%
2022.	38.296.960.014	325.934.838	22.760	824,61 ▲	0,47%	1.739,86 ▲	1,65%
2021.	41.231.194.976	350.679.870	18.743	820,78 ▲	9,64%	1.711,57 ▲	9,29%
2020.	48.752.234.621	414.647.537	18.098	748,61 ▼	-6,62%	1.566,03 ▼	-9,31%
2019.	91.918.041.860	780.641.971	31.115	801,69 ▲	5,25%	1.726,82 ▲	8,65%
2018.	63.187.581.528	534.125.070	60.744	761,69 ▲	0,25%	1.589,35 ▼	-4,40%
2017.	66.907.338.684	552.822.262	66.952	759,80 ▲	5,91%	1.662,53 ▲	5,93%
2016.	44.574.000.173	361.994.482	87.893	717,37 ▲	11,38%	1.569,43 ▲	13,69%
2015.	22.429.152.041	185.770.866	146.232	644,10 ▼	-3,44%	1.380,42 ▲	2,65%
2014.	20.258.653.211	173.518.701	238.023	667,02 ▲	19,54%	1.344,82 ▲	21,71%
2013.	30.164.364.465	267.006.644	344.109	557,97 ▲	6,51%	1.104,92 ▲	9,88%
2012.	24.988.496.333	219.765.572	483.013	523,89 ▲	4,98%	1.005,56 ▲	2,90%
2011.	28.584.502.604	280.180.758	2.887.538	499,05 ▼	-23,43%	977,19 ▼	-23,82%
2010.	23.017.197.757	222.475.934	725.550	651,78 ▼	-1,81%	1.282,66 ▼	-2,22%
2009.	41.778.491.982	441.976.426	77.215	663,77 ▲	17,44%	1.311,84 ▲	9,47%
2008.	71.853.776.130	882.454.957	119.001	565,18 ▼	-75,62%	1.198,34 ▼	-68,72%
2007.	164.990.865.957	2.059.769.522	301.210	2.318,37 ▲	38,39%	3.830,84 ▲	44,12%
2006.	100.583.951.914	1.210.439.480	141.499	1.675,20 ▲	58,01%	2.658,16 ▲	36,01%
2005.	48.350.670.609	581.464.086	173.545	1.060,21	-	1.954,35 ▲	68,29%
2004.	40.583.663.543	556.635.879	138.842	-	-	1.161,30	-
2003.	93.070.409.210	1.420.303.206	127.786	-	-	-	-
2002.	102.298.249.980	1.685.411.342	83.952	-	-	-	-
2001.	50.156.494.837	840.860.293	46.073	-	-	-	-
2000.	8.925.475.009	-	25.068	-	-	-	-
1999.	6.160.024.047	-	5.740	-	-	-	-
1998.	6.004.271.574	-	9.206	-	-	-	-
1997.	3.961.489.000	-	-	-	-	-	-
1996.	2.186.692.000	-	-	-	-	-	-

Source: *https://www. belex.rs/trgovanje/izvestaj/godisnji*

As of May 2022, there was a large decrease in the participation of foreign investors in the total turnover of shares (**FIS**) on BELEX, from 95.35% to 1.19% in January 2023. In the same period, the participation of foreign investors in the total share turnover - buy side (**b-FIS**) decreased from 95.33% to 2.00%, while the participation of foreign investors in the total share turnover - sell side decreased from 95.38% to 0.38%. A smaller drop, in the period from February 2022 to January 2023, was recorded in the participation of foreign investors in the total turnover of bonds (**FIB**), from 10.66% to 2.58%, as well as the participation of foreign investors in the total turnover (**FIT**), from 11.34% to 2.58% (*https://www. belex.rs/trgovanje/ucesce_stranaca*).

Table 3. *Shares - Official Listing Segments, January 2023*

Prime Listing Shares										
Ticker	Issuer	Price RSD	Turnover EUR	Trades	1y price range	Issued shares	Monthly change	Market CAP	P/E	P/B
AERO	Aerodrom Nikola Tesla a.d. , Beograc	1.748,00	32.487	273	1000 - 1750	35.026.129	9,52%	521.628.037	/	2,14
FINT	Fintel energija a.d. , Beograd	630,00	608	2	590 - 650	26.510.506	-3,08%	142.293.782	10.080,00	38,70
JESV	Jedinstvo a.d. , Sevojno	8.000,00	0	0	7200 - 8599	255.130	0,00%	17.389.171	5,75	0,74
MTLC	Metalac a.d. , Gornji Milanovac	1.636,00	8.697	11	1220 - 1850	2.040.000	-2,50%	28.434.187	13,13	0,92
NIIS	NIS a.d., Novi Sad	695,00	361.974	404	482 - 711	163.060.400	2,96%	965.518.640	4,90	0,42

Source: *https://www.belex.rs*

As the table shows, among the five companies whose shares are the best quoted on BELEX, there is only one company that did not emerge from the privatization of social capital in the RS, Fintel energija a.d., Belgrade.

The trading time on the Belgrade Stock Exchange is not eight hours, as in larger exchanges, but only five hours a day, from 9 a.m. to 2 p.m. Stock trading is subject to capital gain tax at a rate of 20% for individuals and 10% for legal entities. Trading on the Belgrade Stock Exchange is slow and expensive. When shares are sold, the money is in the seller's account only after three full business days. The brokerage commission is from 0.5% to 1.5% of the transaction amount, the stock exchange commission is 0.15%, the Central Registry commission is 0.10%, and the absolute rights transfer tax is 0.3%. In addition, banks take a commission on stock transactions from 1.25% to 2.55%, and when buying and selling are taken into account, then the cost of transactions is from 2.5% to 5.1%. It is evident that the high cost of trading on the Belgrade Stock Exchange favors only clientelistic groups organized around the Belgrade Stock Exchange and the Central Registry.

CONCLUSION

The massive mandatory privatization of social capital that has been going on in the RS since 2002 to date has not led to a greater development of the capital market, hence neither of an organized market, the stock exchange, where companies would collect additional capital for investments through the issue of shares. In the aforementioned period, the number of companies appearing on the Belgrade Stock Exchange was halved, and the turnover decreased. Today, only 0.34% of companies registered in the RS can be found on the Belgrade Stock Exchange. Companies operating in the RS as a result of FDI almost never issue their shares on the Belgrade Stock Exchange. Exceptions are Naftna industrija Srbije (NIS) a.d., Novi Sad, Aerodrom Nikola Tesla a.d., Belgrade, Fintel energijaa.d., Belgrade, etc. Shares of the majority of companies that are present on the BELEX are there by virtue of privatization laws.Shares as securities on the capital market in Serbia derived exclusively from the privatization process, i.e. from social capital, although the privatization of social capital was carried out through the sale and transfer of capital free of charge, and not through stock market mechanisms, i.e. initial public offerings.
Until 2018, the Belgrade Stock Exchange, as the operator of the capital market, i.e. the place where the securities of companies that operate on it are traded in order to provide additional financing, traded exclusively in shares acquired in the privatization process of social capital in the RS.

The first initial public offering (IPO) on the Belgrade Stock Exchange was in 2018 by the joint stock company Fintelenergija a.d., Belgrade.
The capital market is characterized by low-volume, low-depth trading, with few liquid securities, and securities' trading is expensive, prices are unstable, and risks are high.
The analysis of market size and liquidity of the Belgrade Stock Exchange (BELEX) in the period 1989-2022 when the privatization of socially-owned enterprises in the Republic of Serbia was carried out, shows that the privatization of social capital was not of use to the development of the capital market, i.e. the market economy, but rather a change in ownership relations in company.

REFERENCE

Atanasov, Vladimir, Ciccotello, Conrad S., and Gyoshev, Stanley B. 2005. How Does Law Affect Finance? An Empirical Examination of Tunneling in a Emerging Market. William Davidson Institute at the University of Michigan Business School. Working Paper Number 742

King, Lawrence P. 2001. Making markets: A comparative studies of post-communist managerial strategies in Central Europe. *Theory and Society 30*: 493-538

Naceur, Samy Ben, Boubakri, and Ghzouani, Samir. 2008. Privatization and Financial Market Development: A Comparison between MENA Countries and Other Regions. Economic Research Forum. Working Paper No. 390

Obradović, Marija. 2017. *Hronika tranzicionog groblja. Privatizacija društvenog kapitala u Srbiji 1989 - 2012 (Chronicles of the Transitional Graveyard. Privatization of Social Capital in Serbia 1989 - 2012).* Beograd: Nova srpska politička misao. Institut za noviju istoriju

Official Gazette of the SFRY
Official Gazette of the FRY
Official Gazette of the RS

Prokopijević, Miroslav. 2006. Tržište kapitala u Srbiji in *Srbija 2000-2006. Država, društvo, privreda* (Capital Market in Serbia in *Serbia 2000-2006. State, Society, Economy*). Edited by Miša Đurković. Beograd: Institut za evropske studije, p.p.204, 205, 208, 209

Stringham, Edward, and Boettke, Peter. Czech Your Premises: Are Regulations the Answer For Stock Markets in Transition? JEL Classification: G1, K2, P2
The Serbian Business Register Agency, *https://www.apr.gov.rs*
https://www.belex.rs
https://www. belex.rs/trgovanje/izvestaj/godisnji
https://www. belex.rs/trgovanje/ucesce_stranaca
https://www. belex.rs/trzista_i_hartije/akcij
https://www. belex.rs/članovi/spisak_članova
https://www.belex.rs/o_berzi/istorijat
www.athexgroup.gr

INFLATION IN FRANCE AND SLOVAKIA: THE EFFECTIVENESS OF THE EUROPEAN CENTRAL BANK'S MONETARY POLICY IN QUESTION

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Abstract: The main aim of this paper is to examine the effectiveness of the European Central Bank's monetary policy in combating inflation in Europe, and more specifically in France and Slovakia.

Key words: monetary policy, European Central Bank, inflation, interest rates, France, Slovakia

INTRODUCTION

The word "crisis" in Chinese is made up of two characters. One represents a danger, the other an opportunity. The citizens of the European Union have witnessed several financial and economic crises in recent decades, which its institutions have had to deal with. While the situation seemed stable, the EU is once again faced with another challenge: high inflation, which threatens the purchasing power of Europeans. The main aim of this article is to assess the effectiveness of the ECB's monetary policy and its impact on the Slovak and French economies.

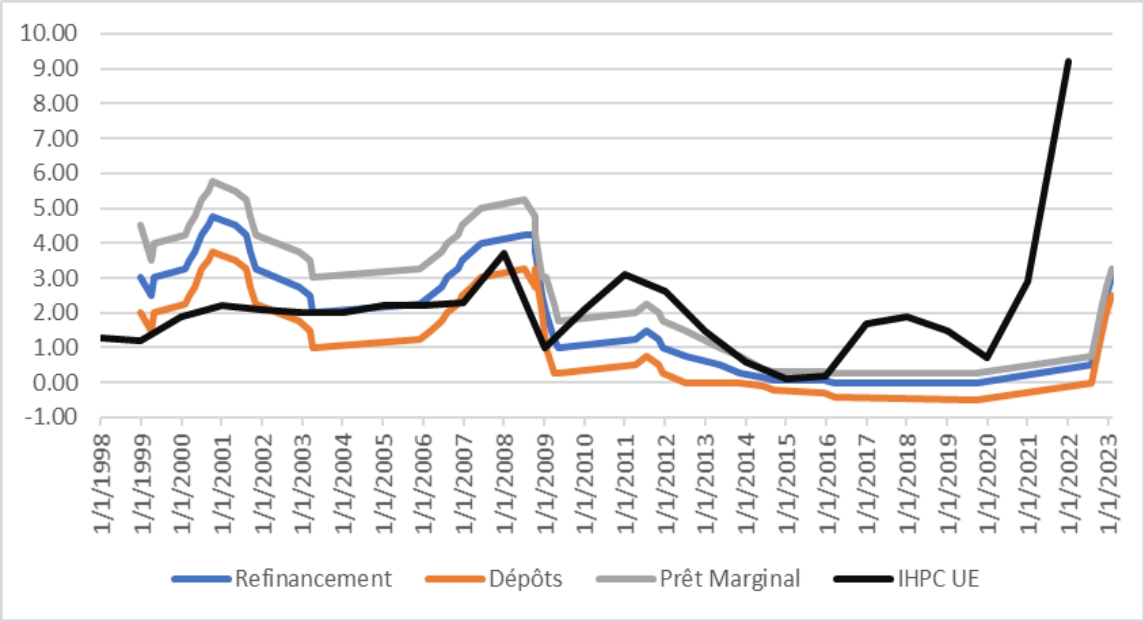
I. INFLATION TRENDS IN THE EU SINCE 1999

Over the period 1999-2008, HICP values were close to the reference value (2%). The average value of the HICP in the eurozone, calculated on the basis of monthly data, is 2.2%. During this period, the price stability target was set below 2% (not exactly 2%, as is the case today[1]) . In 2008, the financial crisis began in the United States. The interdependence of the economy and the financial sector facilitated the spread of the crisis from the United States to Europe. European banks participated in the securitisation of subprime mortgages in the United States and played a fundamental role in transmitting the crisis to the EU. First, the EU faced the Great Recession in 2008-2009, and then, after a brief recovery, several member states were hit by the sovereign debt crisis. The combined crises had disastrous consequences for economic growth, inflation, investment, employment and the budgetary situation in many Member States. The EU has taken short-term "fire-fighting" measures such as bailouts to rescue banks and help struggling states, while reforming the inadequate framework. Although there were signs of a moderate recovery in 2014, the risk of falling into deflation or secular stagnation remained high[2]. Chart 1 shows that in 2011 the value of the HICP peaked (3.1%) and then

[1] DĚDEK, O. *Doba eura. Úspechy i nezdary společné evropské měny*. Praha: Linde, 2014. p. 78,79
[2] EUROPEAN PARLIAMENT. *A decade on from the crisis.* [online]. europa.eu. [Consulté le 2023-02-10]. Disponible sur: <A decade on from the crisis (europa.eu) >

began to fall. This decline lasted until 2015, when its value was historically at its lowest (0.1%).

Graph 1 : Inflation and key interest rates



In 2014, the ECB adopted negative interest rates for the first time in its history in an attempt to halt the regression of the economy and stimulate its growth[3]. In March 2015, the ECB launched quantitative easing. This enabled it to buy up a large number of public and private assets previously held by banks and financial institutions, such as securitised loans, sovereign bonds and covered bonds[4] . The aim of this programme was to encourage economic growth and prevent deflation in the eurozone. It began injecting €60 billion into the financial system every month. After this step, the HICP began to rise[5]. In 2017, the EU economy returned to a state similar to that before the crisis. In the spring of 2020, the first wave of the Covid-19 pandemic arrived in Europe. In an effort to stop the pandemic, Member State governments introduced restrictive measures and closed their economies. With the gradual imposition of restrictive measures, inflation in the eurozone accelerated and prices began to rise. Since the end of February 2022, inflation has continued to rise due to the war between Russia and Ukraine[6]. Commodity and energy prices were already rising before the Russian invasion, but the conflict has intensified this phenomenon. Russia and Ukraine are the main exporters of energy and raw materials (agricultural products - wheat). Energy prices are rising exceptionally (crude oil prices jumped 350% between April 2020 and April 2022), as are food prices, since Ukraine and Russia account for around 30% of international wheat exports. Europe is particularly dependent on Russian gas to run its economy (43% of natural gas is

[3] EUROPEAN PARLIAMENT. *A decade on from the crisis.* [online]. europa.eu. [Consulté le 2023-02-10]. Disponible sur: <A decade on from the crisis (europa.eu) >

[4] BUZELAY, A. 2022. *D´un certain dogmatisme* à *plus de pragmatisme.* Supplément revue banque. Décembre 2022, N°874, p.22, 23.

[5] TREND. *Eurozóna aj EÚ sa prepadli do deflácie.* [online]. trend.sk. [Consulté le 2023-02-20]. Disponible sur: < Eurozóna aj EÚ sa prepadli do deflácie | TREND>

[6] DAUZAT, F. M., PALLUET, A. *Le taux d´inflation en Europe.* [online]. touteleurope.eu. [Consulté le 2023-02-20]. Disponible sur: <https://www.touteleurope.eu/economie-et-social/le-taux-d-inflation-en-europe/

imported from Russia), and this has been reflected in the growth in the value of the HPC, which reached a value of 9.196% in December 2022[7].

The ECB's response to this situation was to change from an expansionary monetary policy to a restrictive one. In the summer of 2022, the ECB raised rates for the first time in ten years. In July 2022, the ECB decided to cut deposit rates from -0.5% to 0%, before raising key rates by 75 points in September. The other key rates applied to banks on marginal lending and refinancing operations rose to 1.50% and 1.25%.45 The rate increases continued in the following months. The interest rates on the main refinancing operations, the marginal lending facility and the deposit facility were raised to 2.50%, 2.75% and 2.00% respectively from 21 December 2022. In addition, through the asset purchase programme, the ECB is trying to reduce the money supply. This reduction will average 15 billion euros per month until the end of the second quarter of 2023, after which the pace will be adjusted over time[8].

II. THE EFFECTIVENESS OF THE ECB'S MONETARY POLICY IN QUESTION

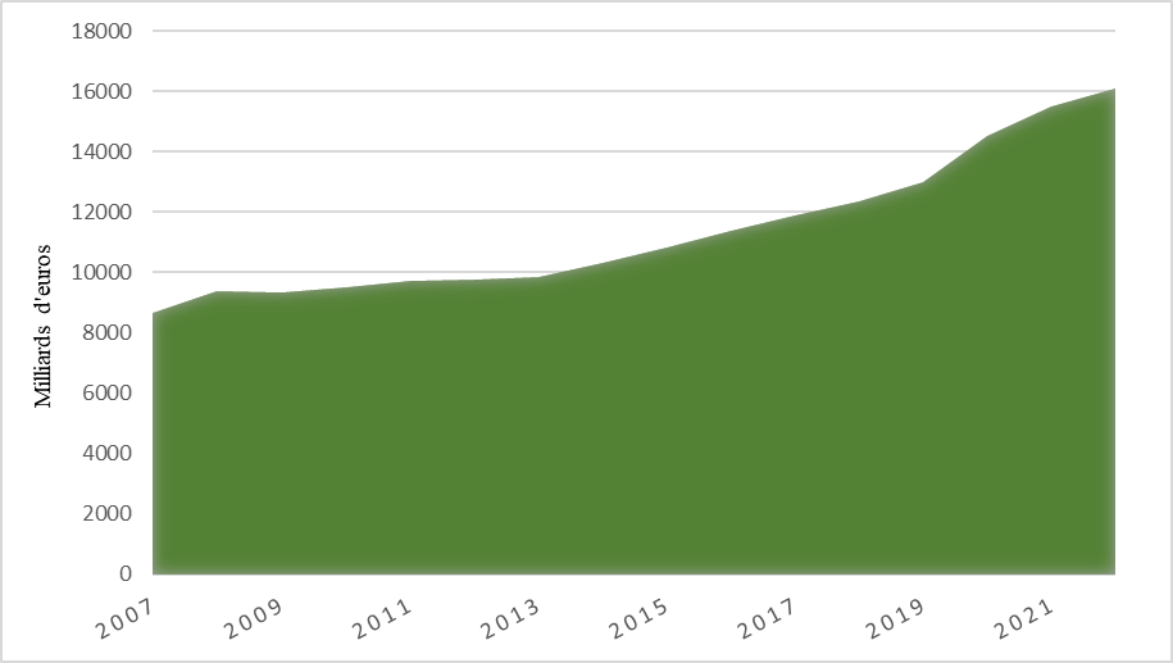
This section mainly evaluates the effectiveness of monetary policy through the use of different monetary policy instruments on the economy.

It is possible to question the role of the increase in the money supply on inflation in Slovakia. When the ECB introduced expansionary monetary policy and unconventional measures, their aim was to get closer to the inflation target (2%), which was also achieved in 2017. This led to an increase in the money supply (graph 2).

[7] GLOBAL RATES. *Inflation Europe (HICP).* [online]. global-rates. [Consulté le 2023-02-23]. Disponible sur: < https://www.global-rates.com/en/economic-indicators/inflation/consumer-prices/hicp/eurozone.aspx

[8] LA BANQUE CENTRALE EUROPÉENNE. *Décisions de politique monétaire du 15 décembre 2022.* [online]. ecb.europa.eu. [Consulté le 2023-02-25]. Disponible sur: < https://www.ecb.europa.eu/press/pr/date/2022/html/ecb.mp221215~f3461d7b6e.fr.html

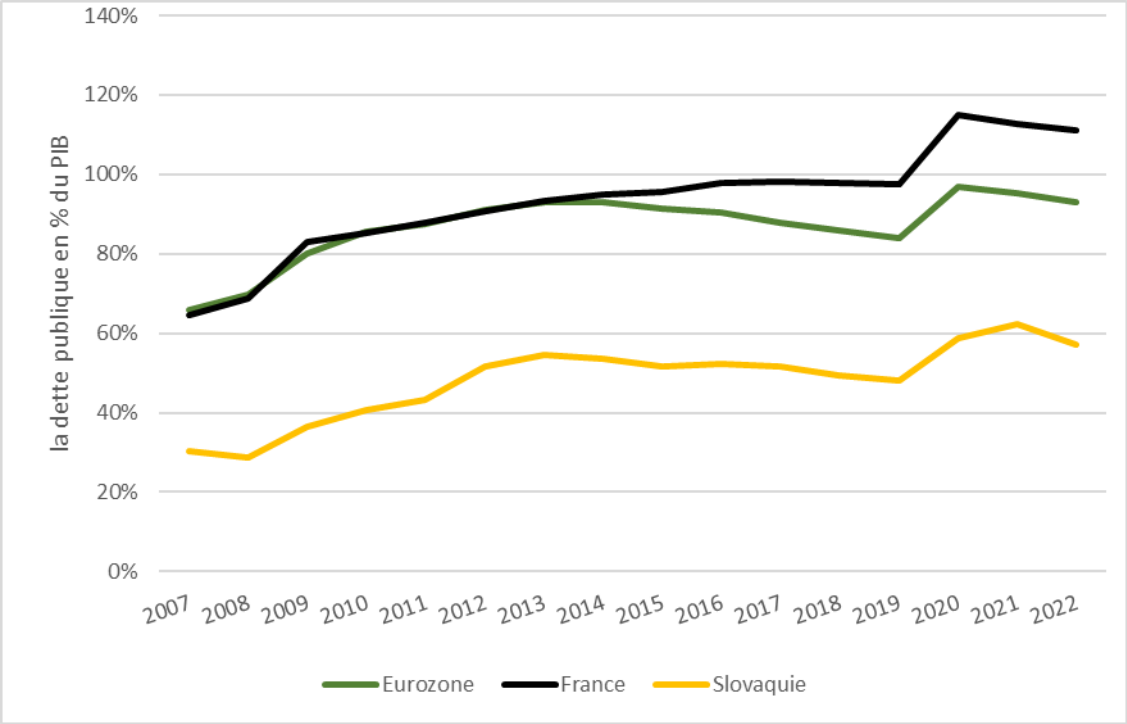
Graph 2: Money supply in the eurozone



Given the overall economic situation during the period under review, the ECB considered these measures to be effective, as they were necessary and fulfilled their purpose. Nevertheless, one of the negative side-effects was, for example, an increase in household debt in Slovakia (Graph 3).

This graph shows the evolution of indebtedness in Slovakia, France and the eurozone. We can see that the growth rate of debt in both countries, and in the eurozone as a whole, is gradually increasing. The reason for this is that we have been living in relatively good times for a longer period of time - the economy is growing, unemployment is low. Another, and at the same time the most important, reason for this growth is the favourable availability of loans and low interest rates, which have enabled households to borrow money in recent years. In Slovakia, households have mainly invested in the purchase of property. The chart shows the difference between the three countries being compared. Slovakia ranks among the developing economies, France among the developed economies. The different level of indebtedness is a consequence of the poorer households having less access to credit. In general, poorer households in emerging economies borrow less. As a developed economy, France even exceeds the eurozone average - it is one of the most indebted countries in the European Union. In 2019, we are seeing a sharp increase in all three curves. The health crisis and the war in Ukraine have prompted the government to step up its support measures. The current rise in interest rates and inflation have also contributed to the increase in debt. The issue of debt reduction is mainly linked to fiscal policy, which is not coordinated by the ECB, but the measures and monetary policy implemented by the ECB have contributed to its growth.

Graph 3: European Union's state debt as a % of GDP

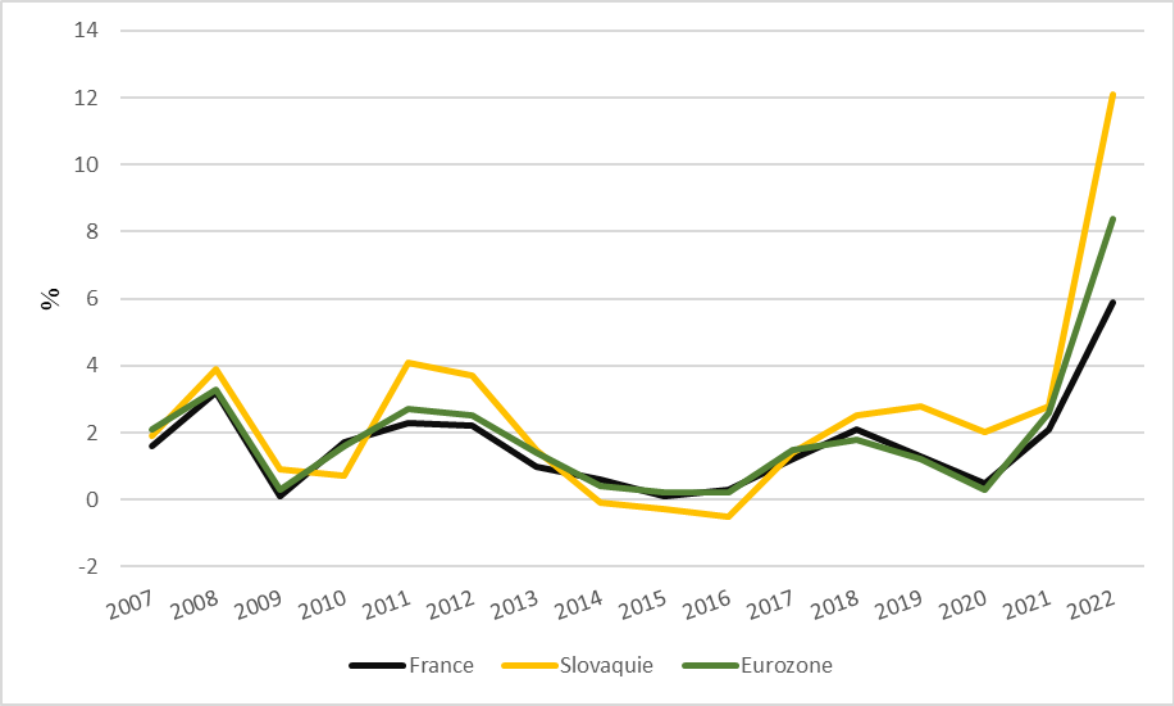


There are two approaches to analysing the impact of an increase in the money supply on inflation: monetarist theory and quantitative theory. The reconciliation of these two theories makes it possible to assert that "the money supply does indeed have an impact on price levels, and therefore indirectly on the rate of inflation, but this impact is not proportional[9]". He also defended the current rise in interest rates by the ECB, which is attempting to curb this growth in the money supply. In his response, he essentially summarised what we have shown in the two charts in this section - the relationship between money supply and debt growth. "If we raise interest rates, borrowing will be more expensive, people will borrow less. And if we borrow less, the banks will give less credit. And if the banks give less credit, the money supply will indirectly grow less quickly.

The modulation of key rates by the ECB is supposed to have an impact on inflation. We can see that, with minor differences, the price level has followed a common trend in Europe. For example, in the years when it fell (2011-2016), a fall was recorded in both countries and also in the eurozone. The same applies to growth. Since 2007, despite the crisis of 2009, none of the curves has exceeded 4%. We can therefore see that inflation in the European countries will evolve in more or less the same way until 2020. However, we can see that the price level has been rising steadily since 2020, and we have yet to see the impact of the ECB's measures to halt it. What's more, inflation is growing much faster in Slovakia, and the trend is no longer identical.

[9] BUZELAY, A. 2022. *D´un certain dogmatisme* à *plus de pragmatisme.* Supplément revue banque. ISSN 1772-6638, Décembre 2022, N°874, 82 p.

Graph 4: Inflation trends in France, Slovakia and the Eurozone

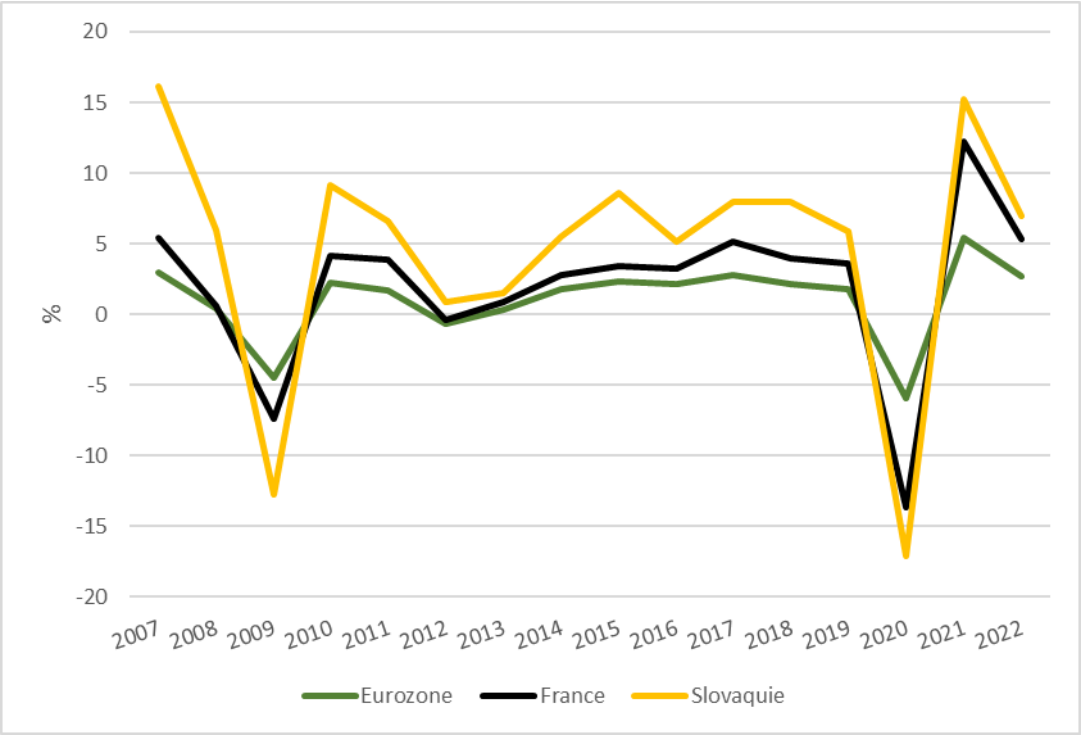


The ECB's response was to establish a restrictive monetary policy - a rise in interest rates. The bank proceeded in the same way in the opposite case - when inflation was below 2% since 2013, it implemented a policy of quantitative easing and negative interest rates, in other words an expansionary monetary policy. But faced with a financial crisis and a health crisis in 2020, the ECB significantly increased its supply of liquidity before reducing it in a context of renewed inflation. It did not raise interest rates until 2022. Respondents were therefore asked why, with current rapid inflation growth, the ECB raised interest rates later than the FED and whether this delayed reaction had any impact on the current situation. Inflation in the US had a different intensity and cause than in France or Slovakia. In the United States, prices started to rise around three quarters of a year earlier and much more strongly than in the eurozone". The main driver of their rise was "strong consumer demand as the pandemic subsided", while in the eurozone "at the same time, inflation was mainly generated by rising energy prices". What's more, monetary policy does not have a direct impact on the prices of consumer goods and services. He does not consider the start of interest rate hikes to be late, as several European countries outside the eurozone raised their rates even later than the ECB. The ECB's reaction could not have been very quick. It was a bit long-winded, because you don't decide with twenty people in the same way as you decide alone. The FED in the United States is more unified than the ECB, which explains the later reaction.

III. The risks of an overly restrictive monetary policy for growth in Slovakia and France

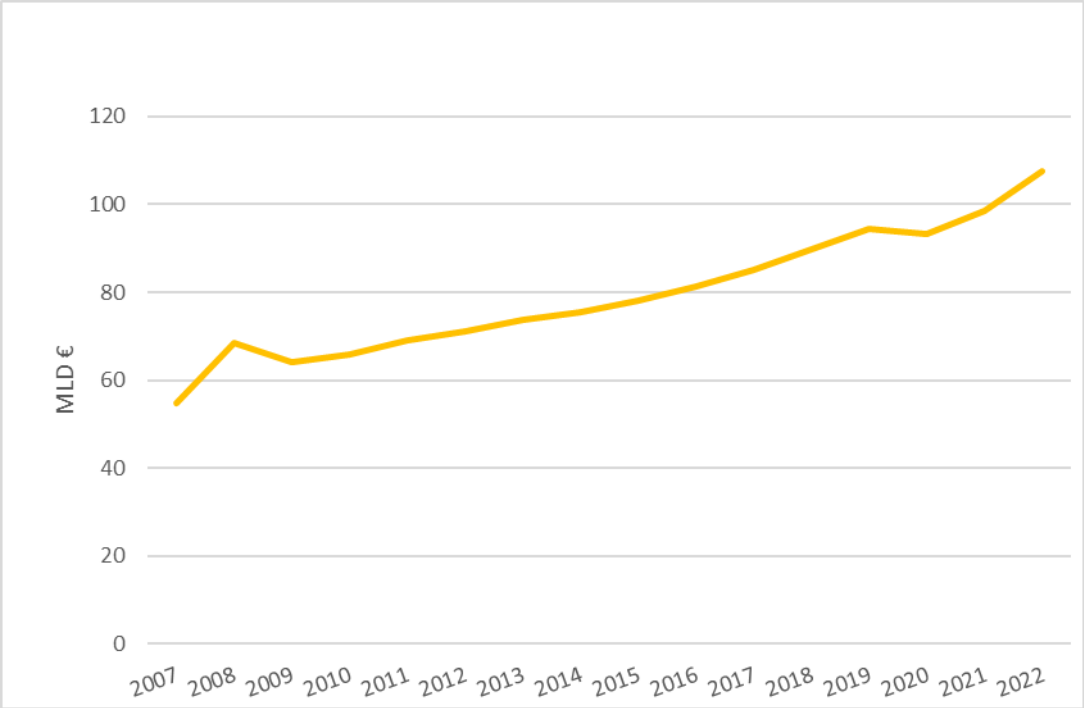
In the long term, a slowdown threatens economic growth if interest rates rise too steadily.

Graph 5: GDP growth rate



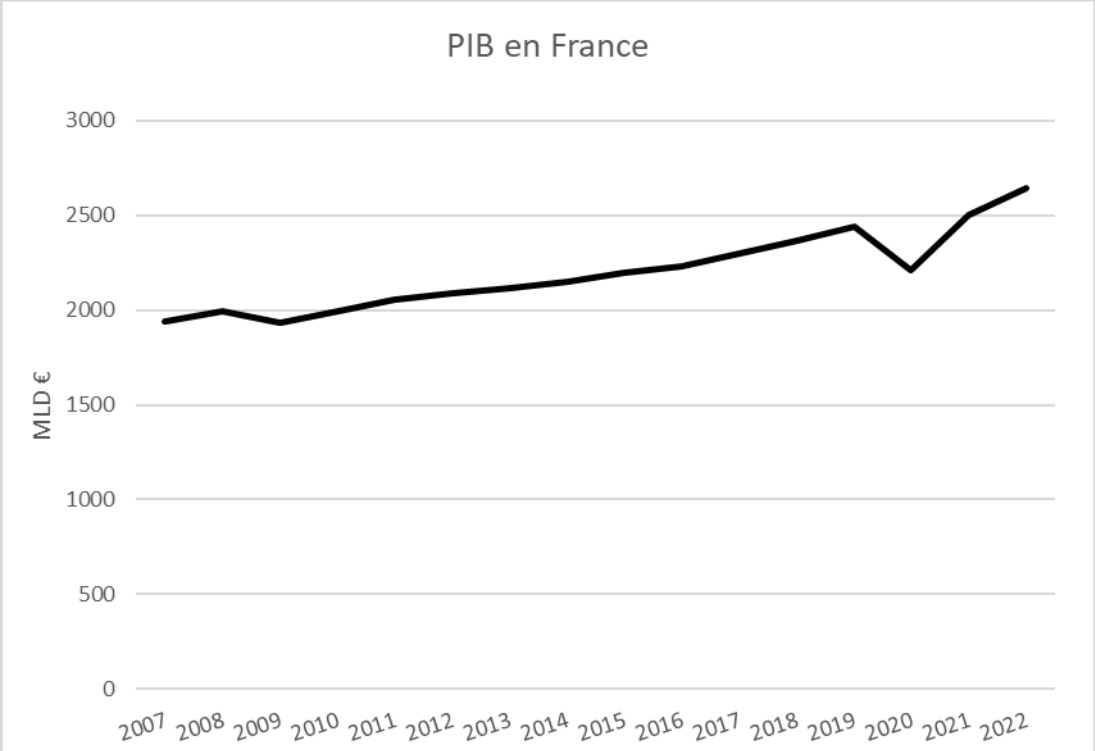
In 2008, the first symptoms of the eurozone-wide crisis began to appear. This can be seen in chart 5, where the GDP growth rate fell, and in 2009 real GDP fell by 4.4%. The global financial and economic crisis of 2009 led to a severe economic recession. In 2010, the economy recovered. Weaker growth was recorded in 2011 and a sharper decline in 2012. Thereafter, from 2013 to 2019, the GDP growth rate rose steadily. It was during these years that the ECB introduced unconventional monetary policy instruments and negative interest rates. As can be seen not only from the curves for Slovakia and France, but for the eurozone as a whole, this step had a positive impact on GDP growth - it supported its growth.

Graph 6: GDP in Slovakia



Source : < https://www.focus-economics.com/country-indicator/slovakia/gdp-eur-bn/ https://www.statista.com/

Graph 7: GDP in France



Source : < https://fr.countryeconomy.com/gouvernement/pib/france?year=2007>

The year 2020 will be characterised by the deepest recession in France since the Second World War. The pandemic also led to a fall in household consumption, as the government severely curtailed economic activity to stem the spread of the disease. The crisis also had an impact on investment, exports and imports. Charts 6 and 7 show that in France, the negative impact and fall in GDP was more marked than in Slovakia. The reason for this is the different policy and intensity of the measures taken to halt the pandemic in these two countries. The reopening of sectors of activity is renewing economic growth. It must be emphasised that the drop in activity seen during the Covid-19 pandemic is not the result of an internal dysfunction in our economies, in particular a decoupling between the real and financial spheres. Rather, it is the result of more or less restrictive strategies adopted by the authorities to deal with the pandemic and avoid hospital overcrowding. What's more, it was not monetary policy that had the negative impact on the economy, but other factors.

Christine Lagarde has communicated the tools quite clearly: in addition to raising interest rates, the asset purchase programme is being gradually deactivated - in the form of a reduction in the volume of assets reinvested in asset purchase programmes". In response to the possible recession controversy, he said that a fall in energy prices and not in overall aggregate demand can help to reduce inflation, as this was an initial supply shock (particularly energy prices) that gradually led to high underlying inflation. The ECB itself is prepared to continue to fight inflation even at the cost of a slight temporary recession, but the ECB's current outlook for the economic development of the eurozone does not indicate that it is likely to be in recession over the next period.

Inflation has causes other than the money supply and interest rates. There are structural and behavioural causes that drive prices up. As an example, he cites the European Union's energy dependence on external supplies of electricity and especially gas. In response to the question of what else can be done in the given situation, he replied that reducing energy dependency means first and foremost reducing inflation. He also sees income inequality as a structural cause, because people with very high incomes buy very expensive goods, and in so doing they fuel inflation. But the ECB "has no control over the structural causes, since these causes are not strictly monetary". He agrees that with the rise in key rates, we can expect a recession, which will have an economic and social impact. However, this can be mitigated by an appropriate policy that will support restructuring, co-competitiveness and redistribution - since, as mentioned above, "inflation has not only a monetary dimension, but also an economic, structural and social one".

IV. FACTORS EXPLAINING THE DIFFERENCE IN INFLATION LEVELS BETWEEN FRANCE AND SLOVAKIA

In this section, we will look in more detail at the reasons for the significant differences in inflation between France and Slovakia. The current inflationary crisis is characterised by different growth rates in different countries. Year-on-year inflation in Slovakia reached 15.4%, while in France it was more than half that. The reason for the differences "is a mixture of different factors in the various eurozone countries". On the one hand, different measures are being taken in each country to combat the energy crisis, and on the other, individual (energy) items have a different weighting in each country's consumption basket. In addition, the structure of the energy mix and of the markets on which different countries buy specific energy commodities, the different tax systems, the regulation of the energy sectors, etc., all

play a part in the energy crisis. Some specialists, including Professor Alain Buzelay, see the national interest rate on loans as one of the consequences of differences in inflation rates between countries. But inflation also has structural and behavioural causes, which vary from country to country. Taking France as an example, we can see that some spending is more unproductive than others". The structural causes and the differences between different countries, taking the development of nuclear energy in France as an example. If France has more domestic electricity, it will be less dependent on external suppliers. However, Slovakia, which will not produce as much of this energy, will have to import it, and so the price will be higher for Slovaks.

CONCLUSION

The main objective of this article was to assess the effectiveness of the ECB's monetary policy in combating inflation in France and Slovakia. Expansionary monetary policy has increased indebtedness in both countries and in the eurozone as a whole. Low interest rates made loans from commercial banks more readily available to households. People started to borrow more. In the analysis of the monetary policy implemented, we described the evolution of the inflation growth rate and the instruments used, as well as the reasons for the emergence of the current crisis. After the outbreak of the financial crisis in 2009, the ECB opted for unconventional monetary policy instruments, as conventional instruments in the form of interest rate cuts were not effective enough to revive economic activity. In the years that followed, any positive effects were undermined by the debt crisis, which led to a fall in GDP in 2011 and 2012. Thanks to the policy of quantitative easing, negative interest rates and the introduction of a programme of long-term refinancing operations, it has been possible to revive and stimulate the economy, as well as mitigate deflation. The favourable trend in the economy and prices was disrupted by the arrival of the Covid19 pandemic in early 2020, which resulted in a health crisis. The various States introduced restrictive measures of varying intensity. The gradual improvement in the pandemic situation and the post-Covid recovery, boosted by monetary measures, began to drive up prices. People bought more, which increased consumption and demand for goods. But while European countries relaxed restrictive measures, in China they were still being applied - in a much stricter form. In the geopolitical context, the globalisation of world markets and the interdependence and dependence of individual producers on Chinese suppliers helped to drive up prices, as supply chains were disrupted. In February 2022, Russia invaded Ukraine militarily. The conflict led to reciprocal sanctions, resulting in numerous supply and production disruptions and growing scarcity, which in turn drove up prices. The rise in prices has mainly affected raw materials imported from these two countries - gas, oil and cereals. The dependence of European countries on their energy, metals and food supplies has had a very negative impact on rising inflation.

Other measures are certainly needed to combat this inflationary crisis. The deglobalisation of the European market could contribute to this - by increasing the autonomy and independence of producers vis-à-vis raw material suppliers. The European Union authorities are looking for solutions to ensure Europe's energy independence from Russian oil and gas supplies, as well as its independence from cereal imports. In March 2022, the Commission announced a series of urgent measures to support agriculture in Europe. These include subsidies and the possibility of growing crops on set-aside land, which will enable farmers to increase their production. However, the main profiteers from the crisis remain a problem - industrialists (in

the oil sector, for example), who have increased their margins and so the price of production is more expensive. The French and Slovak governments have adopted a similar measure to prevent their profiteering. The major retail chains have capped the prices of dozens of products, thereby offering an anti-inflation guarantee. We shall see whether the measures taken have had the desired effect in the months and years ahead. We can conclude that the ECB is trying to curb inflation with a restrictive monetary policy and higher interest rates, but its tools alone are not enough in this battle. It is necessary for the other EU institutions and the governments of the individual states to intervene, using fiscal policy instruments, support programmes and subsidies for European production and agriculture, as well as trying to prevent the main profiteers of the crisis from enriching themselves through higher prices.

REFERENCES:

BLANCHARD, O. *Macroeconomics. A European perspective.* Essex: Pearson Education Limited, 2010. 586 p. ISBN 978-0-273-72800-9

BUZELAY, A. 2022. *D´un certain dogmatisme* à *plus de pragmatisme.* Supplément revue banque. ISSN 1772-6638, Décembre 2022, N°874, 82 p.

DĚDEK, O. *Doba Eura. Úspechy i nezdary společné evropské měny*. Praha: Linde, 2014. 335 p. ISBN 978-80-7201-933-5

LOCHMANOVÁ, A. *Bankovnictví – základy bankovnictví.* Prostějov: Computer Media. 2018, 108 p. ISBN 978-80-7402-305-7

MAJERČÁKOVÁ, D. *Peniaze a bankovníctvo*. Praha: Wolters Kluwer, 2018. 192 p. ISBN 978-80-7552-973-2

MISHKIN, F.S. *The economics of money, banking and financial markets.* 4th Canadian Edition. Toronto: Pearson Canada, 2011. 748 p. ISBN 978-0-321-58471-7

POVAŽANOVÁ, M. et ŠUPLATA, M. *Medzinárodné ekonomické vzťahy*. Banská Bystrica: Belanium, 2018. 187 p. ISBN 978-80-557-1425-7

STOLIČNÁ, Z. et ČERNIČKA, D. *Makroekonómia*. Krakov: Towarzystwo Slowaków w Polsce, 2019. 126 s. ISBN 978-83-8111-108-9

SYSÁKOVÁ, V. et ŠLAHOR, Ľ. *Peniaze a bankovníctvo.* Bratislava: Kartprint, 2010. 142 p. ISBN 978-80-8887-089-0

Internet sources

BANQUE DE FRANCE. *Les facilités permanentes*. [online]. banque-france.fr. 19. 03. 2019. [Consulté le 2022-12-30]. Disponible sur: <https://www.banque-france.fr/politique-monetaire/presentation-de-la-politique-monetaire/definition-de-la-politique-monetaire/les-instruments-de-politique-monetaire/les-facilites-permanentes>

BENCONT WEEKLY REPORT. *Prečo je inflačný cieľ ECB práve 2%?* [online]. bencont.sk. 2015, vol.5. [Consulté le 2023-01-11]. Disponible sur: <https://www.bencont.sk/app/cmsSiteAttachment.php?ID=17&disposition=inline>

BERNANKE, B.S. and GETLER, M. *Inside the Black Box: The Credit Channel of Monetary Policy Transmission*. [online]. Journal of Economic Perspectives. 1995. Vol.9, No 4. 27-48. [Consulté le 2023-01-11]. Disponible sur: < Inside the Black Box: The Credit Channel of Monetary Policy Transmission - American Economic Association (aeaweb.org)>

BERTIEUX, W. *Inflation: comprendre le role de la Banque Centrale Européenne.* [online]. weareclimb.fr. [Consulté le 2023-02-23]. Disponible sur: < https://www.weareclimb.fr/guides/investir-inflation/banque-centrale-europeenne>

CLIFFE, C. *Que sont les taux d´intéret négatifs et quel impact ont-ils?* [online] IG. 2016 [Consulté le 2023-01-22]. Disponible sur: <https://www.ig.com/fr/strategies-de-trading/Que-sont-les-taux-d-interet-negatifs-et-quel-impact-ont-ils-200310> CORPORATE FINANCE INSTITUTE. *Monetary Transmission Mechanism*. [online]. corporatefinanceinstitute.com. 20.12.2022. [Consulté le 2023-01-13]. Disponible sur: <https://corporatefinanceinstitute.com/resources/economics/monetary-transmission-mechanism/ >

CREEL, J. et LEVASSEUR, S. *Canaux de transmission de la politique monétaire dans l´UE: Le cas de trois nouveaux entrants.* [online]. Revue Economique. 2006. 57 (4), p.882. [Consulté le 2023-01-04]. Disponible sur: https://hal-sciencespo.archives-ouvertes.fr/hal-03471868/document%3E

CURRY, B. et JACKSON, A.L. *Quantitative easing explained*. [online]. Forbes. 19. 01. 2022. [Consulté le 2023-01-21]. Disponible sur: <https://www.forbes.com/advisor/investing/quantitative-easing-qe/>

DAUZAT, F. M., PALLUET, A. *Le taux d´inflation en Europe.* [online]. touteleurope.eu. [Consulté le 2023-02-20]. Disponible sur: <https://www.touteleurope.eu/economie-et-social/le-taux-d-inflation-en-europe/>

EUROPEAN CENTRAL BANK. *Monetary Developments in the Euro Area*. [online]. ecb.europa.eu. [Consulté le 2023-04-01]. Disponible sur: <https://www.ecb.europa.eu/press/pr/stats/md/html/index.fr.html>

EUROPEAN CENTRAL BANK. *Monetary policy decisions*. [online]. ecb.europa.eu. [Consulté le 2023-01-04]. Disponible sur: <https://www.ecb.europa.eu/mopo/decisions/html/index.fr.html>

EUROPEAN CENTRAL BANK. *Monthly Bulletin. 10th Anniversary of the ECB*. [online]. Frankfurt am Main: European Central Bank, 2008. 155 p. ISSN 1725-2822. Disponible sur: < https://www.ecb.europa.eu/pub/pdf/other/10thanniversaryoftheecbmb200806en.pdf>

EUROPEAN CENTRAL BANK. *Strategy*. [online]. ecb.europa.eu. [Consulté le 2023-01-25]. Disponible sur: https://www.ecb.europa.eu/mopo/strategy/html/index.sk.html

EUROPEAN CENTRAL BANK. *Transmission mechanism of monetary policy*. [online]. ecb.europa.eu. [Consulté le 2022-12-30]. Disponible sur: <https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html>

EUROPEAN PARLIAMENT. *A decade on from the crisis.* [online]. europa.eu. [Consulté le 2023-02-10]. Disponible sur: <A decade on from the crisis (europa.eu) >

EUROSTAT. [online]. Analyse personnelle de données. Disponible sur: <https://ec.europa.eu/eurostat/web/main/home>

FAVERO, C.A. et GIAVAZZI, F. *La transmission de la politique monétaire dans la zone euro*. [online]. europarl.europa.eu. Série affaires économiques. 01/2001. ECON 110 FR/rév.1, [Consulté le 2023-01-03]. Disponible sur: < https://www.europarl.europa.eu/workingpapers/econ/pdf/110rev_fr.pdf>

FRIEDMAN, B.M. *Monetary Policy*. [online]. NBER Working Paper No. 8057. December 2000. [Consulté le 2022-12-27]. Disponible sur: http://www.nber.org/papers/w8057

GLOBALNEWS. *Inflácia v eurozóne bola v októbri opäť rekordná vzrástla na 10.7 percenta*. [online]. Globalnews. [Consulté le 01-05-2022]. Disponible sur: https://globalnews.sk/uvodslider/inflacia-v-eurozone-bola-v-oktobri-opat-rekordna-vzrastla-na-107-percenta/

GLOBAL RATES. *Inflation Europe (HICP).* [online]. global-rates. [Consulté le 2023-02-23]. Disponible sur: < https://www.global-rates.com/en/economic-indicators/inflation/consumer-prices/hicp/eurozone.aspx >

INSTITUTO NACIONAL DE ESTADÍSTICA. *Harmonised Index of Consumer Prices (HICP).* [online]. ine.es. [Consulté le 2023-01-10]. Disponible sur: https://www.ine.es/en/prensa/ipca_prensa_en.htm

LA BANQUE CENTRALE EUROPÉENNE. *Cinq choses à savoir sur le traité de Maastricht*. [online]. ecb.europa.eu. [Consulté le 2023-01-03]. Disponible sur: https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/25_years_maastricht.sk.html

LA BANQUE CENTRALE EUROPÉENNE. *Conseil des gouverneurs*. [online]. ecb.europa.eu. [Consulté le 2023-01-04]. Disponible sur: <https://www.ecb.europa.eu/ecb/orga/decisions/govc/html/index.fr.html>

LA BANQUE CENTRALE EUROPÉENNE. *Décisions de politique monétaire du 15 décembre 2022.* [online]. ecb.europa.eu. [Consulté le 2023-02-25]. Disponible sur: < https://www.ecb.europa.eu/press/pr/date/2022/html/ecb.mp221215~f3461d7b6e.fr.html>

LA BANQUE CENTRALE EUROPÉENNE. *Le taux d´intérêt négatif de la BCE.* [online]. ecb.europa.eu. 28.07. 2022. [Consulté le 2023-01-22]. Disponible sur : <https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/why-negative-interest-rate.fr.html>

LA BANQUE CENTRALE EUROPÉENNE. *Que sont les réserves obligatoires?* [online]. ecb.europa.eu. 11.08.2016. [Consulté le 2023-01-21]. Disponible sur: <https://www.ecb.europa.eu/ecb/educational/explainers/tell-me/html/minimum_reserve_req.sk.html>

LISSAC, P. *Inflation: qu´est-ce que c´est? Et pourquoi les choses deviennent-elles plus chères?* [online]. bbc.com. 15.08.2022. [Consulté le 2023-01-09]. Disponible sur: https://www.bbc.com/afrique/monde-62633262

NÁRODNÁ BANKA SLOVENSKA. *Rámec menovej politiky.* [online]. nbs.sk. [Consulté le 2022-12-28]. Disponible sur: <https://nbs.sk/menova-politika/ramec-menovej-politiky/> OECD. *Eurosystem.* [online]. stats.oecd.org. [Consulté le 2023-01-05]. Disponible sur: <https://stats.oecd.org/glossary/detail.asp?ID=3024>

ONER, C. *Inflation: Prices on the rise*. [online]. imf.org. [Consulté le 2023-01-09]. Disponible sur: <https://www.imf.org/en/Publications/fandd/issues/Series/Back-to-Basics/Inflation>

SCHELLER, H. K. *La Banque centrale européenne: histoire, rôle et fonctions* [online]. Francfort: Banque Centrale Européenne. 2006. 229 p. ISSN 978-92-899-0028-7. Disponible sur: <https://www.ecb.europa.eu/pub/pdf/other/ecbhistoryrolefunctions2006fr.pdf>

STATISTA. [online]. Analyse personnelle de données. Disponible sur: <https://www.statista.com/>

TREND. *Eurozóna aj EÚ sa prepadli do deflácie.* [online]. trend.sk. [Consulté le 2023-02-20]. Disponible sur: < Eurozóna aj EÚ sa prepadli do deflácie | TREND>

THE ECONOMY AND INFLATION RATE OF THE SLOVAK REPUBLIC

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Abstract: Slovakia has a small and open economy dependent on the economic development in the European Union. The beginning of the pandemics Covid – 19 had a negative impact on the economy of Slovakia and all the European Union similarly. The world's economy is getting back quickly on the pre-pandemic level of economic performance, and it is predicted the same for the second half of the year 2022. The return of the Slovak economy to the pre-pandemic level was predicted at the beginning of 2022, but the inflation and energy crisis slowed it down. The Slovak economy will be slowed by the third wave of inflation and pandemics and the lack of components what will have an impact in the export. Economic factors that act in Slovakia as for instance foreign investments and business activities, have many positive effects on the growth of economy, as well as on the development of the standard of living and on the Slovak state as an entity.

Key words: economic growth, business environment, GDP, investments, employment, the Slovak Republic.

INTRODUCTION

Global pandemics brought up the crisis that from the beginning did not have the significant impact on the Slovak economy and the financial sector. The Eurozone countries fell into recession in 2020 because of the influence of the global pandemic, economic and at the same time financial crisis. This fact was reflected in the development of GDP, unemployment, consumer prices and other indicators. Slovakia dared to resist to pandemics relatively well and the industrial production was able to adapt quickly and function also in these conditions. Slovakia has a small and open economy dependent on the economic development in the European Union. The economy of Slovakia was growing constantly in years 2010-2020. The Slovak economy is dependent on the industry where almost 800,000 people work.

Analysis of macroeconomic indicators of Slovak Republic can be divided into analysis of:
• GDP
• Inflation
• Unemployment
• Foreign Trade

The growth of economy should grow significantly in 2022 (graph no.1). The growth of GDP of Slovakia improved significantly in 2021 in comparison with the pandemic year 2020, and it grew annually to 4.43%. The main reason that GDP will not grow in 2022 is the expected third wave of pandemics, the lack of components in industry that will reflect in export and faster growth of labour productivity.

Slovakia: Growth rate of the real gross domestic product (GDP) from 2017 to 2027

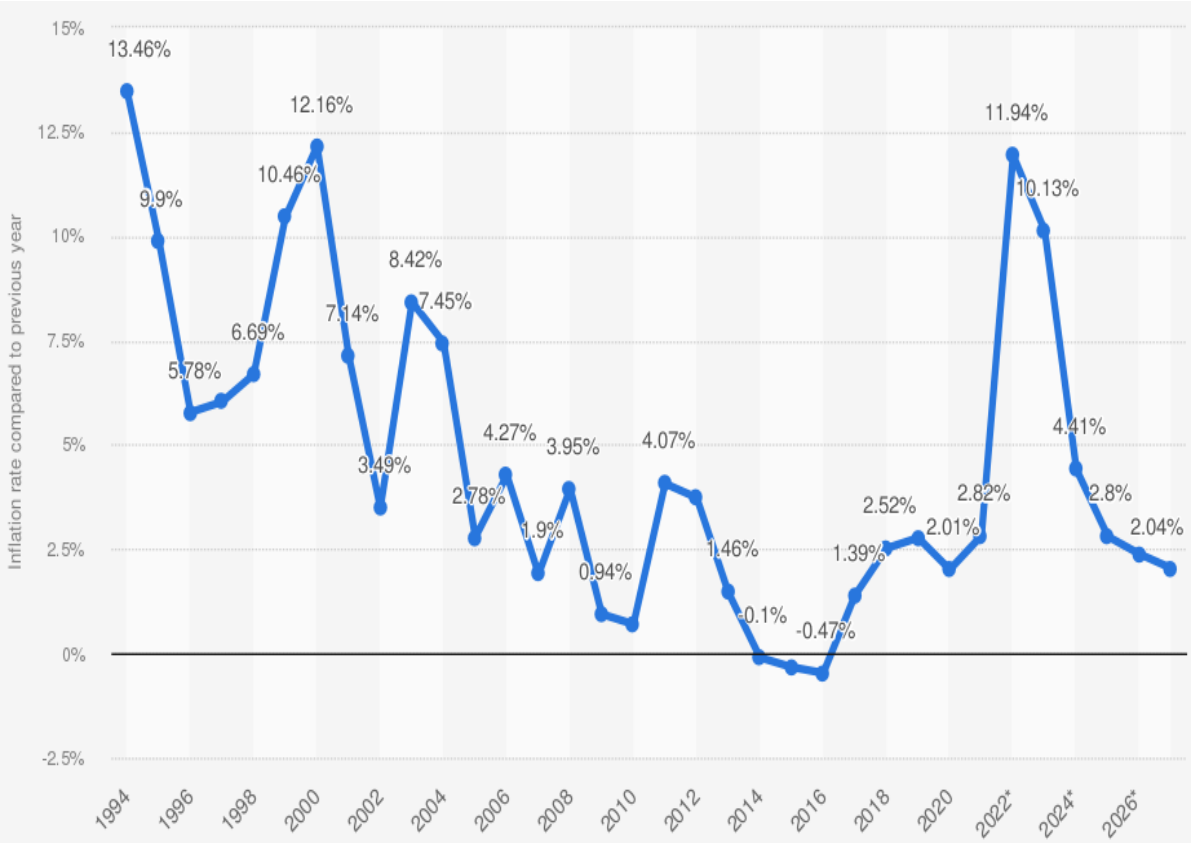
Source: IMF. (April 19, 2022). Slovakia: Growth rate of the real gross domestic product (GDP) from 2017 to 2027 (compared to the previous year) [Graph]. In *Statista*. Retrieved November 14, 2022, from https://www.statista.com/statistics/375270/gross-domestic-product-gdp-growth-rate-in-slovakia/

The growth of the real gross domestic product in Slovakia was forecast to increase between 2023 and 2028 by in total 1.4 percentage points. This overall increase does not happen continuously, notably not in 2026 and 2027. The growth is estimated to amount to 2.7 percent in 2028. While the growth was forecast to increase significant in the next years, the increase will slow down in the future.

Inflation

In 2022 higher inflation is expected. The growth of prices in the Slovak economy was in 2021 2.36%, what is 0.41% less than in 2020. In 2021 faster growth of prices of energies and food could be seen mainly because of the increasing final prices of goods and services. It is predicted that the growth of prices of electricity, gas, fuel, and heating could reach 13% in January and gas 10% what represents inflation risk for the price development in 2022 till 2023.

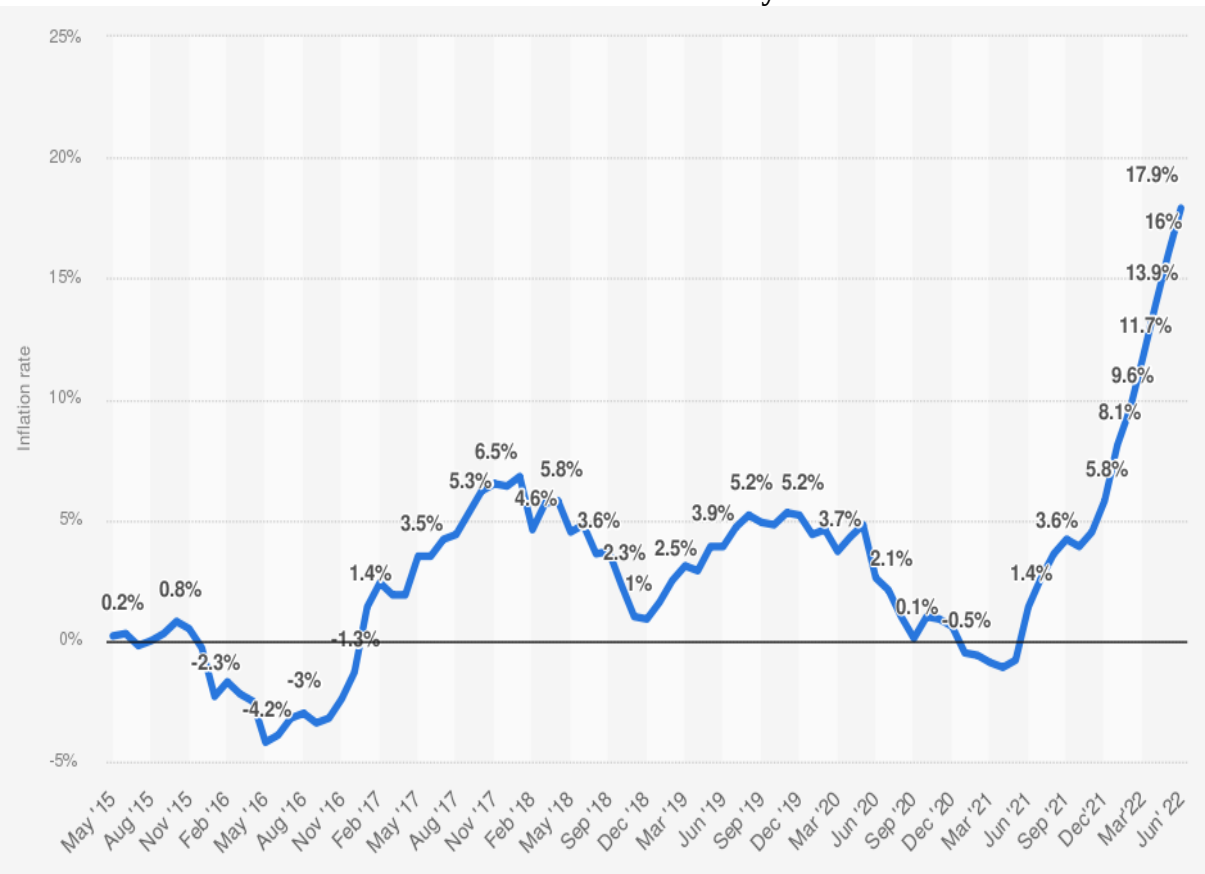
Slovakia: Inflation rate from 1992 to 2027



Source: IMF, & World Bank. (April 19, 2022). Slovakia: Inflation rate from 1992 to 2027 (compared to the previous year) [Graph]. In *Statista*. Retrieved November 14, 2022, from https://www.statista.com/statistics/375275/inflation-rate-in-slovakia/

The average inflation rate of Slovakia was forecast to continuously decrease between 2022 and 2027 by in total 9.9 percentage points. The average inflation rate is estimated to amount to 2.04 percent in 2027.

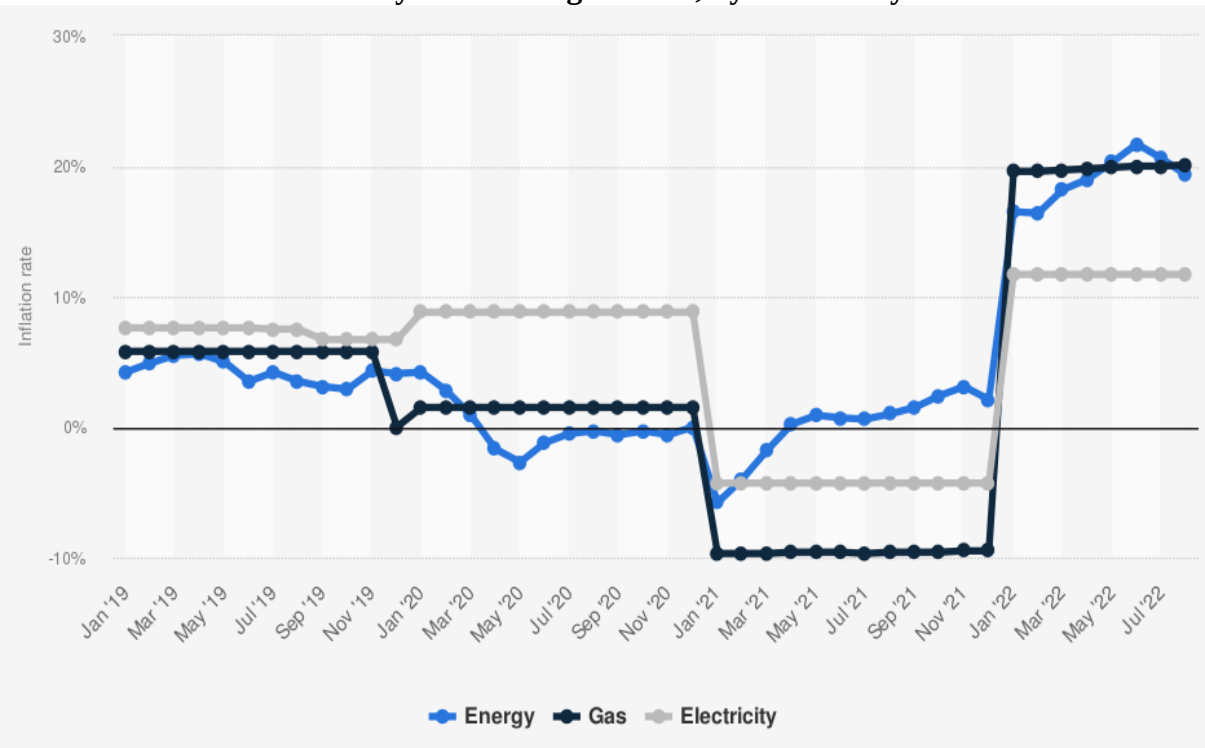
Inflation rate for food in Slovakia from May 2015 to June 2022



Source: Trading Economics. (August 2, 2022). Inflation rate for food in Slovakia from May 2015 to June 2022 [Graph]. In *Statista*. Retrieved November 14, 2022, from https://www.statista.com/statistics/537938/inflation-rate-food-in-slovakia/

In June 2022, the inflation rate for food in Slovakia was at 17.9. In comparison to the same month of the previous year, the cost of food increased by 16.5 percent. In Slovakia food Inflation is reported by the Statistical Office of the Slovak Republic.

Harmonized index of consumer prices (HICP) energy inflation rate in Slovakia from January 2019 to August 2022, by commodity



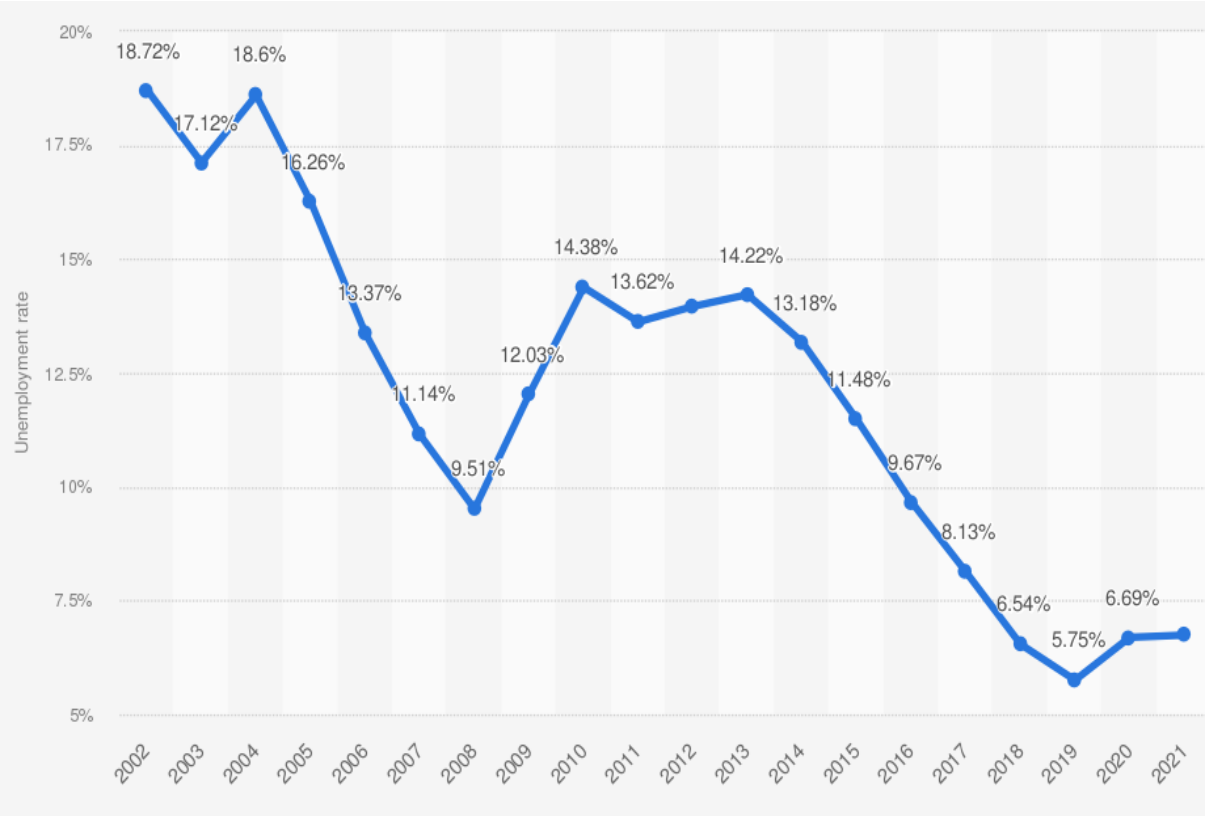
Source: Eurostat. (September 30, 2022). Harmonized index of consumer prices (HICP) energy inflation rate in Slovakia from January 2019 to August 2022, by commodity [Graph]. In Statista. Retrieved November 14, 2022, from https://www.statista.com/statistics/1329487/slovakia-energy-inflation-rate-by-commodity/

Energy commodity price inflation in Slovakia has fluctuated in the period of consideration, with rates rising significantly in 2022. Gas prices saw the highest inflation hike, with the annual change standing at 20.1 percent in August 2022. These increases in inflation were driven further by Russia's invasion of Ukraine, which has caused uncertainty over Europe's security of gas supply, as well as intense energy price volatility.

Unemployment

The slow-down of economic activity should also stifle the growth of unemployment. It is predicted in 2022 that companies will begin to fulfil open job positions very fast. Situation on the labour market should improve with the finish of the third wave of pandemics, fast growth of salaries and solutions of issues with the lack of components.

Slovakia: Unemployment rate from 1999 to 2021



Source:World Bank. (September 15, 2022). Slovakia: Unemployment rate from 2002 to 2021 [Graph]. In *Statista*. Retrieved November 14, 2022, from https://www.statista.com/statistics/375276/unemployment-rate-in-slovakia/

This statistic shows the unemployment rate in Slovakia from 1999 to 2021. In 2021, the unemployment rate in Slovakia was at approximately 6.79 percent.

Investment - foreign direct investment in the territory (sectoral and territorial structure)
Economic factors that act in Slovakia as foreign investments and business activities, have many positive effects on the growth of economy, as well as on the development of the standard of living and the Slovak state as an entity.
Foreign direct investment (FDI) in the Slovak Republic reached at the end of 2020, the value of 51 billion Euro. FDI directed primarily to manufacturing (36%), finance and insurance (25%), wholesale and retail (9%), real estate (7%), administrative and support services (7%), information and communication technologies (6%).

Within production, FDI are primarily directed in following sectors (Trading Economics, 2021):

- engineering and automotive (Volkswagen, PSA Peugeot Citroen, Kia Motors, Jaguar Land Rover)

- electrical industry (Samsung, Foxconn, Whirlpool)
- petrochemical and chemical industry (MOL Group, Continental, Agrofert Holding, BASF)
- metallurgy (US Steel, ArcelorMittal, Nemak)
- energy (energy and industrial Holding, Enel, E.ON)
- food and beverages (Heineken, Nestlé, Meggle).

Foreign direct investments in Slovak Republic are coming from various countries that are presented in Table 1.

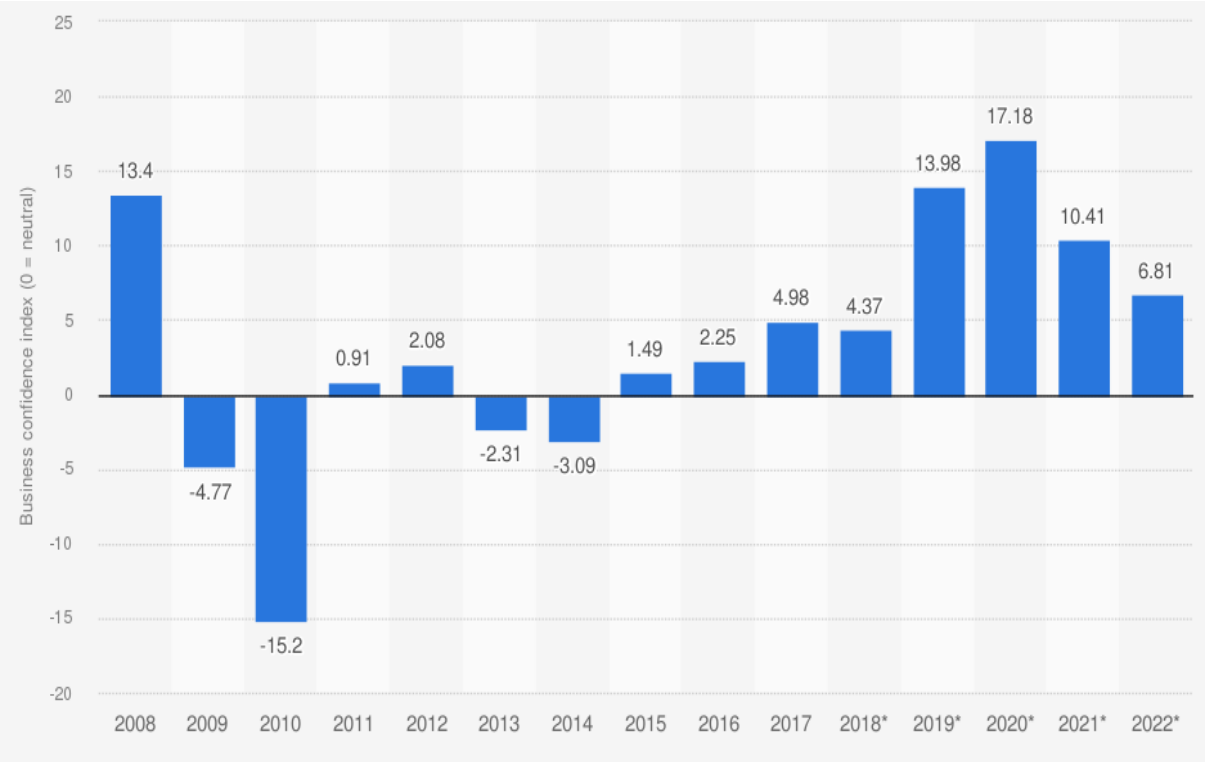
Table 1: Overview of foreign direct investments in the Slovak Republic per countries

Country	Euro	Company
Austria	6.08 billion	Erste Group, Glock, MIBA, Michatek, OMV, ZKW
Czech Republic	5 billion	Agrofert, PPF, Plzensky Prazdroj, Hamé, Czech arsenal, Czechoslovak Group, Charvát Group, TTS Trebic, CEZ Esco
Luxembourg	3.43 billion	ArcelorMittal Gonvarri SSC
Germany	2.97	Volkswagen, Continental, Hella, Osram, Siemens, Deutsche Telecom, T-Systems, Vaillant
South Korea	2.95	Kia Motors, Hyundai Dymos, Mobis, Samsung Electronics, Yura, Hanon Systems
Hungary	2.65	MOL Group
Belgium	2.42	Aspel, Bekaert, Carmeuse, Deltrian, Fremach, Plastiflex
Italy	2.19	Enel, Magneti Marelli, Mevis, Lombardini
United Kingdom	1.09	Jaguar Land Rover, Tesco, GlaxoSmithKline, KMF
Sweden	915 mil.	Ericsson, IKEA, Lindab, Dometic
France	914 mil.	PSA Peugeot Citroen, Alcatel-Lucent, Orange, Treves
Spain	726 mil.	Nemak, Grupo Antolin, CIKAUTXO, Cortizo, Fagor
Switzerland	619 miles.	ABB, Enics, Lafarge, Holcim, Nestlé, Nexis, Novartis, Schindler, Swiss Re
USA	300 mil.	US Steel, Whirlpool, Johnson Controls, IBM, Honeywell, Lear Corporation, Accenture, Amazon
Japan	105 mil.	Minebea, Asahi, Panasonic, Sanyo, Akebono, U-Shin

Source: Trading Economics (2021)

We can say that in 2022 and 2023, the fast growth of economy will help to start new investments. The decrease of real interest rates will be the benefit for the private investments. The huge package of resources from EU from the recovery programme will also help.

Annual business confidence index for the industrial sector Slovakia 2008-2022



Source: Statista. (April 9, 2018). Annual business confidence index for the industrial sector in Slovakia from 2008 to 2022 (0 = neutral) [Graph]. In *Statista*. Retrieved December 02, 2021, from https://www.statista.com/statistics/370764/slovakia-industrial-sector-business-confidence-index/

This statistic shows the business confidence index for the industrial sector in Slovakia from 2008 to 2017, with projections up until 2022. In 2017, the confidence index for the Slovakian industry ranged at approximately 4.98 index points, indicating an increase in business confidence.

Business activity in Slovakia during the pandemics -COVID-19

The year 2020 was one of the worst ones for the business environment in the history of modern Slovakia because of the pandemics - COVID-19. Slovakia provided more types of help to businessmen to mitigate the economic impact of the pandemics and it was: different financial contributions, changes in taxes, customs duties and deadlines, temporary protection of businessmen, changes in deadlines for paying taxes, subsidies for rents, loan programmes and guarantees in bank field and budget rules.

Objectives of Ministry of Economy of Slovakia in next years[1]

The policy statement of the government of Slovakia (hereinafter „PSG SR) indicates different brave objectives and tasks. Ministry of Economy of Slovakia has an ambition to fulfil all of them. The following performances should contribute to improvement of business environment in Slovakia:

1. To realize measures to start again convergency.
2. To participate and actively submit proposals for the improvement of legislation influencing business environment (tax system, labour law, etc.).
3. To propose travelling map with the aim to reach improvement of Slovakia in ladders and to determinate priority fields. To amend indexes of economic freedom into followed ladders. To reach improvement of score of Slovakia in the most popular ladders.
4. To support engagement of Slovak companies in sub-suppliers' chains.
5. To participate in the preparation of legislative proposal to implement universal free trade license.
6. To propose simplified forms for entrepreneurship of pupils and students which would be possible to use in the support of entrepreneurial education and practice under the Euro funds.
7. To realize measures for the support of family entrepreneurship and to take necessary steps with the aim to create positive business environment for family entrepreneurship, mainly so-called generation change or employment of family members.
8. To participate in the preparation of intelligent specialization strategy (RIS3) for the programming period 2021 – 2027, which will bring not only detailed mapping of the relevant aspects of economy development, but it will also determine the main fields of competitive advantage and supporting tools.
9. To carry out the audit of fee burden in entrepreneurship.
10. To carry out the audit of report and accounts under PSG SR. To reassess particularly the requested data and the system of collection of statistic data about entrepreneurship.
11. To carry out the proposal about the protection of a consumer that has its aim to make clearer and to modernize legislation, to remove duplicities and uncertainties, as the new act should absorb the provisions from three present regulations and to transpose some consumer directives and regulations.
12. To carry out draft act about general security of products, that has its aim to make clearer and to modernize legislation, to remove duplicities and uncertainties, as the new act should absorb the provisions from two present regulations.
13. To carry out the analysis of suitability and adequacy of Act on advertising mainly because of the advertising aimed on the groups like children, teenagers, and seniors. To propose the solutions under PSG SR.
14. To carry out the proposal of amendment to Act about holiday packagesas it is about the wide regulation with the aim to carry out detailed and complex consultations with all involved subjects and the revision of the mentioned Act.

[1]MSP na Slovensku - Správa o stave podnikateľského prostredia v Slovenskej republike

CONCLUSION

The strategy of economic policy of Slovakia till 2030 should bring the improvement of business environment with the main objective and priority to actively search for and gain new investors, to create effective and systematic tool for the help to enterprises by implementing new technologies, business models and scientific activities. Future digitization fundamentally changes the nature of industry and has significant impacts on other parts of the economy and society. We can consider innovation as one of the key areas for the economic growth and competitiveness of businesses, regions and, consequently, the economy of the state as such, whilst The Slovak Republic is lagging long term in terms of innovation performance.

LITERATURE

1. Statista - The Statistics Portal (2019). Retrieved April 27, 2019, from:https://www.statista.com/statistics/375270/gross-domestic-product-gdp-growth-rate-in-slovakia/
2. Statista - The Statistics Portal (2019). Retrieved April 27, 2019, from https://www.statista.com/statistics/375275/inflation-rate-in-slovakia/.
3. Statista - The Statistics Portal (2019). Retrieved April 27, 2019, from https://www.statista.com/statistics/370764/slovakia-industrial-sector-business-confidence-index/
4. Trading Economics (2021). Retrieved September 27, 2021, from https://tradingeconomics.com/slovakia/foreign-direct-investment

THE IMPORTANCE OF MEASUREMENT RESULTS IN BUSINESS SUCCESS

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Abstract: The basis for making a decision about the quality of the process or product is the result of the measurement. Emphasizing the importance of credibility of measurement results is of crucial importance and this is recognized in many business improvement strategies. It is common knowledge that if something cannot be measured, it cannot be controlled or improved. The quality of measurement results must be assessed because it is the basis of cognition, decision-making, management and has an active role in quality improvement actions. This paper will provide an overview of the state of techniques and methods for evaluating the quality of measurement results both in laboratory analyzes and in industrial practice.
Keywords: measurement results, measurement uncertainty, measurement systems analysis, repeatability, reproducibility.

1.0 INTRODUCTION

Collection and analysis of measurement results are fundamental activities for science, engineering, and business improvement strategies. The result of the measurement is the fact that caries information, from which, knowledge about something is obtained, based on which management and decisions are made and on base that is being improved. To obtain measurement results, it is necessary to conduct an observation, testing, experiment, and/or survey and with the help of certain means, mostly measuring instruments, perform a measurement process to obtain quantitative or qualitative knowledge about it. However, no measurement process is ideal. The measurement result will always be different from true, real, or accurate results. In a word, each measurement result will possess measurement error. Therefore, special attention should be focused on the quality of the measurement results because it gives a new value [1]. The problem is that all decisions based on poor-quality measurement results will be wrong. Products delivered to customers will have defects, decision-making strategies will be misguided, and the quality of business will be at a minimum. A measurement error in production is impossible to determine because the actual value of the measured quantity is always unknown. Only in the case of measurement reference work items (standards), it is possible to determine the measurement error. An alternative for the determination of measurement quality is an assessment of measurement uncertainty [2].

Many international standards dictate that the measurement uncertainty must be assessed along with the measurement result and that it is only, in that case, the measurement result is complete. However, the estimated measurement uncertainty is an extremely complex task, especially for the industry, because it requires a lot of knowledge and time which, rapidly developing companies cannot afford. The estimation of measurement uncertainty mostly

remained within the framework of calibration laboratories and the measuring instruments used in companies must be controlled by an authorized accreditation body, i.e. to be calibrated [3].

The calibration system is a set of operations that establish, under specific conditions, the connection between the measuring instrument and the traceable standard of a known reference value and uncertainties [4].
Calibration also includes steps for detection, correlation, reporting, or eliminating, through adjustment, any discrepancy in the accuracy of the measuring instrument that compares. The calibration system maintains the metrological traceability of the measuring system by using the calibration methods and standards. Traceability is a chain of calibration actions that originate from the calibration standard of the corresponding metrological capability or measurement uncertainty. Every calibration operation includes all necessary elements including standards, measurement, and equipment to be verified, calibration methods and procedures, records, and qualified personnel. Calibration procedures are conducted in a strictly controlled environment in metrology laboratories where the personnel strictly sticks to the prescribed standards. Measurement conditions in production companies are generally far less favorable than the conditions under which calibration is conducted at measurement laboratories. Therefore, for the same measurement instrument, the measurement uncertainty estimated in the controlled environment, during the calibration process, in the measurement laboratory cannot be used in the production environment.

Also, it is obvious that there is a lot of variability during the measurement process from the calibration process of the same measuring instrument and often two consecutive measurements, which are taken out by the same operator with the same measuring instrument, measuring the same work piece and under the same conditions, have different values. The measurement process is a combination of people, equipment, materials, methods, analysis, and decisions made on measurement results. All measuring systems have a level of uncertainty associated with them due to variability in the factors listed. Especially a major problem is when the variability of the measurement system "conceals" the variability which comes from the production process and in that case, every decision made based on the measurement results will be incorrect.

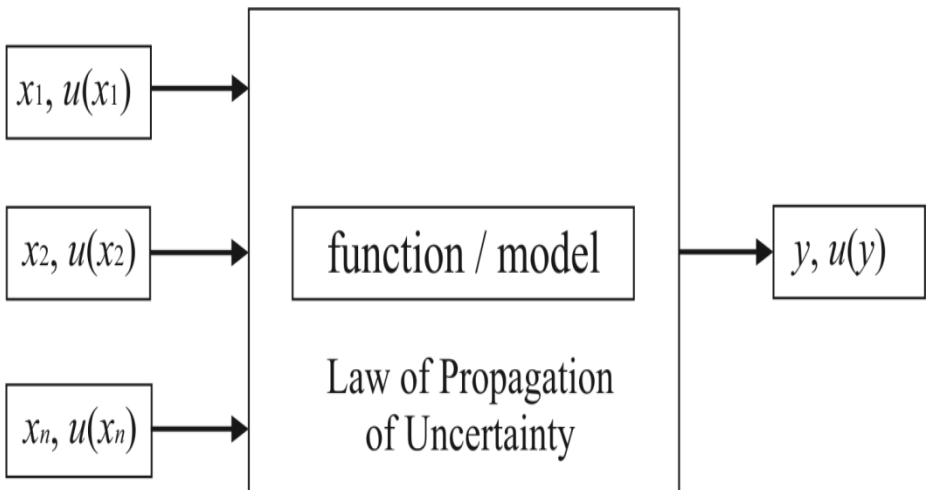
Measurement systems analysis (MSA) is one of the most important quality tools and is used to evaluate the variability of measurement systems used under normal operating conditions. MSA plays an important role in implementing the 6σ methodology and ISO/TS 16949:2009 standards for assessment of the reliability of input and output data in the production process, assessment of variability caused by operators, machines, methods, materials, environment, and data analysis for process improvement. MSA is a method of identifying the level of variability of the whole system to determine whether the measuring system is fit for its intended use. In other words, the level of variation in the measurements is not significant for the measured quality characteristic.

This paper provides an overview of the situation in the field of quality assessment of measurement results. Special reference will be given to the assessment of measurement uncertainty and the repeatability and reproducibility studies of the measuring instrument.

2.0 MEASUREMENT UNCERTAINTY

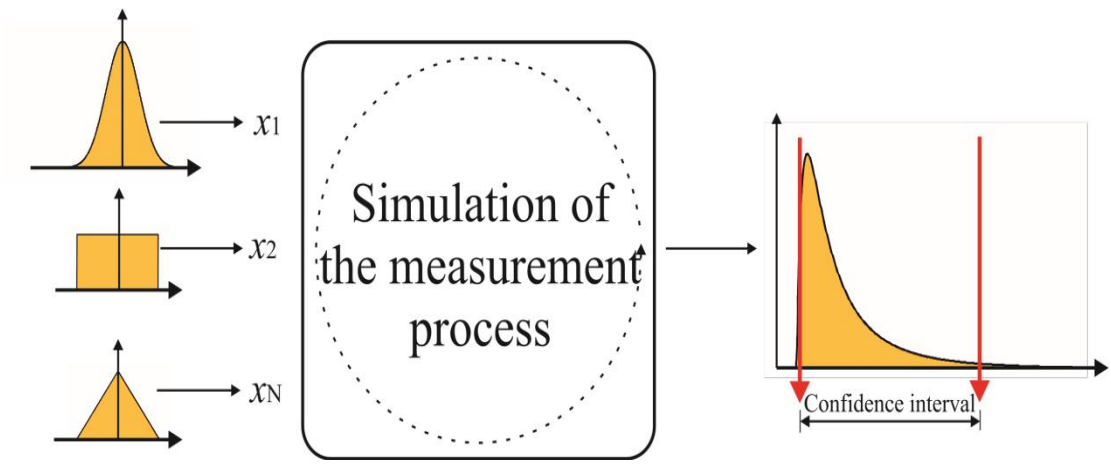
To obtain complete metrological information, the measurement result must contain the value of measurement uncertainty. Measurement uncertainty describes the dispersion of the measurement results which should include the effects of as many uncertainty components as possible in the measurement system. The inclusion of all components, especially with complex measuring systems, is frequently impossible [5].
The GUM method (Guide for the Expression of Measurement Uncertainty), the Monte Carlo method, and the Bayesian method. GUM method for calculation of uncertainty requires the application of the law of propagation of measurement uncertainty and prediction of the output size by a certain distribution to calculate the interval coverage. Information for the A-type and B-type measurement uncertainty components used in the calculation of extended measurement uncertainty represents the state of knowledge related to the input quantities, Figure 1.

Figure 1. *The GUM method for determining the measurement uncertainty*



The Monte Carlo method for determining uncertainty implies the generation of random samples from prior information sharing. Based on the calculated values of the quantities of interest, the obtained distribution is used to calculate the required parameters describing this distribution and the interval confidence, Figure 2. The Bayesian method for determining uncertainty combines prior knowledge of the quantity of interest with the data obtained during the calibration procedure. From the common output distribution, the marginal output distribution is calculated to obtain the parameters that describe the distribution and confidence intervals. The practical application of measurement uncertainty is mostly reflected in two important metrological concepts - maintenance of metrological traceability according to ISO/IEC 17025:2017 and the evaluation of conformity of measurement results with tolerance limits.

Figure 2. *The Monte Carlo method for determining the measurement uncertainty*



2.1 METROLOGICAL TRACEABILITY

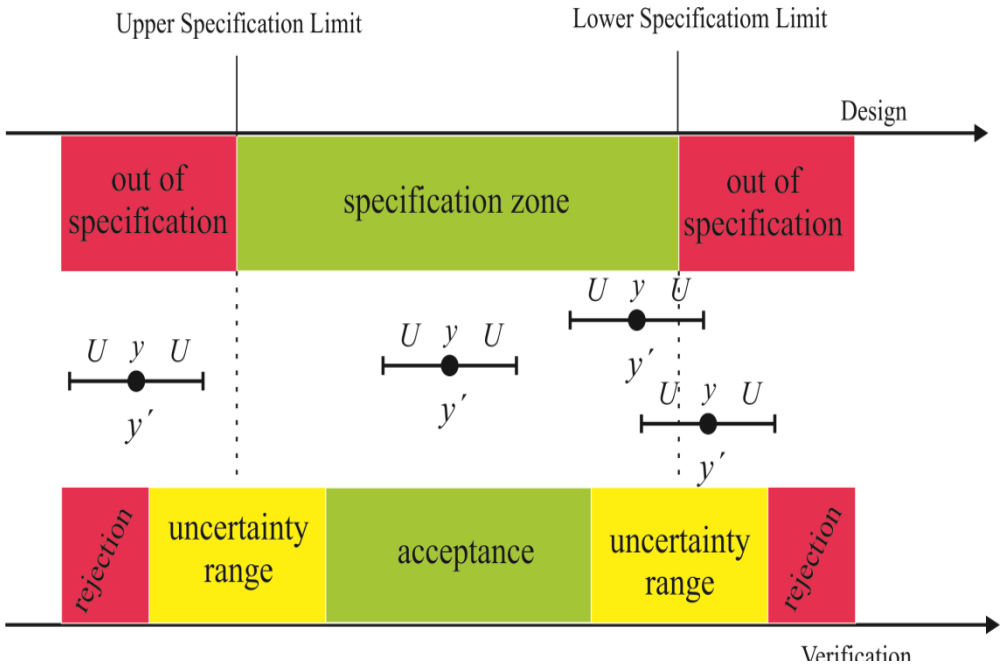
The concept of metrological traceability to the International System (SI) of units, provides consistency of measurement results with a common reference and ensures uniformity in determination of measurement uncertainty, so that a comparison can be made between laboratories and measuring instruments. Traceability establishes confidence in the validity of the measurement results applied outside laboratories or in workshops that perform measurements. The constituent elements of the system of quality management - dimensional traceability, promote trade by ensuring that suppliers meet the requirements of customers regarding the geometric specification of manufactured product parts. Metrological traceability emerged from the need to standardize industrial measurements. Traceability to the SI unit is a requirement for quality management system certification manufacturers and the accreditation of testing and calibration laboratories.

2.2 CONFORMITY WITH SPECIFICATION

Specifications represent a field of permissible deviations. When the influence of the measurement uncertainties is neglected, proving compliance or non-compliance with the specification is straightforward. The specification requirements are satisfied when the value of the measurement result is found between specification limits. When the measured value lies outside the specification limits, then there is a non-conformance to the specification. The range of possible measurement results is divided into the zone of conformity and non-conformity. In practice, however, there will always be measurement uncertainty which should be taken into account.

As a consequence of the distinction between the specification zone and the zone outside the specification, the range of uncertainty will also appear, Figure 3.

Figure 3. *Significance of measurement uncertainty in the assessment of conformity with the specification*



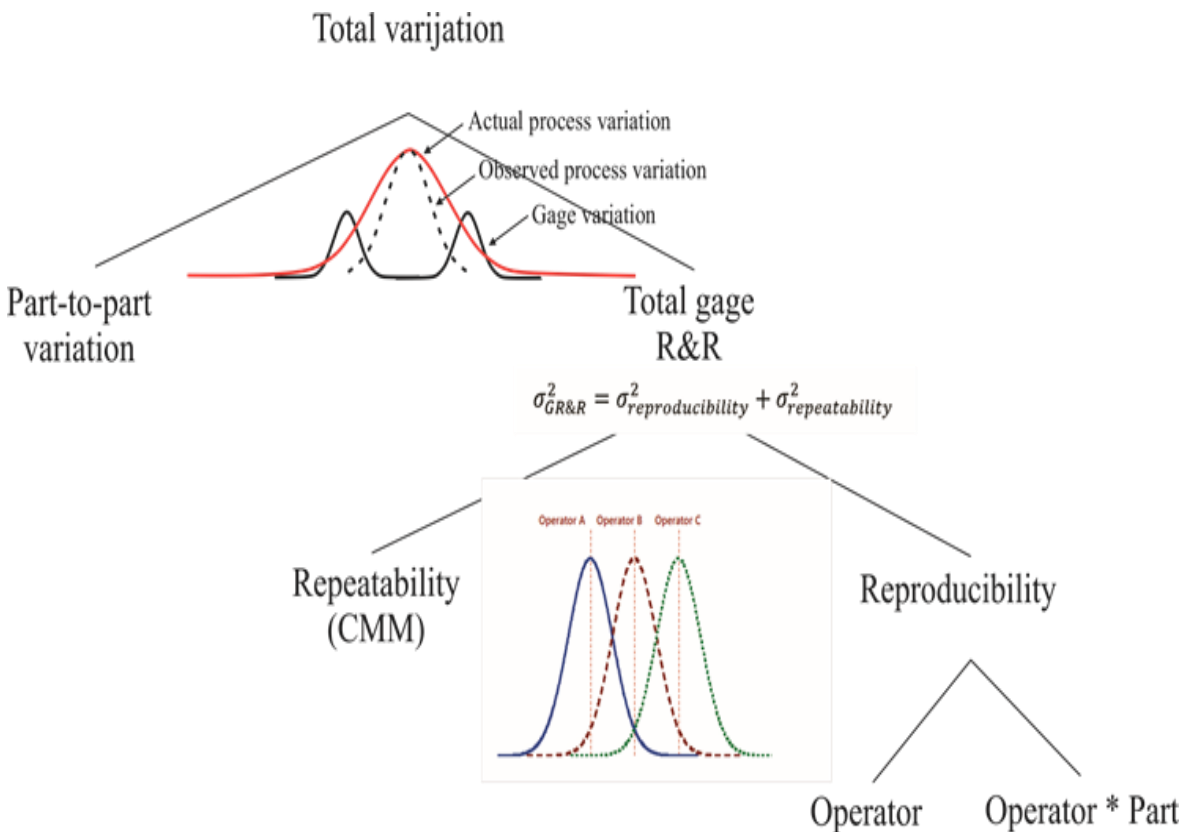
3.0 MSA - GAGE REPEATABILITY AND REPRODUCIBILITY STUDY

As mentioned, measurement uncertainty is difficult to estimate in the industry environment. MSA study is often said to be the substitution to the measurement uncertainty for the industry. Analysis of measurement systems quantifies measurement errors from various sources of variation in the process. Process variation measurements include part-to-part variation, measurement instrument variation, and induced variation by different operators (metrologists), Figure 4. Variations from part to part are deviations of a characteristic of the product caused by the imperfection of the processing procedure. Variations of measuring instrument parameters include linearity, stability, bias, and measurement variations due to imperfections of the measuring instrument obtained when measuring the characteristics of the measuring instrument (repeatability). Variations caused by metrologists are variations caused when different metrologists measure, under the same conditions and with the same measuring instrument, the same quality characteristic (reproducibility).

The study of the analysis of the measurement system includes the assessment of bias (accuracy) which includes the assessment of linearity and stability, and the standard deviation (variance) which includes repeatability and reproducibility studies (gage R&R). The MSA study aims to determine whether the used measurement system is acceptable for its intended purpose. For this purpose, the acceptance criterion of the measuring system is constructed. The criterion for the variability of the measurement system approval will depend on the percentage of variability of the production process or working tolerance items that are

"wasted" on the variation of the measurement system. Final eligibility criteria for specific measurement systems depend on the environment and purpose of the measurement system and should be following the customer's requirements.

Figure 4. *Graphical representation of the GR&R study*



3.0 CONCLUSION

The paper provides an overview of methods and techniques for assessing the quality of measurement results, which is of great importance for laying the foundations of a successful business. Anyone who processes measurement results must be aware that the result of the measurement is never accurate and that before any studies that interpret the same, some of the studies must be conducted to assess the quality of the measurement results. Often in practice, this is not the case and most people take the measurement result as information that does not need to be checked. That is why knowing the concept of measurement uncertainty and concepts in the analysis of the measurement system is necessary for continuous improvement.

LITERATURE

1. Štrbac, B. *Procena merne nesigurnosti koordinatnih mernih mašina*: monografija, Novi Sad: Fakultet tehničkih nauka, 2021, ISBN - 978-86-6022-384-7.
2. Štrbac, B., Ačko, B., Havrlišan, S., Matin, I., Savković, B. & Hadžistević, M. (2020). *Investigation of the effect of temperature and other significant factors on systematic error and measurement uncertainty in CMM measurements by applying design of experiments*. Measurement, 158, 107692
3. Štrbac, B., Rodić, D., Delić, M., Savković, B. & Hadžistević, M. (2021). *Investigation of Functional Dependency between the Characteristics of the Machining Process and Flatness Error Measured on a CMM*. Measurement Science Review, 21(6), 158-167.
4. Štrbac, B., Mikó, B., Rodić, D., Nagy, J. & Hadžistević, M. (2020). *Analysis of characteristics of non-commercial software systems for assessing flatness error by means of minimum zone method*. Tehnički vjesnik, 27(2), 535-541.
5. Radlovački, V., Hadžistević, M., Štrbac, B., Delić, M. & Kamberović, B. (2016). *Evaluating minimum zone flatness error using new method—Bundle of plains through one point*. Precision Engineering, 43, 554-562.
6. Štrbac, B., Ranisavljev, M., Zeljković, M., Knežev, M. & Hadžistević, M. (2021, May). *Supplement to the Standard VDI/DGQ 3442 with Gage R&R Study*. In International Conference "New Technologies, Development and Applications" (pp. 350-356). Cham: Springer International Publishing.

RELATIONSHIP BETWEEN MOTIVATION FACTORS AND EMPLOYMENT PROBLEM IN AGRICULTURAL ENTERPRISES

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Abstract: The goal of the paper was to discover and compare the motivational factors applied by agricultural and industrial companies, in order to determine whether the expressed problem of labor force engagement in agriculture is related to motivational factors.
A questionnaire was distributed to collect data. A quantitative method was used, and data were analyzed in MS Excel. ANOVA was used to check the significance of the data.
The results revealed that industrial companies use more motivational factors than agricultural companies. A significant difference was found between sectors in the application of non-financial motivational factors (p=0.018), but not in the application of financial motivators (p=0.48). The average percentage of application of non-financial motivational factors for agricultural enterprises was 54.01%, and for industrial enterprises 60.60%. The strongest non-financial motivational factors in industry were a safe and stable job and a modern working environment (83.33%), and in agricultural enterprises, a safe and stable job (82.35%) and praise and recognition (76.47%). There were significantly fewer opportunities for a career in agricultural (23.53%) than in industrial enterprises (66.66%), as well as for self-employment - 35.29% and 50.50%, respectively. The application of financial motivators did not differ significantly between sectors: for agricultural enterprises - 36.60%, and for industrial enterprises - 50.00%. Industrial companies paid more premiums (83.33%) and gave significantly more gifts and benefits (66.66%) compared to agricultural companies. For agricultural enterprises, the most important motivational factors were the motivating salary and allowance for transport, which was used by 58.82% of the enterprises.
All companies considered employee motivation important. Enterprises had no major problems with labor force turnover, and moderate problems were reported by agricultural enterprises.
This research showed that labor turnover is not so related to motivation. Therefore, it can be assumed that the fluctuation of the workforce in these companies is caused by some other factor.

Key words: agriculture, industry, motivation factors, workers, enterprise.

INTRODUCTION

Agricultural companies have a problem finding labor, which is especially pronounced during the season. One of the reasons is that during the last decades, rural areas have been a reservoir of labor for industry, and the migration of the population from rural areas to the city has continued to this day.
For this reason, the authors became interested in studying the motivational factors applied by agricultural enterprises, in order to determine whether the lack of motivational factors

generated the problem of the lack of workers in agriculture. The authors also wanted to examine the motivational factors offered by industrial companies. Industrial companies, for the purposes of this paper, are manufacturers of electrical installations for passenger vehicles. By comparing the motivation factors of workers in companies from two different sectors, it is possible to determine how many motivation factors and to what extent each sector applies them.

The aim of the paper was to discover and compare the motivational factors used by agricultural and industrial enterprises, in order to determine whether the pronounced problem of labor force engagement in agriculture is related to motivational factors.

Key questions that are asked:

- Do industrial companies use more motivational factors than agricultural companies?
- Which motivational factors are the most and which are the least used in the surveyed companies?
- Are there significant differences between these two sectors in terms of worker motivation?

LITERATURE REVIEW

Motivation is very important when doing work, because it greatly affects work productivity. In the work environment, motivation is understood as the will to use abilities, that is, knowledge, skills and energy to achieve a certain goal (Stanišić, 2021). Motivation is the internal state of a person, which directs action and behavior. Motivation is a person's internal will to achieve something concrete (Miljković, 2007; Tran, 2018; Locke & Schattke, 2019). Properly motivated managers, white-collar, and blue-collar workers are more efficient, which positively affects the performance and sustainability of the business (Lorincová et al., 2019). A motivated worker is cooperative, solves organizational problems, adapts to changes in the company and is ready to take on greater responsibility (Jayaweera, 2015). That is why it is very important to know how to motivate employees.

Different classifications and theories of motivation exist in the scientific literature. Motivation theories are divided into satisfaction theories and process theories. The theories of satisfaction include the theory of well-being, which refers to the satisfaction of human needs. The most famous authors of the theories of satisfaction are: Maslow, Herzberg, Alderfer, McCelland and McGregor (Pardee, 1990). Common to all theories of needs is that motivation to work is a product of the existence of a certain need. V. Vroom, J. Adams and E. Locke mostly dealt with process theories of motivation (Anselme, 2010). Vroom found that people have specific expectations for their actions. Employee motivation increases as expectations are perceived as more likely and valuable (Pariat & Bagga, 2014). According to Adams' equity theory, people compare their effort-reward relationship with themselves or with other employees who perform similar tasks and follow their reaction (Huseman et al., 1987). Locke developed the theory of goals, according to which large and specific work goals increase the level of employee motivation. By meeting goals and receiving feedback, subordinates see that they are developing, meeting standards and contributing to the growth of the company (Locke & Latham, 2006).

As for motivational factors, they are classified into financial and non-financial. The most significant financial motivators are: money as direct compensation (salary, premium and bonus). Research has shown that employees highly value salary and bonuses, and they like material rewards the most (Schreiner, 2018). This is why it is possible to reward employees with gifts (The Employer ..., 2023). Research shows that employees often leave the company

because of too low a salary (Gligorov et al., 2011). Employees can also be indirectly paid for their work. This includes vacation pay, benefits, social assistance, insurance, training, etc.

Incentives are additional benefits intended for employees in companies and are mainly related to health, transportation, food, accommodation, etc. (Hong et al., 1995). Oyer (2008) found that the relationship between benefits and employee contributions was strongest in companies that offered free food to employees.

In most cases, non-financial benefits are related to motivation. Non-monetary benefits can be a suitable job, suitable working environment, praise and recognition, flexible working hours, opportunities for career and self-development, pleasant atmosphere, opportunities to rest at work, competent management, reputation of the organization, prestige of the work position, feedback, joint events, etc. (Agbenyegah, 2019). A greater variety of non-monetary benefits ensures that the multiple needs of employees are taken into account and are more likely to be met. The motivation system tries to create conditions in which the goals of the employees coincide with the goals of the organization (Aleksić-Glišović et al., 2019).

Employee turnover describes the excessive movement of labor from one job to another. Employee turnover is not always bad, because it often brings new energy and knowledge. When the best employees leave the company, it means that changes need to be made (Zojceska, 2018; Hosen, 2022). The loss of workers can be caused by excessive stress at work, lack of benefits, change of residence, lack of career development opportunities, inflexible work schedule, incompetent management and low wages (Maertz & Kmitta, 2012). Previous research has revealed that labor force turnover is increased by a lack of career opportunities and work that does not provide the need for self-actualization (Weber, 2003). Instead, with stimulation, it is possible to reduce labor force turnover. The more benefits there are for workers, the more likely it is that their needs will be met, and they will be more in the function of productivity growth (Hosen, 2022).

MATERIAL, SAMPLE AND METHODOLOGY

Data were collected through a questionnaire. Filling out the questionnaire took about 10 minutes, and the survey was anonymous. Data were quantitatively analyzed using MS Excel.

The sample consisted of companies that were engaged in the production of agricultural raw materials and electrical installations for passenger vehicles. The companies were chosen randomly by typing the relevant keywords into the search engine.

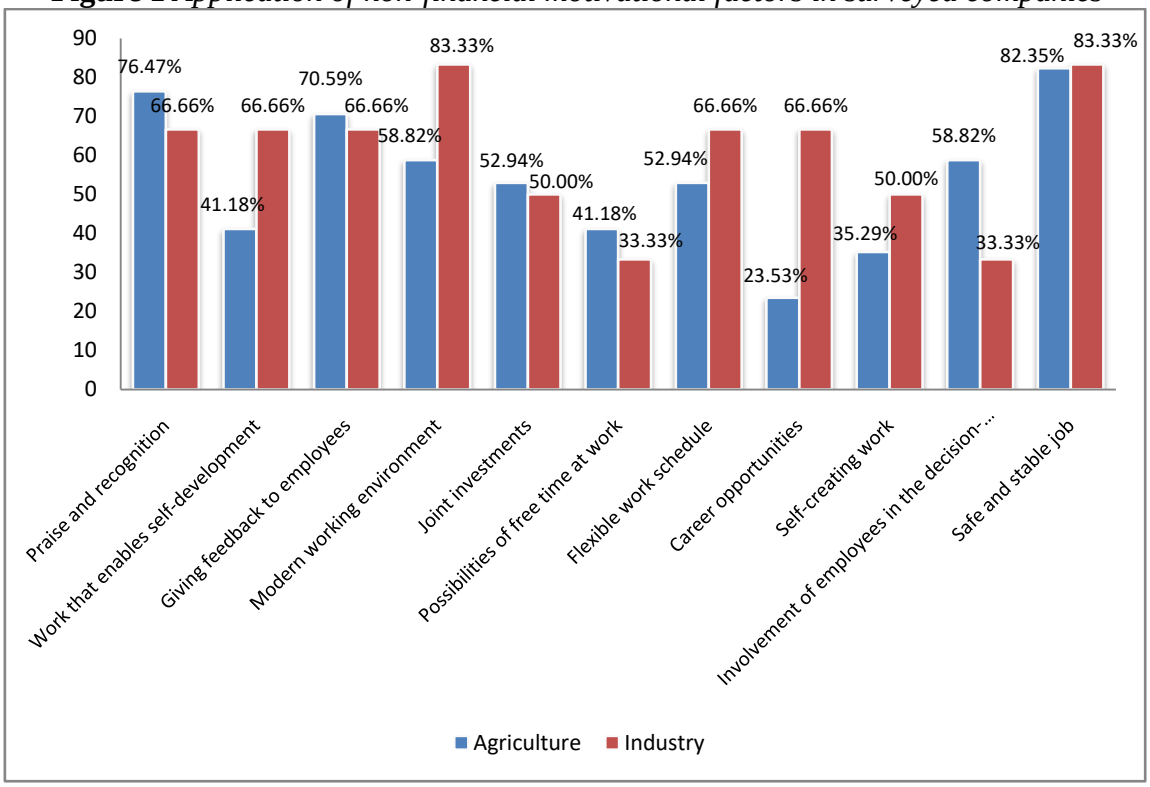
The survey was conducted online, and the companies were contacted by e-mail and telephone. An employee, representing the company, was asked to fill out the questionnaire. Contact was made with 58 agricultural and 9 industrial companies. A total of 23 companies responded, of which 17 are engaged in agriculture and 6 in the production of electrical installations for passenger vehicles. The number of companies that participated in the survey is not the same, but based on the answers, differences by sector can be pointed out. 34.3% of contacted companies responded to the survey. The survey was active from March 17, 2023. until April 06, 2023.

The significance of the results was checked using one-factor analysis of variance (ANOVA). If the p-value is less than the significance level α (0.05), there is a significant difference between the data.

RESEARCH RESULTS

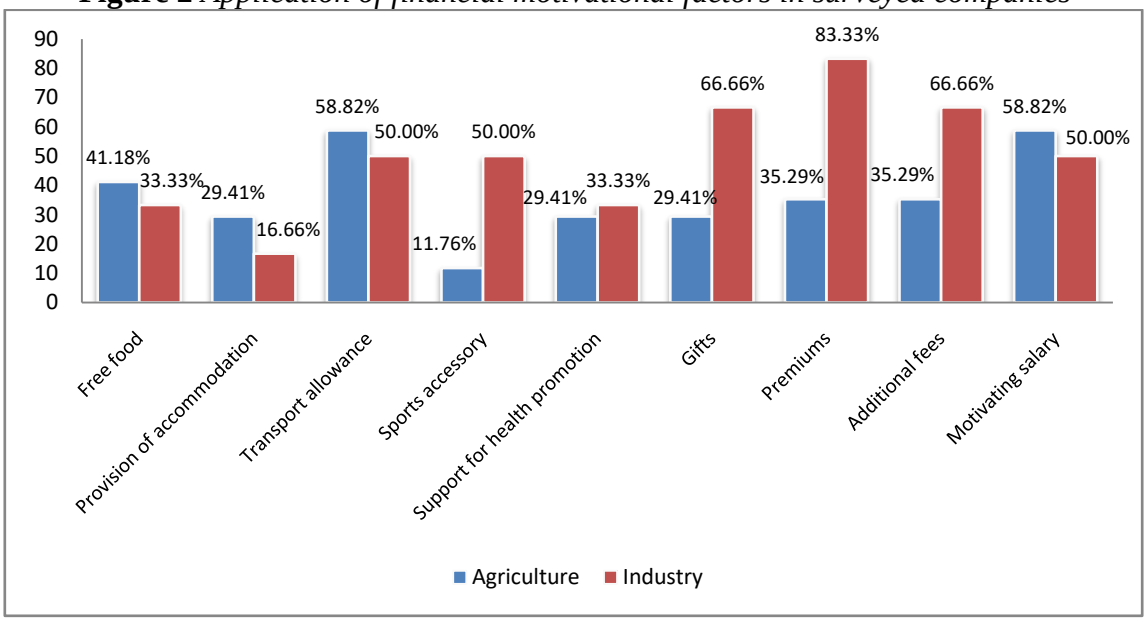
The application of non-financial motivational factors differed significantly between the two sectors (p =0.018). The average percentage of application of non-financial motivators for agricultural enterprises was 54.01%, and for industrial enterprises 60.60%. 83.33% of industrial enterprises offered their employees a safe and stable job (Figure 1). Also, a strong motivating factor in industrial companies is the modern working environment (83.33%). It turned out that secure and stable work (82.35%) and praise and recognition (76.47%) are the most popular motivational factors in agricultural enterprises. There were significantly fewer career opportunities in agricultural companies (23.53%) than in industrial companies (66.66%). Only 35.29% offered self-fulfilling work in agricultural enterprises, which is less than in industrial enterprises (50.00%).

Figure 1 *Application of non-financial motivational factors in surveyed companies*



The application of financial motivational factors did not significantly differ between sectors, because p=0.48 was higher than α=0.05. The average percentage of application of financial motivators for agricultural enterprises was 36.60, and for industrial enterprises 50.00%. Industrial companies paid more premiums (83.33%) and gave significantly more gifts and benefits (66.66%) compared to agricultural companies (Figure 2). For agricultural enterprises, the most important motivating factor was the motivating salary and transport allowance, which was used by 58.82% of the enterprises. The lowest motivating factor for industrial enterprises was the provision of accommodation (16.66%). For agricultural companies, the least used motivational factor is support for sports (11.76%).

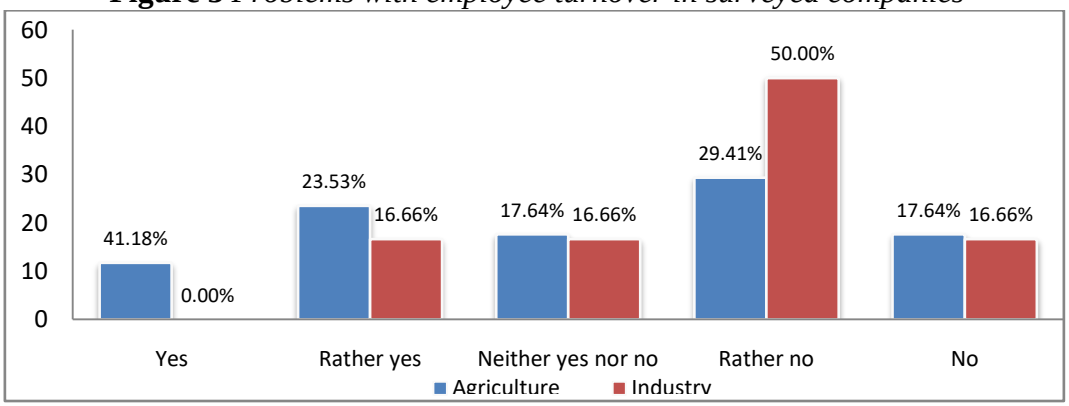
Figure 2 *Application of financial motivational factors in surveyed companies*



During the research, it was discovered that both agricultural and industrial companies consider employee motivation important. 83.33% of industrial and 47.06% of agricultural companies responded that employee motivation is important. Employee motivation was very important for 41.18% of agricultural and 16.66% of industrial enterprises. Only one agricultural company did not consider employee motivation important.

Also, the authors investigated whether companies have problems with workforce turnover (Figure 3). The most popular answer turned out to be 'rather not' and was answered by 29.41% of agricultural and 50.00% of industrial enterprises. The sample also included companies that answered that they had problems with labor turnover, and agricultural companies were more affected.

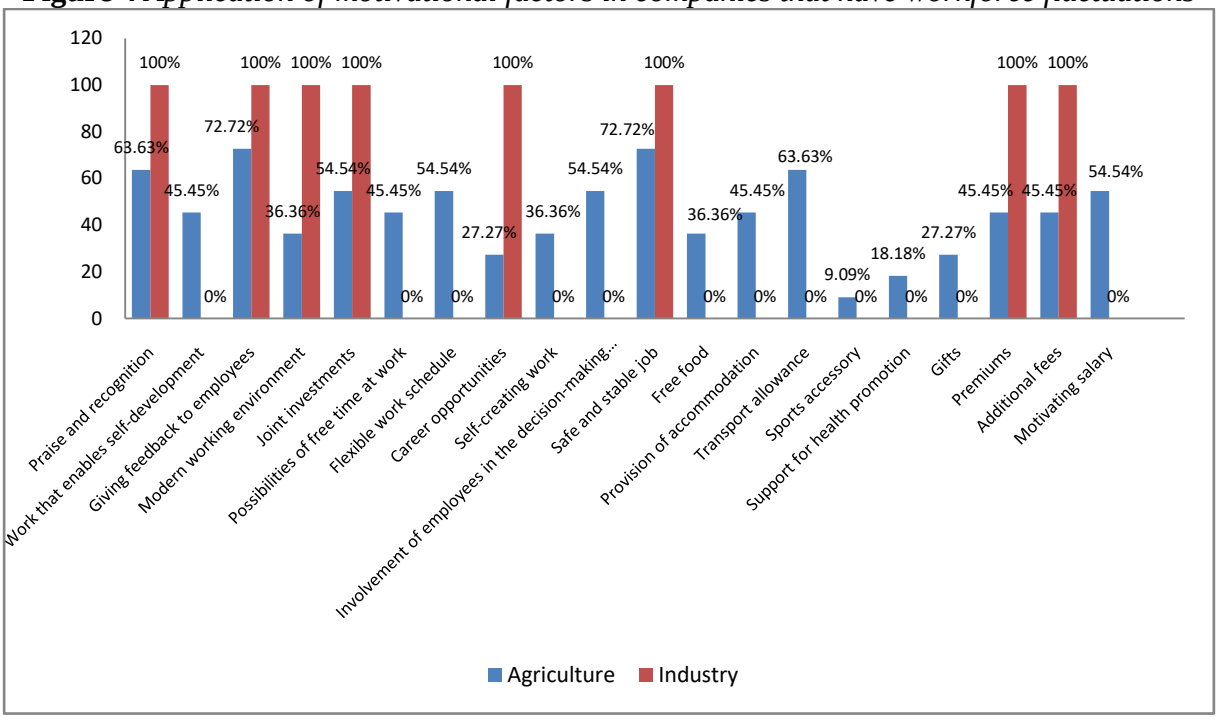
Figure 3 *Problems with employee turnover in surveyed companies*



The following graph shows the application of motivational factors in companies that had problems with labor force turnover (Figure 4). In addition, a variance analysis was prepared for agricultural enterprises, in order to determine whether the application of motivational

factors in enterprises with the problem of labor turnover differs from agricultural enterprises that did not have this problem. No difference was observed in the application of both non-financial (p=0.55) and financial (p=0.64) motivational factors.

Figure 4 *Application of motivational factors in companies that have workforce fluctuations*



DISCUSSION

It was found that the application of non-financial motivational factors differs significantly between the two sectors (p=0.018). The average percentage of application of non-financial motivational factors was higher in industrial companies. The most popular non-financial motivational factor was a secure and stable job, as found by Maslow & Lewis (1987). In both sectors, employees are guaranteed a secure and stable job and, according to Maslow, this provides an opportunity for continuous employee motivation. The second most valued non-financial motivational factor was praise and recognition, which Herzberg considered very important (Stello (2011). Career opportunities in agricultural companies were significantly less than in industrial companies. It was observed that the lack of career and work opportunities, which does not provide the need for self-actualization cause labor force turnover (Zojceska, 2018; Hosen, 2022). Lack of career opportunities causes labor force turnover and reduces employee motivation. One manager pointed out that his company trains unqualified workers and enables them to advance. The authors recommend that other agricultural enterprises use the same principle and enable their employees to advance.Also, there was significantly less self-realization and self-development work in agricultural enterprises.

McGregor and Vroom considered it important that employees receive a reward that corresponds to their work (Gannon & Boguszak, 2013). Low wages can cause labor force turnover (Maertz & Kmitta, 2012). Weber (2003) found that more than half of the employees left the company because their salary was too low. Previous studies have shown that employees highly value material rewards (Schreiner, 2018). Also, the production of industrial enterprises has a high added value. That is why we assumed that there is a significant difference between these two sectors in the application of the financial motivation factor. However, the result showed the opposite, because the analysis of variance showed that there was no significant difference (p=0.48). The percentage of use of non-financial motivation factors was only slightly higher in industrial enterprises. If we compare the use of non-financial and financial motivational factors in companies, non-financial factors were used significantly more. The most common factors of financial motivation by industrial companies are bonuses, gifts and incentive salaries. The most popular motivational factors in agricultural enterprises were motivating salary, transport allowance and bonuses. Gifts, sports grants and premiums were significantly more used in industrial enterprises. Agricultural enterprises had a better result only in the case of transport compensation. The obtained results showed that health promotion and support for sports are used rather little. A greater number of motivational factors ensures that companies better take into account the needs of different employees (Eshun, 2011). In the sample, there were significantly more industrial enterprises, which considered employee motivation important.

Lack of career opportunities, work that does not provide self-fulfillment, lack of additional benefits and low wages can cause labor force turnover (Maertz & Kmitta, 2012). This research has shown that there are no serious problems with labor force turnover. Moderate problems with labor force turnover were reported by agricultural enterprises. The authors compared agricultural companies that had problems with labor turnover with agricultural companies that did not have this problem and there was no difference. Therefore, it can be assumed that the fluctuation of the workforce in these companies is caused by some other factor.

CONCLUSION

Agricultural enterprises have a moderate problem with the recruitment of labor. In this regard, it seemed justified to investigate whether the motivation of employees caused the lack and fluctuations of labor force in agricultural enterprises. In order to compare and obtain a clearer picture of motivation and motivators, industrial companies were also included in the research.
The results revealed that there is a significant difference between the sectors in the application of the non-financial motivation factor (p=0.018), but no significant difference was detected in the application of the financial motivation factor (p=0.48). A secure and stable job is the strongest non-financial motivator in both sectors. While the possibility of career development in agricultural enterprises is relatively small, industrial enterprises attach importance to this motivator. Of the financial factors, industrial companies mostly apply premiums, gifts and fees, while for agricultural companies, the most important are earnings and transport compensation. Industrial companies do not attach importance to the provision of accommodation, while agricultural companies give support to sports on a very small scale.
The average percentage of application of motivational factors was higher for industrial companies, and it can be argued that more motivational factors are applied in industrial companies.

When it comes to labor turnover, agricultural enterprises reported moderate problems. In the case of agricultural enterprises, which reported labor force fluctuations, no difference in motivation was identified, compared to enterprises that did not report a fluctuation problem, nor was a significant difference observed in the application of motivational factors.

Given that all companies consider employee motivation important, managers are recommended to continuously work on employee motivation and renew it if necessary. Also, managers are invited to enable employees to better meet their various needs, which will result in increased employee motivation and lower turnover. Certainly, the increase of wages, benefits and bonuses are the basic means of motivation and thereby reducing the fluctuations of employees in agricultural enterprises.

In the end, the research should continue in the light of looking at other factors influencing fluctuations and the lack of workers in agricultural enterprises.

LITERATURE

Agbenyegah, G. (2019). Effect of financial and non-financial rewards on employee motivation in financial institution in Ghana. *International Journal of Innovative Research and Development*, 8 (8), 121-130.

Aleksić-Glišović, M., Jerotijević, G., Jerotijević, Z. (2019). Modern approaches to employee motivation. *Ekonomika*, 65 (2), 121-133.

Anselme, P. (2010). The uncertainty processing theory of motivation. *Behavioural brain research*, 208 (2), 291-310.

Eshun, F. K. D. (2011). *Rewards as a motivation tool for employee performance*. Link (21.04.2023): https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A832968&dswid=-8632

Gannon, D., Boguszak, A. (2013). Douglas McGregor's theory x and theory y. CRIS-*Bulletin of the Centre for Research and Interdisciplinary Study*, 2, 85-93.

Gligorov, V., Ognjenović, K., Vidovic, H. (2011). *Assessment of the labour market in Serbia* (No. 371). wiiw Research Report.

Hong, J. C., Yang, S. D., Wang, L. J., Chiou, E. F., Su, F. Y., Huang, S. L. (1995). Impact of employee benefits on work motivation and productivity. *International Journal of Career Management*, 7 (6), 10-14.

Hosen, M. E. (2022). Factors affecting employee turnover in multinational companies in Malaysia. *Malaysian Management Journal*, 26, 31-54.

Huseman, R. C., Hatfield, J. D., Miles, E. W. (1987). A new perspective on equity theory: The equity sensitivity construct. *Academy of management Review*, 12 (2), 222-234.

Jayaweera, T. (2015). Impact of work environmental factors on job performance, mediating role of work motivation: A study of hotel sector in England. *International journal of business and management*, 10 (3), 271.

Locke, E. A., Latham, G. P. (2006). New directions in goal-setting theory. *Current Directions in Psychological Science*, 15 (5), 265-268.

Locke, E. A., Schattke, K. (2019). Intrinsic and extrinsic motivation: Time for expansion and clarification. *Motivation Science*, 5 (4), 277.

Lorincová, S., Štarchoň, P., Weberová, D., Hitka, M., Lipoldová, M. (2019). Employee motivation as a tool to achieve sustainability of business processes. *Sustainability*, 11(13), 3509.

Maertz Jr, C. P., Kmitta, K. R. (2012). Integrating turnover reasons and shocks with turnover decision processes. *Journal of Vocational Behavior*, 81 (1), 26-38.

Maslow, A., Lewis, K. J. (1987). Maslow's hierarchy of needs. *Salenger Incorporated*, 14 (17), 987-990.

Miljković, S. (2007). Motivation of Employees and Behaviour Modification inHealth Care Organisations. *Acta Medica Medianae*, 46 (2), 53-62.

Moromisato, D. (2021). 6 Reasons Why Documentation Is Important for Your Investment Operations. Empaxis. Link (20.04.2023): https://www.empaxis.com/blog/why-documentation-is-important-operations

Oyer, P. (2008). *Salary or benefits?*. In Work, earnings and other aspects of the employment relation. Emerald Group Publishing Limited.

Pardee, R. L. (1990). *Motivation Theories of Maslow, Herzberg, McGregor & McClelland*. A Literature Review of Selected Theories Dealing with Job Satisfaction and Motivation. Link (12.04.2023): https://eric.ed.gov/?id=ed316767

Parijat, P., Bagga, S. (2014). Victor Vroom's expectancy theory of motivation–An evaluation. *International Research Journal of Business and Management*, 7 (9), 1-8.

Schreiner, L. (2018). *The effects of remuneration and reward systems on employee motivation in Luxembourg* (No. 30). EIKV-Schriftenreihe zum Wissens-und Wertemanagement.

Stanišić, N. (2021). *The role and significance of employee motivation in hotel company business politics*.Doctoral dissertation, Singidunum University, Belgrade.

Stello, C. M. (2011). *Herzberg's two-factor theory of job satisfaction: An integrative literature review*. In Unpublished paper presented at the 2011 student research conference: Exploring opportunities in research, policy, and practice, University of Minnesota Department of Organizational Leadership, Policy and Development, Minneapolis, MN.

The Employer Branding Agency (2023). *Employee recognition – Osnove i 21 ideja za nagrađivanje.* Link (18.04.2023): https://www.employer-branding.rs/employee-recognition-osnove-i-21-ideja-za-nagradivanje/

Tran, A. (2018). *Concrete Resolve: How Concrete Mindset Spurs Approach Motivation and Improves Task Persistence and Performance for Behaviourally Inhibited People*. Doctoral thesis,Waterloo, Ontario, Canada.

Weber, K. (2003). The relationship of interest to internal and external motivation. *Communication Research Reports*, 20 (4), 376-383.

Zojceska, A. (2018). *HR Metrics: How and Why to Calculate Employee Turnover Rate*. TalentLyft. Link (15.04.2023): https://www.talentlyft.com/en/blog/article/242/hr-metrics-how-and-why-to-calculate-employee-turnover-rate

THE PRICE OF SUNFLOWER SEEDS FOR INDUSTRIAL PROCESSINGON THE INTERNATIONAL MARKET UNDER CHANGED MARKET CONDITIONS[1]

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Apstract: Sunflower seeds for industrial processing are very common and important in the international market of oilseeds. Ukraine and Russia are the leaders in the world production of sunflower seeds for industrial processing, therefore the war conflicts between Ukraine and Russia cause large fluctuations in the production and supply of sunflower seeds for industrial processing on the world market, and consequently large fluctuations in the price of sunflower seeds for industrial processing on the international market level. Therefore, by applying scientific methods, research was carried out on the current state and price trends of sunflower seeds for industrial processing on the international market in the past twelve-month period, from April 2022 to March 2023, that is, during the six-month period of the past 2021/2022 economic year (from April 2022 to September 2022) and during the past six-month period of the current 2022/2023 economic year (from October 2022 to March 2023), the results of which are presented in this paper.
Keywords: international market; sunflower seeds; price of sunflower seeds;

INTRODUCTION

Sunflower seeds for industrial processing are widely represented and significant on the European and world market of oilseeds, where, according to tradition, the volume of production, turnover and industrial processing, it is classified in the group of the most important oilseeds (Oštrić-Matijašević and Turkulov, 1980; Vlahović, 2015; Premović , 2014; 2022).

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According to expert estimates, the production of sunflower seeds for industrial processing at the international level will be in the current 2022/23. economic year significantly lower than in the past 2021/22. economic year. War events in the Black Sea region, which is traditionally the largest producer, processor and exporter of sunflower seeds, as well as industrially produced oil from sunflower seeds, also had their direct impact in this way. Russia has taken the leading position in the production of sunflower seeds for industrial processing from Ukraine. However, unlike the decrease in the production of sunflower seeds for industrial processing on the international market, which is estimated to be at the end of the current 2022/23 economic year will amount to about 50 million tons (the reduction in the production of sunflower seeds for industrial processing on the international market will, after the end of the current 2022/23 economic year, according to expert estimates, amount to about 12% compared to the production of sunflower seeds for industrial processing on the international market, which was realized in the past 2021/22 economic year), it is predicted that the production of industrially produced oil from sunflower seeds will still increase by about 3.7%. This can be explained by the high temporary stocks of sunflower seeds for industrial processing, as well as the fact that Russia took over from Ukraine the leading position in the industrial processing of sunflower seeds, that is, in the production of oil from sunflower seeds. Therefore, the increased production of sunflower seeds and oil from Russia will partially offset the lower available quantities of sunflower seeds for industrial processing and sunflower seed oil from Ukraine (www.fas.usda.gov/data/oilseeds-world-markets-and-trade; www.minpolj.gov.rs/dokumenti/izvestaji-sa-trzista/).

Ukraine and Russia are the leaders in the world production of sunflower seeds for industrial processing, therefore the war conflicts between Ukraine and Russia cause large fluctuations in the production, supply and trade of sunflower seeds for industrial processing on the world market, and consequently large fluctuations in the price of sunflower seeds for industrial processing at the international level. Due to all of the above, using scientific methods, research was carried out on the current state and price trends of sunflower seeds for industrial processing on the international market in the past twelve-month period, from April 2022 to March 2023, that is, during the six-month period of the past 2021/2022 economic year (from April 2022 to September 2022) and during the past six-month period of the current 2022/2023 economic year (from October 2022 to March 2023), the results of which are presented in this paper.

1. The price of sunflower seeds for industrial processing on the international market under changed market conditions in the period from April 2022 to March 2023

1.1. The price of sunflower seeds for industrial processing on the international market under changed market conditions in the period from April 2022 to September 2022 past 2021/22 economic years

From April 2022 to September 2022, the past 2021/22 economic years, the prices of sunflower seeds on the world market varied and amounted to (Table 1):

A) At "US Farm Price; USDA": from 725 U.S.$/mt (in September 2022, past 2021/22. economic year) to 886 U.S.$/mt (in May and June 2022, past 2021/22 economic year), with that the last price information in the analyzed time period, from April to September 2022, the past 2021/22 economic year, the price that was recorded for the month of September, is also the minimum value of the price of sunflower seeds for the analyzed time period from April to September 2022, the past 2021/22 economic year.
At "US Farm Price; USDA", the average sunflower seed price for the entire past 2021/22. economic year (from October 2021 to September 2022) was 760 U.S.$/mt. In the April 2022 USDA Report, for the previously examined period from October 2021 to March 2022 (also the past 2021/22 economic year), the average price value was not defined. The average price of sunflower seeds for the analyzed time period from April 2022 to September 2022, also in the past 2021/22 economic year, was 824 U.S.$/mt (Table 1).

B) At "Rotterdam/Amsterdam CIF; E U; Oil World": from 616 U.S.$/mt (in September 2022, the past 2021/22 economic year) to 895 U.S.$/mt (in April 2022, the past 2021/22. economic year), while the last price information in the analyzed time period, from April to September 2022, the past 2021/22. economic year, the price recorded for the month of September is also the minimum value of the price of sunflower seeds for the analyzed time period from April to September 2022 , the past 2021/22 economic year.
At "Rotterdam/Amsterdam CIF; EU; Oil World", the average value of the price of sunflower seeds for the entire past 2021/22. economic year (from October 2021 to September 2022) was 763 U.S.$/mt, while for the previously examined period from October 2021 to March 2022 (also the past 2021/22. economic year) the average value prices defined in the USDA Report from April 2022 amounted to 776 U.S.$/mt. The average price of sunflower seeds for the analyzed time period from April 2022 to September 2022, also in the past 2021/22 economic year, was 750 U.S.$/mt (Table 1).

C) When analyzing and comparing data on sunflower seed prices on "US Farm Price; USDA" and on "Rotterdam/Amsterdam CIF; EU; Oil World" in the observed time period, from April 2022 to September 2022, the past 2021/22. economic year (Table 1), it is observed that the prices of sunflower seeds were variable, which was to be expected considering the conditions prevailing on the market, and it can be concluded that there were certain relatively minor differences in the prices of sunflower seeds that were achieved in the observed period of time on these two world markets/world exchanges, since the prices of sunflower seeds in the observed period of time had values: from 725 U.S.$/mt to 886 U.S.$/mt at "US Farm Price; USDA" and from 616 U.S.$/mt to 895 U.S.$/mt at "Rotterdam/Amsterdam CIF; EU; Oil World", with the average value of the price of sunflower seedsfor the analyzed time period from April 2022 to September 2022 year, past 2021/22 economic year, amounted to "US Farm Price; USDA", 824 U.S.$/mt, and at "Rotterdam/Amsterdam CIF; EU; Oil World", 750 U.S.$/mt.

On both observed world markets/world stock exchanges in the analyzed time period (from April 2022 to September 2022, the past 2021/22 economic year), there is a tendency to fall in the value of sunflower seeds, so that the values of the seed prices were recorded of sunflowers for the last month in the analyzed time period, recorded values of the price of sunflower seeds for the month of September 2022, the past 2021/22 economic years, at the same time amounted to the minimum values of the price of sunflower seeds in the observed time period on both observed and analyzed world markets/stock exchanges (Table 1).

Table 1. Sunflower seed price: April 2022-September 2022 (economic year 2021/22) (U.S.$/mt)

Stock market/Market	***Time period***					
	April 2022 - September 2022, 2021/22 economic year					
	April	**May**	**June**	**July**	**August**	**September**
„US Farm Price; USDA" (U.S.$/mt)	818	886	886	798	833	725
	Min-Max: 725-886			Average (April-September 2022): 824		
„Rotterdam/Amsterdam CIF; EU; Oil World" (U.S.$/mt)	895	878	769	654	686	616
	Min-Max: 616-895			Average (April-September 2022): 750		

Source: UCDA Report, April 2023, www.fas.usda.gov/data/oilseeds-world-markets-and-trade

1.2.The price of sunflower seeds for industrial processing on the international market under changed market conditions for the period from October 2022 to March 2023 current 2022/23 economic years

From October 2022 to March 2023current 2022/23 economic years the prices of sunflower seeds for industrial processing on the world market varied and amounted to (Table 2):

A) At "US Farm Price; USDA": from 626 U.S.$/mt (in November 2022, current economic year 2022/23) to 679 U.S.$/mt (in February 2023, current economic year 2022/23), the latter being the above information on the price of sunflower seeds for industrial processing, until the analysis of the month of April 2023, the current 2022/23 economic year, the price recorded for the month of February 2023 and at the same time the maximum value of the price of sunflower seeds for industrial processing, for the analyzed time period of the economic year 2022/23, with the preliminary value of the price of sunflower seeds for industrial processing for the month of March 2023, the current economic year 2022/23 at "US Farm Price; USDA" in the April 2023 USDA Report, was not listed.

The average price of sunflower seeds for industrial processing for the analyzed time period from October 2022 to March 2023, current 2022/23 economic years at "US Farm Price; USDA": was 646 U.S.$/mt (Table 2).

B) At "Rotterdam/Amsterdam CIF; E U; Oil World": from 591 U.S.$/mt (in December 2022, the current 2022/23 economic year), i.e. from 522 U.S.$/mt (preliminary value of the price of sunflower seeds for industrial processing for the month of March 2023, the current 2022/23 economic year), up to 626 U.S.$/mt (in November 2022, the current 2022/23 economic year), with the last quoted price of sunflower seeds for industrial processing in the analyzed time period, from October 2022 to March 2023, the current economic year 2022/23, until the analysis of April 2023, the preliminary value of the price of sunflower seeds for industrial processing, which is stated for the month of March 2023, the current 2022/23 economic year, amounted to a minimum of 522 U.S.$/mt.

The average value of the price of sunflower seeds for industrial processing for the analyzed time period, from October 2022 to March 2023, of the current 2022/23 economic year is at "Rotterdam/Amsterdam CIF; E U; Oil World" amounted to 594 U.S.$/mt (Table 2).

C) When analyzing and comparing the data on the prices of sunflower seeds for industrial processing on "US Farm Price; USDA" and on "Rotterdam/Amsterdam CIF; EU; Oil World", from October 2022 to February 2023, current 2022/23 economic years (Table 2), it is established that the prices of sunflower seeds for industrial processing on the world market were variable, which is expected, considering the changed and specific conditions prevailing on the market, and it can also be concluded that there are certain differences in sunflower seed prices for industrial processing that were reached in the analyzed time period, from October 2022 to March 2023, current 2022/23 economic year, in the two observed world markets/world exchanges, since the prices of sunflower seeds for industrial processing have values: from 626 U.S.$/mt to 679 U.S.$/mt at "US Farm Price; USDA" and from 591 U.S.$/mt to 626 U.S.$/mt on "Rotterdam/Amsterdam CIF; EU; Oil World".

On both observed world markets/world stock exchanges, the prices of sunflower seeds for industrial processing for the month of November 2022, current 2022/23 economic years, were identical, amounting to 626 U.S.$/mt, after which the sunflower seed price values for industrial processing at "US Farm Price; USDA" market/world stock market in the following

period fluctuated, recording mostly growth, and the last recorded value of the price of sunflower seeds for industrial processing for the month of February 2023, the current 2022/23 economic year (679 U.S.$/mt), was also the maximum value of the price of sunflower seeds for industrial processing in the observed time period, from October 2022 to March 2023, the current 2022/23 economic year, at "US Farm Price; USDA" (Table 2).

Sunflower seed price values for industrial processing are after November 2022, current 2022/23 economic year, at "Rotterdam/Amsterdam CIF; E U; Oil World", fluctuated, recording mostly a decline, so that the preliminary value of the price of sunflower seeds for industrial processing, which was stated for the month of March 2023, the current 2022/23 economic year, was a minimum of 522 U.S.$/mt for the observed time interval, from October 2022 to March 2023, the current 2022/23 economic year (Table 2).

For the sake of comparison, the average value of the seed price of other important oilseeds on the world market in the analyzed time period, from October 2022 to February 2023, current 2022/23 economic years, such as soybean seeds, peanuts and canola seeds, were, respectively: from 525 U.S.$/mt to 632 U.S.$/mt; from 598 U.S.$/mt to 1,613 U.S.$/mt and 594 U.S.$/mt.

Table 2. Sunflower seed price: October 2022-March 2023 (2022/23 economic year) (U.S.$/mt)

Stock market/Market	***Time period***					
	October 2022-March 2023, 2022/23 economic year					
	October	**November**	**December**	**January**	**February**	**March***
„US Farm Price; USDA" (U.S.$/mt)	646	626	650	628	679	N/A
	Min-Max: 626-679			Average (October-March*): 646		
„Rotterdam/Amsterdam CIF; EU; Oil World" (U.S.$/mt)	619	626	591	606	601	522
	Min-Max: (522*) 591-626			Average (October-March*): 594		

* Preliminary
Source: UCDA Report, April 2023, www.fas.usda.gov/data/oilseeds-world-markets-and-trade

INSTEAD OF CONCLUSION

Changes in the produced and available quantities of sunflower seeds for industrial processing at the world level caused changes in the representation and distribution of sunflower seeds on the international market, which also caused variations in the prices of sunflower seeds on international exchanges.

Reduction of the export of sunflower seeds from Russia, which is in April 2023, current 2022/23 of the economic year, compared to the previous period, amounted to 150,000 metric tons (mt) (from 850,000 metric tons in the previous period, to the current 700,000 metric tons) contributed to a significant decrease in the import of sunflower seeds to the member countries of the European Union (which in April 2023, the current 2022/23 economic year amounted to 200,000 metric tons (mt) (from 2,900 metric tons in the previous period to the current 2,700 metric tons). Difficult conditions due to the war conflict in the Black Sea region contributed to the reduction of production of oil and sunflower seed meal in Ukraine and in Russia, which was sanctioned by many member states of the European Union and numerous other countries of the world due to the war events in Ukraine.

In the time ahead, we have to monitor the entire consequences of the war between Ukraine and Russia in terms of fluctuations in the value of prices and achieved prices of sunflower seeds for industrial processing, primarily into sunflower seed oil and meal, as the most important products of industrial processing of sunflower seeds.

LITERATURE

1. Oštrić-Matijašević, B., J., Turkulov (1980). Tehnologija ulja i masti, I deo, Univerzitet u Novom Sadu, Tehnološki fakultet, Novi Sad.
2. Premović, T. (2014). Uticaj vremena skladištenja, sadržaja nečistoće i ljuske semena na senzorni kvalitet, bioaktivne komponente i oksidativnu stabilnost hladno presovanog ulja suncokreta, Univerzitet u Novom Sadu, Tehnološki fakultet Novi Sad.
3.Premović, T. (2022). Nerafinisana ulja suncokreta – ekološki, tehnološki, nutritivni i ekonomski aspekti, Ekonomski institut a.d. Beograd, ISBN 978-86-904242-0-7.
4. Vlahović, B. (2015). Tržište agroindustrijskih proizvoda, Univerzitet u Novom Sadu, Poljoprivredni fakultet.
5. www.fas.usda.gov/data/oilseeds-world-markets-and-trade (pristupljneno 01.04.2023. godine)
6. www.minpolj.gov.rs/dokumenti/izvestaji-sa-trzista/ (pristupljneno 03.04.2023. godine)

ECOLOGICAL AND ECONOMICAL ANALYSIS USING RECYCLED ABRASIVES

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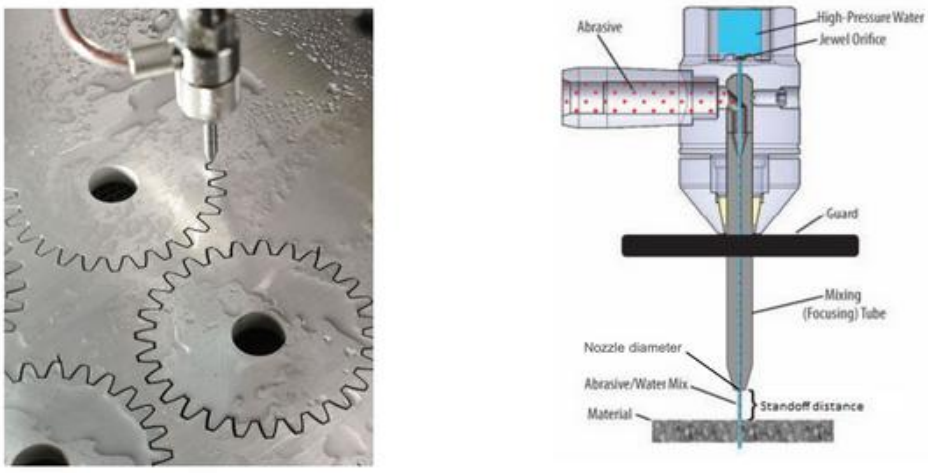
Abstract: Abrasive water cutting is an unconventional processing procedure with particle separation. It is used for cutting a large number of materials (metals, non-metals, polymers, wood, stone, etc.). Abrasive is added to the water jet because the water jet itself has the ability to cut only softer materials. Abrasives are generally used only once. Along with electricity, the abrasive causes the biggest expense when cutting with an abrasive water jet. In the Republic of Croatia there is no facility specializing in the recycling of such waste, therefore the uncontrolled disposal of the abrasive used, and thus the residues of the cut materials represent a serious environmental problem. On the economic side, the abrasive represents about 51% of the total cost of cutting while the electricity consumes about 46% of the cost, and the water is 2-3%. By using recycled abrasives, electricity would account for about 77% of cost, while the cost of abrasives would be equal to about 11%. A total of about 44% savings are achieved by using recycled abrasives.

Keywords: waterjet cutting, abrasives, economical, recycling

INTRODUCTION

More and more people are opting for waterjet cutting for mechanical cutting projects, be it fabricators, professionals, or amateur hobbyists. However, when considering waterjet cutting process, the waterjet cutting cost per hour basis is something to evaluate. In this article, you will learn all about the various parts of waterjet cutting costs. Keep reading to find out how much your next project is going to cost:

Figure 1. Water jet cutting



(a) An AWJ cutter (b) AWJ mechanism

Source: https://giangcodes.com/project/descriptive [1]

When you factor in all the applications of waterjet cutting, you will find that the overall cost of water jet cutting prices is one of the cheapest in the market. If you base your decision purely on a per-hourly rate, waterjet cutting machines can feel to be a more expensive option than other cutting alternatives. However, you are forgetting about the major factors that make waterjet cutting the best cutting process. For instance, unlike other cutting processes, waterjet cutting is a cold cutting process and doesn't harm the material quality since there is an absence of high heat. Additionally, you can create multiple cuts in different layers of bulk materials by placing one layer on top of the other (called stacking). Stacking isn't really possible in other cutting techniques.

1. Operating costs of waterjet cutting

There are various factors that influence the overall cost of abrasive waterjet cutting. These factors are:

Water Consumption: Water is a very minor factor when we discuss the cost of water jet cutting machines. For one thing, most of the water used in the waterjet cutting technology is recycled. Taking national average, cost of water is about $3 for a 1000 gallons. Therefore, you can even disregard the cost of water while calculate cutting costs.

Electricity Consumption: Unlike water consumption, the cost of electricity is a major factor that adds to waterjet cutting cost per hour. The exact cost of electricity will vary based on the machine you use and the cost per KW in your area. It can range anywhere from $3000 to $9000 per year if your machine runs 6 hours a day (2000-2100 hr/year).

Wear of Parts: It is no surprise that when you are using waterjet cutting, machine parts like nozzles and pump seals are going to wear out regularly. Therefore, you need to account for the cost of these parts as well. Here is a list of parts that commonly wear out in waterjet cutters, along with the cost and lifespan of each: Parts Approximate Lifespan Table 1. [2]

Table 1. Parts Approximate Lifespan

Part Name	Approximate Cost	Approximate Lifespan
Nozzles	$80	80 hours
Orifice	$15	40 hours
Mixing Chamber	$150	400 hours
High-Pressure Pump Seal	$120	500-1000 hours

Source: https://www.techniwaterjet.com/waterjet-cutter-costs-and-prices/[2]

Cost of Abrasive: This part makes up the major portion of abrasive waterjet cutting cost per hour basis. Usually, garnet abrasive is added to waterjet cutting, which costs about 25 cents per pound of abrasive. This cost can vary a little based on the type and quality of abrasive you use. For instance, high quality garnet can be expensive compared to uneven hard rock abrasive.

Abrasive waste standards: Less than 5 percent of waterjet users might be at risk of putting hazardous waste down their drain, it is worthwhile to verify that you are in the 95 percent group. Waste after AWJ cutting (sludge) – Fig. 2 is composed of by-products collected at wastewater treatment process. It contains both compounds of agricultural value and to a lesser extent, calcium, sulphur and magnesium), and pollutants which usually consist of heavy metals, organic pollutants and pathogens.

The characteristics of sludge depend on the original pollution load of the treated water, and also on the technical characteristics of the waste water and sludge treatments carried out. Once treated, sludge can be recycled or disposed of using three main routes: recycling to agriculture (landspreading), incineration or landfilling. Other, less developed outlets exist, such as silviculture, land reclamation, and other developing combustion technologies including wet oxidation, pyrolysis and gasification. Each recycling or disposal route has specific inputs, outputs and impacts.

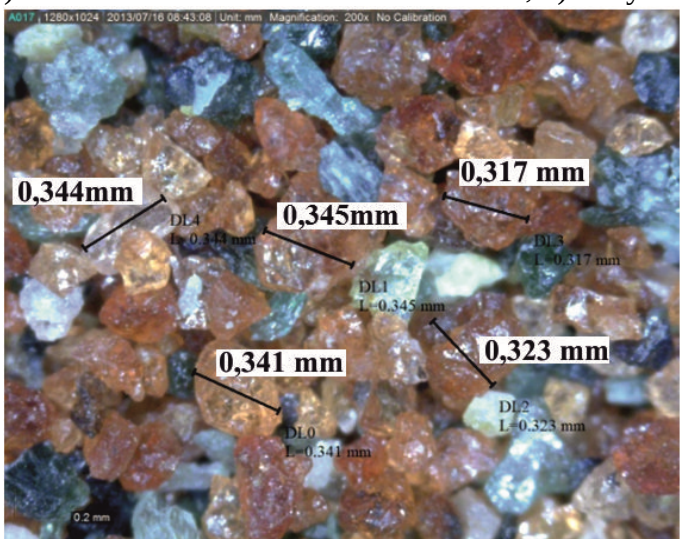
Fig. 2. a) Sludge after AWJ cutting, b) Microscope view of sludge 200X

a) b)

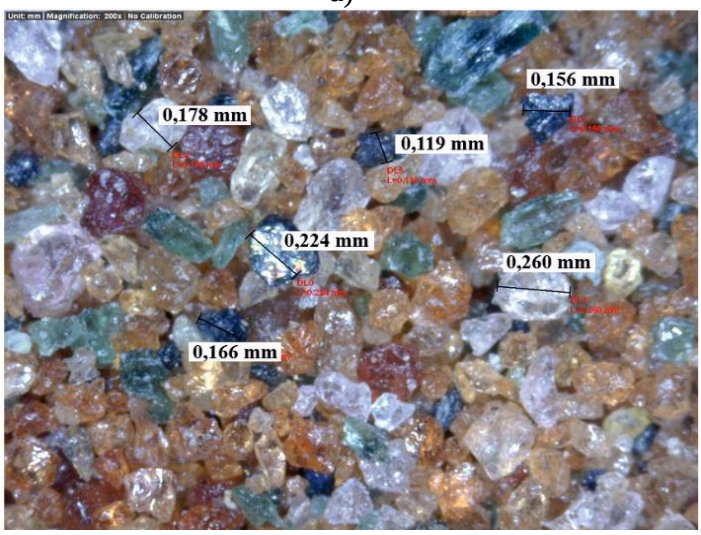
Source: [3]

After drying the recycled abrasive, a microsco picanalysis wasper formed to see the effect of this abrasive recycling process. Figure 3a shows a new unused abrasive, while Figure 3b is recycled abrasive. The abrasive particle safter recycling are smaller in size, some between MESH 80 and MESH 120. If a comparison of Figures 3b and 6b is made, there is no tiny white particle (recycled abrasive) after recycling and we can conclude that the recycling process is successful. In preliminary testing system was shows 60-70% of success. That means that from 100kg of sludge was got some between 60-70kg new abrasives.

Figure 3. a) New abrasive Barton Garnet MESH 80, b) Recycled abrasive



a)



b)

Source: [3]

Quality and Type of Waterjet cutters: As is obvious, different abrasive waterjet cutters perform differently. A high-end waterjet cutter can take up a high initial investment but might save you some money on the running costs. Additionally, pure-waterjet cutting costs significantly less than abrasive waterjet cutting cost, but it only works for soft materials like rubber and foam.

Cutting Time: The longer time you spend on cutting a material, the more resources the cutter will use which will amp up the costs of cutting.

Garnet Flow Rate: Garnet flow rate (or abrasive flow rate) is important to consider when calculating costs of a waterjet cutting system. For instance, metal plate cutting requires about 1 to 2 pounds of typical garnet abrasive per minute, which leads to a cost between $18 to $36 per hour on abrasive alone.

Programming and Data Input: Efficient programming and data input makes sure that the cuts take place in the most effective manner. There is no time and resources wasted on unnecessary processes, leading to reduced costs.

2. Hourly costs to run an abrasive water jet

As we saw in the last section, the costs of waterjet cutting can vary significantly based on the different factors we mentioned. Most of these factors, in turn, depend on the material you intend to cut. Softer materials will go easy on costs due to cutting time and abrasives. The quality of cuts you require will also affect the cost that will incur. For high quality cuts, you need to take the waterjet cutting process a little slower, which will lead to higher hourly cost. If high quality cuts aren't a requirement, you can increase the cutting speed and save on the waterjet cutting cost. Typically, waterjet cutting cost per hourly rate lies somewhere between $12 to $30 per hour. Of course, in specific requirements, this number can go higher or lower. Here is an example of hourly cost breakup of waterjet machine in different situations: hourly cost breakup of waterjet machine in different situations Table 2.

Table 2.

Type of Cost	Waterjet Cutter 1 30 HP Pump 0.01" Orifice	Waterjet Cutter 2 50 HP Pump 0.014" Orifice	Waterjet Cutter 3 60/75 HP Pump 0.016" Orifice
Abrasive Cost	$10.50	$19.50	$24
Power Cost	$2.6	$4.3	$4.8
Cost of Parts	$3	$3.5	$3.7
Water Cost	$0.3	$0.6	$0.75
Misc Cost	$3.5	$4	$4.25
Total Cost	**$19.9**	**$31.9**	**$37.5**

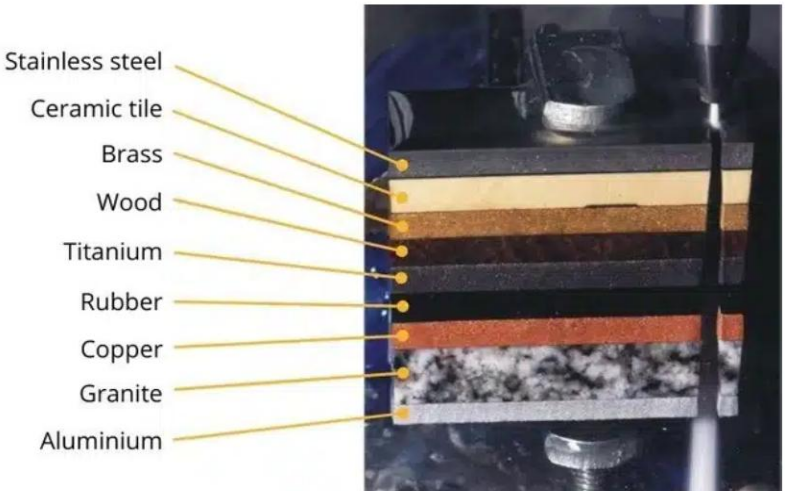
So far we have gone through the cost of the waterjet cutter on hourly basis. However, you might've forgotten tie about one very important cost- the cost of the waterjet cutter itself. This important cost can be a significant one-time investment and something you should factor into your budget decisions. For starters, you can find small waterjet machines at a price point of $60,000. However, those might not give you the best value for money in the long run. If you want to make the most out of your investment, we recommend going with the Techniwaterjet G2 CNC water jet cutters which starts at $100,000. If budget isn't a restriction, you can check out high-end models in the Techniwaterjet series that can range up to $450,000.

3. Calculate Waterjet Costs for a Project

When you are calculating waterjet costs for a project, you should take into account the following four things:

Material Types:

Figure 4. Materials type



Source: https://www.finepart.com/waterjet-cutter/waterjet-cutter-how-it-works [4]

There are different types of materials out there. When you buy a waterjet machine, you will get information on how much time it will take to cut through per inch of any particular material. You can evaluate your time taken with this information.

Material Thickness:
For a material of a particular hardness, the cutting time will be directly proportional to the thickness of the material. For instance, a two-inch thick material will take twice as long to cut as compared to a one-inch thick material.

Figure 5. Materials parameter thickess

Source: Duspara, M, 135-138 [5]

Final Cut Dimensions: Take into account the final dimensions of the cut that you want to achieve. Add the total length and the total width of the cut materials to calculate the total inches that require cutting. Since you already have the time taken to cut per inch, you can calculate the total cost by multiplying it by the total length of the cut.

4. Conclusion

Waterjet cutting costs are something to consider when comparing them to prices of a typical plasma cutting machine or laser cutting technology. While the hourly prices might not always seem lower, the overall total cost for any project will be significantly lower. The high accuracy and efficiency of waterjet cutting machines are second to none. Before you forget, waterjet machines cut through ANY material type, unlike other alternatives which generally work on metals only. Therefore, if you are wondering how much does waterjet cuttingcost, the answer will always be on the cheap side. In the Republic of Croatia there is no facility specialized for the recycling of such types of waste therefore uncontrolled disposal of the abrasive used, and consequent-ly the remains of the cut material is a serious environmental problem. From the eco-nomic side, the abrasive represents about 51% of the total cost of cutting, while elec-tricity consumes about 46% of the cost, and the water is 2-3%. Using recycled abra-sives, electricity would account for about 77% of the cost, while the cost of the abra-sive would equalize with the cost of water of about 11%. A total of 44% savings are made using of recycled abrasives.

LITERATURE

[1] https://giangcodes.com/project/descriptive
[2] https://www.techniwaterjet.com/waterjet-cutter-costs-and-prices/
[3] Miroslav Duspara, Tomislav Palatinuš, Dejan Marić, Ivan Samardžić, Željko Ivandić, Antun Stoić, *New Approach of Recycling of Abrasives for Water Jet Cutting*, Advances in Manufacturing Engineeringand Materials: Proceedings of the International Conference on Manufacturing Engineeringand Materials (ICMEM 2018), 18–22 June, 2018, Nový Smokovec, Slovakia
[4] https://www.finepart.com/waterjet-cutter/waterjet-cutter-how-it-works
[5] M Duspara, *Istraživanje rezljivosti korozijski postojanog čelika AISI 316 L mlazom vode*, PhDtheesis, 135-138

APPLICATION OF LIFE CYCLE ASSESSMENT ON THE EXAMPLE OF HOUSEHOLD FURNITURE

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Abstract: Today's industrial production in synergy with the growth of the human population has a significant impact on the environment and human health. The development of industrial production results in the consumption of large amounts of energy and material resources, which leads to an increase in harmful emissions into the atmosphere and global warming of the Earth. In an effort to reduce harmful impacts in the product life cycle, an approach called complete balancing was created (*Life-cycle assessment -LCA*). Life cycle assessment implies everything related to the product in all its life stages. This approach aims to reduce the impact of the product on the environment, so that the product is made from materials whose process of creation and use has less impact on the environment, and also to optimize the consumption of energy and resources. Eco-indicators help with this. These are numbers derived from product life cycle assessment data, and express the total impact of the product on the environment. The higher the amount of the eco-indicator, the greater the impact of the product on the environment. The main meaning of eco-indicators is the comparison of several different products or components of these products. In the paper, LCA was applied using the Eco-indicator 99 method on the example of three household chairs made of different materials. The results of the analysis showed that the wooden chair has the highest eco-indicator value, followed by upholstered and plastic chairs. The proposed design changes and changes in the recycling method reduced the amount of eco-indicators in all three chairs by more than 50%. Upholstered chairs have the highest rate of 56.5%, plastic chairs have 51.17%, and wooden chairs have the lowest rate of 51.1%. The analysis carried out showed that steel and plastomer are materials that are more suitable from the point of view of environmental impact, not only because they have lower eco-indicator values, but also because of the fact that if they are separated from other materials, they can be recycled and reused.

Keywords: Life-cycle assessment, production, design changes, recycling

1. INTRODUCTION

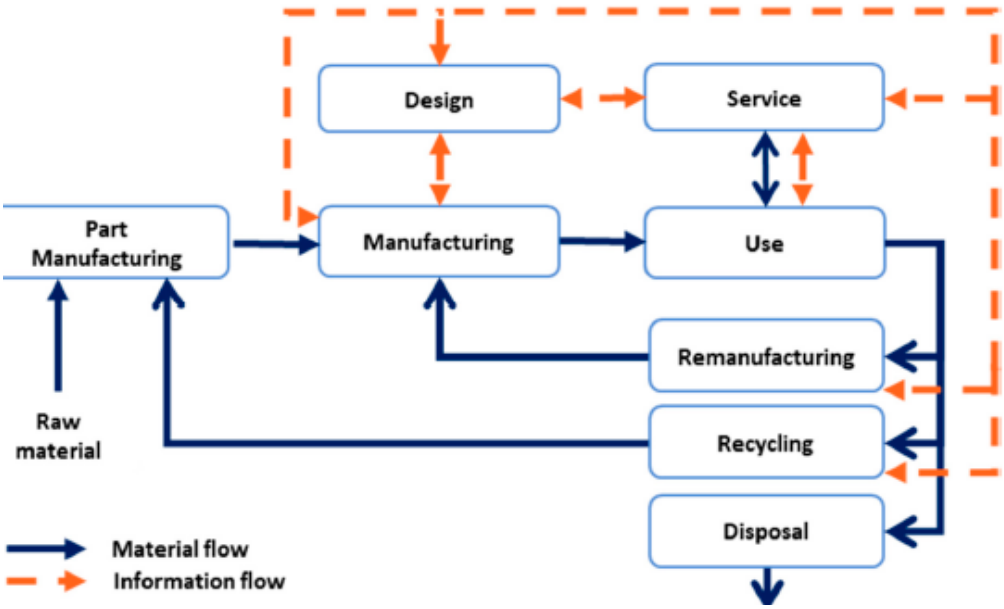
Since ancient times, people have sought to automate as many production processes as possible. Their goal was to make as many products as possible in as little time as possible, whose quality level is the same or higher than the quality level of handmade products. Also, the goal of improving industrial production was to reduce the workforce, which would simultaneously increase the efficiency of production, as well as reduce the possibility of human error during production. However, as the human population grew, so did the need for a larger quantity of products, which further accelerated the production processes and the increase of industrial plants. With the increase in the number of industrial plants, emissions of harmful gases into the atmosphere, the amount of hazardous waste and materials for which recycling procedures were not developed at the time, also increased significantly. Emissions of greenhouse gases (carbon dioxide, methane...) and freon are one of the main causes of global warming on earth. With the aim of better examining, studying and thus regulating the negative impact of industry on the environment, a new approach called integral balancing (LCA, Life Cycle Assessment, Life Cycle Analysis) or eco-balancing is emerging. Complete balancing is the principle of evaluating products, materials, production processes, services and industrial systems with regard to their impact on the environment [1, 2]. LCA analysis is used to collect information, document and monitor the life cycle of a product and its impact on the environment in all life stages. The numbers obtained from the product life cycle assessment data are called eco-indicators. The Eco-Indicator 99 method determines the extent to which different production processes and materials affect human health and ecosystems. This paper briefly describes the LCA method and Eco indicator-99, which are used to carry out ecological analysis. Using the example of three classic chairs, the most significant indicators of the impact of these products on the environment were compared, and construction improvements were proposed in order to reduce the burden on the environment.

2. LCA METHOD OR COMPLETE BALANCING

LCA method, also known as eco-balancing or the method of complete balancing. This method observes the life cycle of the product in all its phases "cradle-to-grave". Observed categories include resource use, impact on human health, and ecological consequences that all stages have on the environment. The life cycle of every product begins with the exploitation of the raw materials necessary for the production of the product and their shaping into the final product ("birth"). After that, that product is transported and distributed to users, and then its use ("maturity") begins. After a certain period of use, the product wears out or breaks down, after which it is either recycled or disposed of as waste ("death") [2, 3].

Production processes and finished products mostly have a negative impact on the environment due to the use of raw materials and energy during their creation. Also, there are products that, in addition to a negative impact, also have a positive impact. Such an impact with a product appears if it produces recycled material or energy during its life cycle. For the effective implementation of the LCA analysis, the input and output flows are analyzed for each previously mentioned life cycle stage, which can be seen in Figure 1.

Figure 1. Input and output flows of the product life cycle

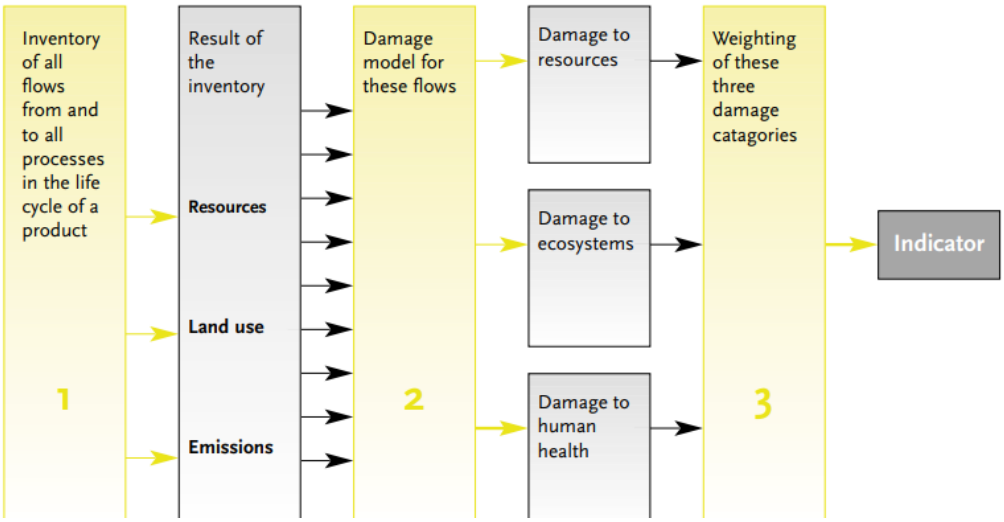


Source: [2]

2.1 ECO-INDICATORS

Eco-indicators are indicators that take into account one or more areas of impact on the environment, and the greater the number of indicators, the greater the impact on the environment. Eco-indicator values have no dimension, therefore they are expressed as points or millipoints (Point, Pt). The importance of eco-indicators is the comparison of two finished products so that the unit of measurement is not crucial [5]. The impact of products on the environment (Figure 2) is observed through three areas in which they can cause damage [6].

Figure 2. Presentation of the methodology for calculating eco-indicators



Source: [7]

The three areas mentioned are: human health (this refers to the number and duration of diseases and to years lost due to premature death), the quality of the ecosystem (implying the impact on the diversity of species, the effects covered are emissions of hazardous substances, acidity, eutrophication and soil exploitation), resources (especially refers to excess energy consumption that will be needed in the future for the extraction of poorer mineral and fossil sources).

To speed up the LCA analysis phase, eco-indicators are pre-calculated for individual phases of the life cycle, which are available in tables and are called standard eco-indicators. Such pre-calculated indicators and eco indicator points are available for: materials (all stages of raw material production are included from ore extraction to the last stage of production and transport within the process of obtaining materials), production processes (indicators refer to emissions of the process itself, but also all emissions up to which occur due to the generation of the necessary energy), transport processes (refers to vehicle emissions, but also those resulting from obtaining the necessary fuel or energy), energy production processes (indicators refer to the obtaining and production of fuel, energy transmission and obtaining electricity), disposal (different products are disposed of in different ways, so it is necessary to think carefully when choosing the indicator which method of disposal is most appropriate).

3. APPLICATION OF ECO-INDICATOR 99 ON THE EXAMPLE OF CLASSIC CHAIRS

An analysis of classic chairs was carried out using the Eco-indicator 99 method, in order to compare the Eco-indicator values of the mentioned chairs in order to determine which of the chairs is the most environmentally friendly by comparing the results. Classical chairs (Figure 3.1) were chosen as the subject of analysis, because they are an indispensable part of the furniture of every household, institution or recreational facility, and therefore it is important that they be constructed so that production and disposal have as little impact on the environment as possible.

Figure 3.1 Presentation of analyzed chairs:
a) wooden chair, b) upholstered chair, c) plastic chair

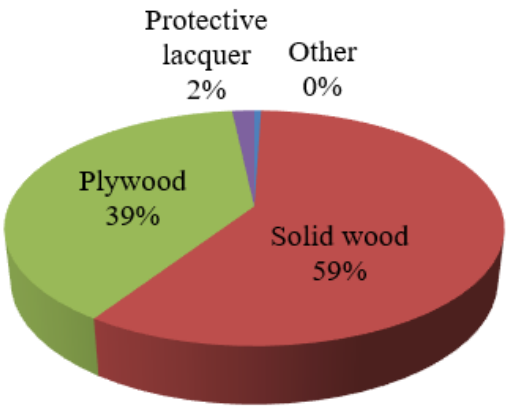
a) ***b)*** ***c)***

The chairs are made of different materials, the first is a wooden chair, the second is an upholstered chair with a steel structure, a wooden upholstered seat and a wooden backrest, and the third chair is a steel structure with a plastic seat and backrest.

3.1 EXAMPLE OF ANALYSIS OF A WOODEN CHAIR

A wooden chair with a classic design, made of solid ash wood, with a backrest and a seat made of plywood, was analyzed. Alkaloid varnish was used to protect the chair. The chair is suitable for use in seminar halls, canteens, hospitals, schools as well as in households.Figure 3.2 shows the proportion of individual materials in a wooden chair, from the display it can be seen that wood and chipboard make up 98% of the materials from which the chair is made. Calculation using the Eco-indicator 99 method can be relatively rough because there are no eco-indicator values for certain materials and processes in order to carry out the analysis optimally.

Figure 3.2 Presentation of the proportion of individual materials in a wooden chair



It is assumed that the chair will remain in use for ten years. It is planned to transport the finished product by 28 t truck over a distance of 300 km, and transport by delivery vehicle 10 km. The life stage of using the chair brings a negligible amount of points, so it will not be taken into account in the continuation of the calculation. After ten years of use, it is assumed that the chair will not be disassembled, but that the entire chair will be recycled by incineration in an electricity production plant, and the energy obtained will be delivered to the electricity grid.

For each stage of the life cycle, the values of the eco-indicators were entered in the table and the total amount was calculated. It happens that when using eco-indicator tables, there is no data for a particular process or material. The results of the analysis are shown in table 3.1, from which it can be seen that the stage of production of the wooden chair has the highest value of the eco-indicator. The materials with the highest eco-indicator values are wood and plywood, while other materials and procedures have many times lower indicator values. Since no energy and/or other resources are used for chair use, the chair use phase is ignored. When using the chair, possible minor repairs such as replacement of screws are possible, which is a negligible amount of eco-indicator points. The disposal of the chair was carried out by energy incineration, which means that the materials were burned, and the energy obtained was used

for the production of electricity. The total sum of negative eco-indicator points obtained by recycling the chair is shown in the part of table 3.1, which refers to the life stage of disposal.

Table 3.1 Eco-indicator 99 points of wooden chairs

Material, processortype of processing	Amount	Unit of measure	Indicator (**mPt**)	Result (**mPt**)
1	2	3	4	5(2x4)
Production				
Steel	0,02	kg	86	1,7
Pressing (steel)	0,02	kg	23	0,5
Polipropilen PP	0,02	kg	330	6,6
Injectionmolding	0,02	kg	21	0,4
Solid wood	3,89	kg	410	1.594,9
Plywood	2,58	kg	410	1.057,8
Protective laquer	0,11	kg	520	57,2
Transport (Truck 16 t (300 km))	2,00	t/km	34	68,0
Transport (Vans<3,5 t (10 km))	0,07	t/km	140	9,8
			Total	2.796,9
Usage				
			Ukupno	0
The end of the chair life stage (Waste disposal)				
Incinerartion, steel	0,02	kg	-32	-0,6
Incinerartion, polypropylen PP	0,02	kg	-13	-0,6
Incinerartion, solid wood	3,89	kg	-12	-46,7
Incinerartion, plywood	2,58	kg	-12	-31,0
			Total	-79,0
Eco-indicator total				2.717,9

Guided by the calculation of the eco-indicator for the wooden chair and the analysis of the obtained results (table 3.1), the constructors could consider the possibility of designing a solution in which the solid wood structure would be replaced by a steel structure, given that there is no wood available for making furniture with a lower amount of eco- indicators. In the case of applying the aforementioned structural improvement, significant reductions in the amount of eco-indicators are also possible in the disposal phase, assuming that the steel is separated from the plywood in the waste management plant and that the steel is recycled for reuse, and the plywood is recycled by incineration in the plant for the production of electricity energy. The amount of indicators for the aforementioned structural improvements is shown in table 3.2. The mass of the steel structure is taken from the example of the plastic chair. The chair production phase has the highest eco-indicator value, but significant improvements compared to the existing solution are visible.

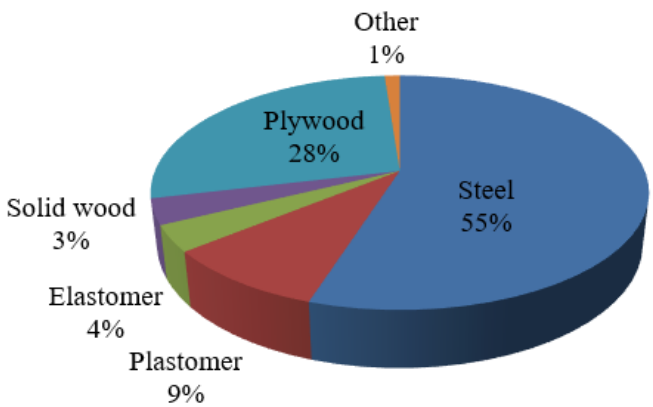
Table 3.2 Eco-indicator 99 for a wooden chair with applied structural improvements

Material, processortype of processing	Amount	Unit of measure	Indicator (**mPt**)	Result (**mPt**)
1	2	3	4	5(2x4)
Production				
Steel	4,09	kg	86	351,7
Pressing (steel)	4,09	kg	23	94,1
Polipropilen PP	0,02	kg	330	6,6
Injectionmolding	0,02	kg	21	0,4
Plywood	2,58	kg	410	1.057,8
Protective laquer	0,11	kg	520	57,2
Transport (Truck 16 t (300 km))	2,00	t/km	34	68,0
Transport (Vans<3,5 t (10 km))	0,07	t/km	140	9,8
			Total	1.645,6
Usage				
			Total	0
The end of the chair life stage (Waste disposal)				
Recycling, steel	4,09	kg	-70	-286,0
Incinerartion, polypropylen PP	0,02	kg	-13	-0,6
Incinerartion, polywood	2,58	kg	-12	-31
			Total	-317,6
Eco-indicator total				1.327,9

3.2 EXAMPLE OF ANALYSIS OF AN UPHOLSTERED CHAIR

In this case, it is an analysis of an upholstered chair, a steel structure, a wooden upholstered seat and a wooden backrest. The chair has a classic design and has the same purpose as a wooden chair. From the graph shown (Figure 3.3), the proportions of individual materials in the chair are visible.

Figure 3.3 Representation of the proportion of materials in an upholstered chair



It is assumed that the chair will remain in use for ten years. It is planned to transport the product by 28 t truck over a distance of 300 km, and transport by delivery vehicle 10 km. During disposal, it is difficult to require the consumer to separate steel from wood, plywood and plastomer, so the analysis assumes that the complete product after ten years of use will be burned in an electricity production plant, and the energy obtained will be delivered to the electricity grid. For each stage of the chair's life cycle, the eco-indicator values are entered (table 3.3). The final amount was calculated and entered in the tables. For wood and wood processing, there are no corresponding eco-indicators in the tables, but the indicator for beech wood is used, which also includes the transportation of raw materials.
From table 3.3 it can be seen that the production phase of the upholstered chair has the highest eco-indicator value. The material with the highest eco-indicator value is plywood, while other materials and procedures have significantly lower eco-indicator values. The disposal of the chair was carried out by energy incineration, which means that the materials were burned, and the energy obtained was used for the production of electricity. The total sum of negative eco-indicator points obtained by recycling stools is shown in the part of table 3.3, which refers to the life stage of disposal.

Table 3.3. Eco-indicator 99 points upholstered chair

Material, processortype of processing	Amount	Unit of measure	Indicator (**mPt**)	Result (**mPt**)
1	2	3	4	5(2x4)
Production				
Steel	5,27	kg	86	453,2
Pressing (steel)	5,27	kg	23	121,2
Plastomer PP	0,88	kg	330	290,4
Injection molding	0,88	kg	21	18,5
Plywood	2,64	kg	430	1.135,2
Solid wood (EU beech)	0,34	kg	430	146,2
Elastomer LPDE	0,34	kg	360	122,4
Protective laquer	0,05	kg	520	26,0
Transport (Truck 16 t (300 km))	2,86	t/km	34	97,2
Transport (Vans <3,5 t (10 km))	0,10	t/km	140	14,0
			Total	2.424,3
Usage				
			Total	0
The end of the chair life stage (Waste disposal)				
Incinerartion, steel	5,27	kg	-32	-168,6
Incinerartion, polypropylene	0,88	kg	-13	-11,4
Incinerartion, plywood	2,64	kg	-12	-31,7
Incinerartion, solid wood	0,34	kg	-12	-4,1
Incinerartion, elastomer LPDE	0,34	kg	-19	-6,5
			Total	-222,3
Eco-indicator total				2.202,0

Guided by the calculation of the eco-indicator for the upholstered chair and the analysis of the obtained results (table 3.3), the constructors could consider the possibility of conceiving a solution in which the plywood used for the seat and back would be replaced by plastomer. The seat would still be upholstered, and the backrest would be made of beech-colored plastomer. In the case of applying the aforementioned structural improvements, significant reductions in the amount of eco-indicators are also possible in the disposal phase, assuming that the materials are separated in the waste management facility and then each separately recycled. Steel and plastomer would be recycled for reuse, and other materials would be recycled by incineration in a power plant. The amount of indicators for the aforementioned structural improvements is shown in table 3.4, from which it can be seen that the value of the eco-indicator in production has decreased, and that the negative amount of the eco-indicator in the disposal phase has increased significantly and is almost half of the value of the eco-indicator of production.

Table 3.4. Eco-indicator 99 for an upholstered chair with applied structural improvements

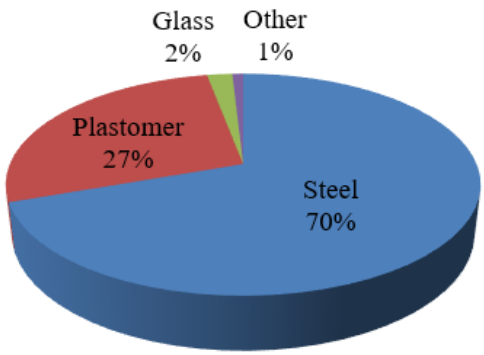
Material, processortype of processing	Amount	Unit of measure	Indicator (**mPt**)	Result (**mPt**)
1	2	3	4	5(2x4)
Production				
Steel	5,27	kg	86	453,2
Pressing (steel)	5,27	kg	23	121,2
Plastomer PP	2,54	kg	330	838,2
Injection molding	2,54	kg	21	53,3
Solid wood(EU beech)	0,34	kg	430	146,2
Elastomer LPDE	0,34	kg	360	122,4
Protective laquer	0,05	kg	520	26,0
Transport (Truck 16 t (300 km))	2,86	t/km	34	97,2
Transport (Vans <3,5 t (10 km))	0,10	t/km	140	14,0
			Total	1871,7
Usage				
			Total	0
The end of the chair life stage (Waste disposal)				
Recycling, steel	5,27	kg	-70	-368,9
Recycling, polypropylene	2,54	kg	-210	-533,4
Incinerartion, solid wood	0,34	kg	-12	-4,1
Incinerartion, elastomer LPDE	0,34	kg	-19	-6,5
			Ukupno	-912,8
Eco-indicator total				958,9

3.3 EXAMPLE OF ANALYSIS OF A PLASTIC CHAIR

A chair with a metal structure, plastic seat and backrest was analyzed, the metal structure is powder-coated, and the seat and backrest of the chair are made of polymer reinforced with glass fibers. The chair is characterized by its small mass and the possibility of use in open spaces, it is ideal for catering and recreational facilities. Figure 3.4 shows the percentages of individual materials in the chair.

It is assumed that the chair will remain in use for ten years. It is planned to transport the product by 28 t truck over a distance of 300 km and transport by delivery vehicle 10 km. When disposing of waste, it is difficult to expect that the consumer will separate the steel structure from the plastic seat and backrest, so it is assumed that the complete product after ten years of use will be recycled by incineration in an electricity production plant, and the energy obtained will be delivered to the electricity grid.

Figure 3.4 Representation of the proportion of materials in a plastic chair



The results of the analysis are presented in table 3.5, from which it can be seen that the production phase of the plastic chair has the highest value of the eco-indicator. The material with the highest eco-indicator value is plastomer, followed by steel, while other materials and processes have significantly lower eco-indicator values. The total sum of negative eco-indicator points obtained by recycling the chair is shown in the part of table 3.5 that refers to the life stage of disposal.

Table 3.5 Eco-indicator 99 points of plastic chairs

Material, process or type of processing	Amount	Unit of measure	Indicator (**mPt**)	Result (**mPt**)
1	2	3	4	5 (2x4)
Production				
Steel	4,09	Kg	86	351,7
Pressing (steel)	4,09	Kg	23	94,1
Polipropilen PP	1,62	Kg	330	534,6
Glass	0,12	Kg	58	7,0
Injection molding	1,74	Kg	21	36,5
Protective laquer	0,05	Kg	1270	63,5
Transport (Truck 16 t (300 km))	1,80	t/km	34	61,2
Transport (Vans <3,5 t (10 km))	0,06	t/km	140	8,4
			Total	1.157,0
Usage				
			Total	0
The end of the chair life stage (Waste disposal)				
Incinerartion, steel	4,09	Kg	-32	-130.9
Incinerartion, polypropylen PP	1,62	Kg	-13	-21,1
Incinerartion, glass	0,12	Kg	5,1	0,6
			Total	-151,4
Eco-indicator total				1.005,6

Guided by the calculation of the eco-indicator for the plastic chair and the analysis of the obtained results (table 3.5), the constructors could consider the possibility of designing a solution in which the steel structure of the chair would be protected with alkaloid varnish instead of powder coating as before. Given that in the production of plastic chairs, the amount of eco-indicators cannot be significantly reduced, attention should be directed to disposal. If the chair was disassembled in a waste sorting facility in such a way as to separate the steel from the plastomer and then recycle it for reuse, the total amount of eco-indicators would be significantly lower. The amount of eco-indicators for the aforementioned structural improvements is shown in table 3.6, from which it can be seen that the reductions in eco-indicators in the production phase are insignificant, and the reason for this is the unchanged construction of the chair. By changing the method of disposing of the chair, there was a significant increase in the amount of eco-indicator points obtained by recycling, considering that these points have a negative sign, the total amount of eco-indicator points was reduced by more than half.

Table 3.6 Eco-indicator 99 for a plastic chair with applied structural improvements

Material, process or type of processing	Amount	Unit of measure	Indicator (**mPt**)	Result (**mPt**)
1	2	3	4	5 (2x4)
Production				
Steel	4,09	kg	86	351,7
Pressing (steel)	4,09	kg	23	94,1
Polipropilen PP	1,62	kg	330	534,6
Glass	0,12	kg	58	7,0
Injection molding	1,74	kg	21	36,5
Protective laquer	0,05	kg	520	26,0
Transport (Truck 16 t (300 km))	1,80	t/km	34	61,2
Transport (Vans <3,5 t (10 km))	0,06	t/km	140	8,4
			Total	1.119,5
Usage				
			Total	0
The end of the chair life stage (Waste disposal)				
Recycling, steel	4,09	kg	-70	-286,3
Recycling, polypropylene PP	1,74	kg	-210	-365,4
			Total	-633,7
Eco-indicator total				485,8

4. ANALYSIS OF THE OBTAINED RESULTS

The total results of the analysis carried out by life cycle stages are presented in table 4.1, where you can see the amount of eco-indicators for production, use, disposal and the total amount for each of the analyzed chairs. If we compare the production phase (table 4.1), we can see that the wooden chair has the highest value of the eco-indicator in production, and the reason for this is the high value of the indicator for wood and plywood, followed by the upholstered chair of massive steel construction, which has a slightly lower amount of eco-indicator in the production phase and the lowest value of the eco-indicator in the production phase is the plastic chair, and the reason for this is the low value of the eco-indicator for steel and plastomer. For the life stage of chair use, the value of the eco-indicator is equal to zero or, if it exists, it is negligible because the chairs do not use energy or additional resources during use, possibly minor repairs such as replacement or tightening of screws are possible during use, which represents a negligible amount of eco-indicator points. All three chairs were disposed of in the same way by being recycled by incineration in an electricity production plant, and the resulting energy was delivered to the electricity grid. From table 4.1, we see that this method of recycling has the greatest potential for upholstered chairs, followed by plastic and wooden chairs. The overall results of the analysis show that the wooden chair has the highest value of eco-indicator points, followed by the upholstered and plastic chair, which has the lowest value of the eco-indicator.

Table 4.1 Presentation of Eco-indicator 99 values for analyzed chairs by life stages

Life stage	Wooden chair	Upholstered chair	Plastic chair
Production	2.796,9	2.424,3	1.157,0
Usage	0	0	0
Waste disposal	-79,0	-222,3	-151,4
Total (mPt)	2.796,9	2.202,0	1.005,1

Negative values of eco-indicators obtained by disposal (recycling) of chairs are also shown in table 4.1. It can be seen from the above that the upholstered chair has the highest potential for recycling, followed by plastic and wooden chairs. In this case, all three chairs were recycled by incineration in an electricity production plant, and the energy was supplied to the electricity grid. This method of recycling was approached due to the assumption that the consumer will not disassemble the chairs and sort the materials.

4.1 ANALYSIS OF THE RESULTS OF POSSIBLE STRUCTURAL IMPROVEMENTS

A comparison of the results of the proposed structural improvements with the results without structural improvements was carried out. Table 4.2 shows the eco-indicator values for the existing solution obtained by conducting the initial analysis and for the improved solution with proposed structural improvements. The result of the proposed structural improvements is shown in the last column of the table, where you can see the reduction of eco-indicators in percentages for each individual life stage as well as for each chair in total.

The wooden chair has the highest eco-indicator value in the production phase, and the reason for this is the high eco-indicator value for wood and plywood. In order to reduce the value of the eco-indicator for the wooden chair, it was proposed to replace the wooden structure of the chair with a steel one. The result of the proposed improvements is a reduction of the eco-indicator value in the production phase by 42.2%. In the existing solution, the wooden chair was disposed of by burning it in a plant for the production of electricity, and the energy obtained was delivered to the electricity grid. With the improved solution, it was assumed that the chair will be disassembled in a waste sorting facility and that the plywood will be burned in an electricity production facility, and the steel will be recycled for reuse. The result of the proposed improvements is a reduction in the eco-indicator value in the disposal phase by 75, 1%. The proposed construction improvements in the production phase and changes in the recycling phase reduced the total amount of eco-indicators for the wooden chair by 51.1%.

The proposed improvements in the production phase of the upholstered chair reduced the value of the eco-indicator by 22.8%, and this was achieved by replacing the plywood with plastomer in the seat and back of the chair. The advantage of plastomer is that, unlike plywood, it can be recycled for reuse and thus reduce the total amount of eco-indicators. The reduction in the amount of eco-indicators in the disposal phase is 75.6%, and this is the result of structural changes and changes in the recycling method, unlike the existing solution, the assumption is that the chair will be disassembled and the materials sorted, steel and plastomer will be recycled for reuse, and the other materials will be burned in the electricity production plant. The result of the aforementioned improvements and changes in the disposal method is a reduction of the total amount of eco-indicators by 56.5%.

Structural changes in the production phase of the plastic chair did not bring significant reductions in eco-indicators, instead of protecting metal parts by powder coating, the use of alkaloid varnish was proposed, which brought a reduction in eco-indicators in production by 3.2%. The disposal phase of the plastic chair brings a reduction of the eco-indicator by 76.1%, unlike the existing solution, in the improved one it was assumed that the chair would be disassembled, the materials sorted and each separately recycled for reuse. The aforementioned improvements and change in the method of recycling in the case of plastic chairs result in a reduction of the total value of the eco-indicator by 51.7%.

Table 4.2 Comparison of analysis results and proposed constructional improvements

Type of chair	Life stage	Pre-existing solutio (mPt)	Improvedsolution (mPt)	Reduction of eco-indicators (%)
Wooden chair	Production	2.796,9	1645,6	41,2
	Usage	0	0	0
	Waste disposal	-79,0	-317,6	75,1
	Total	2.717,9	1327,9	51,1
Upholstered chair	Production	2.424,3	1.871,7	22,8
	Usage	0	0	0
	Waste disposal	-222,3	-912,8	75,6
	Total	2.202,0	958,9	56,5
Plastic chair	Production	1.157,0	1.119,5	3,2
	Usage	0	0	0
	Waste disposal	-151,4	-633,7	76,1
	Total	1.005,1	485,8	51,7

The proposed structural improvements have significantly increased the proportion of materials that can be recycled and reused, primarily referring to the replacement of wood and plywood with steel and plastomer. Unlike the originally performed analysis, where it was assumed that the complete product would be recycled by incineration, and the obtained energy would be used for the production of electricity, in this case, with structural changes, it was assumed that the product would be disassembled in a waste sorting facility and that each material would be specially recycled.

5. CONCLUSION

After conducting an LCA analysis on the example of three classic chairs, using the Eco-indicator 99 method and comparing the results, several conclusions were reached. The results of the analysis showed that the wooden chair has the highest eco-indicator value, followed by upholstered and plastic chairs. Due to the proposed construction changes and changes in the recycling method, the amount of eco-indicators was reduced in all three chairs by more than 50%, the highest in the upholstered chair by 56.5%, then in the plastic chair by 51.17% and the least in the wooden chair by 51 ,1 %. It is important to point out that the method of material recycling greatly affects the total amount of eco-indicators, which was shown by the results of the analysis, where by changing the recycling method, the amount of eco-indicators

in the disposal phase was reduced by more than 75% for all three chairs. Recycling is a process that gives negative eco-indicator points and thus reduces the total eco-indicator value for the analyzed product.

Based on the analysis, it is concluded that steel and plastomer are materials that are significantly more acceptable from the point of view of environmental impact, not only because they have lower eco-indicator values, but also because of the fact that if they are separated from other materials, they can be recycled and reused. Based on the comparison of the results of the initially performed analysis with the results of the proposed structural improvements, it can be concluded that the replacement of solid wood and plywood with steel and plastomers led to a significant reduction in the value of eco-indicators.

Eco-indicator 99 is a useful tool that serves constructors to analyze the impact of their products on the environment. The analysis carried out using the Eco-indicator 99 showed certain disadvantages, considering that the eco-indicator values were not determined for certain materials and procedures, so the analysis could not be carried out optimally. Ecolizer 2.0 is a newer generation and successor to Eco-indicator 99, based on the same principles as Eco-indicator 99, but with data for more materials and processes. With its application, a more complete analysis can be carried out, all with the goal of improving production and products that would ultimately have as little impact on the environment and human health as possible.

REFERENCES

[1] Curran, M. A.: Life Cycle Assessment. CRC Press, Florida (2020).

[2] Haziri, L., Sundin, E.,Sakao, T.,Feedback from Remanu facturing: Its Unexploited Potential to Improve Future Product Design, Sustainability, 11, 2019.

[3] Life Cycle Assessment Methodology https://www.e-education.psu.edu/eme807/node/690, (20.6.2023.)

[4] Goedkoop, M. J., The Eco-Indicator 99: A Damage Oriented Method for Life Cycle Impact Assessment, 2001.

[5] Chastas, P., Theodosiou, T., & Bikas, D., Embodied energy in residential buildings-towards the nearly zero energy building: A literature review. Building and Environment, 105, 267-282, 2016.

[6] Eco-indicator 99 Manual for Designers:
https://pre-sustainability.com/legacy/download/EI99_Manual.pdf, (1.6.2023.)

APPLICATION OF GREEN ECONOMY AND SUSTAINABLE DEVELOPMENT IN CHEMICAL INDUSTRY

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Abstract: Sustainable economic development implies economic growth and development which take care of the environmental protection by connecting sustainable economic growth and improvement of people's health, social justice, employment and environmental protection. Taking into consideration the possibility of another economic crisis, as well as the effects of excessive consumption of resources and destroying ecosystems, green economy (inclusion of environment into economic growth) has recently appeared as a turning point in a way of thinking and is considered to be one of possibly successful solutions for improving economic growth, simultaneously reducing a consumption of resources and preventing the destruction of ecosystems. Serbia has huge potential for the application of green economy, sustainable development and ecological entrepreneurship. In that context, the aim of this paper is to point out possible directions of establishing balance between social and economic development and environmental protection, and thereby refer to the importance of building a long-term sustainable economy whose concept is based on the economic development coordinated with ecological grounds and for that purpose the case study method will be used. There is much more to be done concerning green economy in Serbia, especially considering high level of air pollution and achieving energy efficiency as a key problem in the region (1).

Keywords: green economy, sustainable development, energy efficiency, chemical industry,

INTRODUCTION

The concept of green economy emerged in the 1980s as a kind of means that was supposed to provide assistance to national economies and the society as a whole while heading towards sustainable development. The green economy is a sustainable economy where economic growth and ecological responsibility function together by strengthening one another and simultaneously supporting the progress of social development. The basic assumption of a green economy refers to ecologically responsible business activities that are supposed to enable the economic growth and development complete with a simultaneous increase in the quality of human environment (2).

Green economy and sustainable development are two critical concepts which are becoming more relevant in the current global climate. Green economy refers to an economic model which prioritizes sustainable development through the use of renewable energy, pollution reduction and efficiency improvement in production and consumption of goods and services.

On the other hand, sustainable growth is an approach to economic growth which is focused on meeting the needs of current and future generations without compromising the ability of

future generations to satisfy their own needs. This paper will explore the importance of green economy and sustainable development and how they can be achieved.

Today, huge amounts of funds are being invested in green technology and clean sources of energy, and the biggest world leaders in this area are using more and more the energy of Sun and wind. Also, there is a large number of new job openings thanks to the trending of green economy and use of sustainable energy resources. The concept of green economy is promoted as an instrument which can help on the way of achieving sustainable development. Economic growth must not be at the expense of the environment and social aspects, but must ensure welfare to all. Traditional economic models did not manage to fight against the appearance of social marginalization and excessive consumption of resources. Economic growth must ensure welfare to both society and environment. The green economic growth strategies contribute to sustainable development by creating a more advanced planning framework for the creation of new values, necessary for realization of sustainable development concept (society, economics and environment), whereby this green growth plan regulates the places where the economic interests can be used as a mean to promote optimal management of environment and social balance, and in that context, they suggest the best options for development. (3)

This paper presents extract and promotion of the study on achievements and perspectives towards green economy and sustainable growth in Serbia. It is important to remark that even on the global level there has not been one, generally accepted definition of the term 'green economy' yet. During the preparation of this study we relied on the definition of 'green economy' given by UNEP, as well as taking into consideration the definition given by International Chamber of Commerce (ICC). The concept of green economy is promoted as a means of assistance to the countries on their way to achieving sustainable development. The world testified that, even though economic growth pulled millions out of poverty, it had often been at the expense of ecological and social conditions as well as not being of use to all. Decades in which new values and prosperity on the principles of traditional economic models had been created, did not manage to fight against social marginalization and change ever rising excessive consumption of resources. Therefore, it is important to ensure that economic growth contributes to the society and environment in whole. Sustainability still remains primary long-term goal, but additional efforts must be directed on the implementation of the concept of green economy if that goal is to be achieved. Sustainable development is an overall, holistic concept and paradigm which connects economy, society and environment, within which the green growth strategies can be observed as an appropriate framework that contributes to feasible sustainable development policies. If all of the above is taken into consideration, it is clear that the term green economy represents something more specific than sustainable development.

THE IMPORTANCE OF GREEN ECONOMY

Green economy is of vital importance for achieving sustainable development. The world is facing numerous ecological challenges, including, among others, climate changes, loss of biodiversity and pollution. Traditional model of economic growth has often come at the expense of the environment. For example, excessive consumption of fossil fuels contributed to the emission of the greenhouse gases, which led up to the global warming and exhaustion

of the nature resources. In contrast, the green economy recognizes the importance of environmental protection in the economic growth.
Green economy emphasizes the efficiency of resources, waste reduction and use of renewable resources. This model is focused on increasing productivity and reducing the consumption of nature resources. Green economy encourages companies and consumers to adopt sustainable practices which minimize the negative impact on the environment.

The Green Economy and New Job Openings

By applying the concept of a green economy what are being initiated are the investments the purpose of which is reducing the pressure on environment with an increase of efficiency in the consumption of energy and resources. Due to the needs for increasing employment rates, as well as for the forthcoming innovations in environmental protection, the number of so called "green jobs" and "paperless jobs" is constantly growing. (2)

One of the advantages of green economy is new job openings. The transition to renewable energy sources and waste reduction open new possibilities for employment. For example, development of solar and wind energy requires qualified employees, such as engineers and technicians, to project, install and maintain the infrastructure. Further, recycling industry is opening positions for collecting, processing and distributing of the recycled material. Moving to the sustainable agriculture creates opportunities for employment in cultivation and processing of the organic food.

The Green Economy and Economic Growth

The usual misconception is that the green economy comes at the expense of economic growth. However, it is proven that the green economy can promote economic growth simultaneously with reducing the negative impact on the environment. Actually, United Nations Environment Programme (UNEP) reports that transition to the green economy could generate economic benefits of 26 billion dollars until 2030.
For example, the application of efficiency measures reducing in the cost of energy which results in cost savings for companies and consumers. Moreover, transition to renewable energy reduces the dependence on fossil fuels which are often susceptible to price fluctuations. Further, sustainable agriculture development increases the production of organic food which can be sold at premium prices in the market.

The Importance of Sustainable Growth

Sustainable growth is a long-term approach to the economic development which prioritize the needs of current and future generations. It admits that economic growth must be followed by social progress and environmental protection. Sustainable growth requires balance between economic, social and ecological goals.
Sustainable growth is focused on the efficient use of nature resources, waste reduction and pollution, and promotion of the transition to the renewable energy sources. Further, it emphasizes social equality and inclusion, ensuring that the economic growth serves every member of society.

Achieving Green Economy and Sustainable Growth

Achieving green economy and sustainable growth requires comprehensive approach that includes all aspects of society. The governments, companies and civil society have a role in promoting sustainable development.

One of the key steps is adopting policies and regulations which promote sustainability and discourage harmful practices for the environment. Governments can encourage renewable energy and sustainable agriculture and impose taxes on unsustainable practices. They can also invest into research and development of new technologies which promote sustainability.

Companies, as well, have the key role in promotion of the sustainable development. They can adopt sustainable practices within their work, such as waste reduction, recycle promotion and consumption of renewable energy. They can also invest in research and development in order to find new ways for reducing the negative effect on the environment. Further, companies can incorporate sustainability in their supply chain by working with suppliers that prioritize sustainable practices.

Civil society has another key role in promoting sustainable growth. Individuals can adopt sustainable practices in their everyday life, such as reducing energy consumption, using public transportation and supporting sustainable businesses. They can also advocate for sustainability by raising awareness and pressuring governments and companies to take action.

Education is another essential component of achieving green economy and sustainable growth. Education leads to raising awareness about the importance of sustainability and equipping individual with knowledge and skills for promoting sustainable practices. Education can inspire innovations and new ideas which promote sustainability.

Challenges for Achieving Green Economy and Sustainable Growth

Despite the advantages of green economy and sustainable growth, there are many challenges that must be overcome. One significant challenge is a resistance to changes. Many industries and individuals can resist the transition towards sustainability because of the perceived costs or lack of knowledge and skills. Therefore, education and raising awareness are of utmost importance for overcoming resistance to changes.

Another challenge is a lack of political will. Governments can be unprepared to adopt the sustainability policies because of the pressure of interest groups or short-term political goals. However, political leaders must acknowledge the urgency of ecological challenges and take a decisive action towards sustainability.

Nonetheless, financing the initiatives for sustainability can be an additional challenge. Investing into renewable energy sources and sustainable agriculture can require significant capital which can be difficult to provide. Therefore, governments and companies must work together on securing finances and urging the sustainability initiatives.

Politics and Initiatives for the Promotion of Green Economy

1. Renewable energy: Governments can promote development and consumption of renewable energy sources such as solar energy, wind and hydropower. This can be achieved through policies such as feed-in tariffs, tax incentives and subventions.
2. Energic efficiency: Governments can also promote energic efficiency by setting standards for buildings, devices and vehicles. This can reduce energy consumption, reduce costs and improve air quality.

3. Sustainable agriculture: Promotion of sustainable agriculture practice can reduce the effect of food production on environment while simultaneously promoting food safety and economic development. Governments can encourage agriculturists to adopt sustainable practices such as organic agriculture and agroforestry.
4. Waste reduction: Waste reduction is a critical component of the green economy. Governments can promote waste reduction by implementing policies such as extended liability of producers, goals for waste reduction and encouraging recycling.
5. Sustainable transportation: Promoting sustainable transportation options, such as public transportation, cycling and walking, can reduce congestion, reduce emissions and improve public health. Governments can invest in cycling tracks and systems of public transportation.
6. Green jobs: Transition to green economy can also create new employment opportunities in the sectors such as renewable energy, energy efficiency and sustainable agriculture. Governments can invest in training programs and initiatives for opening new employment positions in order to support this transition.
7. Circular economy: Circular economy aims to eliminate waste by designing products and processes which can be reused, repaired or recycled. Governments can promote circular economy through policies such as product design standards and closed supply chains.
8. Green finances: Financing sustainable initiatives is crucial for achieving green economy. Governments and companies can encourage green investments such as green bonds, low interest loans and tax credits.

Company Policy (Deoflor East – Stara Pazova)

Deoflor East (Stara Pazova) - company policy is focused on achieving customer satisfaction, client trust and loyalty, as well as a full compliance with laws and regulations.
Policy of Quality, Environment and Security represents the translation of the most general business strategy within the Integrated Management System. The management considers the promotion of health and security, respect of environment and ethics as an essential part of its tasks.

Priorities

- To guarantee the respect of valid standards of Quality (ISO 9001 – IFS HPC), Environment (ISO 14001), Safety at work (ISO 45001) and obligations of compatibility related to the product, aspects of environmental protection and safety at work;
- To continue constant improvement of integrated system efficiency in order to guarantee the improvement of service quality, customer satisfaction, performance of environmental protection, services in areas of health and safety at work and business ethics;
- To guarantee the prevention of events and/or accidents;
- To ensure steady communication and cooperation with all guaranteed parties both internal and external from organization.

Principles

- Attention to current and future needs of customers and guaranteed parties;
- Constant research of ecological sustainability of product, activity and service;
- Adoption and promotion of the concept of risk prevention of accidents, harms and professional illnesses in every work environment;
- Inclusion of personnel in achieving company goals through creating motivational work environment and continual professional growth;
- Approach based on processes and careful management of relations that bind them;
- Continual improvement which was seen as the principle behind every individual activity and process;
- Mutually beneficial relationships with suppliers with special attention to development of continuous partnership;
- Machines, equipment, premises and building need to be in a good condition and in accordance with the requirements of IFS standards.

With special reference to the ethics and information security, Deoflor obliges to respect and share the code of ethics in order to guarantee the continuity of management, planning and implementation of the management system for information security, integrated with all of the company processes in order to protect confidentiality, integrity and availability thereof.
All employees are invited to actively participate in adoption of the principles stated above with commitment, attention and determination. We are convinced that effective application of these principles can also significantly contribute to the creation of the best conditions for professional and fulfilled work.

Sustainability

Our goal is the growth of our company and in particular its production. To reach this goal we adopt the most suitable measures to preserve the environment for the benefit of the community and future generations.
We adopt behaviors that comply with the legislative provisions from time to time in force in terms of sustainable development.
We are committed to developing increasingly effective products and processes in the exploitation of resources to reduce the environmental impact. We aim to reduce emissions, waste, recycle organic waste, developing eco-friendly packaging and reducing waste.
We focus our activities and processes on an efficient use of energy resources and on promoting the use of renewable energy sources.

Certifications

We assume our responsibility towards the environment, the society and towards those who collaborate with us. This is why we are committed to obtain the certifications that give proof of it.

Deoflor SPA has following certifications:

- Since 2003 we are certified UNI EN ISO 9001
- We were the first Italian company who received, in 2012, the IFS HPC Certification: safety and quality of the product and its production chain.
- In 2012, we adopted the code of ethics, controlled by the accredited certification organization: SMETA (Sedex Members Ethical Trade Audit).
- In 2013, we obtained the UNI EN ISO 14001 Certification (environment) and BS OHSAS 18001 Certification (safety at work).
- In 2014, we obtained the UNI CEI ISO 27001 Certification (system of management of confidential information).
- Again in 2014, we joined the Responsible Care program.

In particular for Deoflor East:

- In 2017 we received the IFS HPC Certification: safety and quality of the product and its production chain.

CONCLUSION

In conclusion, green economy and sustainable growth are of utmost importance for achieving long-term economic, social and ecological goals. Green economy promotes sustainable development by prioritizing resource efficiency, waste reduction and consumption of renewable resources. Sustainable growth acknowledges the importance of economic growth, social progress and environment protection. Achieving green economy and sustainable growth requires a comprehensive approach that includes all sectors of society. Governments, companies and civil society have a role in promoting sustainable development. Overcoming challenges such as a resistance to change, lack of political will and financing sustainability initiatives is crucial for achieving green economy and sustainable growth.

REFERENCE

(1) Đorić Žarko: Zelena ekonomija i održivi razvoj u zemljama zapadnog Balkana.
(2) Premović, J., Pejanović, R. (2016). Green economy in the function of sustainable tourism development of Serbia, Thematic Proceedings II: The First International Scientific Conference: Tourism in function of development of the Republic of Serbia - Spa Tourism in Serbia and Experiences of Other Countries, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, ISBN 978-86-89949-09-4, ISBN 978-86-89949-11-7, Vrnjačka Banja, 2-4 June, 2016, pp. 394-411
(3) Riznić Dejan: University of Belgrade, Technical Faculty in Bor, Ekonomski aspekti održivog razvoja i uticaj na životnu sredinu. Zbornik Međunarodne konferencije o obnovljivim izvorima električne energije.

LEADERSHIP AND THE IMPORTANCE OF APPLYING AN ENTREPRENEURIAL APPROACH IN PUBLIC ADMINISTRATION

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Abstract: In the modern environment, public administration faces increasing challenges, and leadership and an entrepreneurial approach are the key success factors. The application of this concept contributes to a more efficient and innovative management of the work of the public administration, reducing costs, as well as achieving better results in the implementation of public policies. This paper emphasizes that the application of a leadership and entrepreneurial approach can be very useful in public administration, and leaders must be able to apply it in order for the organization to achieve its goals and respond to the needs of citizens and the economy. The main goal of the paper is to point out the importance of applying leadership and entrepreneurial approach in public administration, as well as to determine to what extent employees in public administration in the territory of Raška District are familiar with this concept. The results show that, in addition to the fact that the entrepreneurial approach is of great importance for improving the efficiency of public administration work, a relatively small number of employees in the Raška District are still familiar with and involved in the application of this concept.

Keywords: *leadership, entrepreneurial approach, public administration, Raška District*

INTRODUCTION

Public administration is a very complex and dynamic sector that faces numerous challenges and changes in the environment under the conditions of globalization. The role of public administration is of great importance in the daily functioning of society, as it affects many aspects of citizens' lives. Despite its importance, there are areas in which the public administration can advance and improve its work, primarily in terms of greater efficiency and effectiveness. Precisely, the application of new approaches and concepts of leadership and entrepreneurial approach becomes essential. These concepts can contribute to improving the efficiency, innovation, and quality of services that public administration provides to citizens and the economy. Although entrepreneurship is increasingly researched in the private sector,

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there are few works dealing with the concept of entrepreneurship in public administration, as well as the importance of leaders in the application of an entrepreneurial approach in the public sector in the Republic of Serbia. This paper will investigate the importance of leadership and entrepreneurial approach in public administration and analyze to what extent the employees in the territory of Raška District are familiar with the application of the entrepreneurial approach in public administration. Through the analysis of the existing scientific literature, all the advantages of the application of these concepts will be listed, and recommendations will be made for their successful application in public administration.

LEADERSHIP IN PUBLIC ADMINISTRATION

In every organization, there are two groups of employees: those who manage the department and those who are executors. Leadership is part of management, but not all managers need to be leaders. Leadership is a process in which an individual influences followers to achieve company goals (Williams 2011). There are different definitions of leadership and leadership approaches in the literature. Some of the definitions of leadership were given by Mašić 2010, who defines leadership as the leader's influence on followers, during which goals for the group or organization are chosen, the leader organizes work activities at work, forces teamwork and provides support to members of the group or organization in which he works. For the successful operation of an organization, it is of crucial importance how motivated the employees are to work and achieve the organization's goals. If you work on the motivation of employees, you can achieve much higher success of an organization. Rewarding and motivation are very important activities in leadership. From the literature on leadership in public administration, Fernandez et al. 2010 developed the concept of integrated leadership, which includes five leadership roles essential for the success of leaders in the public sector: task-oriented leadership; relationship-oriented leadership; change-oriented leadership; diversity-oriented leadership; and integrity-oriented leadership. Their integrated approach envisions the unit of analysis as the collective efforts and behaviors of public managers working at multiple organizational levels and in positions that confer a degree of formal authority over subordinates. Specifically, these five roles are shared by team leaders, supervisors, managers, and senior executives. They are not consolidated in the hands of one person at the top of the hierarchy. There are several large empirical studies on leadership in the public sector, one of them is Trottier et al. 2008 which addresses important research questions regarding leadership competencies and their impact on follower satisfaction, as well as how important transformational leadership is compared to transactional leadership in government settings. Traditional leadership theory in public administration thus mainly focuses on leaders and the actions of individuals, rather than on the dynamic, complex systems, processes and practices that make up leadership (Uhl-Bien 2006).

ENTREPRENEURIAL APPROACH IN PUBLIC ADMINISTRATION

Tthe entrepreneurial approach plays a significant role in the efficient and successful functioning of public administration. The concept of entrepreneurship is most often associated with the private sector, but it also has applications in the public sector and can be defined as "the process of creating value for citizens by combining unique combinations of public and/or private resources to exploit social opportunities" (Morris & Jones 1999). Public administration is a complex and dynamic sector that faces numerous challenges and changes

in the environment. At a time when cities around the world are facing various challenges, the application of an entrepreneurial approach through innovation in public administration is becoming increasingly important, in order to respond to these challenges and achieve better cooperation with citizens and the economy (Schellong & Mans 2004). The application of innovations in public administration represents a new approach used in order to improve the quality of services provided to citizens and the economy, increase efficiency and reduce costs. These innovations can be technological in nature, such as the implementation of new data and process monitoring software, and organizational in nature, such as new management and decision-making strategies (Batalli 2011).

The application of innovations in public administration can have numerous benefits, and some of them are greater transparency in the work of public administration, improvement of services to citizens, reduction of time needed to solve problems, saving money, and increasing the efficiency of officials. Also, innovations in public administration can contribute to creating a positive impact on society and the environment. Public organizations which innovate may increase the levels of job satisfaction among employees, and improve their performance (Grandey 2003). Some examples of innovations in public administration are the use of digital technologies to improve the interaction of citizens with the public administration, the application of artificial intelligence for data analysis and forecasting trends, the use of social media for greater transparency and communication, and the application of an agile approach in project management and decision-making. The application of an entrepreneurial approach in public administration first of all implies changes in the organizational culture and way of thinking of the employees. In this sense, it is necessary to engage leaders who are ready to support innovative ideas and take risks in order to achieve better results (Mašić 2010). Also, it is important to establish a system of rewarding employees for innovation and successful results. The application of an entrepreneurial approach also requires the establishment of a system of monitoring and evaluation of work, in order to ensure the efficiency and effectiveness of the process.

Public administration and a company are two completely different institutions. Table 1 provides a parallel between a private sector organization, which refers to privately owned businesses that derive most of their resources from private sources, and public administration, which refers to government-owned and state-funded organizations.

Table 1. Schematic representation of corporate entrepreneur and entrepreneur in the public sector

	Corporate entrepreneur	**Entrepreneur in the public sector**
Founder	Corporate Director	State / Public Service
Goal	Creating new business opportunities and products that will bring profit and growth to the organization	Improving the quality of services provided to citizens and more efficient use of public resources (improving the quality of community life or solving public problems)
Financing	from own sources	from public sources and funds
An environment	that focuses on competition and profitability	governed by laws, regulations and political processes
Innovation	tends towards innovation in products and business models	focuses more on innovation in services and processes (E-governance)
Skills	good managerial skills, risk management and creation of innovative products or services, marketing	management of public resources and services, good political skills, to use the media
Measuring success	Profit, revenue and market share	Improving service quality, efficiency and reducing costs
Risks and failure	Takes risks	Rational risk taker

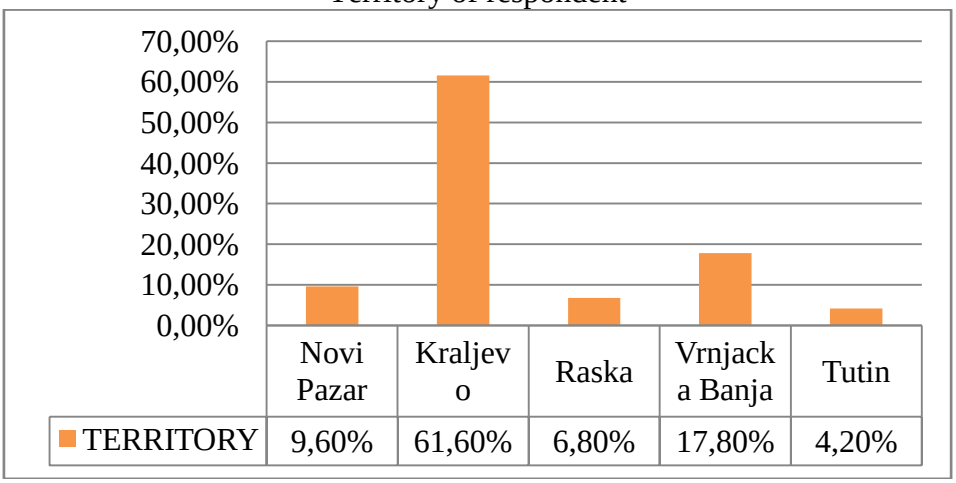
Source: Author according to Rainey, 2009, p. 80.

RESEARCH

In this paper, it was analyzed to what extent the employees in the territory of Raška District are familiar with the application of the entrepreneurial approach in public administration. By reviewing the relevant literature, it can be concluded that no concrete study has been done in Serbia so far. This is the first scientific work that empirically examines the attitudes of employees from the territory of the Raška Administrative District on the application of an entrepreneurial approach in public administration. This research on leadership and the importance of applying an entrepreneurial approach in public administration in Serbia was conducted from February to April 2023. In addition to the analyzed relevant literature in the field of leadership and entrepreneurship in public administration, this research used a qualitative research method, through a survey of employees and managers of public enterprises and organizations in the public administration of the Republic of Serbia. A total of

73 respondents participated in this research. Why Raška district? Raška administrative district is one of a totals of 29 administrative districts in Serbia has a significant administrative role in this region. It is located in the southwestern part of the Republic of Serbia, with the administrative center in the city of Kraljevo. The area covers almost 4,000 km^2, the district includes the territory of two cities and three municipalities that are important for this region: Vrnjačka Banja, Kraljevo, Novi Pazar, Raška and Tutin (https://raski.okrug.gov.rs/). According to the latest census data from 2022, around 300,000 inhabitants live in this territory (Statistical Office of the Republic of Serbia, 2022). Residents and businessmen of the Raška district have different needs and demands, and the administrative district has the task of meeting their needs in various spheres, such as: education, health, infrastructure, culture, and so on. Raška district is a very important district that contributes to the economic growth and development of Serbia.

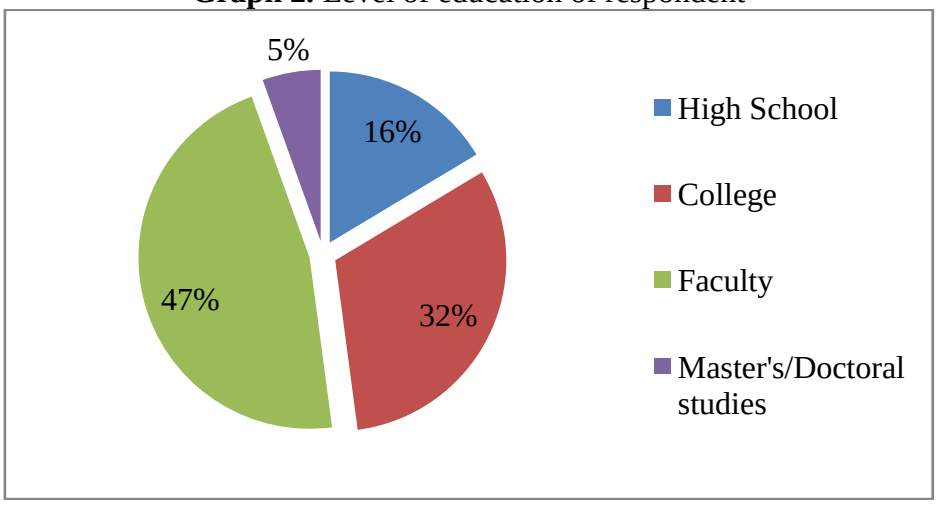
Graph 1. Demographic characteristics of the respondents
Territory of respondent



Source: Author

The largest number of respondents is from the territory of Kraljevo, 61.6%, then from Vrnjačka Banja, 17.8%, and the smallest number is from the territory of Tutin, 4.2%.

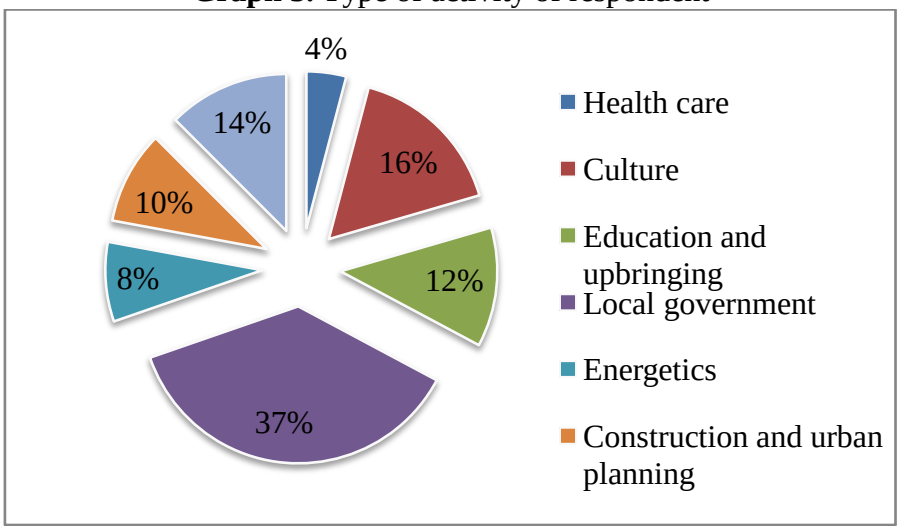
Graph 2. Level of education of respondent



Source: Author

The majority of respondents (47%) have a faculty degree, followed by college (32%), after high school (16%), and the least of respondents have completed master's and doctoral studies (5%).

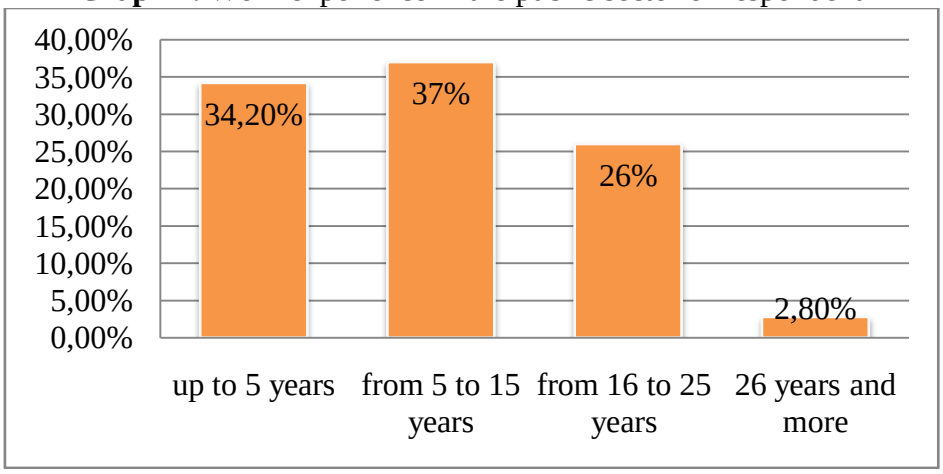
Graph 3. Type of activity of respondent



Source: Author

The largest number of respondents are from the local government sector (37%), followed by the sectors: culture (16%), education and upbringing (12%), while the smallest number of respondents are from the energetic sector (8%) and health care (4%).

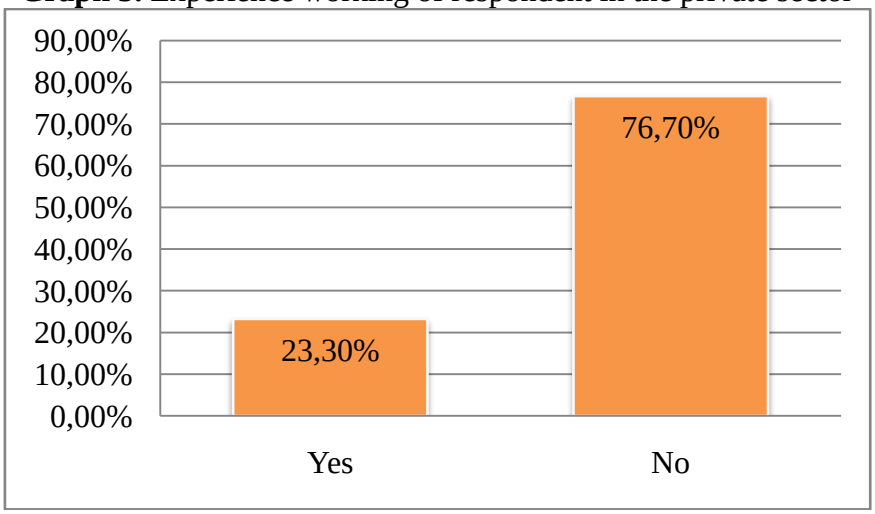
Graph 4. Work experience in the public sector of respondent



Source: Author

The largest number of respondents, even 37%, have between 5 and 15 years of work experience in the public sector, followed by employees with up to 5 years of work experience (34.2%) and employees with 16 to 25 years of work experience (26%). The smallest numbers were employees with 26 years and more of experience in the public sector.

Graph 5. Experience working of respondent in the private sector



Source: Author

The majority of respondents, even 76.7%, were employees who had no experience working in the private sector, while 23.3% of respondents had experience working in the private sector.
The extent to which employees in the public sector in Serbia are familiar with the concept of entrepreneurship (by conceptual areas: entrepreneurship, entrepreneurial leadership, crowdfunding, public-private partnership, entrepreneurship in the public sector) was tested through a series of closed-ended questions on a *Likert scale* ranging from 1 to 5 (1 - I am not familiar at all; 2 - I am mostly not familiar; 3 - I do not know, I did not think; 4 - I am mostly familiar; 5- Yes, I am completely familiar).

Table 2. Concept of entrepreneurship

Assessment of understanding of the following terms	Mean (M)	Standard Deviation (SD)
Entrepreneurship	3,18	1,06
Entrepreneurial leadership	3,03	1,11
Crowdfunding	2,77	0,70
Public-private partnership	3.88	1,01
Entrepreneurship in the public sector	2,68	0,88

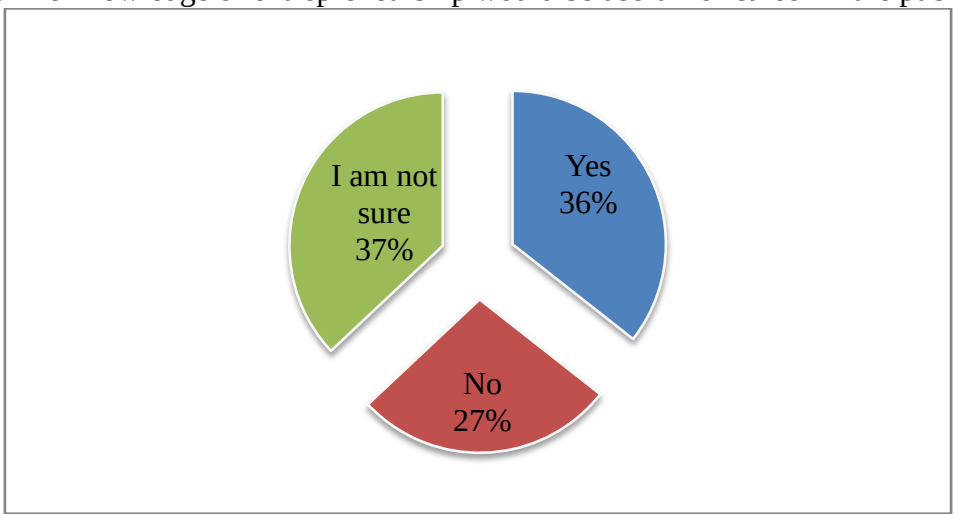
Source: Author

Table 2. presents an assessment of understanding of the concept of entrepreneurship across conceptual areas: entrepreneurship, entrepreneurial leadership, crowdfunding, public-private partnerships, and entrepreneurship in the public sector. Based on the results in this table, it can be observed that the knowledge of basic entrepreneurship concepts among employees in

the public sector is at a medium level (M = 3.18). Regarding employees' awareness of other concepts, the results are as follows: entrepreneurial leadership (M = 3.03), crowdfunding (M = 2.77), public-private partnerships (M = 3.88), and entrepreneurship in the public sector (M = 2.68). Furthermore, it can be concluded that employees in the public sector have a weak understanding of these concepts and the concept of entrepreneurship.

On a Likert scale ranging from 1 to 5 (1 - Strongly disagree; 2 - Disagree; 3 - Neutral; 4 - Agree; 5 - Strongly agree) the respondent rated the level of support their organization provides to employees for the development of entrepreneurial skills with M= 3,21.

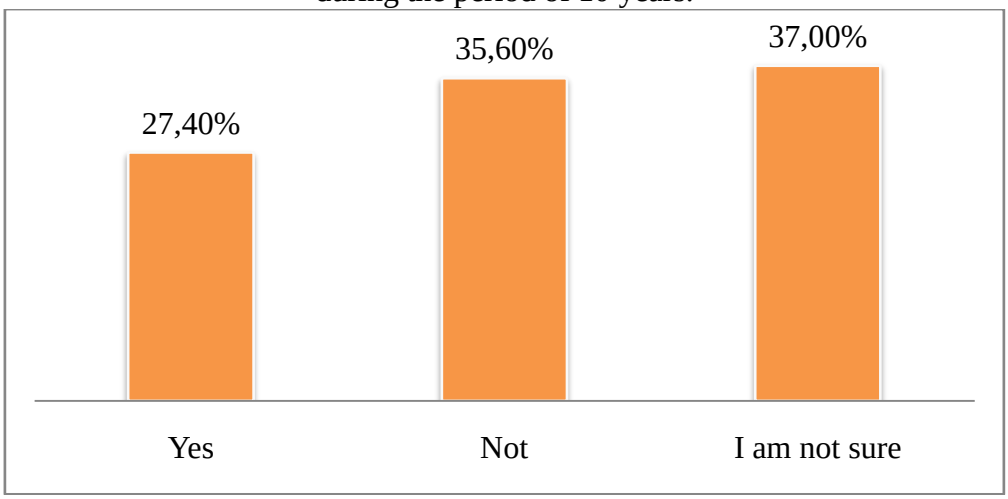
Graph 6. The knowledge of entrepreneurship would be useful for career in the public sector.



Source: Author

Only 36% of respondents think that knowledge about entrepreneurship can be useful for a career in the public sector, while 27% do not think so and 37% are not sure.

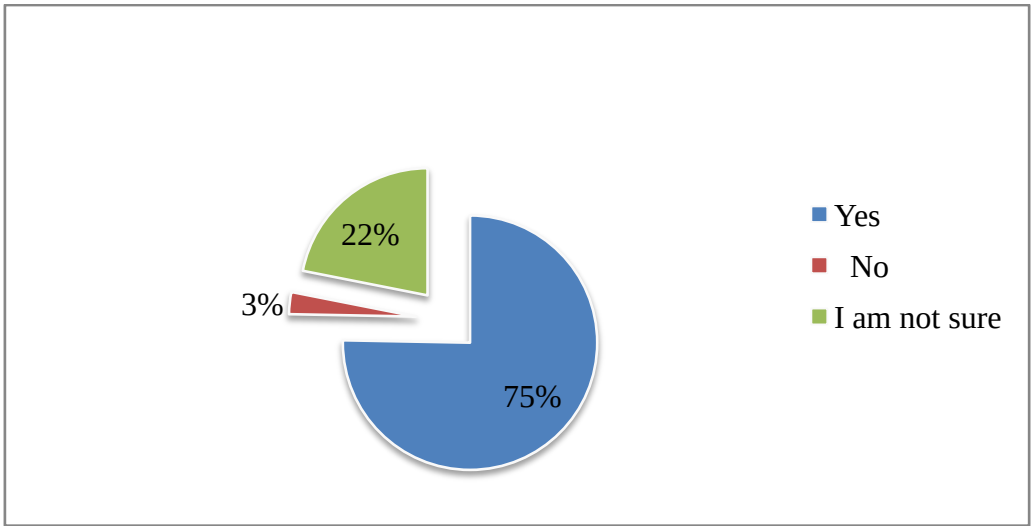
Graph 7. The organization applied some of the concepts of entrepreneurship in business during the period of 10 years.



Source: Author

Only 27.4% of respondents said that their organization applied some of the concepts of entrepreneurship in business during the period of 10 years, while 35.6% of respondents said that their organization did not use any of the concepts of entrepreneurship in business during 10 years and 37% of respondents said that they were not sure.

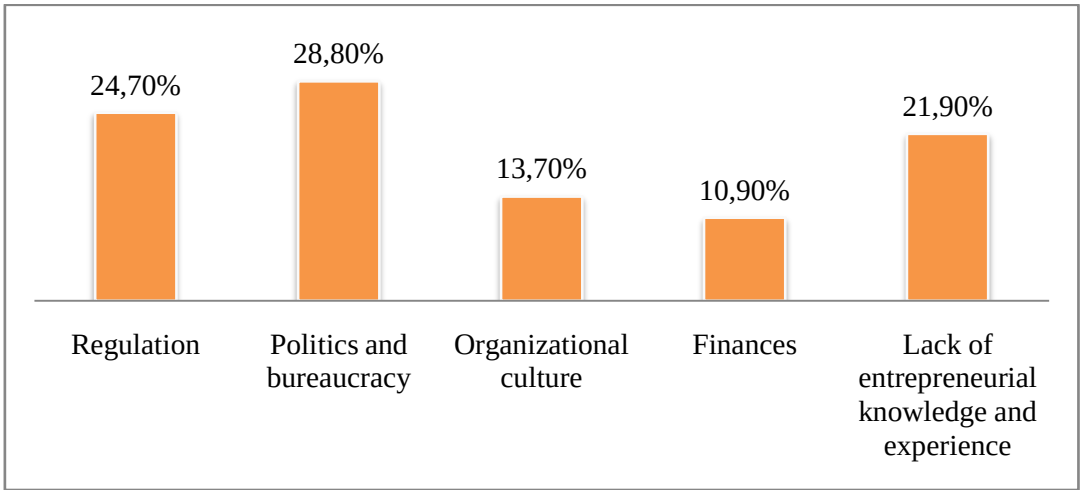
Graph 8. Applying the concept of entrepreneurship can improve the efficiency of public service.



Source: Author

The majority of employees, even 75%, think that applying the concept of entrepreneurship can improve the efficiency of the public sector, while a minority of only 3% do not think so and 22% are not sure.

Graph 9. As the biggest challenges in applying the concept of entrepreneurship in the public sector, the respondents mentioned following



Source: Author

As the biggest challenges in applying the concept of entrepreneurship in the public sector, the respondents mentioned politics and bureaucracy in the first place 28,8%, second place regulation 24,7%, and third place the lack of entrepreneurial knowledge and experience 21,9% , then organizational culture 13,7% and, last but not least, finances 10,9%

CONCLUSION

An entrepreneurial approach in public administration is necessary in order to improve the efficiency, effectiveness, and innovation of public administration, all with the goal of improving the quality of services that the state provides to citizens and the economy. The results of this study show that in addition to the fact that the entrepreneurial approach and leadership are of great importance for the efficient and successful functioning of public administration, a relatively small number of employees in the public administration are still familiar with and involved. Also, these results indicate the importance of regulating and applying the entrepreneurial approach in the public sector in Serbia.

In order to eliminate these problems, several things are necessary: the education of officials, attending seminars, it is necessary to co-finance the development of human capital, training and further training of employees, to create tools for motivating, encouraging and supporting employees in the public administration to adopt the concepts of an entrepreneurial approach. The state should play a key role by providing legal support to entrepreneurship in public administration, as well as public service organizations and employees. In summary, these are some recommendations that emerged from this work.

LITERATURE

1. Statistical Office of the Republic of Serbia (2022). The first results of the Census of Population, Households and Dwellings 2022. available at: https://publikacije.stat.gov.rs/G2022/HtmlL/G20221350.html , accessed: 09. 03. 2023.
2. Official website Raška district available at :https://raski.okrug.gov.rs/ accessed: 14. 03. 2023.
3. Rainey, H. G. (2009). *Understanding and managing public organizations* (4th ed.). San Francisco, CA: Jossey-Bass
4. Fernandez, S., Cho, Y. J., & Perry, J. L. (2010). Exploring the link between integrated leadership and public sector performance. *The leadership quarterly*, *21*(2), 308-323.
5. Trottier, T., Van Wart, M., & Wang, X. (2008). Examining the nature and significance of leadership in government organizations. *Public administration review*, *68*(2), 319-333.
6. Uhl-Bien, M. (2006). Relational leadership theory: Exploring the social processes of leadership and organizing. *The leadership quarterly*, *17*(6), 654-676.
7. Schellong, A., & Mans, D. (2004). Citizens preferences towards one-stop government. In *Proceedings of the 2004 annual national conference on Digital government research* (pp. 1-3).
8. Batalli, M. (2011). Impact of public administration innovations on enhancing the citizens' expectations. *International Journal of e-Education, e-Business, e-Management and e-Learning*, *1*(2).

9. Grandey, A. A. (2003). When "the show must go on": Surface acting and deep acting as determinants of emotional exhaustion and peer-rated service delivery. *Academy of management Journal*, *46*(1), 86-96.
10. Mašić, B., Babić, L., Đorđević-Boljanović, J., Dobrijević, G., & Veselinović, S. (2010). *Menadžment: principi, koncepti i procesi*. Univerzitet Singidunum, *Beograd*.
11. Williams, C., (2011). *Principi menadžmenta – MGMT*, Data Status, Beograd
12. Mašić, B. (2010). *Management*, Singidunum University, Belgrade

THE IMPORTANCE OF BLOCKCHAIN TECHNOLOGY IN THE MANAGEMENT OF MODERN SUPPLY CHAIN

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Abstract: The highest level of strategic organizational change is a change in the business model. This change includes a reconsideration of the nature of business, the nature of the organization itself, and its transformation following the demands of the market. A large number of data, their exchange, and their increasing importance led to the creation of information and communication technology (ICT).Information makes the supply chain transparent which is necessary for making appropriate decisions. ICT significantly affects industrial and post-industrial development and forms the backbone of Industry 4.0. Regardless of whether it is a global distribution of goods or regional and local suppliers, the supply chain participants must ensure, at all times, a high level of quality and safety for their final products. The need to research the implementation and application of modern technologies in supply chains stems from the fact that it is a growing concept that has a widespread and significant impact on business development.Application of new technologies such as the Internet of Things (IoT), Autonomous (AV) and Automated Guided Vehicles (AGV), Artificial Intelligence (AI), Virtual (VR) and Augmented Reality (AR), Big Data, Data Mining, Blockchain, Cloud Computing (CC), 3D printing, etc. are united in the Logistics 4.0 concept and should ensure transparency, agility, faster reactions to the needs and demands of customers while optimizing business operations through lower costs and greater efficiency. Among the above-mentioned technologies, Blockchain is considered the fastest-growing one, and its application can lead to significant changes and improvements in modern business. This paper aims to present the main characteristics of Blockchain technology and its impact on the efficiency and security of the supply chain through a review of the relevant literature.

Keywords: Logistics 4.0, Blockchain, globalization,supply chains, information technologies.

I. INTRODUCTION

Globalization has led to many actors from different countries participating in logistics activities, the participation of the public and private sectors at different levels of development, different cultures, different legal frameworks and standards, levels of education, and different needs. With such a large number of participants in the supply chain, a large amount of data is created, the

possibility of error increases, low transparency of information flow, and non-compliance of processes occur. To effectively implement and optimize just one segment of business in such conditions, it is necessary to harmonize standards, procedures, regulations, and ways of doing business, as well as the education of employees, which requires time and expertise. Due to the mentioned complexity of the global supply chain, the implementation of digital solutions represents a need but also an immense challenge. Kilpatrick [1] considers it necessary to transform traditional supply chains into digital supply networks (DSNs) with a free flow of information and visibility from producers to end consumers, contributing to the agility and optimization of the entire system. Today, there is significant untapped potential in logistics, mainly resulting from the insufficient connection of logistics processes.Hofmann and Rüsch [2] highlight two dimensions of logistics operations: 1) The physical dimension of the supply chain and 2) The value chain dimension of digital data. The physical dimension includes autonomous and self-controlled logistics systems, automated material handling systems, and autonomous order processing systems (e.g. smart contracts based on Blockchain technology) that are connected and interact with each other. The digital dimension, on the other hand, includes sensor and machine data that is collected from the physical dimension of the supply chain and is a key input for strategic business decisions. Challenges within physical and digital processes are united within the concept of Logistics 4.0.Logistics 4.0 is considered an integral part of Industry 4.0 [3] and using its solutions and technologies should make supply chains more sustainable, agile, networked, and technologically advanced. Timm and Lorig [4] define Logistics 4.0 as a transformation from hardware-oriented to software-oriented logistics. Logistics 4.0 includes the latest information and communication technologies, software applications, and new business models that together enable complete digitalization and automation of logistics processes and activities [5].

An important link in creating a competitive advantage in digital supply chain management stems from the information exchange as evidence of trust between participants. One of the problems of digitization in the technological sense is the lack of standards for the information exchange process. The authors [6, 7] state Blockchain is a principal technology to reduce risk and improve the efficiency of information exchange. It is a technology that increases transparency in the supply chain, provides cybersecurity solutions, and ensures a high level of data protection at all times [8]. Blockchain leads to faster exchange of information, reduces the use of paperwork, speeds up communication in the chain, and the use of smart contracts is an example [9]. Several large companies have already implemented this technology, which contributes to their being leaders in their fields today.

II. THEORETICAL REVIEW

Blockchain is a distributed database system with a large number of users in the network. It is a technology based on a decentralized "peer-to-peer" network where computers communicate with each other without intermediaries. All participants in the chain have all the data, and there is no need for a central database. It was developed in 2008 by someone under the pseudonym Satoshi Nakamoto.

Given that it is a decentralized system [10], it is necessary to point out its advantages and disadvantages. The main advantages of decentralized systems are 1) Fault tolerance, 2) Resistance to attacks, no single point of attack, and 3) Negligible possibility of arrangement between participants for misuse. Some of the disadvantages and limitations of decentralized systems are 1) Loss of focus, 2) Impossibility of error correction, 3) Duplication of jobs, and 4) Maintenance costs.

Blockchain technology includes the following principles. Within the server network, there are the so-called nodes, that is, validators, which check, approve or reject each transaction. When the transaction is approved, specific nodes send data through the network, and each server records the transaction. Nodes are computers. Depending on the type of transaction that is performed, the types of computers also vary. They can be computers for home use or special computers whose sole function is to validate transactions.All transactions are verified and authenticated in the network itself, new blocks are created and the chain is constantly growing. Blocks represent digital records that are interconnected by cryptographic algorithms that ensure the authenticity and security of information [11]. Blocks are linked to each other with the help of a so-called cryptographic signature or a "hash". A "hash" is a string of characters that converts digital content into a digital signature through mathematical operations. Each block contains a link to the previous block, thus forming a chain. Also, each block contains a time stamp when the information was recorded in the block. A chain is an electronically distributed ledger or list of entries maintained by users or participants via a network of computers. Each transaction in the distributed ledger is confirmed by the consensus of the majority of participants in the network, thus ensuring integrity [12].Data encryption and coding in Blockchain improve transparency, efficiency, and trust when exchanging information. Data is updated in real-time. What gives security in Blockchain technology is the impossibility of data disappearing, or being retroactively changed, given that the databases are located online with all users. We conclude that the four main characteristics of Blockchain are: 1) Immutability, 2) Decentralized system, 3) Existence of consensus, and 4) Transparency [13]. Simply put, Blockchain can be described as a digital ledger where data about transactions or digital interactions is permanently, securely, and immutably stored.

Although it was originally conceived as a public database, today we distinguish between three basic types of Blockchain depending on the type, access, and participants in the network: 1) Public Blockchain, 2) Private Blockchain, and 3) Hybrid Blockchain [14].

Table 1. Characteristics of Blockchain architecture

Characteristics	PublicBlockchain	PrivateBlockchain	HybridBlockchain
Network type	Decentralized	Centralized	Partly decentralized
Network access	Anyone	Single organization	Several known organizations
Network participants	Unknownidentity	Known identity	Known – Unknown identity

Source: Created by the author according to [14].

The process of globalization has influenced supply chains to become more and more complex. When delivering goods, different forms of transport are used in different locations, documentation is in digital format, and the development of trade has led to the fact that production is in one part whereas the customer is in another part of the world. The challenge facing modern supply chains is to ensure transparency and reliability of the entire process. Transparency is reflected in the connection of all participants in the chain (suppliers, manufacturers, distributors, traders, and buyers) and automatic monitoring of the origin and flow of goods. In this way, it is possible to plan, monitor and determine the time from the appearance

of a request to its final realization based on real data [15]. Blockchain technology is an important link in the processes of connecting goods and information flows. Thanks to its ability to ensure the immutability and public availability of data flows, Blockchain can increase the efficiency, reliability, and transparency of the supply chain and positively affect all processes, from storage to delivery and billing.The task of Blockchain is the creation of a digital database, that is, a digital ledger that is used when exchanging documents and contracts and tracking transactions from the movement of goods to payment. Since each transaction is tracked and recorded in the block and there are copies in the database, the process is fully traceable and transparent. Also, the entire process and all data are secure since each block is connected with the previous and the next block [16]. The advantage of Blockchain technology compared to other decentralized networks is that it provides a higher degree of trust, that is, there does not have to be trust between participants in the network, but the technology itself guarantees that trust is implemented in the system. Since Blockchain enables the transfer of data anywhere in the world without using the so-called services of a third party, it is suitable for a global supply chain [17].

Benefits of applying Blockchain within the supply chain:

- reduces costs and optimizes processes,
- reduces paper documentation,
- reduces product delay time,
- reduces the possibility of human error and fraud,
- makes it easier to trace the origin of the product,
- increases consumer and supplier confidence.

Blockchain technology is widely used in food product supply chains. The modern consumer is well-educated and wants to have all the available information about the desired product. To respond to increasingly strict consumer demands, supply chain participants must offer a high level of quality for their products and services [18]. Blockchain technology, on the one hand, ensures transparency, traceability, integrity, and security of data for all participants in the chain, starting from suppliers of raw materials, manufacturers, processors, transport companies, wholesalers, retail chains, and to the end users, who through applications and by scanning QR codes on products have insight into all data related to a specific product (origin, method of cultivation or production, used resources, time spent in transport, method, and conditions of storage, humidity, temperature,etc.) [19, 20]. Data transparency provides the customer with a guarantee of security.

In addition to the evident advantages, Blockchain also has certain disadvantages reflected in the field of further research that needs to be identified and worked on to eliminate them. Some of them are 1) The size - with the increase in transactions, the number of blocks and therefore the Blockchain network increases, and at one point it threatens to turn into a centralized system, which is contrary to the concept, 2) The speed of transactions - the time required for a new block to be created, which can make this system uncompetitive in business, 3) It cannot guarantee complete privacy of information. Also, within the Blockchain, some technologies need to be improved so that they do not become subject to misuse, and it refers, among other things, to the work of the Proof of Work and Proof of Stake algorithms.

A significant obstacle to the further development ofBlockchain technology in the field of the supply chain is the lack of regulation at both international and national levels. A negligibly small number of regulations have been adopted, they are mainly in the domain of instructions, announcements, and opinions, and there are very few of those at the level of the law, and there is almost no regulatory framework for the technology itself [21, 22]. One of the reasons for the lack of regulation is the immaturity of the technology itself and its susceptibility to speculative influences. Due to constant improvements and new technological solutions, each regulation would carry with it the risk of becoming outdated or unusable very quickly and subject to changes. In addition to challenges in the field of regulation, additional activities for further implementation and development of Blockchain relate to digitization and standardization of data, knowledge sharing, and a better understanding of the technology by all partners in the supply chain. Also, the cost of implementation and the lack of qualified personnel for the implementation process can be limiting factors [21]. The basic idea of Blockchain technology is to replace large and rigid systems with simple, functional, faster ones while eliminating the role of intermediaries.

III. CONCLUSION

Traditional supply chains face problems related to the speed of movement of goods, quality of delivery, security, and cost. In addition to these challenges, a big problem is the non-transparency of data. Modern supply chains use the 7R concept, which means: the right product, right quantity, right conditions, right place, right time, right customer, and the right price. By applying innovative technologies this long and complex chain can become transparent and more efficient. Digitization of the supply chain represents progress towards a fully integrated set of solutions that facilitate, speed up the flow of data and, at the same time, affect the greater security of the entire chain. Blockchain increases transparency in the supply chain, providing protection of origin, the validity of transactions, and acceleration of communication in the chain. This technology reduces paperwork, quickly provides relevant information, and prevents potential fraud. Blockchain technology has significant potential in the segment of security and optimization of costs associated with document processing through the application of smart contracts. All of the above contributes to a faster response to the needs of end users, based on which participants in the supply chain increase their competitive advantage and become business leaders. In the end, we can conclude that Blockchain, combined with other technologies and solutions included in the Logistics 4.0 concept, brings several advantages in the form of integration of the physical and virtual world, greater flexibility, and speed of implementation of manipulative activities while improving performance in all segments of supply chain functioning. Based on the theoretical overview, it is necessary to define indicators of advantages and limitations for the implementation of Blockchain technology within the guidelines for future research. Empirical research should include a cost-benefit analysis of the implementation of Blockchain technology from the perspective of costs, the time required for implementation, as well as costs and time for retraining the workforce in this area. The structure of the questionnaire should include business entities that differ according to their size, profitability, and field of work. Such a research approach would complement the scientific and professional view of the possibilities of applying this technology in supply chains.

REFERENCE

[1] Kilpatrick, J. COVID-19: Managing Supply Chain Risk and Disruption. Available online: https://www2.deloitte.com/ca/en/pages/finance/articles/covid-19-managing-supply-chain-risk-and disruption (accessed on 04 April 2023).
[2] Hofmann, E., Rüsch, M. (2017). Industry 4.0 and the current status as well as future prospects on logistics. Computers in Industry, Vol. 89: 23–34.
[3] Kostrzewski, M., Varjan, P.,Gnap, J. (2020). Solutions Dedicated to Internal Logistics 4.0, Sustainable Logistics and Production in Industry 4.0, Springer Nature Switzerland AG, Cham, Switzerland, 243-262.
[4] Timm, I.J., Lorig, F. (2015). Logistics 4.0 - A Challenge for Simulation. In: Proceedings of the 2015 Winter Simulation Conference, edited by L. Yilmaz, W. K. V. Chan, I. Moon, T. M. K. Roeder, C. Macal, and M. D. Rossetti, Huntington Beach, CA, USA, 3118–3119.
[5] Strandhagen, J.O., Vallandingham, L.R., Fragapane, G., Strandhagen, J.W., Stangeland, A.B.H., Sharma, N.(2017). Logistics 4.0 and emerging sustainable business models. Advances in Manufacturing., 5(4), 359-369.
[6] Demirkan, S., Demirkan, I., Mckee, A. (2020). Blockchain technology in the future of business cyber security and accounting, Taylor & Francis Online.
[7] Zhang, H., Nakamura, T., Sakurai, K. (2019). Security and Trust Issues on Digital Supply Chain, IEEE Xplore Digital Library.
[8] Tijan, E., Aksentijević, S., Ivanić, K., Jardas, M. (2019). Blockchain Technology Implementation in Logistics, Sustainability, 11(4), 1-13.
[9] Gatteschi, V., Lamberti, F., Demartini, C., Pranteda, C.,Santamaría, V. (2018). Blockchain and smart contracts for insurance: Is the technology mature enough?, Future Internet, Vol. 10, 20.
[10]Kravchenko, P., Skriabin, B., Dubinina, O. (2018). Blockchain and decentralized systems. Kharkiv: Distributed Lab.
[11]Nurgazina, J., Pakdeetrakulwong, U., Moser, T., Reiner, G. (2021). Distributed ledger technology applications in food supply chains: A review of challenges and future research directions. Sustainability, 13(8), 4206.
[12]Christidis, K., Devetsikiotis, M. (2016). Blockchains and smart contracts for the Internet of Things. IEEE Access, 4: 2292– 2303.
[13]Paksoy, T., Koçhan, C., Samar Ali, S. (2021). Logistics 4.0Digital Transformation of Supply Chain Management, CRC Press Taylor & Francis Group, LLC.
[14]Niranjanamurthy, M.,Nithya, B.N., Jagannatha, S. (2018). Analysis of Blockchain technology: pros, cons and SWOT. Cluster Computing, 1–15.
[15] Khan, M. A., Salah, K. (2018). IoT security: Review, blockchain solutions, and open challenges. Future Generation Computer Systems, 82, 395-411.
[16]Bledsoe G., Rasco B. (2018). Recent Advances on Intelligent and Active Packaging in Food and Beverage Technology. Food Health and Technology Innovations 1(2): 72-74.
[17] Breese, J.L., Park, S.J., Vaidyanathan G. (2019). Blockchain Technology Adoption in Supply Change Management: Two Theoretical Perspectives. Issues in Information Systems,20(2): 140-150.
[18]Talal, M., Kazmi, R., Joyia, G. J., Naz, T. (2020). Improving Traceability Using Blockchain and Internet of Things (IoT) in the Food Supply Chain. In International Conference on Engineering Software for Modern Challenges (pp. 16-25). Springer, Cham.
[19] Naz, T. (2021). Improving Traceability Using Blockchain and Internet of Things (IoT) in the Food Supply Chain. In Engineering Software for Modern Challenges: First International Conference, ESMoC 2021, Johor, Malaysia, Revised Selected Papers (p. 16). Springer Nature.

[20] Zhao, G., Liu, S., Lopez, C., Lu, H., Elgueta, S., Chen, H., Boshkoska, B. M. (2019). Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions. Computers in industry, 109, 83-99.
[21] Nallapaneni, M.K., Pradeep, K.M. (2018). Blockchain technology for security issues and challenges in IoT, Procedia Computer Science 132, 1815–1823.
[22] Wang, M., Wu, Y., Chen, C., Evans, M. (2021). Blockchain and Supply Chain Management: A New Paradigm for Supply Chain Integration and Collaboration Operations and Supply Chain Management 14(1) pp. 111 – 122.

COMPARATIVE ANALYSIS OF THE APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES AT HIGHER SCHOOLS AND FACULTIES

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Abstract: The beginning of the third millennium is characterized by the expansion of theapplication of information and communication technologies that have been incorporated into all areas of human life. One of the crucial requirements that the modern age places on a person is the possession of adequate knowledge in the field of application of information and communication technologies. Considering that knowledge is the most important resource in this century, as well as that information literacy stands just behind the technique of writing and reading, today it is impossible to imagine the educational process without the application of modern information and communication technologies. On the other hand, considering that the Republic of Serbia aspires to join the European Union, it is clear that the scientific and professional public in the field of information and communication technologies must contribute to the increase of information literacy among new generations of experts.Numerous previous researches point to different degrees of application of these technologies in higher education institutions. For this reason, a comparative analysis of the application of these technologies at higher schools and faculties was made in this paper. The research was conducted by surveying respondents, and the obtained results were analyzed using modern statistical methods.

Key words: information and communication technologies, teaching process, higher schools, faculties

INTRODUCTION

In an economy based on knowledge economy and the use of modern technologies, education is a strong driving force for the economic development of every country. The results of the research so far have unequivocally shown that the application of modern information and communication technologies in educational institutions is an important determinant of economic development (*Stakićet al., 2018*).

In the knowledge economy of the 21st century, information and communication technologies enable educational institutions to more efficiently educate staff who, after completing their education, will perform tasks at their future jobs much more productively and efficiently (*Milićević, 2021*).For the educational system to be successful, it needs to follow contemporary trends in the application of information and communication technologies. Research has shown that the degree of application of these technologies in education varies from country to country. For example, while in the Republic of Serbia the conditions and options for the use of information and communication technologies in education were examined, at the same time, the effects and consequences of the use of these technologies were assessed in Denmark (*Milenković, 2012*).

The importance and use of information and communication technologies in educational institutions is the subject matter of research of numerous researchers (*Oliver, 2002; Nakaznyiet al., 2015; Ahmed et al., 2018; Kaljević, 2018*).Most of the studies on the application of these technologies were related to schools and faculties from central Serbia and AP of Vojvodina (*Grahovac, 2013; Džigurski et al., 2013;Milićević et al., 2016; Petrović et al., 2016;Milićević et al., 2021*). The lack of these studies from the AP of Kosovo and Metohija was observed. For this reason, we considered it of interest to analyze the degree of application of information and communication technologies in higher education carrying out their educational activity in the northern part of AP of Kosovo and Metohija. The objective of this paper is to compare the views of students and teaching staff on the degree of application of information and communication technologies in the analyzed higher education institutions.

The subject of this paper are thirteen higher education institutions carrying out their educational and scientific activity in the northern part of the AP of Kosovo and Metohija founded by the Government of the Republic of Serbia.

The research presented in this paper was conducted through a survey of two groups of respondent - teaching staff and students. A total of 196 teachers and 508 students were surveyed. The data obtained were analyzed using the contemporary modern statistical methods.

The results of this research will serve to assess the current status of the effects of the application of information and communication technologies at the analyzed faculties and higher schools of vocational studies. In addition, the results obtained could be used by these higher education institutions to identify the existing issues in the application of these technologies, which need to be eliminated, in order to achieve greater efficiency of the teaching process.

1. Work methods

A comparative analysis of the application of information and communication technologies in the teaching process at two levels of study (vocational schools and faculties) was made in this paper. The research included three higher schools of vocational studies within the Academy of Vocational Studies of Kosovo and Metohija and ten faculties within the University of Priština with temporary head office in Kosovska Mitrovica. These higher education Institutions deliver classes in the northern part of the AP of Kosovo and Metohija in Kosovska Mitrovica, Leposavić, Zvečan and Lešak (Table 1).

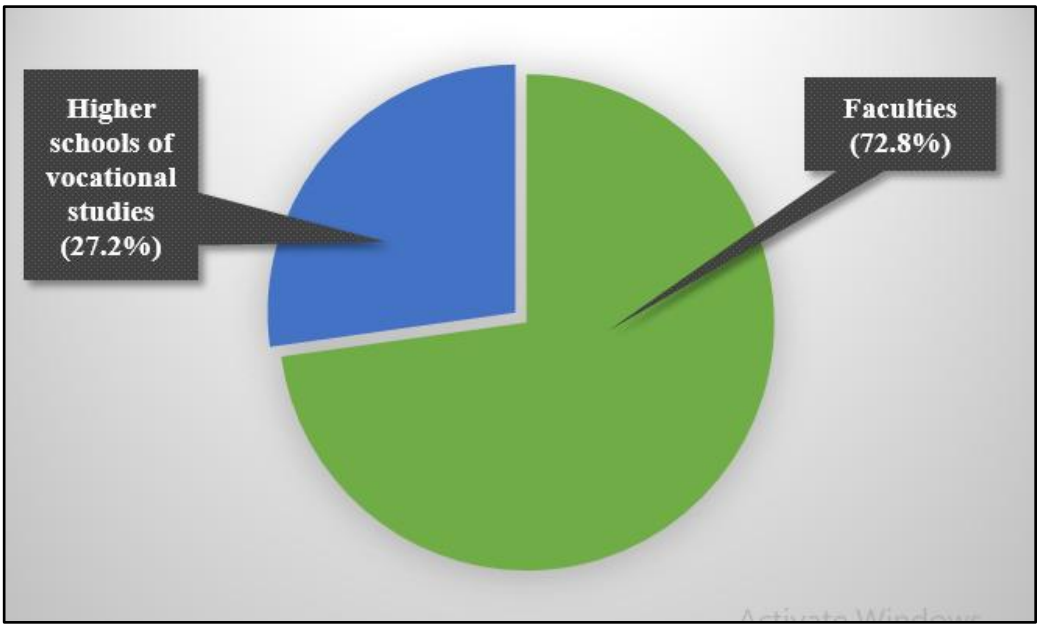
Table 1. Overview of analyzedhigher schools of vocational studies and faculties

No.	Higher School of Vocational Studies/Faculty	Place	Academy/University
1.	Higher School of Vocational Technical Studies	Zvečan	Academy of Vocational Studies of Kosovo and Metohija
2.	Higher School of Vocational Economic Studies	Leposavić	
3.	Higher School of Vocational Technical Studies	Leposavić	
4.	Faculty of Economics	KosovskaMitrovica	University of Priština in KosovskaMitrovica
5.	Faculty of Law		
6.	Faculty of Philosophy		
7.	Faculty of Medicine		
8.	Faculty of Technical Sciences		
9.	Faculty of Arts		
10.	Faculty of Natural Sciences and Mathematics		
11.	Faculty of Pedagogy	Leposavić	
12.	Faculty of Sports and Physical Education		
13.	Faculty of Agriculture	Lešak	

A total of 704 respondents from the mentioned vocational schools and faculties participated in this analysis, of which 508 were students and 196 were teachers. The study had two phases. In the first phase, respondents were surveyed through questionnaires in printed form.In the second phase, the obtained results were processed using statistical data processing software, IBM SPSS version 23.0.

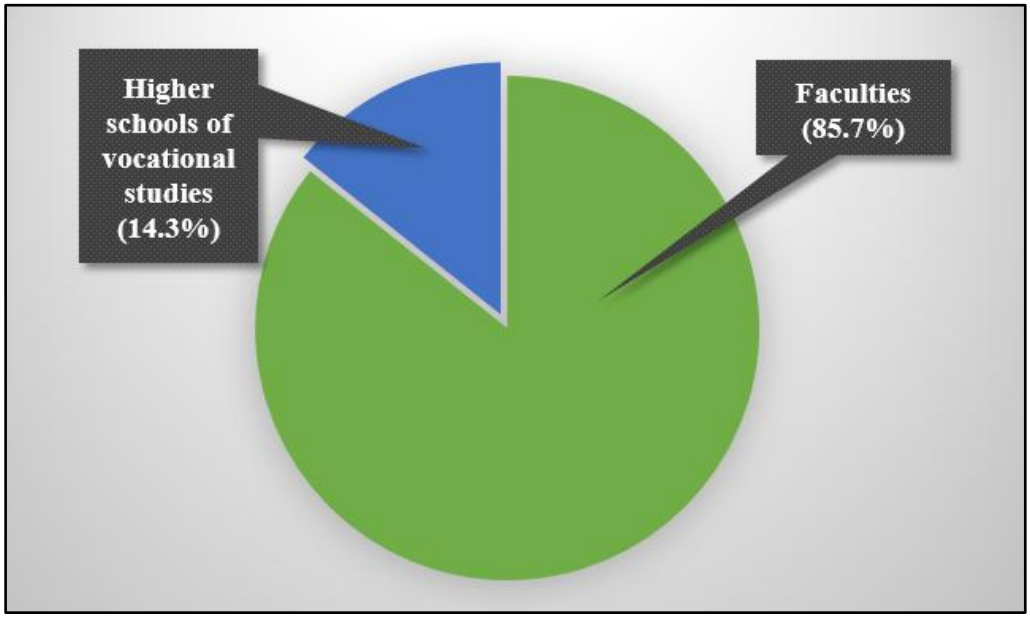
The structure of surveyed students consists of 370 students (72.8%) from faculties and 138 students (27.2%) from higher schools of vocational studies (chart 1).

Chart 1 Structure of the students surveyed



The structure of the surveyed teaching staff consists of 168 respondents (85.7%) from faculties and 28 respondents (14.3%) from higher schools of vocational studies (Chart 2).

Chart 2 Structure of the teaching staff surveyed



The comparative analysis was done on the basis of the results of a survey conducted at higher schools of vocational studies and faculties, and was discussed in the function of the following:

1) form of teaching,
2) computer use model,
3) degree of Moodle-based e-learning,

4) factors influencing the degree of application of information and communication technologies,
5) degree of following the curricula of modern information and communication technologies,
6) Wi-Fi use,
7) evaluation of the information and communication technologies application effects at faculties,
8) dynamics of computer equipment use, and
9) dynamics of computer programs and learning materials use.

The results of comparing the similarities and differences in the attitudes of these two groups of respondents will enable an overview of the current status and the identification of guidelines for a more effective application of these technologies at the analyzed higher education institutions.

2. Comparison of the students' and teachers'attitudes on the application of information and communication technologies at higher schools of vocational studies

The effects of the application of information and communication technologies were analyzed in three higher schools of vocational studies, two of which carry out their educational activity in Leposavić, and one in Zvečan. A total of 166 respondents were surveyed, of which 138 were students (83.13%) and 28 were teachers (16.87%).

The concordance of the answers is observed through the comparison the survey results on the forms of teaching in higher schools of vocational studies, obtained by surveying students and teachers. The largest number in both groups of respondents, i.e. 73 students (52.90%) and as many as 23 teachers (82.14%) supported the claim that both forms of teaching are used in their schools. A slightly lower number in both groups of respondents, i.e. 49 students (35.51%) and 4 teachers (14.29%) opted for teaching assisted by information and communication technologies. However, as the lowest number in both groups of respondents, i.e. 16 students (11.59%) and one teacher (3.57%) opted for the conventional form of teaching, it could be stated that the information and communication technologies are increasingly used in the teaching process in these schools.

The review the survey results on models of computer use at higher schools of vocational studies, provided by the answers of surveyed students and teachers, shows that the answers are identical. The largest number in both groups of respondents, i.e. 120 students (86.96%) and 20 teachers (71.43%) claim that the "one computer - one student" model is used in their higher schools of vocational studies.However, the fact that 18 students (13.04%) and 8 teachers (28.57%) claim that the model "one computer - several students" is used indicates that there is a higher school of vocational studies without a sufficient number of computers.

Comparison of the survey results on the implementation of e-learning using Moodle at higher schools of vocational studies, obtained from the answers of students and teachers, indicates that 95 students (68.84%) and 13 teachers (46.43%) claim that their institutions have an option for this form of learning. Since 43 students (31.16%) and 15 teachers (53.57%) provided negative answers, it can be concluded that some higher schools of vocational studies do not have the option for e-learning using Moodle.

Based on the survey results on the factors that influence the degree of information and communication technologies use in higher schools of vocational studies, obtained from the answers of students and teachers, it can be seen that the largest number of respondents, i.e. 79 students (54.25%) and 18 teachers (64.29%) believe that the equipment of higher schools of vocational studies enabling the use of contemporary information and communication technologies is the major factor.Slightly fewer respondents, i.e. 49 students (35.51%) and 10 teachers (35.71%) opted for the activity and expertise of the teaching staff. However, 10 students (7.25%) and no teachers voted for the activities of school principals and the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Comparison of the survey results on following the modern information and communication technology curricula, obtained by surveying students and teachers, indicates that the majority of respondents, i.e. 71 students (51.45%) and 19 teaching staff (67.86%) rated it "sufficient", and slightly less respondents rated it “partially”, i.e. 53 students (38.41%) and 7 teachers (25%). These results show that 89.86% of students and 92.86% of teachers are satisfied with the following of modern information and communication technology curricula.However, 10.14% of students are not satisfied, i.e. 7 students (5.072%) rated this option with “insufficient” and 7 students (5.072%) with “not sure”.In addition, 7.14% of the teachers are also not satisfied, i.e. one respondent rated this option with “insufficient” and one with “not sure”. No students and teachers selected “not satisfied at all” rating.

Comparison of the survey results on Wi-Fi at higher schools of vocational studies, obtained from the surveyed students and teachers,indicates that the largest number of respondents, i.e. 135 students (97.83%) and 28 teachers (100%) say that there is Wi-Fi in their schools, and only 3 students (2.17%) and no teachersay that there is no Wi-Fi in their schools. These results show that the answers of students and teachers are quite similar, i.e. that there is Wi-Fi at the higher schools of vocational studies.

Comparison of the survey results on ratings of the effects of the application of information and communication technologies in higher schools of vocational studies, obtained from the answers of students and teachers, shows that the average students' ratings range from 3.57 (SD=1.032) to 3.99 (SD= 0.920), and teachers’ ratings range from 3.46 (SD=1.232) to 4.43 (SD=0.742).Based on the answers provided, it can be concluded that the teachers rated the degree of application of these technologies in higher schools of vocational studies slightly higher than the students.

Comparison of the survey results of students and teachers on the dynamics of the use of computer equipment in higher schools of vocational studies indicates that the mean values of the students' answers range in the interval from 2.04 (SD=1.186), corresponding to the dynamics of “several times a week”, to 4.05 (SD=1.411), corresponding to the dynamics of “several times a month”.However, among teachers, the mean values of the answers range from 1.14 (SD=0.356), corresponding to somewhat less often than “everyday”, to 4.46 (SD=1.036), corresponding to less often than “several times a month”.Although the range of mean response values is narrow, it is obvious that teachers use this equipment a bit more often than students.

Comparison of the survey results of students and teachers on the dynamics of the use of computer programs and learning materials in higher schools of vocational studies indicates the mean values of the students' answers range in the interval from 2.20 (SD=1.115), meaning

they use them less often than "several times a week",to 4.24 (SD=1.282), meaning they use them less often than "several times a month", However, the mean values of teachers' responses range from 1.50 (SD=0.962), corresponding to the dynamics between "everyday" and"several times a week", to 4.79 (SD=0.787), corresponding to the dynamics between "several times a month" and "not used". Based on the narrow range of mean values of the answers, it can be concluded that teachers use computer programs and learning materials a bit more often than the students.

3. COMPARISON OF THE STUDENTS' AND TEACHERS' ATTITUDES ON THE APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES AT FACULTIES

The survey included 538 respondents from all ten faculties, out of which 370 students (68.77%) and 168 teachers (31.23%). Considering there are two groups of respondents, we thought it would be interesting to compare the views of students and teachers on the effects of the implementation of these technologies at their faculties.

Comparison of the survey results on the form of teaching at the faculties, obtained from the answers of students and teachers, indicates that both groups of respondents, i.e. 243 students (65.66%) and 117 teachers (69.64%), declared that both forms of teaching are used at their faculties. A total of 68 students (18.38%) opted for teaching assisted by information and communication technologies, and 27 teachers (16.07%) for the conventional form of classes. Finally, 59 students (15.95%) opted for the conventional form of classes, and 24 teachers (14.29%) teaching assisted by information and communication technologies.

Comparison of the survey results on the model of computer use at the faculties, obtained from the answers of students and teachers, shows that the order of their statements matches. The largest number of respondents, i.e. 186 students (50.27%) and 106 teachers (63.10%) claim that the prevailing model at their faculties is "one computer - several students". Still, 184 students (49.73%) and 62 teachers (36.90%), claim that the"one computer - one student" model is used. This attitude of both groups of respondents indicates the deficit of computers at the faculties.

The review of the survey results on the use of the Moodle for e-learning at the faculties, obtained from the answers provided by students and teachers, shows that their answers match. This means that the majority of respondents, i.e. 311 students (84.05%) and 138 teachers (82.14%) claim that there is no option for this kind of classes at their faculties. However, the fact that a significantly lower number of respondents, i.e. 59 students (15.95%) and 30 teachers (17.86%) claim that their faculties use Moodle clearly indicates that that a small number of faculties use this e-learning tool.

Comparison of the survey results on the factors influencing the degree of application of information and communication technologies at the faculties, obtained from the answers of students and teachers, shows that the answers match. The largest number of respondents, i.e. 196 students (52.97%) and 98 teachers (58.34%), believe that the equipment of higher schools of vocational studies enabling the use of contemporary information and communication technologies is the major factor. Slightly fewer respondents, i.e. 122 students (32.,97%) and 62 teachers (36.90%) opted for the activity and expertise of the teaching staff. The lowest number of respondents i.e. 52 students (14.05%) and 8 teachers (4.76%) opted for the activity

of faculty deans and the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Comparison of the survey results on following the modern information and communication technology curricula, obtained from the answers of students and teachers, shows a great similarity in the answers provided. The largest number of both groups of respondents, i.e. 194 students (52.43%) and 74 teachers (44.05%) rated this with "partially", while slightly fewer respondents, i.e. 92 students (24.86%) and 46 teachers (27.38%) rated it "sufficient". These results indicate that 77.29% of students and 71.43% of teachers are satisfied with the following of the modern information and communication technology curricula. Among the rest of the dissatisfied respondents (22.71% students and 28.57% teachers), the largest number, i.e. 54 students (14.59%) and 37 teachers (22.02%) rated it with "insufficient", slightly fewer respondents, i.e. 22 students (5.95%) and 8 teachers (4.76%) with "not sure", and the lowest number, i.e. 8 students (2.16%) and 3 teachers (1.79%) rated it with "not satisfied at all".

Comparison of the survey results on Wi-Fiat the faculties, obtained from the answers of students and teachers, shows that the majority of both groups of respondents, i.e. 299 students (80.81%) and 165 teachers (98.21%) claim that there is Wi-Fi at their faculties, and a significantly lower number, i.e. 71 students (19.19%) and 3 teachers (1.79%) say that there is no Wi-Fi at their faculties. These results indicate that there is noWi-Fi at some faculties.
Comparison of the survey results on ratings of the effects of the application of information and communication technologies at faculties, obtained from the answers of students and teachers, shows that the average students' ratings range from 3.18 (SD=0.985) to 3.79 (SD=1.123) , the average teachers' ratings range from 3.36 (SD=1.028) to 4.27 (SD=0.886).
It can be also concluded that that teaches' average ratings for all 8 comparable questions about the effects of the implementation of information and communication technologies at their faculties are slightly higher than the students' ratings.
Consideringthe survey results on the dynamics of the use of computer equipment obtained from the answers of students and teachers, it may be seen that the mean values of the students' answers range from 2.08 (SD=1.158), corresponding to the dynamics of "several times a week", to 4.13 (SD=1.246), corresponding to the dynamics of less frequent than "several times a month". However, the mean values of the responses of the teachers range from 1.68 (SD=0.980), corresponding to the dynamics of more frequent than "several times a week", to 4.27 (SD=1.109) corresponding to the dynamics of less frequent than "several times a month".

Comparison of the survey results on the dynamics of the use of computer programs and learning materials, based on the answers of the students and teachers, indicates the mean values of the students' answers range in the interval from 2. 51 (SD=1. 380), corresponding to the dynamics of between "once a week" and "several times a week", to 4. 39 (SD=1. 127), corresponding to the dynamics of less often than "several times a month". The mean values of teachers' responses range from 1.63 (SD=1.001), corresponding to the dynamics of between "several times a week" and "everyday", to 4. 23 (SD=1.262), corresponding to the dynamics of less frequent than "several times a month". Based on the mean values of the answers, it can be concluded that teachers use computer programs and learning materials a bit more often than the students.

CONCLUSION

This paper analyzes the views of students and teachers on the effects of the application of information and communication technologies at two levels of study: higher schools of vocational studies and faculties.

The comparative analysis of the results of the survey on the attitudes of students and teachers at the faculties resulted in the conclusion that the attitudes coincide in the following parameters: form of teaching (classes), computer use model, degree of Moodle-based e-learning, factors influencing the degree of application of information and communication technologies, degree of following the curricula of modern information and communication technologies and the use of Wife.

However, the effects of the application of information and communication technologies at the faculties were rated slightly better by the teachers than by the students. In addition, compared to students, teachers show a slightly more frequent use of computer equipment, computer programs and learning materials. On the other hand, a comparative analysis of the results of the survey on the attitudes of students and teachers at higher schools of vocational studies shows the same agreement of answers as at the faculties.

Certain shortcomings were identified based on the analysis of the survey results of students and teachers staff on the current status of application of information and communication technologies in the analyzed higher education institutions.The results of thisresearch can serve higher education institutions to improve the effects of knowledge acquisition among students. On the other hand, the research may be used for the development of the strategy on a more efficient use of these technologies in the process of teaching at the higher education institutions.

REFERENCES

1. Ahmed, A., Abu-Naser, S., El Talla, S., Al Shobaki, M. (2018), *The Impact of Information Technology Used on the Nature of Administrators Work at Al-Azhar University in Gaza*, International Journal of Academic Information Systems Research, 2(6), 1-20,
2. Grahovac, D., (2013). *Uticaj informalnog učenja na nivo informacione pismenosti učenika srednjih škola*, Doktorska disertacija, Univerzitet u Novom Sadu, Tehnički fakultet „Mihajlo Pupin“, Zrenjanin,
3. Džigurski S., Simić S., Marković S., Šćepanović D. (2013), *Istraživanje o upotrebi informaciono-komunikacione tehnologije u školama Srbije*, Tim za socijalno uključivanje i smanjenje siromaštva Republike Srbije, Kabinet potpredsednice Vlade Republike Srbije za evropske intergracije, Beograd,
4. Kaljević, J. (2018). *Statistička procena poboljšanja uspeha studenata koji su studiral ipreko DLS platform*, https://singipedia.singidunum.ac.rs/preuzmi/42917-statisticka-procena-poboljsanja-uspeha-studenata-koji-su-studirali-preko-dls-platformi/3474,
5. Milenković, J. (2012), *Informacione tehnologije u nastavi u Srbiji i Danskoj – Komparativna analiza*, Univerzitet u Beogradu, Matematički fakultet, Beograd,
6. ilićević V., Denić N., Milićević Z., Arsić Lj. (2016), *Uticaj primene informacionih tehnologija na kvalitet obrazovanja*, Međunarodna naučno-stručna konferencija “Kako do kvalitetnijeg života“, MEF, Beograd, 12. maj 2016. godine, Zbornik radova, str. 309-315,

7. Milićević, V. (2021). *Efekti implementacije informaciono-komunikacionih tehnologija u nastavnom procesu na visoko školskim ustanovama*, Doktorska disertacija, Fakultet informacionih tehnologija, Beograd,
8. Milićević, V., Denić, N., Milićević, Z., Arsić, Lj., Spasić-Stojković M., Petković D., Stojanović, J., Krkic, M., Sokolov-Milovančević, N., Jovanović, A. (2021). *E-learning perspectives in higher education institutions*, Technological Forecasting and Social Change, Volume 166, May 2021, 120618, *https://doi.org/10.1016/j.techfore.2021.120618*,
9. Nakaznyi, M., Sorokina, L., Romaniukha, M. (2015). *ICT in Higher Education Teaching: Advantages, Problems, and Motives*, International Journal of Research in E-learning Vol. 1(1), pp.49-61,
10. Oliver, R. (2002). *The role of ICT in higher education for the 21st century: ICT as a change agent for education*. Available from: https://www.researchgate.net/publication/228920282,
11. Petrović M. (2016). *Model e-učenja za podršku razvoju informatičkih kompetencija zaposlenih u obrazovanju*, Doktorska disertacija, Prirodno-matematički-fakultet, Departman za matematiku i informatiku, Novi Sad,
12. Stankić, R., Jovanović-Gavrilović, B., Soldić-Aleksić., J. (2018). Informaciono-komunikacione tehnologije u obrazovanju kao podsticaj ekonomskom razvoju, Ekonomski horizonti, 20(1), 61-73.

ANALYSIS OF THE NEED FOR DIGITALIZATION OF THE TEACHING PROCESS IN HIGHER EDUCATION IN THE REPUBLIC OF SERBIA

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Abstracts: Digitization is one of the priority goals of the Strategy for developing higher education in the Republic of Serbia until 2030. This paper aims to assess the need for introducing digital tools in teaching based on students' opinions. Students' attitudes were based on the results of an online questionnaire on a sample of 62 students of the Novi Sad School of Business. The results confirm the students' need to introduce digital tools in teaching. In their opinion, ideally organized teaching today represents a combination of synchronous and asynchronous education, that is, live teaching accompanied by modern digital tools, such as video lectures, quizzes, and others.

Keywords: higher education, digitization, synchronous teaching, asynchronous teaching, modern digital tools.

INTRODUCTION

Digitization affects all levels of society and social activity [8]. With the advancement of digitalization, the digital gap in Europe has also increased. In contrast, digitalization has simultaneously influenced the transformation of business dynamics, work organization, education, health, and government services. The further development of digitalization aims to ensure future competitiveness in the new, digitized environment [2]. The development of digital technologies has changed all segments of life, business and especially of education [7]. The digital transformation of the education system has proven to be a global need. The European Investment Bank (EIB), through support programs, has directly contributed to the improvement of digital infrastructure and digital teaching materials [6], providing direct help and support to the education system of the Republic of Serbia [5] [1]. Serbia recognized the role that education plays in digitization. According to Eurostat data, the level of individual digital skills in Serbia increased from 32% in 2015 to 46% in 2019 [5]. In 2018, there were 2,000 digitally equipped classrooms across Serbia. One year later, such classrooms grew to over 10,000 [6].

Digitization is one of the priority goals of the strategy for developing higher education in the Republic of Serbia until 2030 [9]. Setting this goal is related to the fact that current generations of students are strongly connected to digital technologies. Therefore, we examined whether students believe that introducing modern digital tools can bring the quality of highereducation closer to their needs and expectations.

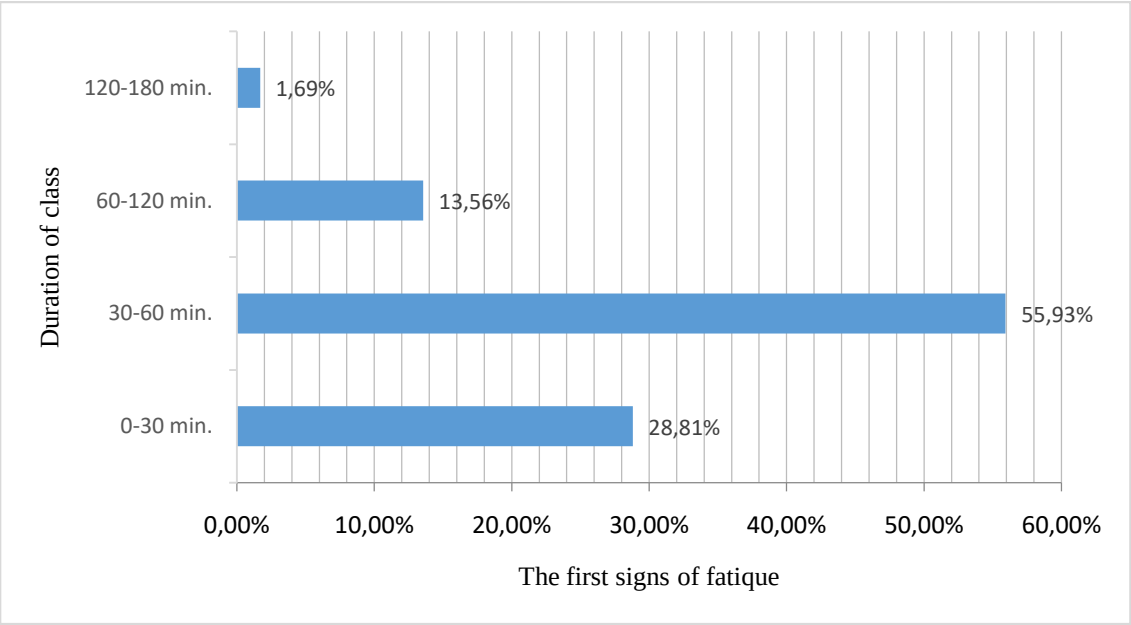
The research was conducted on a sample of 62 Novi Sad School of Business (NSSB) students who have already gained some experience in attending classes using digital tools, such as video lessons, online classes, online quizzes, questionnaires, and so on. Students of all study levels participate in the sample structure: 44.7% of students of 6 EQF level studies, 40.4%of students of 7 EQF level studies, and 14.9% of students of 6 EQF level studies (distance learning program).Within the NSSB, the use of modern digital tools in teaching is in the initial phase. Thus, the sample of students included in the research is relatively small compared to the total population of students, which relativizes the objectivity of the paper's conclusions.

CHARACTERISTICS OF TRADITIONAL TEACHING CLASSES IN SERBIA

The traditional classes involve synchronous learning-live teaching in real-time and according to a precisely defined schedule. The main advantage of synchronous learning is easy and efficient communication between students, and students and teachers. On the other hand, its main drawback is the precisely determined terms of realization, which disable students from choosing the time for learning.

According to the student's opinion, one of the main characteristics of the traditional teaching process in Serbia is the lack of interaction during the class because most of the time, the teacher talks while the students passively listen to the presentation. For this reason, we examined how long after a traditional class of average quality, the first signs of fatigue, i.e. lack of attention, appear in the respondents. The obtained results are shown in Graph 1.

Graph 1. First signs of attention loss among students during the class



Source: Authors' calculation

Based on the graphic representation, it can be stated that 28.8% of respondents feel the first signs of attention loss in the first 30 minutes of the lecture, while 55.9% of them experience loss of attention in 30-60 minutes. Considering that classes last 135 minutes (three school hours) on average, it can be concluded that fatigue in the first hour of class among 84.7% of students reduces the teaching process's effectiveness. It is a clear starting point that teaching should be organized differently to approach students' needs and expectations.

ADVANTAGES OF USING DIGITAL TOOLS IN TEACHING

Using digital tools in teaching provides teachers with a wide range of possibilities, such as organizing online classes in real-time and creating various interactive educational materials. Integrating digital tools into the teaching process brings teaching methods closer to the needs of students, especially if they contain game elements - gamification.

Picture 1. Gamification in education

Source: https://myeltcafe.com/articles/gamification-in-education/[4]

Gamification aims to make learning more enjoyable, intending to achieve learning outcomes through play. The essential elements of the game are conflict, chance, and reward. Typical examples of gamification are quizzes. Gamification affects students' motivation, connection and cooperation, which results in the easier achievement of the planned teaching goals. On the other hand, through gamification, teachers receive immediate feedback and gain a clear insight into the effectiveness of the learning process. Therefore, gamification can solve the problems of increasing students' concentration, interactivity of the teaching process and creation of functional knowledge.

Picture 2. Digital tools in asynchronous and synchronous learning

Source: https://elearningindustry.com/asynchronous-and-synchronous-modalities-deliver-digital-learning [3]

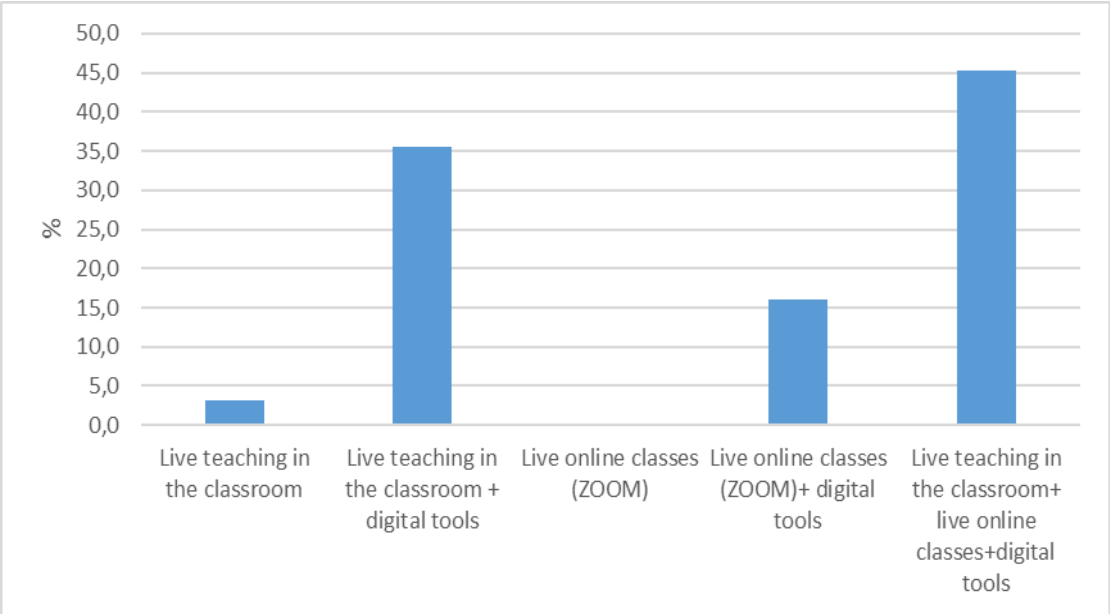
The next advantage of using digital tools in teaching is the possibility of creating educational materials for asynchronous learning. Asynchronous learning is independent learning in which students choose when to review the materials that the teacher has set for them (video lessons, quizzes, questionnaires, presentations, and so on). The advantages of asynchronous learning are flexibility in terms of time and place of learning and the ability to view educational content multiple times. Asynchronous learning allows students to deal with educational materials more thoroughly and give themselves enough time to solve specific tasks to understand the material better. For asynchronous learning to be effective, overcoming problems such as lack of interaction, isolation, lack of motivation to learn, the necessity of time to receive feedback and answers to questions, and so on is necessary.

Therefore, using digital tools in teaching enables raising the quality of education that is carried out in real-time (synchronous learning) and creating interactive materials that allow students to learn independently (asynchronous learning).

RESEARCH RESULTS - RESPONDENTS' OPINION ON THE NECESSITY OF DIGITIZATION OF TEACHING

Bearing in mind that new generations of students use digital technologies daily, we wanted to estimate their opinion on what a well-designed lesson represents for them and whether there is a real need for the implementation of digital tools in the teaching process. The obtained answers are presented in Graph 2.

Graph 2.The structure of modern teaching



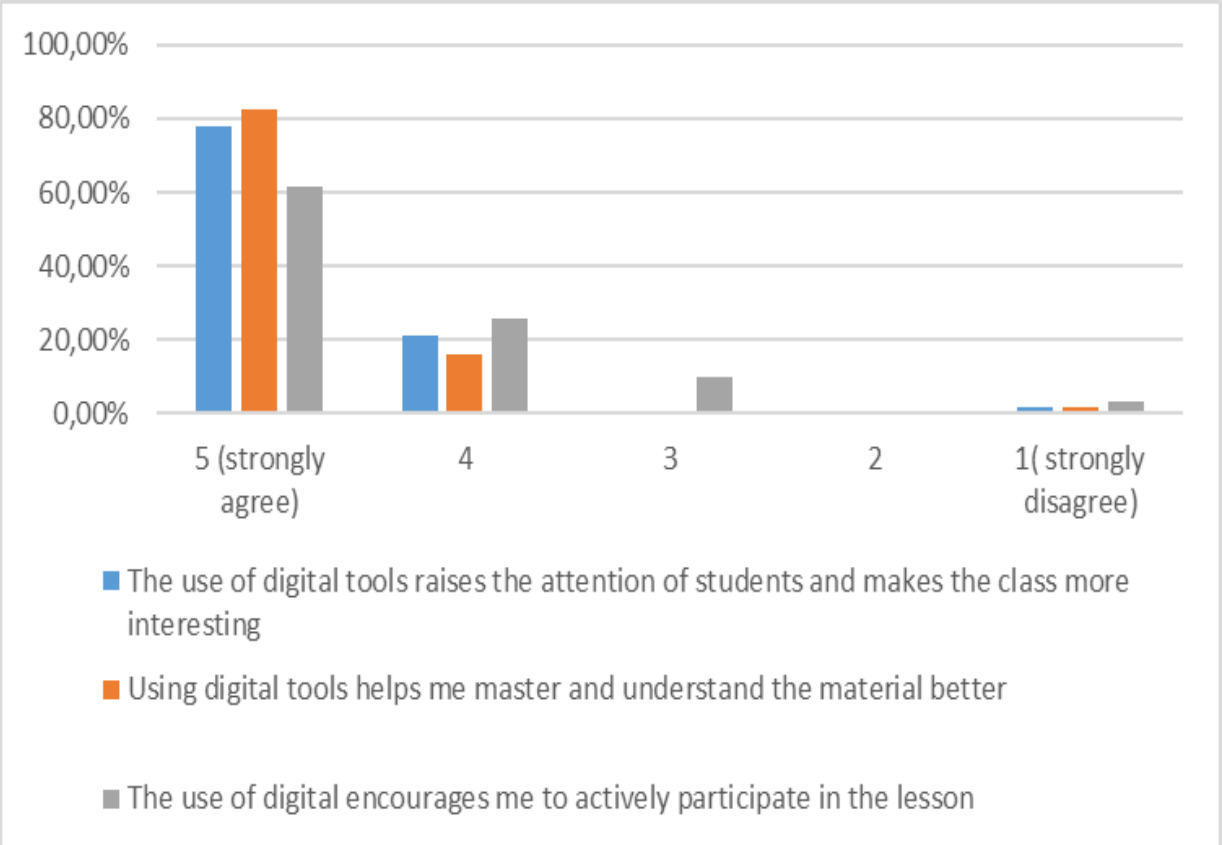
Source: Authors' calculation

Graph 2 shows that only 3% of students believe well-organized teaching classes should not include digital tools. About 45% of students believe that modern teaching should be organized as a combination of live teaching in the classroom and online with the use of modern digital tools and educational materials. It is important to emphasize that 16% believe efficient classes can be organized just online, including modern digital tools.

Regarding the type of digital tools that students prefer, 58% of them chose online quizzes as their favourite digital tool, noting that the effectiveness of quizzes is more significant when they are part of synchronous learning. The second online tool students prefer is video lessons, so they enable asynchronous learning.

In the next step, we examined why students support the implementation of modern tools in teaching. The obtainedanswers are presented in Graph 3.

Graph 3.The structure of modern teaching



Source: Authors' calculation

Based on thereceived answers, it can be concluded that more than 90% of respondents express a high degree of agreement with the statement that the use of digital tools affects the increase of students' attention, makes classes more exciting, and helps students to understand analyzed learning topics. Also, over 80% of respondents express a high degree of agreement with the statement that the use of digital tools encourages the more active participation of students in classes, which increases the interactivity of the teaching process.

CONCLUSION

The impact of digitalization on the higher education sector in Serbia is significant because new generations of students increasingly use digital technologies in all segments of life. It means that teachers have to develop a high level of digital skills to respond successfully to the needs and expectations of new generations of students. The need to improve the teaching process is one of the main goals of the Strategy for developing higher education in the Republic of Serbia until 2030.

The research supports the assessment that digitalizing the teaching process in higher education is necessary. The students who participated in the survey pointed out the growing gap between the current concept of organizing classes and their expectations. Respondents indicated that using digital tools in the teaching process raises students' attention, making

lessons more exciting and interactive and contributing to the more effective achievement of learning outcomes and acquisition of functional knowledge.

Current relevant research at the national level indicates that the level of teachers' digital skills is deficient and that there is a real need to organize training to encourage the development of teachers' digital skills and acquire knowledge on integrating basic pedagogical principles into digital educational materials.

REFERENCES

[1] Digital Education Action Plan 2021–2027. European Commission, 2021. https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en, April 2023.
[2] Digitalisation in Europe 2021-2022. Evidence from the EIB Investment Survey. European Investment Bank, 2022.
[3] https://elearningindustry.com/asynchronous-and-synchronous-modalities-deliver-digital-learning
[4] https://myeltcafe.com/articles/gamification-in-education/
[5] https://webalkans.eu/en/stories/serbian-schools-prepare-for-the-digital-age/, April 2023.
[6] https://www.eib.org/en/stories/serbia-digital-education, April 2023.
[7] Krivokuća, M.; Ćoćkalo, D.; Bakator, M.: *The potential of digital entrepreneurship in Serbia*, The Annals of the Faculty of Economics in Subotica, Vol. 57, No. 45, 2021, pp. 97-115, doi: 10.5937/AnEkSub2145097K.
[8] Neuvonen, A.; Lindgren, J.; Mokka, R.; Neuvonen, A.; Toponen, A.: *Digitization - The whole picture of the transition*. Tammi, Helsinki, 2019.
[9] Strategija razvoja obrazovanja i vaspitanja u Republici Srbiji do 2030. god. („Sl. glasnik RS“, br. 63/21).

MODERN TRENDS IN HIGHER EDUCATION IN ACCORDANCE WITH THE BOLOGNA PROCESS

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Abstract: Observed through contemporary trends and challenges, imposed equally on society and the university, it becomes clear that the goals and outcomes of higher education are based on the principles of the knowledge society. In such a climate, the primary requirement of a university is to develop adequate competencies for students, both through subjects and study programs. The fulfilment of this requirement is largely dependent on the processes of integration and regionalization. In this paper, the integrated structure of the university is presented as capable of responding to the challenges facing higher education. The authors represent the State University in Novi Pazar as a model that incorporated integration requirements and balanced regional development. The departmental model of the organization of the teaching process, in accordance with the requirements of the Bologna Declaration, is the key area of interconnection between the multidimensional aspects of teaching and science appropriate to the modern requirements of higher education.

Key words: *higher education, Bologna Declaration, integration, regional development*

INTRODUCTION

Education is the barometer of the progress of any country. The education system as an institutionally organized system plays an essential role in the socio-economic development of society. Therefore, the questions of the model and organization of the education system, the consideration of the factors that affect this system but also those affected by the system, are crucial. A responsible approach to these issues and all the risks they entail prevents going into absurdity. It means when quantity is created at the expense of quality. This should be kept in mind especially because the transformation of higher education is a long process and, depending on the social context, distinct paradoxes can occur in it. Authors very often characterize this state as a "hybrid state", since it includes suppressing or even eliminating old experiences and values, and implementing new approaches from above without sufficient explanation (Tkač, Turisova, Hodolič, 2012). Increasing expectations are expected from higher education in the direction of providing services to as many users as possible, within the framework of limited resources.

The implementation of the Bologna model of higher education has brought with it a discussion about the organizational structure of higherstate education institutions. It has been demonstrated that the institutionalization of higher education as a process, as well as a principle, can have the same importanceas the principles of efficiency, rationality and economy. The main argument that the authors emphasize in the paper is that the integrated university model is the only one capable of resisting the most of the negative aspects of contemporary trends imposed to higher education, but also a formula of keeping pace with European and world higher education. This question gains importance in further scope of traditional higher education requirements as well as individual improvement. The processes of

understanding and goal of the university as promoting the overall development of individual aspects, as well as the state and society as a whole, are also included. The objective of the work is to analyse the contemporary trends of higher education in accordance with the Bologna process, especially through an integrated university. The paper first starts from the consideration of the principles of the knowledge society as the essential basis of higher education. It continueswith the development of the model of an integrated university which isthe basis of the strong correlation of the process of integration and regionalization and the university.

THE PRINCIPLES OF THE KNOWLEDGE SOCIETY AS THE FOUNDATION OF HIGHER EDUCATION

Considering the structure and development of modern society, as well as the nature of knowledge on which modern society is based, understanding the essence of post-industrial society occupies a very prominent place. The importance of this topic is increasing, especially if oneconsiders that there are two different tendencies: super-industrialism, which is characterized by material values, and post-industrialism, which is characterized by post-material values. American sociologist Daniel Bell develops a "new paradigm" about the changes in the structure of post-industrial society. The emphasis is shifting from the production of goods to services, knowledge and information (Marjanović, 2016). Entrepreneurs and industrialists are no longer in the foreground, but scientists and experts whose knowledge is necessary in the decision-making process. The transition from the industrial to the post-industrial society is defined as the transition from the "society of work" to the "society of knowledge". Universities are given the primary role in that development, and education becomes a key social process. Knowledge as a basic resource is characterized by “the possibility of uncontrolled expansion and vertical mobility through the education system“(Šundalić, 2012). Asnoticeableknowledge has gone from being an auxiliary means in the production of the labour society to the sole stronghold of production in the knowledge society.

Contemporary society considers knowledge a matter of economic, political and cultural importance. This indicates that the development of society is possible if it is about the development of forementioned individual aspects.The development of the latter imposes the necessity of activating different types of knowledge. The basis of general development is, therefore, a society of knowledge that can be created if both traditional and modern sources of knowledge are available to the individual.

Each step of education develops its own level of knowledge with an open exit to the top. It means, it is directed towards developing more complex individual competencies compared to each previous level. Thus, higher education implies an advanced level of knowledge whose goal is the development of critical thinking and understanding. Starting from this, one comes across models of competences that higher education should contain (Račić, 2013) as presented:

- Focus on professional, scientific and research work;
- Work independence and finding new solutions in practice;
- Local and regional entrepreneurial activity;
- Competencies for conscious and purposeful networking;
- Competencies for lifelong learning;
- Competencies of multilingualism and interculturality;
- Recognizing and respecting basic values in society and acting in accordance with them.

The knowledge society is determined by the concept of lifelong education as a formula for adapting developing countries to social and economic changes brought about by technological progress (Macanović, 2019). Lifelong education is not only a means of personal development, but also a means of combating economic exclusion and a means for the flow of knowledge around the world. The Bologna process has shown that it aims, above all, to create a space for unique systems of evaluating the quality of national education systems, which is the basis of the emergence of a competitive European scientific economy (Tkač, Turisova, Hodolič, 2012). In order to maintain the quality of the pedagogical process at a high level, the application of the Bologna process is based on an approach that involves the use of the basic theoretical instruments of quality management which are adapted to the needs of educational institutions. The Bologna process is therefore also related to quality assurance processes. Therefore, it is increasingly highlighted as a permanent requirement for all institutions. The agenda for the modernization of the European higher education system (2011) highlights as the main goals: an increase in the number of highly educated citizens, attracting students from abroad, increasing the passing rate of courses, improving the quality of teaching and research experience, harmonizing the content of teaching processes with the real needs of the labour market and encouraging international cooperation (Pejanović, 2014).

Human knowledge, expertise and abilities become the most important resource in the knowledge society (Barić, Raguž, 2010). The dominant role in social and economic development is provided by the knowledge society through its four pillars: 1. education; 2. innovation system; 3. information and communication sector and 4. legal and economic framework. The World Bank's methodology for the systematic evaluation of each country's progress towards the knowledge society is based on these four pillars. The basic meaning of the knowledge society is to enable easier acceptance and understanding of new knowledge and skills, to strengthen the connection between education and the economy, and to prevent any form of exclusion.

THE INTEGRATED UNIVERSITY MODEL AS A RESPONSE TO MODERN HIGHER EDUCATION REQUIREMENTS

Universities began as a unique community of university teachers and students (Kerr, 2001) and over time transformed into a community with a much larger number of actors and a much larger number of functions and a community that is obliged to satisfy many interested parties. It is possible to talk about university organization through two basic models. The first implies that faculties have the status of a legal entity and must be united in a university. They prescribe their internal organization independently, taking care to ensure that it is in accordance with legal and university regulations. The second model represents an integrated university. The basic meaning of this model is to ensure the rationalization of costs within the system through integration (Đorđević, 2019).

The differences between these two models of university organization are clearly visible in the structural sense. However, the question that arises is whether these structural differences lead to differences in terms of the functions of the two university models. Starting in general from the function of higher education institutions - acquisition and transfer of knowledge, it can be said that it is provided by both integrated and non-integrated universities. However, if we look at mission and function, not only through the quality of the knowledge outcomes that graduate students acquire, but also through the quality of management, there are differences between these two models. Unlike the integrated model, where faculties are constantly encouraged to

be innovative in order to be competitive on the scientific research market, the faculty model exhausts most of its and institutional energy through the formation of a management team.

One of the main arguments in favour of an integrated university is the possibility to organize interdisciplinary and multidisciplinary study programs, in the implementation of which several different departments that are part of it can participate. Also, the integrated university is increasingly perceived as a system where disciplinary and integrated curriculum meet, i.e. curriculum understood as content and curriculum as practice. Therefore, an integrated university is not only the integration of different study programs, but also the values on which expectations of education are based.

Achieving and maintaining the high quality of the organizational structure of the university is achieved, first of all, through the meaningful connection of organizational units as a whole. Each unit represents a place of realization of the integrative function of the system in accordance with the highest act of the university. Thus, the university as a system consists of three subsystems: academic subsystem (faculties, departments, scientific institutes, centre for multidisciplinary studies and distance learning), administrative subsystem (services for study programs, student affairs, international cooperation, etc.) and enterprise subsystem (Marinković Nedučin, Cosić, Lalić, Cučković, 2012).

At the centre of the concept of an integrated university is an expert who is the bearer of a wide range of knowledge. An integrated university shapes a versatile individual who is ready to tackle both existing problems and new challenges that arise. This versatility is the product of good cooperation between the departments which are the basic fields within such a university. It should be emphasized that these characteristics of an integrated university create predispositions for opening up the education system and establishing a more stable connection with its environment. This is especially important if we consider contemporary trends in higher education (Pejanović, 2014): entrepreneurial activity of universities, education of highly qualified staff, distance learning, electronic learning, combined learning, the process of internationalization of higher education.

INTEGRATION, REGIONALIZATION AND THE UNIVERSITY

Attempts to measure social development based on quantitative indicators as key elements of the development process have long been recorded (Laska, 1964; Adams, Adams, 1968). The main indicator on this path was the level of education. In his model, Laska (1964) talks about three stages of education systems: "the first stage requires a limited amount of higher education, the second stage is characterized by universal primary education, while the third stage is characterized by vertical expansion to potentially universal secondary education" (Bilinović, Škorić, 2015). In addition to theorists who give education the role of a key factor

in a high level of social development, there are also those (Brennan, 2008) who understand education as a barrier against the dehumanization of society, which technological development brings with it.

Observing higher education through the processes of integration and regionalization makes several elements of organizational culture constantly aware: people, environment, tradition, goals, strategies, technologies. For some authors, "with regionalization, the education system could achieve its goals through a broader and more humane understanding of education and the adoption of new values of education" (Karavidić, Čukanović-Karavidić, 2009). In addition to this, consideration of higher education through processes of integration and regionalization indicates the importance of situational factors. According to Henri Mintzberg (Mintzberg, 1980), organizational context (situational factors) consists of several independent variables: environment, power, age and size, business strategy and technology. Situational factors are particularly important, since the appearance of the organizational situation and organizational structure depends on them (Čizmić, 2015). As universities belong to the category of professional organizations, the management of these factors in the area in which they operate is imposed as the only way for their sustainability.

Universities prevent the demographic depletion of regions and the loss of their development potential. By strengthening their educational resources, the regions, especially the underdeveloped ones, get out of their peripheral positions. Their basic purpose is to raise the educational level of their population (Kostadinović).

The strategy for the development of education in the Republic of Serbia until 2020 presented the development of education through the following goals: quality, efficiency, relevance and scope ("Official Gazette of RS", no. 107/12). This laid the foundations of pre-university and university education in the 21st century, which relate to increasing the quality, scope, relevance and efficiency of education, with an emphasis on the personal and professional development of each individual, and thus the development of the state and society, on knowledge as a key value.

The analysis of the results achieved in the field of higher education underlined that the achievement of an equal system of higher education, fair and equal access for all groups in society, is at the top of the goals for all countries participating in the Bologna process. As can be seen in Serbia, some social groups are still underrepresented in higher education. This under-representation applies especially to young people from the poorest families, from families with the lowest level of education, members of the Roma nationality and people with disabilities (SROVRS 2030, 2021). Therefore, it can be concluded that a more successful implementation of the principle of "equal access for all" can be joined by a platform of strong connections between universities and the regionalization process, especially with the emphasis on key measures to improve coverage, quality, relevance and efficiency in higher education. If one adds to this the concept of an integrated university, the mission becomes even more complicated. Nevertheless, it should be said that there is a strong correlation between this university model and the process of regionalization and the aspiration that this correlation is constantly made positive and sustainable, a lobby for a socially responsible university that is based on the application of academic principles and values in the realization of education and research as basic functions, but and solving social challenges of the local, regional and wider community. Also, the connection between an integrated university and regional development emphasizes the social responsibility of the university, which obliges the university to actively participate in the social, economic, political and cultural development of the local communities, and thus society as a whole.

All this affects the stratification of subjects, disciplines, scientific fields and the growth of the need for knowledge exchange, both within communities and in the wider society, but also on the renewal of the connection between institutions of higher education and numerous social actors.

CONCLUSION

Higher education faces a large number of challenges, but also the expectations of diverse actors in this field.

Universities are an important factor in the development of the region because they are the factory of guidelines for the direction of the economy of a certain region should develop. Through educational and research activities, universities participate in building a better environment for business, but also for life as a whole. To achieve a higher quality of higher education, in terms of balanced regional development, the authors recognized the model of an integrated university. Integrated universities are a field where an integrative approach is more easily realized as a necessary and indispensable factor in adapting higher education to contemporary trends. Cooperation and linking of different study programs and modules within this organizational model contribute to a clearer definition of goals related to technological and economic processes, and especially, the inclusion of students in all segments of those processes. The main lesson from the analysis of the relationship between the integrated university and the regionalization process is that an integrated university is a need of society, and especially the need of those areas that exude diversity. As the concept of an integrated university is dominated by unity, connection, coordination, its position as a key factor in bridging and connecting differences into a quality that is capable of resisting any disintegration, undoubtedly stands out as its mission. The development frameworks given in the Bologna Declaration enable the preservation of the recognition that the region possesses in terms of geographical, cultural and social characteristics. This is undoubtedly a significant factor in its competitiveness.

LITERATURE

Adams, D. and J. Adams (1968). Education and Social Development. *Review of Educational Research*, 38 (3): 243-263.

Barić, V., Raguž, M. (2010). „Hrvatska na putu prema društvu znanja“. *Poslovna izvrsnost*, god IV, br. 2: 57-77.

Bilinović, A., Škorić, J. (2015). „Obrazovanje kao faktor socijalnog razvoja“. u: „*Regioni i regionalizacija – komparativna analiza“*(43-63). Univerzitet u Novom Sadu: Filozofski fakultet.

Brennan, J. (2008). Higher Education and Social Change. *Higher Education* 56 (3): 381-393.

Čizmić, E. (2015). Proces redizajniranja organizacijske strukture javnih institucija visokog obrazovanja. *Pregled – časopis za društvena pitanja*. https://pregled.unsa.ba/index.php/pregled/article/view/839/856

Đorđević, S. (2019). „Prednosti i nedostaci integrisanog univerziteta“. u: Zbornik radova *„Sloboda pružanja usluga i pravna sigurnost“* (749-755). Kragujevac. DOI: 10.46793/XVMajsko.749DJ

Karavidić, S., Čukanović-Karavidić, S.(2009). „Regionalizacija i decentralizacija obrazovanja u Srbiji“. *Uzdanica*, VI/2: 229-237.

Kerr, C. (2001). *The uses of the university*. Cambridge, MA: Harvard University Press.

Kostadinović, A. „Obrazovna nejednakost i razvoj pograničnih regiona“. Pirot. https://konferencija.komorapirot.com/46.OBRAZOVNA%20NE-JEDNAKOST%20I%20RAZVOJ%20POGRANICNIH%20REGIONA.pdf

Laska, J. A. (1964).”The Stages of Educational Development.” *Comparative Education Review*, 8: 251-263.

Macanović, N. (2019). „Kompetencije i društvo znanja“. u: Zbornik radova *„Društvo znanja“*(str. 7-20). Banja Luka : Centar modernih znanja.

Marinković Nedučin, R., Cosić, I., Lalić, B., Cučković, D. (2012). „Prilog razvoju integrisanog univerziteta“. XVIII Skup *TRENDOVI RAZVOJA: “INTERNACIONALIZACIJA UNIVERZITETA”*. Kopaonik, 27. 02. - 01. 03. 2012.

Marjanović, M. (2016). *Sociologija*. Novi Sad : Školska knjiga.

Mintzberg, H. (1980). Structure in five-A Syntesis of the Research on Organization Design. *Management Science*.

Pejanović, R. (2014). „Održivi razvoj i visoko obrazovanje“. *Letopis naučnih radova*, god. 38, br. 1: 5-19.

Račić, M. (2013). „Modeli kompetencija za društvo znanja“. *Suvremene Teme*, god. 6, broj 1: 86-100.

Šundalić, A. (2012). „Između društva rada i društva znanja“. *Media, culture and public relations*, 3, 2012, 2: 120-130.

Tkač, M., Turisova, R., Hodolič, J. (2012). „Bolonjski proces sa aspekta visokoškolskog obrazovanja u postkomunističkim zemljama“. XVIII Skup *Trendovi razvoja: „Internacionalizacija univerziteta“*. Kopaonik. (www.trend.uns.ac.rs).

Online sources:

https://digital.gov.ru/en/activity/statistic/rating/indeks-ekonomiki-znanij/?utm_referrer=https%3a%2f%2fwww.google.com%2f#tabs|Compare:Place

https://www.dunp.np.ac.rs/o-univerzitetu/

https://prosveta.gov.rs/wp-content/uploads/2021/11/1-SROVRS-2030_MASTER_0402_V1.pdf

ACHIEVING EDUCATIONAL EQUALITY AS SUSTAINABLE DEVELOPMENT GOAL

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Abstract: The development of education has always been closely related to the values of democracy. Hence, education was seen as the main means of introducing and maintaining equality. Today, we cannot talk about modern education unless women and men have the same access to educational institutions. The authors of the paper start from the achievement of equality between women and men and the provision of quality education as the goals of sustainable development foreseen by the 2030 Agenda of the United Nations. Acting in the direction of achieving equality between women and men entails the necessity of ensuring the same educational opportunities for women and men. With better education, their participation in the labor market also increases, which simultaneously improves the position of women in many other spheres of life. In modern society, which is characterized by frequent and major technological changes, formal education is quickly becoming obsolete, so the concept of lifelong/permanent education will also be discussed in the paper, with a special emphasis on the issue of women's participation in these types of education. Since there is no binding mechanism for implementing the given goals, it is necessary that education be additionally recognized in the social community as an important aspect of sustainable development. Although the major importance of education is undoubtedly the acquisition of knowledge and skills that are necessary for the performance of work, one must not neglect the humanistic aspect of education, where an individual acquires certain moral and cultural values.

Keywords: equality, education, sustainable development, United Nations.

INTRODUCTION

Education today more than ever has multiple importance for the life of an individual but also for society as a whole. Quality education enables an individual to acquire the knowledge and skills necessary for employment. In the era of frequent technological and organizational changes, practical knowledge becomes necessary for an individual to be competitive on the labor market. In addition to the practical segment, an individual acquires moral and cultural values through education, which makes society as a whole prosperous. The importance of education was perhaps best recognized by the Inter-American Court, considering in its rulings that the basic right to life cannot be fully realized unless food, water, health care and education are provided (Antkowiak, 2020).The very fact that education is included together with basic human needs, food and drink, speaks volumes about the importance of education.

"Modern education not only means functional literacy and encyclopedic knowledge, socialization, but also the development of the creative potential of individuals, of their abilities and ambitions, the acquisition of practical and applicable knowledge" (Vilic, 2014).
Taking into account that earnings are often the only source of income for an individual, the practical i.e. applicable knowledge and skills they acquire through education enable them to ensure their own existence, and often the existence of their family members. In addition, the development of abilities and potential through education enables an individual to improve

their social position. As nowadays education has a great impact on the individual's position in society, we cannot talk about modern education if it is not available to women and men under equal conditions. In particular, it is necessary to identify quality education and equality between women and men as important levers of sustainable development. This can only be achieved with the constant cooperation of all social subjects: educational institutions, employment providers, economic and political stakeholders, etc.

ACTIVITY OF UNITED NATIONS IN SPHERE OF EQUALITY BETWEEN WOMEN AND MEN AND SUSTAINABLE DEVELOPMENT

One of the first and most important documents regulating in detail the issue of equality between women and men is the United Nations 1979 Convention on the Elimination of All Forms of Discrimination against Women[1]. Article 10 of the Convention regulates in detail the scopes of eliminating discrimination against women and ensuring equal rights with men in terms of education. In particular, the obligation of member states to provide women with equal rights to achieve diplomas in educational establishments of all categories, as well as to reduce female student drop-out rate, is highlighted.[2]It is particularly interesting to point out that the Convention provides for the elimination of any stereotyped concept of the roles of men and women at all levels and in all forms of education.[3]Although the Convention was adopted in 1979, no major progress has been made in the implementation of this obligation. The Convention also established the Committee on the Elimination of Discrimination against Women, whose primary responsibility is to monitor the implementation of the Convention. By the Optional Protocol to the Convention, jurisdiction was extended to consider cases whose subject being the violation of the rights of an individual or a group of individuals (Tubic, 2019).

The Millennium Declaration (hereinafter: the Declaration),[4]adopted by the United Nations General Assembly on September 08, 2000 by the leaders of 189 countries, lists among other things gender equality and access to and achievement of basic education in its list of goals. The Declaration sees the promotion of gender equality as a successful means of combating poverty and hunger, and stimulating sustainable development. Also, equal rights and opportunities for women and men are included in the most important values and principles. Certainly, the most important goal in the field of education set by the Declaration is to eliminate gender differences in primary and secondary education by 2015, and for girls and boys to have equal access to all levels of education.In a 2015 report[5]on meeting the goals of the Declaration, the United Nations stated that many more girls are attending school now than 15 years ago, and that developing countries have largely eliminated educational gender inequality.[6] Nevertheless, the United Nations states that women with a higher level of education have a higher unemployment rate than men with a similar level of education, and

[1]Convention on the Elimination of All Forms of Discrimination against Women (*Official Gazette of SFRY - International Treaties*, No. 11/81).
[2]More details: Art. 10 of the Convention on the Elimination of All Forms of Discrimination against Women.
[3]Ibid.
[4] https://rodnaravnopravnost.ombudsman.org.rs//attachments/013_Milenijumska%20deklaracija%20UN.pdf
[5] https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf
[6]According to the report on the implementation of the Millennium Declaration, in the Republic of Serbia in 2015, 97.5% of the population attended primary school. https://rsjp.gov.rs/wp-content/uploads/za_sajt_2_srp.pdf

that despite progress, there is still an uneven gender representation in the domain of work and decision-making.

The 2030 Sustainable Development Agenda (hereinafter: the Agenda),[7]of the United Nations includes quality education and gender equality among the 17 sustainable development goals. In relation to the Declaration, the Agenda expands the circle of goals and scope of rights concerning the role of girls and women in the domain of education and sustainable development. In the first place, the Agenda states that the goal is to eliminate educational gender inequality by 2030 and to ensure that all girls and boys complete free, equal and high-quality primary and secondary education, as well as have equal access to university education. The Agenda recognizes the possibilities of education in promoting and realizing sustainable development, overlooking the fact that it is necessary for all students to acquire the knowledge and skills needed to promote sustainable development, among other things, through education about sustainable development and sustainable lifestyles.

In terms of gender equality, one of the most important goals is to provide women with equal leadership opportunities at all levels of decision-making in social life. It would be difficult for women to achieve this goal unless they have equal access to education as men.

CONSEQUENCES OF EDUCATIONAL INEQUALITY BETWEEN WOMEN AND MEN

Educational inequality between women and men not only affects the degree and level of knowledge acquired, but also produces long-term lifelong consequences. Undoubtedly, major impact is on the employment process, but it also affects the social status and social position of women. Of course, it is not possible to draw a clear line between the influences of education on all spheres of life. If women invest more in education, their status on the labor market should also improve, which will inevitably lead to an improvement in their position in many other areas as well (Ganguli, Hausmann, Viarengo, 2014).

Discrimination against women in education is closely related to discrimination in employment. "If there is discrimination in education, professional training, expert training, then the absence of discrimination in employment itself loses its full meaning" (Lubarda, 2012). This statement by Professor Lubarda is based on the necessity to achieve real/essential equality. Namely, equal treatment of persons seeking employment will not be enough to achieve equality, because individuals are not equal, since they were not provided with equal opportunities, in this case, equal access to education. Thus, some authors see the causes of gender inequality, which manifests itself through the share of women in the total employment of the working-age population, the difference in earnings between women and men, the distribution of qualified jobs, etc., among other things, in poor education and low skill level (Ghai, 2003).

Indisputably, educational inequality between women and men may subsequently produce inequality in employment. However, research shows that educational inequality may not be the only, i.e. the main cause of subsequent inequality in employment. Although many countries have closed the educationgap between women and men, differences in labor force participation remain. For example, in Argentina, Brazil, Colombia, the Philippines, Panama

[7]https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

and Venezuela there is no education gap between women and men, but in all these countries there is still a gap in labor force participation between 40 and 70 percent. However, in countries such as China, Vietnam and Kenya, there is still a large education gap but little difference in labor force participation (Ganguli et al., 2014). In these countries, minor differences in labor force participation are explained by the fact that there is large percentage of low-skilled women present in the labor market (Ganguli et al., 2014). In this example, we can see that the equal representation of women and men in the labor market does not necessarily mean that equality has been achieved. We can hardly talk about equality if women are the ones who perform the majority of low-skilled jobs. Therefore, equal access to education is one of the prerequisites that should be ensured so that women subsequently have the opportunity to apply equally for all types of jobs.
Similar conclusions about the impact of education on the labor market were confirmed in another study. Namely, it was determined that there were significant effects of different outcomes of education on the unemployment rate, the overqualified rate and the level of earnings, but also that education may not be the only reason for all these differences (Homs, Marcos, 2018).

As education and experience are the two major elements when determining earnings (Braga, 2018), education has a far greater impact on the equal remuneration of women and men in the employment relationship than on the employment process itself. For example, the expansion of the higher education system in Russia in the period 1990–2005 had a positive effect on the employment process but also on the earnings of those who enhanced or improved their education (Kyui, 2016). Also, the increasing supply of educated labor in Turkey, attributed to the increase in the number of universities and reforms in the education system, had a significant impact on the distribution of earnings between 2002 and 2010 (Popli, Yilmaz, 2017). Undoubtedly, the level of education affects the amount of salary and other benefits that a person earns in an employment relationship, or on some other basis of performing work. Women with higher levels of education will have better opportunities for employment, higher earnings and generally their position on the labor market will be better. However, this does not mean that their position will be the same as the position of men with the same level of education, especially when it comes to differences in earnings. Although higher education leads to higher incomes, it does not erase the differences that exist in the unequal remuneration of women and men. One study shows just the opposite. Women with primary education earn 80.4 percent of men's earnings, women with high school education 77.2, while women with college degrees earn 75.2 percent of men's earnings (Watkins, 2018). In this case, better education does not have a positive effect on achieving equality in remuneration between women and men. More precisely, the lack of education cannot be the reason for the difference in earnings. The situation with remuneration is similar to that of employment, education alone cannot be the main cause of subsequent inequalities.

There is another way in which education indirectly affects the remuneration of workers. The choice of faculty itself of an individual subsequently determines the choice of occupation they will pursue. Thus, men more often study technical sciences, engineering and economics, while women more often choose to study humanities, pedagogy and social sciences. Also, women drop out of technical sciences, engineering and mathematics more often than men. Faculties in which male students are more represented are mostly associated with professions dominated by high salaries, so the choice of faculty can significantly influence the later remuneration of women and men (Speer, 2017; Fischer, 2017). By the way, these differences in the choice of faculty are well known and are studied by a large number of scientific

disciplines. Also, only the choice rests on the principle of freedom of work, which includes the freedom to choose an occupation. From a social and legal point of view, it is difficult to undertake any justified intervention in this field. The only thing that needs to be done is to ensure equal access to education and equal opportunities so that every woman/girl has the same educational conditions as men. If such access is provided, then the further choice of each individual depends on personal and professional affinities, each of which has both positive and negative sides.

LIFELONG EDUCATION

In modern society, formal education is not the only form of acquiring knowledge. The reason for this is that, on the one hand, education acquired through regular means often quickly becomes outdated, and constant training and improvements are necessary for individuals to remain competitive on the labor market. On the other hand, there is also a decrease in the demand for certain skills, so individuals are forced to acquire new knowledge and abilities. Constant training and acquisition of new knowledge does not only benefit employees. Employers have an equal interest in constantly investing in the development of their employees. With new and adequate knowledge, they adapt more easily to the new work environment, which occurs due to frequent technological changes (Egger, 2003).

The relationship between education and work has never been static. Although at the end of the 19th century there was a formal separation of education and work, certain models of learning through work still exist in many countries (Owens, Stewart, 2016). Dual education modalities are especially relevant today. Also, internships and volunteering play an increasingly important role in preparing workers for work. "In order to ensure the necessary degree of adaptability of the workforce, constant learning while working becomes necessary (the concept of *lifelong education*, *permanent education*, as well as *return education* - returning from employment to school for a certain period, with paid leaves)" (Jasarevic, 2008).

In its work, the International Labor Organization (hereinafter: the ILO) has indirectly dealt with the issue of lifelong education, with the 1974Convention No. 140 on Paid Educational Leave[8]standing out.The Paid Educational Leave Convention foresees an employment policy aimed at acquiring and improving the skills of each employee. In addition to general education, the Convention provides for the approval of paid leave for trade union education as well as for training needs at all levels.[9]

For the achievement of educational equality between women and men, the most important provision of the Convention is that it prohibits discrimination on the basis of gender. "Paid educational leave shall not be denied to workers on the ground of race, colour, sex, religion, political opinion, national extraction or social origin."[10]

It is especially commendable to point out that the Convention does not necessarily tie education only to the performance of work. Thus, Article 3 prescribes that the policy of approving paid leave for educational needs, in addition to improving the professional and

[8]The ILO Convention No. 140 on Paid Educational Leave (*Official Gazette of SFRY - International Treaties*, No. 14/82).
[9]See: Art. 2of the Convention No.140.
[10]Art. 8of the Convention No.140.

functional abilities of employees in the conditions of technological development and structural changes, should also contribute to the social and cultural advancement of workers.[11] Although the Convention was adopted in 1974, it has not lost its relevance even today. This especially applies to countries in transition, where major technological and structural changes are taking place, which also increases the need for the training of workers. To successfully overcome such changes, companies need to receive subsidies for training their workers, while public services must provide information about the skills needed in the labor market (Egger, 2003).

The ILO 1975 Convention No. 142 on Professional Orientation and Vocational Training for Human Resources Development[12]foresees obligations for member states to develop systems of general and professional education, whether these activities take place within the system of formal education or outside it.[13]

Like the previous convention, the Convention on Professional Orientation and Vocational Training prohibits discrimination in the exercise of the rights it regulates. "The policies and programmes shall encourage and enable all persons, on an equal basis and without any discrimination whatsoever, to develop and use their capabilities for work in their own best interests and in accordance with their own aspirations, account being taken of the needs of society."[14]

Inequality between women and men is also present in these forms of education. Thus, for example, the gendered nature of the German vocational education system is reflected in the unequal gender distribution between dual and regular education. In total, there are only 41 percent of women in dual education (Haasler, 2020). Also, constant training, which today is almost necessary for an individual if they strive to maintain and improve their chances and opportunities for advancement at work, creates difficulties for women in particular. Due to family obligations, women are often not able to allocate the necessary time for additional training, unlike men. This is often reflected in their position in multinational companies, where women, although they make up 41 percent of employees, fill only 19 percent of leadership positions and 12 percent of managerial positions (Buribayev, Khamzina, 2019).

We need to mention that education modalities outside the regular schooling system also carry a number of risks that affect both genders. Although training and work experience programs are acceptable models because they represent a stepping stone between education and (paid) work, they can still have negative effects. Especially if they are poorly designed, these modalities can be misused. Instead of being a step closer to stable and decent work, they often keep young people in a state of uncertainty, because they move in a circle of temporary work, periods of insecurity and new temporary work (Owens, Stewart, 2016). In this case, young people with a lower level of education can be particularly vulnerable.[15] (Votinius, 2014).Also, the rights of persons engaged in this way can be less compared to the rights of persons in an employment relationship. For example, in the US, courts sometimes refuse to extend the

[11]Art. 3of the Convention No.140.
[12]The ILO Convention No. 142 on Professional Orientation and Vocational Training for Human Resources Development(*Official Gazette of SFRY - International Treaties*, No. 14/82).
[13]Art. 1 and Art. 2 of the Convention No.142.
[14]Art. 1, para. 5 of the Convention No.142.
[15]The employment law in France particularly emphasizes the importance of supporting young people with a lower level of education.

application of anti-discrimination laws to interns on the grounds that they are not considered employees (Owens, Stewart, 2016). The uncertainty these types of education bring is also recognized in the actions of the European Union. In several strategies, the European Union emphasizes the importance and significance of clearly identifying and recognizing skills and knowledge acquired outside of formal education. (Casano, 2016).

The major problem in achieving equal access of women and men to all modalities of lifelong education is ensuring equal opportunities for women to access education and training programs under the same conditions as men. Prohibition of discrimination against women, either when making decisions by the employer approving such types of education and training, or by professional bodies that provide such training, is not a sufficient condition. In addition, through the active promotion of equality, it is necessary to raise women's awareness of the importance and opportunities that lifelong education brings. Next, it is necessary to provide real opportunities in which women will have equal access to the modalities of lifelong education as men. This particularly refers to the successful reconciliation of family and professional life, which is becoming a priority in modern society.

CONCLUSION

The importance of education has always been measured by the extentto which it enables individuals to develop their abilities and talents, but also by its role in introducing equality. This way of valuing education has been maintained until today, but at the same level with those criteria that education manifests a much stronger tendency towards expressing and potentiating of the existing inequalities than changing such a situation. Hence, the aspiration for equality of opportunity in education by states and educational institutions is increasingly recognized as an aspiration at the global level. In the second half of the twentieth century, the importance of education for the acquisition of status privileges has decreased. It becomes necessary for any social status. The author's intention is to influence the formation of the reasoning that education is not only the key to the fight against inequality, but also the key to achieving overall social development, starting from the multiple importance that education has for the life of both an individual and society as a whole, through acts that emphasize equality and non-discrimination against women and men in the sphere of education and the consequences due to deviation from them to highlighting the importance and possibility of lifelong education and training as a safe mechanism in the fight against inequality. As we have seen throughout the paper, educational inequality is a good way towards inequality in employment, hence achieving educational equality would be a proper basis for solving inequality in numerous areas of society.

In modern societies, the responsibility and obligation towards educational equality belongs to all levels of education. With their educational contents and the level of knowledge they produce, they represent the main landmark of society and at the same time a suitable ground for the development and promotion of democratic values. Only a responsible understanding of the essence of this role, among other things, implies the realization of equality as a goal of sustainable development.

REFERENCES

Antkowiak, T. M.(2020). A Dignified Life and the Resurgence of Social Rights.*Northwestern Journal of Human Rights*, бр. 1/2020, 1-51.

Braga, B. (2018).Earnings dynamics: The role of education throughout a worker's career.*Labour Economics*, бр. 3/2018, 83-97.

Buribayev, Y. A.,Khamzina, Z. A.(2019).Gender equality in employment: The experience of Kazakhstan. *International Journal of Discrimination and the Law*, бр. 2/2019, 110-124.

Casano, L.(2016).The Future of European Labour Law and the Right to Employability: Which Role for the Validation of Non-Formal and Informal Learning.*EuropeanLabour Law Journal*, бр. 3/2016, 498-519.

Egger, P. (2003).Decent Work and Competitiveness: Labour Dimensions of Accession to the European Union. *International Labour Review*, br. 1/2003, 5-28.

Fischer, S. (2017).The downside of good peers: How classroom composition differentially affects men's and women's STEM persistence. *Labour Economics*, бр. 3/2017, 69-88.

Ganguli, I.,Hausmann, R.,Viarengo, M.(2014).Closing the Gender Gap in Education: What Is the State of Gaps in Labour Force Participation for Women, Wives and Mothers. *International Labour Review*, бр. 2/2014, 173-208.

Ghai, D. (2003). Decent work: Concept and indicators. *International Labour Review*, бр. 2/2003, 113-146.

Haasler,S. R.(2020).The German system of vocational education and training: challenges of gender, academisation and the integration of low-achieving youth. *European Review of Labour and Research*, бр. 1/2020, 57-71.

Homs, F. O., Marcos, V. S.(2018). Education outcomes and the labor market. *Labour Economics*, бр. 5/2018, 14–28.

Јашаревић, С.(2008).Социјално-економскаправа у вези с радом у међународним и европским стандардима. *Радно и социјално право*, бр. 1/2008.

Kyui, N.(2016).Expansion of higher education, employment and wages: Evidence from the Russian Transition. *Labour Economics*, бр. 2/2016, 68-87.

Лубарда, Б. (2012). *Раднoправо – расправа о достојанству нараду и социјалном дијалогу*. Београд.

Owens, R.,Stewart, A.(2016).Regulating for Decent Work Experience: Meeting the Challenge of the Rise of the Intern. *International Labour Review*, бр. 4/2016, 679-710.

Popli, G.,Yılmaz, O.(2017).Educational Attainment and Wage Inequality in Turkey.*Labour: Review of Labour Economics and Industrial Relations*, бр. 1/2017, 73-104.

Speer, J. D.(2017).The gender gap in college major: Revisiting the role of pre-college factors.*Labour Economics*, бр. 1/2017, 69-71.

Тубић, Б. Н.(2019). Поступци пред појединим универзалним телима УН за заштиту људских права – актуелна питања и перспективе. *Зборник радова Правног факултета у Новом Саду*, бр. 4/2019, 1187-1206.

Вилић, Д.(2014). Улогазнања и образовања у савременом друштву. *Политеиа*, бр. 8/2014, 389-404.

Votinius, J. J.(2014).Young Employees: Securities, Risk Distribution and Fundamental Social Rights. *European Labour Law Journal*, бр. 3-4/2014, 366-389.

Watkins, T. A.(2018).The Ghost of Salary Past: Why Salary History Inquiries Perpetuate the Gender Pay Gap and Should Be Ousted as a Factor other than Sex. *Minnesota Law Review*, бр. 2/2018, 1041-1088.

LEGAL SOURCES

Convention on the Elimination of All Forms of Discrimination against Women(Official Gazette of SFRY - International Treaties, No. 11/81).

The ILO Convention no. 140 on Paid Educational Leave Convention(Official Gazette of SFRY - International Treaties, No. 14/82).

The ILO Convention No. 142 on Professional Orientation and Vocational Training for Human Resources Development (Official Gazette of SFRY - International Treaties, No. 14/82).

ONLINE SOURCES

https://rodnaravnopravnost.ombudsman.org.rs//attachments/013_Milenijumska%20deklaracija%20UN.pdf

https://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20(July%201).pdf

https://rsjp.gov.rs/wp-content/uploads/za_sajt_2_srp.pdf

https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

FOREIGN LANGUAGE LEARNING THROUGH THE USE OF MOBILE APPLICATIONS - STUDENTS' ATTITUDES AND EXPERIENCES

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Abstract: In today's modern world, it is almost impossible to imagine life without the use of information technologies and new technological achievements. Their rapid development has led to important changes in all spheres, including the sphere of education. When it comes to learning foreign languages, mobile learning - MALL (Mobile Assisted Language Learning), an approach that can greatly enrich the ways of learning and improving languages can have a significant application. The fact that the vast majority, especially members of the younger population, own smart phones, that they almost always have with them, as well as that access to the Internet is increasingly accessible, speaks in favor of the fact that this type of learning, during which one does not have to be tied to a specific place and time, can be useful in many ways and give good results. The paper presents research, the aim of which was to determine the extent to which the student population is aware of the opportunities offered by this way of learning a foreign language, as well as what are the attitudes of students towards this modern way of acquiring and improving language knowledge. It was also determined which mobile applications for learning a foreign language students mostly use , how often and for what purposes, as well as whether they are satisfied with the use of mobile applications, or whether they notice certain progress. Three groups of students, with different educational profiles, participated in the research, so an additional motive was to compare their views.

Keywords: MALL, learning foreign languages, mobile applications

INTRODUCTION

In today's modern world, it is almost impossible to imagine life without the use of information technologies and new technological achievements. Their rapid development has led to important changes in all spheres, including the sphere of education. Foreign language learning has been greatly enhanced by the use of modern technologies that have become inseparable part of the globalized world. The use of these technologies has significantly transformed foreign language learning, making it more accessible, interactive, and immersive, at the same time providing learners with new and innovative ways to acquire language skills, communicate with native speakers, and immerse themselves in authentic language contexts.

Learners now have a wide range of resources, platforms, and tools at their disposal to improve their language knowledge, enhance their language skills and connect with native speakers and language communities worldwide.

One of the technological advances of the modern age is mobile phone which, as a new addition to information and communication technologies has created new ways to help learners in the process of foreign language learning. It is not just a communication device any more. It is a useful computer that fits into students, pockets, is always with them and nearly always on, and can be used in any kind of learning (Prensky, 2005). Mobile phone, as a new technology, has brought about a new type of language learning called MALL (Mobile Assisted Language Learning).

Widespread access to such an inexpensive and sophisticated device has somewhat changed the setting of e-learning in many ways. In fact, mobile learning, that takes advantage of the portability and ubiquity of mobile devices, allowing learners to access language learning resources and engage in learning activities anytime and anywhere, can be considered the next generation of e-learning (Sharples, 2000), taking precedence over CALL (Computer-Assisted Language Learning) which, on the other hand, requires learners to be at a computer or laptop, limiting accessibility and mobility. Mobile learning, often referred to as m-learning, leverages mobile devices such as smart phones and tablets to deliver educational content and facilitate learning experiences. With the widespread adoption of mobile devices and the advancements in technology, mobile learning has gained significant momentum and has several advantages over traditional e-learning methods.

The fact that the vast majority, especially members of the younger population, own smartphones, that they almost always have with them, as well as that access to the Internet is increasingly accessible, speaks in favor of the fact that this type of learning, during which one does not have to be tied to a specific place and time, can be useful in many ways and give good results.

The appearance of mobile applications for language learning has evolved significantly over the years. Developers have focused on creating user-friendly interfaces and engaging designs to enhance the learning experience. These applications have become increasingly popular and are widely used by language learners around the world, offering them convenient and accessible ways to improve language skills on the go.

The aim of this paper is to determine the extent to which the student population in Serbia is aware of the opportunities offered by this way of learning a foreign language, as well as what are the attitudes of students towards this modern way of acquiring and improving language knowledge. It is also determined which mobile applications for learning a foreign language students mostly use, how often and for what purposes, as well as whether they are satisfied with the use of mobile applications, or whether they notice certain progress. Three groups of students, with different educational profiles, participated in the research, so an additional motive was to compare their views.

1.1.THE ORIGIN AND DEFINITION OF MALL

Mobile Assisted Language Learning (MALL) refers to the use of mobile devices, such as smart phones and tablets, to enhance language learning. It is a learner-centered approach that recognizes the ubiquity of mobile devices in our daily lives and leverages their capabilities to support language learning. It also provides learners with flexibility, convenience, and a wealth of resources to enhance their language skills and promote autonomous learning.

The term MALL originated from the broader concept of Computer-Assisted Language Learning (CALL) and evolved as mobile technology became increasingly prevalent and powerful. The roots of MALL can be traced back to the emergence of CALL in the 1960s and 1970s when computers were first used for language learning purposes. As technology advanced and mobile devices became more accessible, language learners and educators began to explore the potential of using mobile devices for language learning.

The definition of MALL encompasses the integration of mobile technology into language learning activities. It involves utilizing mobile devices and their associated applications, platforms, and resources to support language acquisition, practice, and communication. MALL offers several advantages, such as the flexibility to learn anytime and anywhere, personalized learning experiences, instant access to language resources, and opportunities for authentic communication and cultural immersion. Overall, MALL represents the integration of mobile technology into language learning, providing learners with a portable and interactive language learning environment that complements and enhances traditional language learning approaches. It has also been defined as the use of “mobile technologies in language learning, especially in situations where device portability offers specific advantages” (Kukulska-Hulme, 2013, p. 3701) and "the use of mobile and handheld technologies in language learning, supported by wireless and mobile networks, to create new opportunities for language learning" (Vavoula and Sharples (2009).They emphasize the integration of mobile devices, wireless connectivity, and mobile networks to enable novel language learning experiences. Kukulska-Hulme and Shield (2008) define MALL as "the exploitation of portable or mobile technologies for language learning purposes, with or without wireless connectivity." Their definition recognizes the portability of mobile devices and the potential for language learning even in the absence of internet connectivity while Chinnery (2006) offers a broader definition of MALL, stating that it is "the use of mobile and handheld technologies in learning, combining with the resources and support of e-learning", emphasizing the convergence of mobile technologies with e-learning resources, highlighting the potential for enhanced language learning through the integration of multiple learning platforms.

All of the mentioned definitions highlight the key elements of MALL, including the use of mobile devices, wireless connectivity, and the integration of technology into language learning processes. They also underscore the opportunities created by MALL for portable, anytime, and anywhere language learning experiences.

1.2.THE CONCEPT OF MALL

The concept of MALL goes beyond simply using mobile devices as portable language learning tools. It also involves leveraging the unique features and capabilities of these devices, such as mobility, interactivity, connectivity, and multimedia, to create engaging and personalized learning experiences. It revolves around the integration of mobile devices and technology into language learning activities. It recognizes the widespread use of smart phones, tablets, and other portable devices as powerful tools for language acquisition and practice.

Mobile-assisted language learning (MALL) encompasses various key aspects that contribute to its effectiveness and popularity. One crucial aspect is mobility, as mobile devices enable learners to engage in language learning activities anytime and anywhere, providing flexibility and convenience. Additionally, MALL ensures accessibility by allowing learners to access language learning materials and resources easily through their mobile devices, overcoming barriers of time and location. Personalization is another vital component, as MALL empowers learners to tailor their language learning experience based on their individual needs and preferences, choosing specific apps, setting goals, and tracking their progress. Moreover, interactivity plays a significant role, as mobile devices offer multimedia features and interactive content that engage learners in a dynamic and immersive learning environment. Communication and collaboration are fostered through MALL, as learners can connect with native speakers, participate in language exchange, and collaborate on language learning projects, enhancing their language skills through authentic interaction. These key aspects collectively contribute to the effectiveness and versatility of MALL, transforming language learning into a flexible, engaging, and personalized experience.

1.3.MOBILE APPLICATIONS FOR LANGUAGE LEARNING AND THEIR MAIN CHARACTERISTICS

Mobile language learning applications have become increasingly popular and are widely used by language learners around the world. These applications have revolutionized the way people approach acquiring new languages, offering them convenient and accessible ways to improve language skills on the go. They leverage the convenience and accessibility of smart phones and tablets to provide learners with flexible and interactive learning experiences. According to some researchers opinions (Kukulska-Hulme& Shield 200; Stockwell, 2010; Thornton & Houser, 2005) their main characteristics are:

- *Accessibility*–Mobile language learning applications enable learners to access language lessons and practice materials anytime and anywhere. Learners can study on their commutes, during breaks, or whenever they have a spare moment, making it easy to incorporate language learning into their daily routines.
- *Gamification*–Many language learning applications incorporate gamification elements to engage and motivate learners. They use features such as points, levels, badges, and leader boards to create a sense of achievement and encourage regular practice, making learning feel like a fun and rewarding experience.
- *Interactive Content*–Mobile applications provide interactive content that goes beyond traditional textbooks, offering multimedia resources such as audio recordings, videos,

images, and interactive exercises, allowing learners to practice various language skills, including listening, speaking, reading, and writing.

- *Personalization*– Language learning applications often offer personalized learning experiences. They use algorithms to track learners' progress, adapt the difficulty level of lessons, and provide tailored feedback. Some of them also allow users to set goals, customize study plans, and focus on specific areas of language learning.
- *Vocabulary and Phrase Learning* – Most of these applications emphasize vocabulary acquisition. They provide word lists, flashcards, and interactive exercises to help learners build their vocabulary. Some also offer audio recordings and examples to practice pronunciation and reinforce context.
- *Grammar and Sentence Structure*–Mobile applications often include lessons and exercises to teach grammar rules and sentence structures. They provide explanations, examples, and practice exercises to help learners grasp the underlying rules of the language and apply them in practical contexts.
- *Speech Recognition and Pronunciation Practice*– Some language learning apps use speech recognition technology to evaluate learners' pronunciation. They provide speaking exercises and offer feedback on pronunciation accuracy, helping learners improve their speaking skills and develop correct pronunciation.
- *Language Exchange and Community*–Several language learning apps facilitate language exchange and community interaction. They connect learners with native speakers or other learners of the target language, enabling language practice through messaging, voice calls, or video chats. This immersive experience allows learners to apply what they've learned in real-life conversations.
- *Progress-Tracking*– Language learning apps often have progress-tracking features that allow learners to monitor their advancement. They provide statistics, performance analytics, and proficiency levels, giving learners a clear sense of their progress and areas that require further attention.

It's very important to note that while mobile language learning applications offer numerous benefits, they should be used as a complement to other language learning methods. Building a well-rounded language learning routine may involve incorporating other resources, such as textbooks, language classes, and real-life language practice opportunities. It is also important to note that the popularity of these applications can vary over time and among different user groups, so it's always beneficial to explore and assess various language learning applications to find the ones that best suit individual learning preferences and needs. According to some research the most popular language learning applications are the following: *Duolingo* – an application that offers courses in numerous languages and utilizes gamification to engage learners through interactive exercises and quizzes; *Babbel* – the one that provides interactive language courses with a focus on practical conversation skills, offering grammar explanations and personalized study plans; *RosettaStone* - a renowned language learning platform that focuses on immersive language learning, emphasizing listening, speaking, reading, and writing skills through interactive lessons and speech recognition technology; Memrise – application that combines vocabulary building with gamification techniques and offers a vast range of user-created courses in various languages and uses mnemonic techniques and spaced repetition to help learners remember new words and phrases; HelloTalk - a language exchange application that connects language learners with native speakers worldwide. Using this application, users can practice their target language through text, voice messages, and

video calls, while also helping others learn their native language. All of previously mentioned applications have gained popularity due to their user-friendly interfaces, engaging learning experiences, and accessibility across multiple platforms.

2.1. RESEARCH DESIGN AND METHODOLOGY

The research was conducted in March 2023, among the students from the Faculty of Technical Sciences and the Faculty of Economics at the University in Priština with a temporary seat in Kosovska Mitrovica and students of Academy of Educational and Medical Vocational Studies Kruševac. More precisely, the research included 37 second-year students from the Faculty of Economics, as well as 33 first-year students of the Faculty of Technical Sciencesand 32 first- year students of Academy of Educational and Medical Vocational Studies Kruševac.
The research was conducted using Google Forms Questionnaire that was distributed online to the students. All the students participating in the study, 102 of them, of whom 58 were female and 44 were male, aged 19 to 22 were previously introduced to the purpose and goals of this research and agreed to participate in it voluntarily. The research was conducted anonymously, and the participants were only asked to state the name of the higher education institution where they study and their age.

For the purpose of this research, we used a questionnairethat consisted of 13 questions divided into three groups. The first group had four questions related to whether and to what extent students are aware of the existence of mobile applications for language learning, whether they use them, to what extent and which of these applications they choose most often. In the second group were five questions concerning student attitudes related to the advantages and disadvantages of language learning through mobile applications. The third group also contained four questions concerning the students' personal experience, i.e. whether mobile language learning applications increase their motivation to learn languages in general, how satisfied they are with the results achieved, in which areas they notice the greatest progress and whether and which application they would recommend to their friends. The collected data were interpreted quantitatively to ensure more precise conclusions and the results were presented in charts. Instructions and explanations for completing the questionnaire were given in writing.

It should also be emphasized that the research was conducted on a small sample of respondents from only three different scientific fields, which is a major drawback, and therefore the results obtained should be viewed with a certain reserve.

2.2. RESEARCH QUESTIONS

According to what has been specified in the introduction part, the research questions in this study can be formulated as follows:

1. What is the students’ awareness of the existence of mobile applications for language learning and the possibilities that they offer.
2. What are the students' attitudes towards mobile applications for language learning and their advantages and disadvantages.

3. What are the students' experiences and expectations from mobile applications for language learning.

2.4. DISCUSSION

As already mentioned, the questionnaire consisted of three groups of questions. The answers obtained were processed quantitatively and presented in the tables below. When it comes to the first group of four questions related to awareness and information about the existence of mobile applications for learning a foreign language and the opportunities they offer (Table 1), the answers of our respondents show that they are very well informed. As many as 51.96 percent declared themselves as very aware and 26.47 percent extremely aware. After such a response, the response to the second question is not unexpected at all, where absolutely all respondents confirmed that they have tried using mobile applications for learning a foreign language. The most frequently used applications among the studied student population are Duolinguo and Hellotalk, whose use is mostly moderate. However, as many as 24.51 percent of respondents declared that they use these applications daily, which is certainly a rather high percentage.

Table 1. Mobile applications for language learning awareness and their use among students

1.	**To what extent are you aware of the existence of mobile applications for language learning?**				
	not at all	slightly aware	moderately aware	very aware	Extremely Aware
	/	6,86	14,70	51,96	26,47
2.	**Have you ever used mobile applications for language learning?**				
	No		Yes		
	0		100		
3.	**If you use mobile applications for language learning, how often do you use them?**				
	Rarely	occasionally	moderately	quite a lot	every day
	2,94	32,35	11,76	28,43	24,51
4.	**Which mobile application for language learning do you choose most often?**				
	Duolinguo	Babbel	Rosetta Stone	Hello talk	Other
	38,23	11,76	8,82	26,47	14,70

When it comes to the advantages and disadvantages of using mobile applications for learning a foreign language, the answers are presented in Table 2. The greatest advantages are the convenience of learning anytime and anywhere according to the opinion of 31.37 percent of respondents, followed by access to a wide variety of language learning resources (21, 56). Interactive and engaging learning experience and personalized learning content based on individual needs are represented by 15.68 and the 13.72 percent, respectively. Gamification elements that make learning fun and the opportunity to connect with language learners worldwide are considered somewhat smaller advantages, with 9.80 and 7.84 percent respectively, although as authors we personally thought that they would be more prevalent. When it comes to shortcomings, the biggest is considered to be dependence on technology and internet connectivity, while limited opportunity for face-to-face interaction and speaking practice and lack of immediate feedback from a language instructor are also equally

important. Potential distractions from other applications or notifications and Insufficient cultural context in language learning materials with 8.82 and 7.84 percent of responses, our respondents see as less important disadvantages that characterize this way of learning. The majority of our respondents also declared that they believe mobile applications are more (43.13 percent) and much more (21.56 percent) effective in helping learn a language compared to traditional methods, as well as that they have a very important and significant role in supplementing classroom language learning, which also significantly affects their motivation for this type of learning.

Table 2. Student's attitudes regarding the advantages and disadvantages of language learning through mobile applications

5. What are the main advantages of learning a language through mobile applications?					
Convenience of learning anytime and anywhere	Access to a wide variety of language learning resources	Interactive and engaging learning experience	Personalized learning content based on individual needs	Gamification elements that make learning fun	Opportunity to connect with language learners worldwide
31,37	21,56	15,68	13,72	9,80	7, 84
6. What are the main disadvantages of learning a language through mobile applications?					
Limited opportunity for face-to-face interaction and speaking practice	Lack of immediate feedback from a language instructor	Potential distractions from other applications or notifications	Difficulty in understanding complex grammar concepts without guidance	Insufficient cultural context in language learning materials	Dependence on technology and internet connectivity
20,58	20,58	8,82	14,70	7,84	27,45

7. How effective do you consider mobile applications are in helping you learn a language when compared to traditional methods?				
Much less effective	Less effective	Equally effective	More effective	Much more effective
4,90	17,64	12,74	43,13	21,56

8. In your opinion, what role do mobile applications play in supplementing classroom language learning?				
They are not useful as a supplement	They have a minor role as a supplement	They have a moderate role as a supplement	They have a significant role as a supplement	They are essential for supplementing classroom learning
5,88	15,68	15,68	37,25	25,49

9. To what extent do you feel motivated to learn a language through mobile applications?				
Not at all motivated	Slightly motivated	Moderately motivated	Highly motivated	Extremely motivated
4,90	13,72	26,47	31,37	23,52

Learning a foreign language through the use of mobile applications also had the effect of increasing the motivation of our respondents to learn foreign languages in general (Table 3.) In the same table, the answers to how satisfied the students are with the achieved results and in which areas they notice the greatest progress are presented. As expected, the majority indicated that the greatest improvement was observed in the area of vocabulary as well as listening and speaking skills. All this speaks in favor of the fact that our respondents, as many as 76.47 percent of them, would recommend mobile applications to their friends for their friends to use mobile applications when learning a foreign language.

Table 3.Student's attitudes regarding experiences and expectations from mobile applications for language learning.

10. **Do mobile language learning applications increase your motivation to learn languages in general?**				
Not at all	Slightly	Moderately	Highly	Extremely
/	7,84	30,39	50,98	10,78
11. **How satisfied are you with the results you have achieved through mobile language learning applications?**				
Not at all	Slightly	Moderately	Highly	Extremely
0	6,86	46,07	36,27	10,78

12. **In which areas do you notice the greatest progress while using mobile language learning applications?**					
Vocabulary	Grammar	Listening skills	Speaking skills	Reading comprehension	Writing skills
33,33	5,88	21,56	18,62	7,84	12,74

13. **Would you recommend a specific mobile language learning application to your friends?**		
No	I don't now	Yes
2,94	20,58	76,47

CONCLUSION

Mobile applications have revolutionized the field of language learning by providing learners with convenient and accessible tools for language acquisition. They offer a flexible and personalized learning experience, allowing learners to study at their own pace and according to their individual needs. The interactive features, such as gamification and multimedia content, enhance engagement and motivation, making language learning a more enjoyable process. Moreover, the integration of social features and the availability of real-time feedback facilitate collaborative learning and provide opportunities for language practice and communication with native speakers. The findings indicate that students generally exhibit

positive attitudes towards mobile applications in language learning. Due to the opportunities for independent and self-paced learning that these applications offer, learners greatly appreciate their convenience, accessibility, and flexibility. Additionally, the interactive and gamified features of many language learning apps engage students and enhance their motivation, making the language learning process enjoyable and engaging.

Despite these advantages, it is important to acknowledge the challenges faced by mobile applications in language learning. Technical limitations, such as compatibility issues and limited offline accessibility, can hinder the learning experience. Moreover, the quality and accuracy of content and the effectiveness of instructional design vary across different applications, highlighting the need for critical evaluation and selection.

To maximize the benefits of mobile applications in language learning, it is recommended that learners adopt a balanced approach by combining app-based learning with other traditional language learning methods. Language educators should play a vital role in guiding learners in the selection and evaluation of appropriate applications and integrating them into the overall curriculum. Furthermore, developers should focus on continuous improvement, user feedback, and rigorous content development to enhance the quality and effectiveness of language learning applications.

As technology continues to advance, mobile applications are expected to play an even more significant role in language learning. With the integration of emerging technologies like augmented reality, virtual reality, and natural language processing, the future holds great promise for creating immersive and highly personalized language learning experiences through mobile applications. In conclusion, mobile applications have the potential to revolutionize language learning, offering learners greater accessibility, flexibility, and engagement. By harnessing the power of technology and embracing the opportunities it presents, language learners can embark on a transformative journey of acquiring new languages in an increasingly connected and digital world.

REFERENCIES

Chinnery, G. M. (2006). Emerging Technologies: Going to the MALL: Mobile Assisted Language Learning. Language Learning & Technology, 10(1), 9-16.

Kukulska-Hulme, A., & Shield, L. (2008). An Overview of Mobile Assisted Language Learning: From Content Delivery to Supported Collaboration and Interaction. Re CALL, 20 (3), 271-289

Kiili, K. (2015). Digital game-based learning: Towards an experiential gaming model. The Internet and Higher Education, 25, 36-43.

Kukulska-Hulme, A. (2013). Mobile-assisted language learning. In C. Chapelle (Ed.), The encyclopedia of applied linguistics (pp. 3701-3709). New York: Wiley.

Prensky, M. (2005). What Can You Learn from a Cell Phone? Almost Anything! Innovate: Journal of Online Education, 1, No. 2 http://nsuworks.nova.edu/innovate/vol1/iss5/2

Sharples .M. (2000).“The design of personal mobile technologies for lifelong learning”. Computers & Education, 34(3-4), pp. 177-193.

Stockwell, G. (2010). Using mobile phones for vocabulary activities: Examining the effect of the platform. Language Learning & Technology, 14(2), 95-110.

Thornton, P., & Houser, C. (2005).Using mobile phones in English education in Japan. Journal of Computer Assisted Learning, 21(3), 217-228.

Vavoula, G., & Sharples, M. (2009). Meeting the Challenges in Evaluating Mobile Learning: A 3-level Evaluation Framework. International Journal of Mobile and Blended Learning, 1(2), 54-75.

Vurdien, R., & Tosuncuoglu, I. (2017). Social network usage for language learning: A comparative analysis of Facebook, Twitter, Instagram, and Snapchat. In S. D. Atis& A. B. Ergenç (Eds.), Handbook of Research on Mobile Learning in Contemporary Classrooms (pp. 144-162). IGI Global.

LABOR LAW STATUS OF MANAGERS AND DIRECTORS OF MODERN COMPANIES

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Abstract: Modern business in conditions of various global challenges (economic crises, pandemics, etc.) also required a modern company through which business could be more easily adapted and modified. Through such a process, there was inevitably a modification of both jobs, their systematization and content, as well as within them the position of director or manager as a person authorized to represent the company. Although formally, their position is regulated by labor law and commercial law regulations, which have not undergone major changes in recent years, in fact, socio-economic circumstances have imposed certain modifications and opened up numerous issues especially for directors and managers. As one of them, in this case, perhaps the previous question, is establishing the similarity between director and manager. Environmental protection and awareness of limited resources have opened up questions about the relationship between business and sustainable development. As managers and directors are persons authorized for representation, their position here can be viewed through the prism of modern company operations, on the one hand, and sustainable development, on the other. After the outbreak of the global pandemic with the corona virus, the adaptation of companies' operations came to the fore even more. The recommendations of the World Health Organization, concern for the health of the population, actualized working from home everywhere and in all activities where it was possible. The emphasis is on the actualization and not the introduction of working from home, because working from home is a model of employment relationship that existed in most legal systems, it was only applied to a limited extent and where there was a need for it. As a new trend during the pandemic, the application of working from home had its own specifics when considering managers and directors. Therefore, the specifics of this job, which entail great powers (representation of companies), but also great responsibility, set them apart from others and require their special legal analysis.

Key words: *directors, managers, labor legal status, sustainable development, work from home*

Introduction

Modern companies, or corporations, as they are called from the aspect of commercial law, are defined by different sciences. From the aspect of management, for example - management is often seen in theory and practice as a system of government, that is, as a group of people who have certain powers in the management of affairs. In this approach, the key issue is to identify and determine the people who will be the bearers of authority, then determining their authority and determining the scope of work to which their authority applies (Ondrej J. et al., 2014: 39-42). The fifth written is in favor of the fact that the terms manager and director can be used as synonyms. However, is this always the case?

However, since the right affects every activity, establishment, individualization, registration and finally business and relations with other entities (business partners, the state, etc.), definitions from the law are the starting point. Exactly the same applies to determining the rights and obligations of managers, that is, directors in companies. Although they can be used as synonyms in certain situations, this is not always the case. From the aspect of labor law provisions and commercial law provisions, both companies, but also managers and directors are defined differently, according to those elements that are the most important for those branches of law. As the law in itself is not enough and cannot function independently of reality, only the practical application of the given provisions, and their adaptation to the circumstances that exist or appear in reality (e.g. Covid19, economic crises, etc.), can provide a more complete description of a certain institute. The most recent example is certainly the global pandemic, which actualized certain forms of work (working from home, for example), and required a high degree of adaptability of companies in order to survive on the market during the pandemic.

Environmental protection, awareness of limited natural resources, and therefore resources for the production of certain products, actualized the concept of sustainable development. In accordance with it, modern companies are also forced to introduce new technological processes into their operations, invest in new, so-called clean technologies, and to conduct business in a socially responsible manner. The latter has become an appropriate imperative in the 21st century, if one takes into account the speed of the flow of information, and cases in which the value of certain companies has drastically decreased due to the knowledge obtained by the end consumers.

MODERN COMPANY AND DIRECTORS (MANAGERS) FROM THE ASPECT OF COMMERCIAL LAW

Today, companies everywhere in the world (with very few exceptions) are recognized as legal entities, which in other words would mean that the company is independent in the performance of its activities, as a rule, registered and that it can independently appear on the market in its own name and on its own account. The moment when the company becomes independent and when it starts running the so-called "separate" life different from its owners as natural persons, but also from the persons who represent it - directors, in most legal systems is its registration in the prescribed register. However, it was not always like that, and even now in theory there are understandings that completely deny the legal subjectivity of companies. Although their claims have been overcome due to the needs and requirements that modern business has placed before the world economy, one can still find arguments that equate the complete independence of companies with expediency and political reasons, and that this independence is constructed by law (Jovanović, V., 1990 :98). World trends are of the opinion that companies are completely separated from their personal substrate, and that they have their own interests that can be not only completely different, but also opposed to the interests of their owners (Guinnane, T. et al., 2007:19). However, in connection with legal subjectivity is also the business capacity of companies. Business capacity for natural persons means that they can acquire, change or cancel rights and obligations by declaring their will (Nikolić, D., 1999:206). If we try to apply this definition of business capacity to companies, the question arises, how will they declare their will? If the will is understood as a psychological state of consciousness, it is clear that a company cannot have a will. Only natural persons can have a will, and therefore the will in the case of companies implies the will of the members of the bodies of the company or its representatives as natural persons. Although it has legal subjectivity and can be an independent bearer of rights and obligations,

a company acts through its representatives in legal transactions (Jankovec, I., 1996:95). Therefore, the legal subjectivity, and therefore the business capacity of the company, is expressed through the management body of the company, or through its representatives.
In American legislation, the legal nature of a corporation is defined as a legal entity created and recognized by law that is identified by a specific name. Corporations are recognized as "persons" by federal law, but also by the laws of member states, and they enjoy many, though not all, rights that are also recognized by natural persons, citizens of the USA. The Bill of Rights (Jentz A. G. et al., 1993:710) guarantees certain rights and protection to "persons" and corporations are subsumed under this term in most cases. Thus, corporations have the same rights as natural persons and the same protection from the Fourteenth Amendment - the right to access the courts (sue and be sued) and the like. Corporations are also guaranteed the right to freedom of speech, as well as individuals (First Amendment). In addition to freedom of speech in the sense of expression through marketing and advertising of one's services, this freedom is also extended to freedom of expression of political opinion in certain matters (Jentz A. G. et al., 1993:711). The difference compared to natural persons exists in the case of possible criminal acts committed by a corporation, because a corporation as an artificial legal person cannot be sent to serve a prison sentence, so criminal responsibility is transferred to persons who can be tortiously responsible - persons who manage or represent corporations. However, the Anglo-Saxon legal system knows the ultra vires doctrine, which in translation means acting beyond its power, i.e. it applies in cases when a company in its operations exceeds the business capacity given to it by regulations (Lipton, P. & Herzberg, A., 2000 :82). Therefore, companies are recognized as having legal and business capacity, but only within the framework of carrying out the tasks established in the founding act and on the basis of the authorizations given by the regulations, and this legal and business capacity is not general and cannot be equated with the legal capacity of natural persons.

If a company is viewed in this way, then it would represent an independent legal entity, separate from its owners, which is established with the purpose of performing a certain activity and with the aim of gaining profit (Bulatović, I. et al., 2016). It is precisely this acquisition of profit that determines the modern company to reduce costs as much as possible, i.e. with minimal investment, maximum profit and maximum profit.

In domestic legislation, a company, as a form of association of persons and capital for the purpose of carrying out some of the economic activities, is a creation of recent history, and a consequence of the development and strengthening of the market economy. Therefore, the concept of commercial law has evolved for about two hundred years both theoretically and in positive law, so that it simultaneously contains the basic characteristics or most important elements of a commercial company. A commercial company could be defined as an association of several persons (legal or physical), who enter their roles and combine their work, thus forming the basic capital of the company, so that under a common (personal or real) business name, they perform a certain economic activity for the purpose of obtaining profit. - profit, which they share among themselves according to the foundation contract, i.e. the company statute (Milenović, 1997:86). Although at first the definition may appear to be too broad and somewhat unwieldy, it must be given the right to include almost all the elements that a company should have. Of course, no definition can be valid as a universal postulate and must, for reasons of "giving life" to legal norms, suffer certain exceptions in practice, and that is the case here as well. Probably for these reasons, the legislator in the new Law on Business Companies of the Republic of Serbia decided to define the concept of a business company which is very vague and short, i.e. - A business company (hereinafter:

company) is a legal entity that performs activities with the aim of making a profit ("Official Gazette of RS", No. 36/2011, 99/2011, 83/2014 - other laws, 5/2015, 44/2018, 95/2018, 91/2019 and 109/2021, Article 2.). Therefore, this definition of the concept of a business company is somewhat different from the one that was in the previously valid Law from 2004, where a business company was defined as follows: A business company is a legal entity that is established by a founding deed by legal and/or natural persons for the purpose of carrying out activities aimed at gaining profit ("Official Gazette of the RS", no. 125/2004 and 36/2011 - Dr. Law, Article 2). At first glance, it is clearly noticeable that the definition in the current law completely omits the part concerning who can establish a company, but the emphasis is on the fact that, after its establishment, a company becomes an independent legal entity, regardless of whether it was founded by a natural or Legal entities.

And where are the managers and company directors in all this? Although companies are recognized as legal entities, they must be represented by natural persons. From the aspect of commercial law, a commercial company, depending on the type, has bodies, collective and external, whose jurisdiction is regulated by law, the company's founding act and the company's statute. Thus, for example, for a limited liability company (LLC), depending on the type of management of the company (unicameral or bicameral), the foreseen bodies of the company are the assembly, one or more directors, that is, the assembly, the supervisory board and one or more directors (Article 198 of the Law on Business Companies of the Republic of Serbia). There can be more than one director in a company, but the scope of their powers is determined, partly by the Law, and partly by the general acts of the company (foundation act and/or statute of the company). And what would those powers be? The most important thing is the representation of the company towards third parties in accordance with the founding act, the decisions of the company's assembly and the instructions of the supervisory board, if the management of the company is bicameral (Article 221 of the Law on Companies of the RS). The second, very important authorization is to manage the affairs of the company in accordance with the founding act and decisions of the assembly, as well as with the instructions of the supervisory board if the management of the company is bicameral (Article 224 of the Law on Companies of the RS). In addition to the powers that are really very broad (controlled, but certainly very broad), for the legal status of the director, his responsibility and obligations are also very important, also prescribed in the same way as the powers.

MODERN COMPANY AND DIRECTORS (MANAGERS) FROM THE ASPECT OF LABOR LAW

Although both labor and commercial law arose from civil law, their development later went in different directions. Thus, commercial law remained in the area of private law, where the influence of the state in the regulation of relations is less and where there are more discretionary norms, i.e. where it is left to the subjects of law to independently regulate their relations. On the other hand, labor law has become part of public law, that is, an area in which the state has more need to intervene and to more precisely regulate relations within it. However, the reality of the last thirty years has almost erased the dividing line between public and private rights, because, in the circumstances of frequent economic and other types of crises, state intervention has become inevitable in those areas where it was not necessary before, and sometimes not even desirable.

Be that as it may, the modern company and directors, i.e. managers can also be viewed from the aspect of labor law norms, where the company is the employer, and the director can be a natural person employed by the employer, or a person hired by the employer to perform representation and representation of the employer. on the basis of some other contract, which is not an employment contract.

In the labor law legislation, a company is defined as an employer in the following way: An employer, in the sense of this law, is a domestic or foreign legal or physical entity that employs, or hires, one or more persons. (Labor Law "Official Gazette of RS" No. 24/2005, 61/2005, 54/2009, 32/2013, 75/2014, 13/2017 - US decision, 113/2017 and 95/2018 - authentic interpretation). An entrepreneur is also considered a natural person here, even though it is not a company, the commercial legal position of an entrepreneur is regulated by the Law on Companies of the RS. From the aspect of labor law, if one or more natural persons are employed, all the provisions concerning the employer apply to the entrepreneur.

As far as directors are concerned, according to the previous labor legislation, there were no norms on the labor law status of directors of a company, which in practice created great difficulties and ambiguities. In such a state of affairs, it became necessary to regulate the issue with the Labor Law, which was done. In accordance with the established rules, the director can establish an employment relationship by concluding an employment contract for an indefinite or a fixed period of time. However, the duty of a director can be assumed even without establishing an employment relationship (Kulić, Ž. & Škorić, S. 2020:164).

It goes without saying that we are talking about directors whose labor law status is basically regulated by the provisions of the Labor Law, and not by the provisions of another general act. In other words, it is about directors, that is, other legal representatives whose rights, obligations and responsibilities from the employment relationship are regulated by the Labor Law.

In order for a certain person to become a director, it is not always necessary to conclude an employment contract with him. The provisions of the Labor Law allow a certain person to become a director, or another legal representative of the employer, even without establishing an employment relationship. The mutual rights, obligations and responsibilities of the director, i.e. another legal representative of the employer, who has not established an employment relationship with the employer, are regulated by a separate contract, not an employment contract (Article 48 of the RS Labor Code).

Therefore, the status of a director, or other legal representative of the employer, can be acquired in two ways: 1) by concluding an employment contract, or establishing an employment relationship; 2) by concluding a special contract, i.e. without establishing an employment relationship.

The person who is entrusted with the duty of director, i.e. the legal representative of the employer, is most often determined to establish an employment relationship. Such determination is quite logical, among other things, because it demonstrates the determination to fully share the destiny with the employees and the organization in which he works, which can be a reason for additional obstacles on the way to achieving the projected goals. In addition, such determination, in a certain sense, shows greater trust in the organization, its resources and its goals, which is in the interest of both the employer and the employees (Kulić, Ž. & Škorić, S., 2020:165).

However, a director who is determined to establish an employment relationship does not have to base such a relationship exclusively on an indefinite period. On the contrary, the Labor Law allows the possibility to establish it for a certain period of time. Whether it will be based on an indefinite or a fixed period of time is decided in each specific case, depending on the

plans, wishes, ambitions, interests and determination of both parties in such a relationship. In other words, it is decided not only by the director, but also by the employer.
The employment relationship with the director, or other legal representative of the employer, is based on the conclusion of the employment contract. A fixed-term employment relationship can last until the end of the term established by the employment contract. However, in the case of dismissal of the director, as well as in other justified cases, such a relationship may last even shorter than the established term.
The employment contract by which the director, or other legal representative of the employer, establishes the employment relationship, is concluded by the director, or other legal representative, and the competent authority of the employer. On behalf of the employer, it is concluded by the competent authority established by law or general act of the employer (Kulić, Ž. & Škorić, S., 2020:165).
Another way of hiring a director is when an employment contract is not concluded with the director, but he is hired by some other contract that is not an employment contract. This way of hiring directors was not allowed under the previous legislation. However, time and real market conditions have taken their toll, where business has become more and more uncertain, and job security has become less and less. With such a state of affairs, the need to make the norms of labor legislation more flexible and closer to real life was imposed with reason. In this context, the determination of the creators of the Labor Law should be observed that directors are not required to establish an employment relationship at any cost (Article 48 of the Labor Law of the RS).

A separate contractual relationship is established with the director, or other legal representative of the employer, who has not established an employment relationship. The mutual rights, obligations and responsibilities of the employer and the director are regulated by a separate contract, not an employment contract. Thanks to that, the position of the director, or other legal representative of the employer, is not based on an employment relationship but on a contractual relationship.
The contract on rights, obligations and responsibilities with the director, or other legal representative of the employer, with whom a contractual relationship has been established, on behalf of the employer, is concluded by the competent authority established by law or general act of the employer. Such a contract can be concluded for an indefinite period or for a certain period of time, regardless of the fact that it is not written anywhere in the Labor Law. A different conclusion would be illogical and contrary to the principles on which market economic conditions are based (Kulić, Ž. & Škorić, S. 2020:166).

THE ROLE OF MANAGERS AND DIRECTORS IN CORPORATE SOCIAL RESPONSIBILITY

In recent years, a new environmental ethic can be observed, which should be based on the active relationship of man who builds and restores his environment. The United Nations World Commission on Environment and Development defines sustainable development as follows: "meeting the needs of the present generation so as not to jeopardize the ability of future generations to meet their needs" (Topić M. et al., 2007: 61). If we analyze the concept of the entire legal system in the Republic of Serbia, as well as all regulations whose norms directly or indirectly protect the environment, we get the impression that all legal regulations are oriented and conceived in such a way that they glorify environmental protection as a priority for every behavior of an individual, group or community (Škorić , S., 2018:219-221). Socially responsible behavior, i.e. business operations of companies is one of the newer

institutes of management, and today it is associated with the sustainable development of the entire society, especially the economy as one of the three pillars of sustainable development, which includes the development of the economy. And what is the central issue in sustainable development as a perfect combination of the present and the future, is precisely the environment, its protection, rational use of natural resources, etc. (Škorić, S. & Maričić, G., 2019).

In this sense, sustainable development can be defined in many ways, but the most frequently cited definition is from the report of the UN Commission on Ecology and Development "Our Common Future" from 1987, also known as the "Bruntland Report" (after the president of this commission Bruntland Gro Harlem), according to which: "sustainable development is development that meets the needs of the current generation, while not jeopardizing the opportunities for future generations to meet their needs" (Saks, Dž. 2014:5). By adopting the National Strategy for Sustainable Development in 2008, the Republic of Serbia accepted that sustainable development would become its permanent development commitment, with the fact that the strategy states a much more extensive definition according to which, in a slightly more sublimated version, sustainable development represents a long-term concept that implies constant economic growth which, along with economic efficiency, technological progress, more clean technologies, innovation of the whole society and socially responsible business, ensures poverty reduction, long-term better use of resources, improvement of health conditions and quality of life and reduction of pollution (to a level that can be sustained by environmental factors, prevention new pollution) and preservation of biodiversity (Kapor, P. 2015:106). It is clear that sustainable development is a complex and multidimensional process that has three basic dimensions: economic, social and environmental. However, when talking about the business of modern companies and the alignment of that business with the principles of sustainable development, it is necessary to mention the so-called personal substrate of the company, on which, after all, every decision, including the company's business, depends. Although there are company bodies that make appropriate decisions, the vast majority of those decisions are implemented by directors as representatives of the company and as persons who manage the company's operations. Both commercial law and labor law regulations are fairly uniform in what the rights, powers, obligations and responsibilities of company directors are, regardless of whether they have established an employment relationship in the company or work on the basis of some other contract that is not an employment contract.

Namely, the rights, obligations and responsibilities of the director, i.e. another legal representative of the employer, are regulated not only by the law but also by other appropriate acts, depending on whether it is the person with whom the employment relationship was established or the person with whom the contractual relationship was established. relationship. Given that such a person performs a very responsible duty, his rights, obligations and responsibilities must be regulated in a clear and unambiguous way, so that it is always possible to know which are his rights and which are his obligations from the employment relationship, i.e. from the contractual relationship. On the other hand, a high degree of his authority implies a high degree of his responsibility, which is why they should be arranged in a responsible manner.

The law establishes basic rights and obligations, and the employment contract - special rights and obligations of such a person. The basic rights and obligations of such a person, in principle, are considered to be the rights and obligations that other employees of the employer also have, in accordance with the law. On the other hand, special rights and obligations arise from the specific position of such a person in the organization.

Based on the above, it can be concluded that the director, or other legal representative of the employer, with whom the employment relationship is based, has the right to appropriate earnings, safety and protection of life and health at work, health care, protection of personal integrity and other rights in case of illness , reduction or loss of working capacity and old age, material security during temporary unemployment, as well as the right to other forms of protection, in accordance with current regulations. In addition, an employment contract or other act may grant him other rights, i.e. authorizations, so that he can successfully perform his duties at the employer (Kulić, Ž. & Škorić, S., 2020:167).

In contrast to the rights, i.e. the powers, the duties and obligations of the director, i.e. the other legal representative of the employer, with whom the employment relationship is established, are prescribed. His basic duties are determined by law and basically do not differ from the duties of other employees of the employer. In this sense, it can be said that he is obliged: to conscientiously and responsibly perform the tasks entrusted to him, to respect the conditions and rules of the employer in connection with the fulfillment of contractual and other obligations from the employment relationship, to inform the employer of important circumstances that affect or could affect to perform the tasks specified in the employment contract, to inform the employer about any potential danger to life and health and the occurrence of material damage and the like. In addition to such usual obligations, the employment contract may prescribe other appropriate obligations.

The responsibility of the director, i.e. another legal representative of the employer, for the assumed obligations is great. The greater the authority, the greater the responsibility. Whoever performs his duty irresponsibly and negligently must be ready to face his responsibility. In addition to dismissal from office, he may also face proceedings for determining criminal, misdemeanor, material and other liability (eg due to abuse of official position, accepting bribes, violation of employee rights, conclusion of harmful contracts, illegal enrichment and the like).

CONCLUSION

Therefore, it can be freely concluded that directors, i.e. managers play a key role in the company's operations and that, in the process of its representation and business management, together with it, they build its business image that is recognizable to third parties. Although the previous statement is not so simple, because the directors answer and submit reports to the bodies that elected them and can be dismissed if they do not behave in accordance with the provisions of the law, general acts of the company or in accordance with the decisions of the assembly and other bodies of the company. However, even this does not diminish the importance of directors for a company. The part that concerns different titles, i.e. director or manager, can be viewed from the aspect of recent trends in the economy, including the fact that it was only with the Labor Law from 2005 that the legal possibility was opened that directors do not have to be employed by the company in order to perform the duties of a director. The so-called trends have been present in the world for a long time. professional managers, who come at the invitation of a certain company, in order to improve its business and make it more profitable. So, perhaps the difference in the names director and manager could be found precisely in this - the employment relationship of the director, that is, the employment of a person under a contract that is not an employment contract - the manager.

REFERENCE

Bulatović, I., Škorić, S., Jovanović, V. (2016). Branding a business name, *Economics of Agriculture,* br. 4, str. 1323-1332.

Guinnane, T., Harris, R., Lamoreaux R., Naomi and Rosenthal, Jean-Laurent N. R. (2007). Putting the Corporation in its Place; *Oxford University Press on behalf of the Business History Conference*. Advance Access publication July 19, str. 678-729

Jankovec, I. (1996). Privredno pravo, Beograd.

Jentz A. G., Miller L. R., Cross B. F. (1993). *West Business Law*; Fifth edition, West publishing company.

Jovanović, V. (1990). *Preduzeća i društva prema Zakonu o preduzećima /Companies and companies according to the Law on Companies*/, Beograd.

Kapor, P. (2015). *Dobro upravljanje javnim finansijama kao faktor održivog razvoja / Good management of public finances as a factor of sustainable development*/, Megatrend revija, Vol. 12, No 3, str. 105-126.

Kulić, Ž., Škorić, S. (2020). *Radno pravo / Labor Law*, Pravni fakultet za privredu i pravosuđe, Novi Sad.

Lipton, P., Herzberg, A. (2000). *Understanding Company law*; Melbourn, Australia.
str. 39-42.

Milenović, D. (1997). *Subjekti privrednog prava / Subjects of commercial law/,* Niš.
Nikolić, D. (1999). *Uvod u sistem građanskog prava / Introduction to the civil law system*/, Novi Sad.

Saks, Dž. (2014). *Doba održivog razvoja / The age of sustainable development/,* Jp Službeni glasnik – Centar za međunarodnu saradnju i održivi razvoj (CIRSD), Beograd.

Škorić, S. (2018). Pravo građana da učestvuju u procesu donošenja odluka o životnoj sredini u pravnom sistemu Republike Srbije; u okviru monografije Transponovanje zahteva Arhunske konvencije u pravni sistem Republike Srbije sa posebnim osvrtom na nadležnost jedinica lokalne samouprave na teritoriji AP Vojvodine / The right of citizens to participate in the process of making decisions about the environment in the legal system of the Republic of Serbia; within the monograph Transposition of the requirements of the Arhun Convention into the legal system of the Republic of Serbia with special reference to the competence of local self-government units on the territory of AP Vojvodina/, Novi Sad, str. 209-221.

Topić M., Božović R. i Topić R., G (2017). *Sušenje i sušare sa aspekta obnovljivih izvora energije i održivog razvoja/ Drying and dryers from the aspect of renewable energy sources and sustainable development/,* TEHNIKA–MAŠINSTVO 66, str. 61-67.

Zakon o privrednim društvima, Službeni glasnik RS / Law on Business Companies, Official Gazette of the RS/, br. 125/2004 i 36/2011 – other laws.

Zakon o privrednim društvima, Službeni glasnik RS / Law on Business Companies, Official Gazette of the RS, br. 36/2011, 99/2011, 83/2014 - other laws, 5/2015, 44/2018, 95/2018, 91/2019 and 109/2021

Zakon o radu Službeni glasnik RS / Labor Law, Official Gazette of the RS, br. 24/2005, 61/2005, 54/2009, 32/2013, 75/2014, 13/2017 - odluka US, 113/2017 i 95/2018 - autentično tumačenje)

CORPORATE SOCIAL RESPONSIBILITY AS A MARKETING STRATEGY

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Abstract: The subject of this paper is the concept of Corporate Social Responsibility (CSR) as a company's marketing strategy, which must be implemented in order to achieve a competitive advantage, build a strong company reputation, brand market positioning, profitability while respecting the three key dimensions of Corporate Social Responsibility: sustainability, responsibility, transparency. In addition to adequate implementation of the concept of Corporate Social Responsibility, it is necessary to publish an annual report detailing its activities, results, and impacts. More precisely, the importance of reporting on all interest groups on which the company's actions had an impact is highlighted. This indicates the necessity of reporting on interest groups, on the effects of the actions taken by the company, and how those actions affect the mentioned interest groups.
For a better understanding of the importance of the concept of CSR, the initial analysis in the paper refers to the definition of the concept of CSR and its historical development. Then the focus is directed to determining the importance of applying the concept of CSR as part of the company's marketing strategy in modern business, considering its key models and measuring the degree of influence after applying the concept.
Reviewing the current literature and conducted research, it is evident that companies are increasingly focused on applying the concept of CSR in marketing strategy, due to its significant contribution to overall business goals, opening new markets, and building long-term relationships with stakeholders.
The main goal of the research in the paper is to identify the positive impacts and benefits of introducing and implementing initiatives and activities of the CSR concept.

Keywords: Corporate social responsibility, socially responsible marketing, marketing strategy

INTRODUCTION

Based on the analysis of relevant sources of literature that deal with the issue of the relationship between the concept of CSR and the company's operations, it was determined that there is a clear and strong connection between a company's CSR and its marketing activities. Within this paper, that connection will be shown, i.e. why socially responsible behavior is important for the company's marketing activities, how it is integrated, and how it becomes an integral part of the company's marketing strategy.
The concept of corporate social responsibility (CSR) is gaining more and more importance in the professional and academic public during the last few decades.

Although there are different definitions of this concept, its unique interpretation cannot be determined. The professional public agrees that CSR activities are aimed at understanding the impact that the company has on its various interest groups, as well as managing that impact in the right way. What has changed over time is the company's reason for implementing CSR activities. Namely, respect for the interests of strategic groups in addition to the company itself (local community, non-governmental sector, environmental protection organizations, associations for the care of endangered animal and plant species, etc.) at the beginning of the application of this concept, came as an externally imposed obligation of the regulatory authorities of the state in which the company operates.

Today, companies are increasingly resorting to this concept themselves, because it can represent a serious source of competitive advantage in future market performance and differentiation. As a consequence of this change, in addition to the more intensive application of CSR activities, an increase in the importance of reporting on these activities is also evident. Thus, the number of companies that annually publish the so-called Reports on CSR. There are also numerous scientific studies that talk about the positive impact of CSR on various interest groups of companies, profitability, but also on the general business image, and reputation.

The broadest definition of CSR focuses on the relationship between multinational corporations, governments, and individual people. Locally, the term focuses on the connection between a business and the community in which it exists or operates. Regardless of the angle from which this issue is viewed, it appears to be a form of social contract between business and society. This contract implies some form of altruistic behavior and responsibility towards current and future members of society (Crowther, Aras, 2008:12). Firms, consumers, shareholders, and all other members of the community belong to one social system. They all share the available limited resources, and to enhance their sustainable use, all members must agree to a social contract that is just and fair to all (Idowu, 2013:600).

The key point is that CSR is an evolving concept that still does not have a universally accepted definition. Hohnen and Potts state that the concept of CSR is the way in which companies integrate social, environmental, and economic issues into their values, culture, decision-making, strategy, and operations in a transparent and responsible manner, establishing better business practices, creating wealth, and improving society.

CSR implies the following activities related to (Hohnen, Potts, 2007:4):

- Corporate governance and ethics;
- Health and safety;
- Environmental resources;
- Human rights (including basic labor rights);
- Sustainable Development;
- Working conditions (including safety, working hours, wages);
- Community involvement, development, and investment;
- Respect for different cultures and peoples;
- Corporate philanthropy and employee volunteering;
- Customer satisfaction and respect for the principles of fair competition;
- Measures against bribery and the fight against corruption;
- Accountability, transparency, and performance reporting;
- Supplier relations, both for domestic and international supply chains.

Many factors and influences have led to increasing attention being paid to the role of the concept of CSR. CSR is the starting point for identifying and adapting to challenges related to the company's business plans, the environment, and consumers. On the other hand, economic globalization, with its attendant emphasis on cross-border trade, international corporations, and global supply chains, is rapidly expanding CSR issues into human resource management policies, environmental sustainability, and health and safety. CSR plays an important role in determining how the industry affects the rights of workers, local communities and markets, and what actions can be taken to ensure that businesses contribute to the good of all.

Regardless of the lack of a single interpretation, the importance and effects of applying socially responsible behavior are multiple. Deciding to implement the concept of CSR, companies have an impact both on the immediate business environment in which the company operates, as well as on the wider local environment, but also on the global environment.

The importance of applying the concept of corporate social responsibility is as follows:

• Rational use of natural resources in company production
• Improving the company's competitiveness in relation to market competition
• Improving the local community through increasing employment opportunities
• Reducing the negative impact on the land through waste reduction and increased use of renewable energy sources
• Reduction of emissions of gases that cause the "greenhouse" effect
• Increasing responsibility and care for consumers through improving the quality of the product or service, harmonizing the price
• Implementation of legal and legal regulations in business
• Reduction of gender, racial, and discrimination of persons with disabilities and their active engagement
• Poverty reduction through donor actions.

The answer to the question of the relationship between marketing and corporate social responsibility is complex, ie. there are several relevant reasons for this connection. The mentioned relationship is not one-sided but complex and intertwined.
On the one hand, adequate marketing activities of companies aimed at promoting socially responsible behavior can have a positive effect on attracting consumers who want to make a positive difference and influence society with their actions (Why is social responsibility important in marketing? website, available at http: //www.investopedia.com/ask/answers/042215/why-social-responsibility-important-marketing.asp).

On the other hand, many companies have developed socially responsible marketing strategies, as a way to sincerely help the community in which they live and work, and produce products or services that will benefit that community the most. For example, a company's marketing department can launch campaigns that encourage consumers to buy more of the company's socks, in return for a certain amount of money being donated to the homeless in the local community. As a result of such generous donations, the company brands itself as both socially responsible and ethical, which in turn attracts customers who are committed to socially responsible behavior and who want to support the well-being of the community. Only on the

basis of this example, the previously mentioned complex cause-and-effect relationship is clearly visible (Ibidem).

When explaining the integration of socially responsible behavior and marketing activities of the company, it is important to point out that it must be honest and complete. Corporate social responsibility goes "hand in hand" with its active practice, and by no means only declaratively, as a marketing trick. For example, the company's managers and administration,

as well as its relevant interest groups, must actively practice ethical behavior and actively join the community in promoting responsible marketing activities. Merely pretending or imitating environmental and socially responsible practices, including misleadingly promoting products or processes as environmentally friendly when they are not, clearly indicates that a company is not sincerely committed to socially responsible behavior, which can harm its brand and image, as well as its overall success. companies. Today's consumers are characterized by a high level of sophistication and can easily see through quasi-responsible behavior that is not authentic. This essentially means that although at the beginning of sincere socially responsible behavior, there may be a decrease in profits, in the long term it creates a permanent positive image that affects the improvement of performance in the long run (The role of CSR in marketing and branding, website, available at https: //smallbiztrends.com/2017/04/csr-marketing.html).

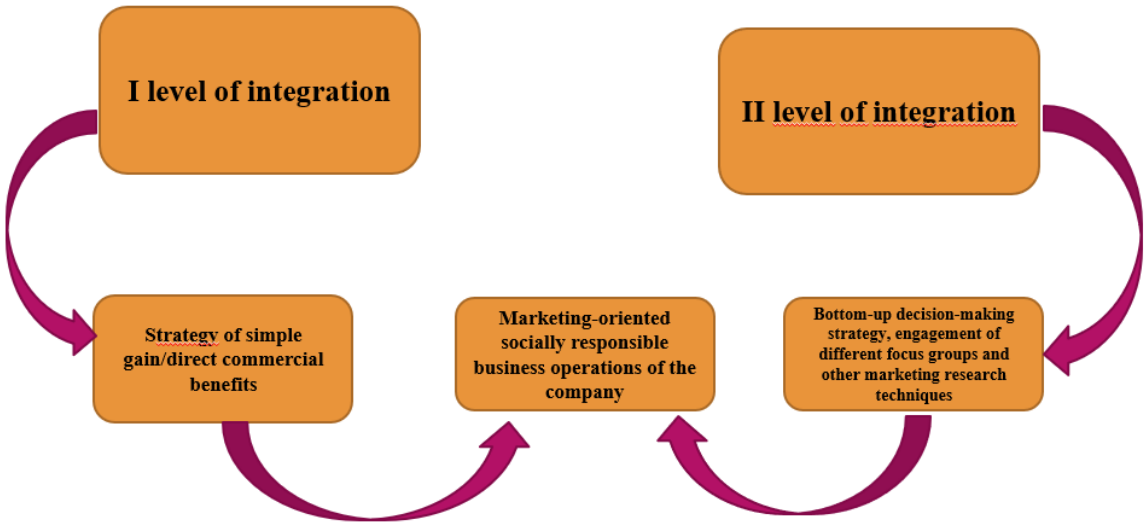
Since the company initially opted for sincere socially responsible business, the next step concerns the integration of socially responsible business and marketing activities. It is possible to distinguish at least two levels of integration:

The first level involves the determination of direct benefits from the business on the basis of socially responsible behavior. It is a simple operation that involves the measurement of direct commercial benefits for a company that applies CSR (measurement of profit increase due to the use of recycled material, measurement and reduction of carbon dioxide emissions). The activities of the first level of integration bring increased profits in business, as well as society as a whole, but do not mean the full extent of the integration of socially responsible business into marketing activities.

The second level emphasizes the overall business value that this kind of integration can achieve. In order to fully realize the marketing benefits of socially responsible business, companies still have to go the indirect way of influencing interest groups. This primarily involves determining how key interest groups respond to corporate social responsibility initiatives. This practically means orientation to the "bottom-up" decision-making process, the engagement of different target groups, and other marketing research techniques, in order to better understand the psychological needs that the implementation of socially responsible business provides to the company's interest groups (e.g. self-esteem and pride among consumers resulting from identification with a company that practices socially responsible behavior, and whose products or services the consumer uses). With such a level of integration, which is significantly more complex than the first level, companies can respond significantly more to the demand of target groups, learn significantly more and achieve long-term profitability.

The integration of marketing activities and corporate social responsibility activities is shown in Figure 1.

Figure 1. Integration of marketing activities and corporate social responsibility activities



Source: Adapted from online article: Corporate Social Responsibility: It's All About Marketing, https://www.forbes.com/2009/11/20/corporate-social-responsibility-leadership-citizenship-marketing.html.

Based on the above, it was logical to ask the question and show how the concept of Socially Responsible Business is part of the marketing strategy in business. The first step in that process is building strong relationships with important interest groups of the company, in order to improve communication and ensure their more active participation in the creation of business initiatives. This approach in thinking leads to the improvement of the effects of socially responsible business, such as increasing the loyalty of consumers and employees in the company (Maigner, I., Ferell, O. (2004). Corporate social responsibility and marketing: An integrative framework. Journal of the Academy of Marketing Science, Vol. 32, No. 1, p. 3 -19).

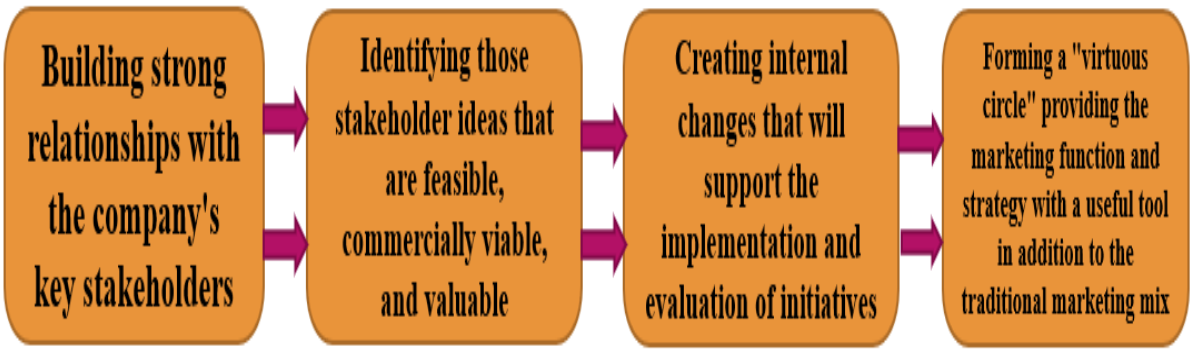
Of course, in this process of strengthening relations, the company must be realistic. Since external interest groups are usually the biggest and harshest critics of the company itself, they will often insist on initiatives that are too ambitious and unprofitable for the company. Therefore, the next relevant challenge is to identify those stakeholder ideas that are feasible, commercially viable, and valuable. At the same time, external interest groups represent an invaluable source of information on marketing activities that can improve the image of the company and its products. This results in an improved image of the company and its social responsibility (Ibidem).

The next step of the process is the creation of internal changes, which will support the implementation and evaluation of initiatives. Companies are often criticized for the insufficient involvement of the board of directors in socially responsible initiatives. However, such criticisms are usually wrong and unjustified, because in practice the decision-making process of this kind is usually "top-down". In order to effectively channel the path towards

value creation related to social responsibility, programs must be developed that function through traditional and developed business channels. A particularly important role in this process is played by marketing teams since they possess the necessary knowledge to implement purposeful campaigns and measure the return on invested funds. Moreover, the inclusion of marketing activities in consumer research and analysis allows social responsibility programs to be presented to those who are to be influenced (Corporate Social Responsibility: It's All About Marketing, Internet site, available at: https://www.forbes.com /2009/11/20/corporate-social-responsibility-leadership-citizenship-marketing.html)

The procedure for incorporating socially responsible businesses as part of the company's marketing strategy is given in the following picture.

Figure 2. The process of incorporating socially responsible businesses as part of the company's marketing strategy



Source: Adapted from online article: Corporate Social Responsibility: It's All About Marketing, https://www.forbes.com.

It is emphasized that, in a highly competitive world, it is necessary to work on practices to strengthen the brand and make it sustainable to achieve success in the market. When it comes to integrating CSR into marketing strategies, the following perspectives are meant (Sanclemente-Téllez, 2017:20-21):

• Extending the concept of marketing: applying the main marketing concepts and techniques to support the social goals and roles of companies. Marketing strategies are applied for purposes that go beyond the mere promotion of consumer goods.

• Marketing and Society: Marketing and economic development, macro marketing, marketing's contributions to society as a whole, and business opportunities at the "bottom of the pyramid." The marketing system is analyzed as a whole.

• Specific dimensions of social responsibility in marketing: marketing ethics; retail and socially responsible business; social marketing; fair trade, responsible consumption; green marketing and "greenwashing". Social/environmental aspects are linked to economic aspects and are linked to marketing influencing CSR constructs.

• CSR, corporate associations, image, reputation, and stakeholders: this area examines CSR actions as a communication tool to increase consumer loyalty and to build reputation, corporate marketing, consumer identification, and responses (perceptual associations) to companies based on their CSR actions. The needs of stakeholders are also taken into account.

• The relationship between CSR and overall firm performance: This involves considering CSR as a corporate strategy and as a source of competitive advantage in organizations. The performance of the company is also related to the actions taken in this regard.

• Promotion of social issues: the company provides funds, contributions, or other corporate resources to increase awareness or concern about a social issue,

• Marketing related to social issues: a corporation commits to donating a percentage of revenue to a specific cause based on product sales,

• Corporate social marketing: a business supports the development and/or implementation of a behavior change campaign, which aims to improve public health, safety, the environment, or community well-being,

• Corporate philanthropy: the company makes a direct contribution to a charitable organization or cause, most often in the form of monetary donations and/or services of another kind,

• Community volunteering: the company encourages employees, partners, and/or franchise members to volunteer their time in support of local community organizations and goals and,

• Socially responsible business practices: the company adopts and implements discretionary business practices and investments that support social goals to improve community well-being and protect the environment.

If the company has decided to actively integrate CSR into the marketing strategy of the brand, it should take into account the following items (Steenkamp, 2017:237):

• Confidence that the brand can fulfill its promises. It is necessary to make sure that a certain social goal is truly an integrative element of the marketing strategy, even when its returns are uncertain and distant. Then, is there an adequate organizational structure and brand management processes for the company to fulfill its CSR promise? As well as whether there is enough space for managers in implementing socially responsible business.

• Selection of an appropriate social, environmental, or economic component, which the company will integrate into the brand offers. Managers should select one or two aspects of CSR that are relevant to a specific target segment, fit the product category, and differentiate the brand from other brands.

• Communication of brand efforts. It is necessary to build awareness through advertising, labels and packaging design, social media, and your own workforce as brand advocates. Consumers understand that CSR is not necessarily completely altruistic, but if they suspect that it is done out of self-interest, the effect on consumer behavior will be insufficient. A brand's reputation can even suffer if consumers perceive the brand to be dishonest and manipulative.

• Progress monitoring. Do target segment members in key stakeholder groups see the brand as socially responsible? What motives do consumers attribute to CSR efforts? Do perceptions improve over time?

CONCLUSION

It can be concluded that many companies are very successful in implementing socially responsible activities and initiatives. CSR practices are strategies that businesses adopt because they positively impact consumers, leading to a competitive advantage. It is important to point out that CSR is part of brand building and has a strong impact on perceived quality, brand loyalty, and consumers, as well as their relationships with the brand. Companies that continuously implement socially responsible activities in practice also have an obligation to announce, ie. convey such behaviors to the desired audience. In this way, the risk of these activities not being noticed, and therefore the company not realizing the benefits resulting from these behaviors, is reduced. Socially responsible behavior in organizations can bring very satisfactory and desired results to any company.

After the analysis presented in the paper, we can say that a clear connection and multiple interdependencies between marketing and corporate social responsibility activities have been identified. Several levels of dependence have been determined, as well as the procedure for how socially responsible businesses can become an integral part of a company's marketing strategy.

LITERATURE

1. Crowther, D, Aras, G. (2008). Corporate Social Responsibility: Part I Principles, Stakeholders & Sustainability, Ventus Publishing.
2. Hohnen, P, Potts, J. (2007). Corporate Social Responsibility: An Implementation Guide for Business, International Institute for Sustainable Development.
3. Idowu, S. O, (2013). Encyclopedia of Corporate Social Responsibility. Springer-Verlag Berlin Heidelberg.
4. Maignan, I., Ferell, O. (2004). Corporate social responsibility and marketing: An integrative framework. Journal of the Academy of Marketing Science, Vol. 32, No. 1, стр. 3-19.
5. Sanclemente-Télle, J.C. (2017). Marketing and Corporate Social Responsibility (CSR). Moving between broadening the concept of marketing and social factors as a marketing strategy, Spanish Journal of Marketing - ESIC, Vol. 21, No. 51, стр. 4-25.
6. Steenkamp, J. (2017). Global Brand Strategy: World-wise Marketing in the Age of Branding, Palgrave Macmillan.
7. Corporate Social Responsibility: It's All About Marketing, https://www.forbes.com.
8. Corporate Social Responsibility: It's All About Marketing, https://www.forbes.com/2009/11/20/corporate-social-responsibility-leadership-citizenship-marketing.html .
9. The role of CSR in marketing and branding, internet sajt, dostupno na: https://smallbiztrends.com/2017/04/csr-marketing.html,
10. Why is social responsibility important in marketing?, internet sajt, dostupno na: http://www.investopedia.com/ask/answers/042215/why-social-responsibility-important-marketing.asp

FOCUS GROUP TECHNIQUE IN QUALITATIVE MARKETING RESEARCH[1]

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Abstract:**:** The article deals with the possibilities of using focus group techniques in marketing research to clarify the state of consumer literacy and preferences of Slovak consumers in relation to local products. The starting point is the knowledge of the strengths and weaknesses of this research technique and the methodology of implementation, which are elaborated in detail. Subsequently, the theoretical knowledge was confronted with the knowledge from practice on the example of the survey implementation itself. In particular, the possibilities of using the mind map as a tool for content analysis in qualitative research and the importance of group dynamics in conducting focus groups were discussed. The article highlights selected critical points of conducting focus group research that have the potential to affect the value of the outcomes. The article also identifies the limitations of conducted focus group research.
Keywords**:** Focus Group, Qualitative Research, Marketing Research, Group Dynamics, Mind Map

INTRODUCTION

There is no doubt about the need to obtain up-to-date data for managerial decision-making. Authors from different scientific disciplines point to the need to use adequate data collection tools. Whether it is in the system of education (Barnová & Krásna 2020; Bočková, Porubčanová & Dohnanská 2019; Kožuchová, Barnová, Stebila & Krásna 2023), management of organizations (Milošovičová 2019) or applications in the conditions of the travel industry (Dudić, Mrkvová, Dudić & Škatarić 2021). The reviewed works show that obtaining authentic and relevant evidence for managerial decision-making is essential. From a marketing management perspective, it is possible to identify several relevant data sources that draw attention to the importance of marketing research (Olšavský, Štarchoň, Mitková & Dudić 2022; Strážovská & Vilčeková 2023; Štarchoň & Weberová 2016; Vrhovac, Vasić, Milisavljević, Dudić, Štarchoň & Žižakov 2023).

In this article, we will take a closer look at the need for conducting data collection in terms of marketing management. According to ESOMAR, a global organisation of marketing researchers, marketing research is "the systematic gathering, recording, analysis, and interpretation of data about a specific marketing problem. The objective of marketing research is to provide management with relevant, accurate, reliable, up-to-date, and insightful information to aid in making marketing-related decisions" (ESOMAR 2023). Marketing research can take the form of qualitative or quantitative research. Quantitative research ensures its relevance by the robustness of the sample of respondents. Its aim is to ensure the representativeness of the statements by using statistical methods. Qualitative research, on the other hand, is based on knowledge of deeper motives and aspects in human decision-making. According to Cambridge Business English Dictionary qualitative research is "a type of market

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research that aims to find out people`s opinions and feelings rather than information that can easily be shown in numbers“ (Cambridge Dictionary 2023).

Quantitative research focuses on obtaining numerical data that are measurable and can be further processed in mathematical and statistical analyses. They are most often obtained through structured questionnaires, observations and experiments. The sample of respondents is larger to ensure that the results are representative. The aim of the survey is to focus on formulating conclusions that can be approximated to the whole population. Qualitative research aims to obtain non-numerical data that relates to the subjective opinions, attitudes, motivations and behaviours of respondents. The sample of respondents is substantially smaller, chosen to allow for individual interviews with each participant. As a result, the data are processed interpretatively. That is, semantic similarities are sought, and content analysis is processed. The aim is to uncover the deeper perspectives and motivations of the respondents. On this basis, more thoroughly based conclusions are drawn. Qualitative research most often uses the following data collection tools: observation, in-depth interview, literature review, focus group interview, projective techniques and case studies.

It wouldn't be accurate or appropriate to claim that there is one "best" tool for all qualitative marketing research cases. Each tool has its advantages and limitations, and selecting the right method depends on the specific research objectives, questions being studied, and the characteristics of the target audience or problem being explored. Similar to other types of research, in marketing research, it's often appropriate to use a combination of different tools, known as mixed tools. Employing mixed tools allows researchers to gain a more comprehensive and multifaceted view of the marketing issue at hand. In-depth interviews and focus group discussions are useful when you need to gain detailed opinions and perspectives from consumers, while observation can provide insights into consumers' actual behavior in their natural environment. Document analysis and unconventional tools, such as photo elicitation and storytelling, can be used to gain a deeper understanding of consumers' attitudes and experiences from their own perspectives. The choice of tools or combination of tools depends on the specific research problem and research objectives. It is important to select an appropriate tool and tailor it to the specific context and target audience to ensure the accuracy and relevance of the research findings. In the following, the technique of focus group interviews will be described in detail.

THEORETICAL BACKGROUND

Focus group technique has been of interest to researchers and practitioners for a variety of reasons. Let us list the basic definitions of this tool. According to the American Marketing Association “it is a form of qualitative research in which a small group of people (typically 6-10 participants) come together for an interactive discussion facilitated by a moderator. The group members are selected based on specific criteria, and the discussion is designed to explore their perceptions, attitudes, opinions, and experiences related to a particular product, service, or topic” (AMA 2023). According to Ritchie and Lewis (2003) focus group “is a method of data collection which involves a group of people, usually 6-10 participants, who are brought together to take part in a guided discussion on a particular topic, product, or issue. The aim is to elicit a range of views and experiences from the participants, through the interaction with each other as well as with the moderator.” Another author identifies the focus group as “a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, nonthreatening environment. The participants are guided by a

moderator who uses an unstructured method of inquiry to encourage the discussion" (Merriam 2009).
These definitions highlight the common elements of the focus group technique, which involve bringing together a small group of individuals to engage in a guided discussion on a specific topic, product, or issue, facilitated by a trained moderator. The purpose is to gather in-depth qualitative data and insights from the participants' perspectives and interactions within the group setting.

Conducting a focus group technique requires certain conditions to be met in order to obtain valid and credible results. Here is a summary of the conditions that are considered important by authors in the field of research and focus group discussions:

- Group size: Focus groups should consist of a small number of participants, usually between 6 and 10, to allow for interactive discussions and effective recording of the views of all group members (Morgan, 1997).
- Homogeneity of participants: participants should be chosen to be somewhat homogeneous with respect to their experiences, status, opinions, or characteristics that are relevant to the research topic (Krueger & Casey, 2014). (Krueger & Casey, 2014)
- Obtaining informed consent: participants should be informed about the purpose and procedure of the focus group discussion and agree to participate. (Krueger & Casey, 2014)
- Informal setting: Focus groups should be held in a comfortable and informal setting that allows participants the freedom to express their views. (Morgan, 1997)
- Qualified moderator: the moderator should be trained by conducting the focus group discussion, able to stimulate discussion and maintain balance among the participants. (Krueger & Casey, 2014)
- Recording and transcription: Focus group discussions should be recorded or transcribed to allow for thorough recording and subsequent analysis of the topics discussed (Morgan, 1997).
- Clear discussion framework: The discussion should be guided by clear questions and objectives to be covered during the focus group discussion (Krueger & Casey, 2014). (Krueger & Casey, 2014)
- Confidentiality: Participants should be assured that their views and information will be kept confidential and anonymous. (Krueger & Casey, 2014)

Both authors simultaneously assess the strengths and weaknesses of focus group implementation. Morgan (1997) states that the strongest is that "focus groups are particularly useful for exploring complex social phenomena, generating in-depth qualitative data, and gaining insights into participants' attitudes, perceptions, and experiences in a group context". Krueger and Casey (2014) mentioned that "they offer a platform for participants to interact and build on each other's ideas, enabling the exploration of diverse perspectives and group dynamics that might not be evident in individual interviews". Weaknesses are identified by Morgan (1997) as that "the group setting may inhibit some participants from expressing their true opinions, especially if they have dissenting views from the majority". Krueger and Casey (2014) point out that "focus groups can be influenced by dominant personalities within the group, leading to potential conformity bias or social desirability effect" and "moderator bias or leading questions can unintentionally influence the direction of the discussion and affect the outcomes".

MATERIAL AND METHODS

In the application part of the article, the findings from the implementation of two qualitative surveys will be presented. These surveys served as a starting point for the processing of a quantitative survey in the form of a questionnaire. The aim was to reveal significant areas of consumer behaviour in relation to the purchase of Slovak products and to determine the level of consumer literacy of the Slovak consumer. A framework questionnaire was developed and the task of the focus group was to identify other potential themes that were not foreseen in the questions.

The characteristics of the individual qualitative surveys are summarised in the table below. Meetings were conducted with two groups of respondents:

- Slovak consumers group, which consisted of 8 representatives. The survey was carried out for 2 hours 38 minutes. Its length exceeded the original plan by 38 minutes, which caused one participant to be unable to attend the meeting until the end. The scope of the questions was not communicated to them in advance, only the topic of discussion.
- A group of Slovak retailers consisting of 7 representatives. The survey lasted 2 hours and 15 minutes. In terms of time, the meeting was extended by 15 minutes, but each participant lasted until the end of the meeting. The meeting with the retailers was very long in planning and difficult to organise due to the workload of the managers themselves. For this reason, the theses for discussion were made available to the participants prior to the meeting.

	SLOVAK CONSUMERS	**SLOVAK RETAILERS**
SAMPLE SIZE	8	7
DATE OF RESEARCH CONDUCTED	21. 12. 2021	4. 5. 2022
DURATION OF DISCUSSION	2h 38m	2h 15m
OPEN QUESTIONS	23	27
PROVIDING THESES/QUESTIONS BEFORE THE MEETING TO RESPONDENTS	no	yes
CONTACT PLATFORM	MS Teams	MS Teams, e-mail
RESEARCH CONDUCTED BY	Department of Marketing, Comenius University in Bratislava	Department of Marketing, Comenius University in Bratislava

Table 1: Conditions of conducted focus group researches
Source: author

Based on our own experience with the implementation of the described focus groups, it was possible to elaborate a set of critical factors that can influence the benefits of these meetings. Group dynamics appeared to be important during the meetings. According to Forsyth (2014) “group dynamics refers to the patterns of interactions and relationships among individuals within a group. It explores how individuals within a group influence one another,

communicate, collaborate, and make decisions. Understanding group dynamics is essential in various contexts, including focus group discussions, team collaborations, and organizational behavior research". During the meetings, positive manifestations such as interaction and idea generation, stimulating creativity, were fully manifested when the participants' statements led to the presentation of their own creative attitudes. The dynamics of the atmosphere were also influenced, creating space to present one's opinion without fear of embarrassment. On the contrary, the presentation of dominant participants appeared negative and the quieter ones had to be invited to respond individually. Especially the younger and less combative participants started to adopt the views of the other, more dominant ones later on. The moderator's role was to invite them to present their own opinion without interfering in the democratic discussion.

When conducting a focus group, it is always necessary to stick to the objective of the survey and to subordinate its conduct to it. For this reason, the length of both meetings was exceeded. The most time beyond the intended scope was lost by not interfering too significantly with the statements of the more communicative participants, which could have led to a disruption of the friendly atmosphere. Additional time scope was sacrificed to this issue.

Mind mapping is a very useful tool when processing focus group outputs. According to Cohen, Manion & Morrison (2018) mind mapping, also known as a concept map or cognitive map, is a visual technique used to represent ideas, concepts, information, and relationships between topics. In the context of focus group discussions, mind mapping can be an excellent tool for visualizing participants' opinions and associations regarding a specific topic. Therefore, this tool was used to analyze the collected statements of the respondents and their connections with each other. The classical approach of processing on a paper map with colour highlighting of key words and ideas was chosen. Later, this allowed the researchers to go back to the outputs and visualize the individual opinions and attitudes of the respondents. At the same time, a wide range of software solutions can be used in mind map processing. Examples include MindMeister, which enables real-time collaboration between multiple users, XMind which is a desktop application, Coggle which is a user-friendly tool or MindManager, which is again a user-complex software. Of course, there are far more solutions.

After the focus group, it is appropriate to thank the participants for their participation and their time in the discussion. If it is appropriate for future collaboration or if the participants requested the results of the survey because they were interested in the topic, the framework results of the survey should be sent to them. In this way they can be recruited for further meetings and involvement in the discussions and the development of the topic in their practical life - in this case consumer behaviour and consumer literacy.

CONCLUSIONS AND LIMITATIONS

On the basis of the interviews conducted, a number of topics were identified that would be useful to expand the quantitative survey. The objective of the focus groups has been achieved by identifying the topics that need to be developed in more detail. Specifically, the topic was the identification of Slovak local products that are difficult to include in the offer of the national retail network because they cannot guarantee the minimum required volume. At the same time, however, they are of high quality, demanded by customers and at the same time are of high importance for the development of a particular region and its image. The second

topic concerned the specific support for Slovak production by retailers. This was the most controversial topic, where respondents disagreed on the need to support Slovak and foreign products in a different way. The third theme was the lower literacy of Slovak consumers in asserting their rights. Therefore, it was suggested how consumer literacy could be improved.

For the successful implementation of a focus group it is very necessary to prepare a detailed interview scenario. It is not necessarily necessary to send the questions to the participants, but the thesis could be sent in advance, especially to participants who have limited time to attend the meeting physically/online. Further, the facilitator's readiness to lead a professional discussion and ability to resolve potential conflict situations between participants appears critical. It is very important to adopt a neutral position towards the views of all participants and to keep the conversation within the topic and with respect to the defined time pool of the meeting. The length of the meeting should not exceed the agreed time. It is also very important to ensure that the data provided is not used for purposes other than those communicated. This will guarantee one of the important rules of marketing research - ethics.

The availability of respondents in hard-to-reach segments such as members of management, salespeople and entrepreneurs appears to be a significant limiting factor. Matching their agenda with each other is challenging. This has to be taken into account in advance to avoid the time stress of handling a time-limiting project. Further limiting factors can be feigned complacency and a reluctance to present their own views. In such a situation, it would be appropriate to use an in-depth interview with the participant individually, but that is a different research method. By inappropriate intervention, the moderator can influence the course of the discussion, so his role is seen primarily in the minimalist role of “guardian of the topic of discussion”. Another limiting aspect is the group dynamics themselves, which can influence the reactions of the participants. It is then up to the personality of the individual to react, and the moderator's role is to take note of this information and lead the discussion with this in mind. Further, the moderator's ability to effectively interpret the diverse views of the respondents is a limit. Therefore, if he/she does not understand a response, he/she should ask for additional clarification of the statement.

The focus group appears to be a very useful data collection tool. If the facilitator has experience in conducting it, it is a useful method for collecting the data needed to process the background for the quantitative survey and to orient oneself to the survey being conducted. It is indispensable for obtaining attitudes and motives in consumer behaviour.

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REFERENCES

AMA. (2023). Definitions. https://ama.org

Barnová, S. & Krásna, S. (2020). Manažment a organizácia škôl. Dubnica nad Váhom: VŠ DTI.

Bočková, K., Porubčanová, D. & Dohnanská, M. (2019). Colour Preference for Probolct Team Members in the Context of Their Team Role. International Journal of Management Science and Business Administration, 6(1), 27-36, DOI: 10.18775/ijmsba.1849-5664-5419.2014.61.1004

Cambridge Dictionary. (2023). qualitative research. https://dictionary.cambridge.org/dictionary/english/qualitative-research

Cohen, L., Manion, L., & Morrison, K. (2018). Research Methods in Education (8th ed.). Routledge.

Dudić, B., Mrkvová, K., Dudić, Z. & Škatarić, G. (2021). Brewing industry Slovakia in the process of tourism. The journal of entrepreneurship and business resilience, 4(2), 91-99. https://www.fimek.edu.rs/downloads/casopisi/jebr/arhiva/JEBR-Number-8.pdf

ESOMAR. (2023). Definitions and Standards. https://esomar.org

Forsyth, D. R. (2014). Group Dynamics (6th ed.). Cengage Learning.

Kožuchová, M., Barnová, S., Stebila, J. & Krásna, S. (2023). Inquiry-based approach to education. Acta Educationis Generalis, 13(2), 50-62.

Krueger, R. A., & Casey, M. A. (2014). Focus groups: A practical guide for applied research (5th ed.). Sage Publications.

Merriam, S. B. (2009). Qualitative Research: A Guide to Design and Implementation. Jossey-Bass.

Milošovičová, P. (2019). Interkulturelles Management. Praha: Wolters Kluwer ČR.

Morgan, D. L. (1997). Focus groups as qualitative research. Sage Publications.

Olšavský, F., Štarchoň, P., Mitková, Ľ. & Dudić, B. (2022). Dynamics of the Slovak consumer behaviour in the context of ethnocentrism: managerial implications. Poljoprivreda i šumarstvo, 68(3), 7-21. http://www.agricultforest.ac.me/paper.php?id=3132

Ritchie, J., & Lewis, J. (2003). Qualitative Research Practice: A Guide for Social Science Students and Researchers. Sage Publications.

Strážovská, Ľ. & Vilčeková, L. (2023). Management of marketing communication in state administration. Developments in information and knowledge management systems for business applications, 7, 23-47.

Štarchoň, P. & Weberová, D. (2016). Attitudes of Czech and Slovak consumers towards brands from the point of view of gender affiliation. *Hradec Economic Days*, *6*, 1095–1103. https://uni.uhk.cz/hed/site/assets/files/1047/proceedings_2016_1.pdf

Vrhovac, V., Vasić, S., Milisavljević, S., Dudić, B., Štarchoň, P. & Žižakov, M. (2023). Measuring e-commerce user experience in the last-mile delivery. Mathematics, 11(6), 1-21. https://www.mdpi.com/2227-7390/11/6/1482

NEWCHALLENGES OF FORMULATING A COMPANY'S MARKETING STRATEGY BASED ON SOCIAL NETWORK ANALYSIS

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Abstract: The aim of the paper is to present the results of research related to the influence of new technologies on the formulation of marketing strategy. For years, there has been a feart hat the data obtained from the analysis of social networks is insufficiently precise. The technology of bots has advanced so that today weal ready have systems that are hardly different from real users, which leads to the creation of fake content but also to the artificial increase of various parameters related to views and content sharing Marketing experts rely heavily on various metrics obtained by analyzing various sources from the Internet, and data obtained by analyzing social networks is one of the most important factors in formulating marketing strategies.

Keywords:social networks, bot technology, marketing strategy, Internet, artificial intelligence

1. INTRODUCTION

The world is in the midst of an information revolution, and few industries are unaffected by the spread of the new wave of information management. The Internet as a phenomenon is one of the main drivers of the new wave of changes. However, marketing as a discipline may have experienced the biggest changes in the way of approaching the market. The time of painstaking field research is behind us, today the Internet is largely the basis for creating marketing strategies.

Social networks become gathering places for a large number of people, so it becomes a fertile ground for creating a realistic picture of possible consumers. Already today, there are a large number of techniques and tools that can be used to test a new entry on the market, to evaluate the effects of marketing, etc. In this light, it can be said that marketing has become more accurate and effective.

The development of information sciences shows no signs of slowing down, so new changes in business methods are to be expected. One of the new moments important for the Internet is the emergence of artificial intelligence embodied in bot technologies. These are specialized programs that are able to change a person in various aspects of working with the Internet.

More precisely, bots can be programs that help in quick response to user inquiries or programs that help in the dissemination of information, etc. However, the same technology can be used to impersonate users or create content. It follows that numerous results related to social networks or websites may be influenced by new technology. So a question can be raised regarding the validity of the analysis results.

2. SOCIAL NETWORKS

"In this digital era, social networking has become a basic need and the most preferred option for Internet users (netizens) to communicate with each other" (Aggrawal&Anand, 2023, p. 1). This tells us that social networks are practically indispensable parts of the daily life of billions of people. Personal contacts and dissemination of information in "traditional" ways is a thing of the past, today information can be sent in just a few seconds and it is visible all over the world.

An increasing number of people are joining social networks so that they have become a very important platform for commercial purposes as well. Tracking consumer habits is becoming relatively easier and simpler today than it was just ten years ago. Most large companies eschew field research, which was the dominant form of research at the turn of the century.

The importance of social networks is evident in all stages of life, research was done related to migration and one of the results is very interesting. "The encouragement, example, and support of a strong bond were often very influential in migration stories" (Ryan, 2023, p. 62). Of course, social networks cannot encourage migration, but they can facilitate this very complex process. Moving from one country to another as an expat can be a very stressful process.

Of course, social networks are not only a tool for well-being, but numerous negative examples can also be found. The relationship between delinquency and social networks is particularly interesting. "Crime and delinquency are linked to social network ties, where delinquents often have friends who have committed offenses, and social ties are a means of influencing the commission of crime" (Shende, Vasal, &Vishwanath, 2023, p. 265). So social networks are interesting in this field as well.

Some of the parameters monitored can be:

User engagement tracking: This parameter includes tracking the number of likes, comments, shares and views of posts. This allows marketers to better understand what content attracts audiences and increases engagement.

Reach Tracking: Reach refers to the number of people who saw a post on a social network. Reach tracking helps marketers understand how effective their marketing activities are in reaching their target audience.

Conversion Tracking: A conversion refers to a desired user action, such as clicking a link, downloading an e-book, or purchasing a product. Conversion tracking allows marketers to understand which posts have the most impact on increasing conversions.

Audience Tracking: Audience tracking includes demographic data, such as audience age, gender, and location. This parameter helps marketers understand the target audience and adjust marketing activities according to their preferences.

Competitive Tracking: Competitive tracking allows marketers to better understand how their brand compares to other brands in the same industry. It can help to adjust marketing strategies and improve competitiveness.

Trend Monitoring: Trend monitoring enables marketers to adapt to new trends and adjust their marketing activities accordingly.
Following influencers: Influencers can be a great force in promoting brands and products on social networks. Tracking their influence can help marketers understand which influencers are influencing their audience the most.

3. BOT TECHNOLOGY

The first technology that can be considered the first bots was the automation of certain processes related to handling information. However, with various frameworks emerging to help with bot creation, one of the more challenging bot creation projects is the chat bot one. "The result is that chat bot development has become significantly more accessible to millions of developers." (Rozga, 2018, p. 2).

The problems with waiting bots is that they didn't have the ability to easily adapt to users. The need for quality bots was and remains in the interest of many companies. "Engaging customers through chat bots means you have to understand their requirements, offer the right products, and create the look and feel of the product with images" (Waghmare, 2019, p. 32). "Chat-bot" or chat bot is extremely complex because it must be able to provide the right information to customers and help them make decisions.

It follows that bots are useful, and largely harmless assistants that help businesses grow and users make decisions more easily. The development of artificial intelligence gives a new dimension to bots so that they are not much different from humans in communication. However, this is far from the truth because bots are used for various automations such as answering questions or redirecting information to the right address, but also for various not so moral things.

Bots can be created very quickly and easily, various researches give an insight into the number of bots. Research (Wojcik, Messing, Smith, Rainie, &Hitlin, 2018) found that about 66% of links shared from Twitter essentially have bot features. This is a very large percentage that has a very serious impact on a better understanding of metrics.

Bad bots aim to cause various disruptions that can lead to wrong conclusions. Examining the proportion of bad bot traffic by country reveals that several countries exceeded the global average of 27.7%. In Germany and Singapore, almost 40% of traffic comes from bad bots (Lynch, 2022). Namely, some content creators employ bots to provide them with statistics of views, likes, etc. In extreme cases, this is a way to deceive social networks and thereby gain a certain advantage and even make a profit.

Bad bots are used a lot in politics, "… a team of academics, led by Oxford University professor Philip Howard, also found that 33% of pro-Trump traffic was driven by bots and highly automated accounts, compared to 22% for Clinton" (Howard , 2016). This is one of the more extreme cases. "The vast majority (96 percent) of these fake news accounts were fully automated, using services to monitor blog activity and automatically tweet new blog posts"

(Cleary, 2019). This is another extreme case, which only suggests that they bots very powerful and can lead to wrong conclusions.

"A relatively small number of bots was enough to influence the climate of opinion in the direction of the opinions supported by the bots, which started a spiraling process of silence that eventually led to the opinion of the bots being accepted as the opinion of the majority" (Ross, et al., 2019, page 16). This research gives a very interesting insight into the power of bots and the psychology of social network users.

The theory of the dead Internet is a rather pretentious name and is not supported by science or the profession. Also, there is currently no literature or research to support this "theory". Certain premises, however, provide plenty of food for thought. The dead Internet theory assumes that most Internet traffic is essentially generated by bots.

The development of artificial intelligence gives the power to create automatic content, and on the other hand, it is possible to automate its consumption. Artificial intelligence is still not at the level where it cannot be distinguished from real users, but it is very close. So, even if this "theory" is not valid today, it can be expected that the premises of this "theory" will come true in the near future.

"Chat GPT" is one of the most discussed AI models at the moment. This language model empowers the user to ask questions and model how the answer is obtained. Already this is a model with impressive capabilities. In the near future, this or a similar model will have the power of human-level communication.

4. RESEARCH

A survey of respondents was conducted with the aim of discovering attitudes towards malicious bots. The research was conducted on the territory of AP Vojvodina and included 37 respondents who are currently employed in jobs related to digital marketing. In many respects, these respondents can be seen as experts in their field. The sample was chosen according to the system of random selection, and the research itself was anonymous and was carried out using the "google forms" tool.

In this paper, we will select only eight questions from a much larger set used for larger research related to digital marketing. The first three questions were related to the respondents' demographic characteristics, that is, their favorite social networks. In this way, we get important data about the respondents themselves.

The other six questions were formulated in the form of a Likert scale where statements related to work issues were asked, and respondents were asked to rate the statement from one to five. Score one indicates complete disagreement with the statement, score two indicates slight disagreement, score three is neutral and indicates both agreement and disagreement with the statement, score four indicates slight agreement while score five indicates full agreement with the statement.

These eight claims read:

- I rely heavily on metrics obtained from social network analysis
- I trust the results obtained from the analysis of social networks more than the results of some other marketing research
- Social network analysis is a more economical solution than some other market research techniques
- Social network analysis is a more effective solution than some other market research techniques
- I consider malicious bots to be a major threat to my profession
- I have less and less confidence in the results of social network analysis

The results of the research are such that out of 37 respondents, 22 (59.5%) were female and 22 (40.5%) were male. In our survey, there were 15 (40.5%) respondents who have been in the world of digital marketing for over ten years, followed by 14 (37.8%) respondents who have less than three years of work experience in digital marketing. and 8 (21.6%) respondents who have seven to nine years of work experience in digital marketing. There were no respondents with four to six years of experience in digital marketing.

The results of these six questions are shown in the following tables.

Table 1. I rely heavily on metrics derived from social network analysis

	Frequency	Percentage	Valid percentage	Cumulative percentage
I agree and disagree	1	2.7	2.7	2.7
I agree	36	97.3	97.3	100.0
Total	37	100.0	100.0	

Source: Authors

Table 2. I trust the results obtained from the analysis of social networks more than the results of some other marketing research

	Frequency	Percentage	Valid percentage	Cumulative percentage
I agree and disagree	3	8.1	8.1	8.1
I agree	1	2.7	2.7	10.8
I totally agree	33	89.2	89.2	100.0
Total	37	100.0	100.0	

Source: Authors

Table 3. Social network analysis is a more economical solution than some other market research techniques

	Frequency	Percentage	Valid percentage	Cumulative percentage
I do not agree	2	5.4	5.4	5.4
I agree and disagree	1	2.7	2.7	8.1
I agree	34	91.9	91.9	100.0
Total	37	100.0	100.0	

Source: Authors

Table 4. Social network analysis is a more effective solution than some other market research techniques

	Frequency	Percentage	Valid percentage	Cumulative percentage
I completely disagree	2	5.4	5.4	5.4
I do not agree	1	2.7	2.7	8.1
I agree and disagree	1	2.7	2.7	10.8
I totally agree	33	89.2	89.2	100.0
Total	37	100.0	100.0	

Source: Authors

Table 5. I consider malicious bots to be a major threat to my profession

	Frequency	Percentage	Valid percentage	Cumulative percentage
I completely disagree	2	5.4	5.4	5.4
I do not agree	1	2.7	2.7	8.1
I agree and disagree	1	2.7	2.7	10.8
I agree	8	21.6	21.6	32.4
I totally agree	25	67.6	67.6	100.0
Total	37	100.0	100.0	

Source: Authors

Table 6. I have less and less confidence in the results of social network analysis

	Frequency	Percentage	Valid percentage	Cumulative percentage
I completely disagree	15	40.5	40.5	40.5
I do not agree	22	59.5	59.5	100.0
Total	37	100.0	100.0	

Source: Authors

5. CONCLUSION

By analyzing the obtained results, it can be determined that the respondents are mainly oriented towards the analysis of social networks. Our respondents generally have a positive attitude towards social network techniques and analytics. This is not surprising because in the last ten to fifteen years social networks have been used to a large extent to formulate marketing strategies. However, in question number five, it can be seen that respondents are concerned about the appearance of malicious bots. But even so, they have full confidence in social network analytics.

Such results tell us that the time of artificial intelligence is just ahead of us and that its effects have not yet been felt in the field of marketing. Although there are indications that very soon there will be big mentions from research and conversations with marketing experts, one gets the impression that these disruptions are still far away. Maybe the influence of malicious votes can be felt more in the domain of politics and less in other domains, but the question is how long this status will be maintained.

For now, there is no data that and how artificial intelligence will affect the formulation of marketing strategies. It is already evident that the data obtained from the analysis of social networks is "polluted" by the excessive use of bots and many metrics are no long er valid. It is to be expected that the world of digital marketing will have to adapt to new moments.

Extreme fears stemming from the development of artificial intelligence are not well founded for now. And yet this phenomena on should be closely monitored because it is to be expected that the moment will come very soon when artificial intelligence and bots will become a force to be reckoned with. Future research will have to focus on the latent effects of artificial intelligence and modeling the reactions of social network users.

REFERENCES

Aggrawal, N., & Anand, A. (2023). *Social Networks: Modelling and Analysis.* Boca Raton: CRC Press.

Cleary, G. (2019, 05 05). *Twitterbots: Anatomy of a Propaganda Campaign*. Preuzeto 02 18, 2023 sa Symantec enterprise blogs: https://symantec-enterprise-blogs.security.com/blogs/threat-intelligence/twitterbots-propaganda-disinformation

Howard, P. (2016, 10 20). *A third of pro-Trump tweets are generated by bots*. Preuzeto 02 15, 2023 sa Oxford Internet Institute: https://www.oii.ox.ac.uk/news-events/news/a-third-of-pro-trump-tweets-are-generated-by-bots/

Lynch, B. (2022, 08 02). *US Websites Targeted by 40% of the Bad Bot Traffic Worldwide*. Preuzeto 03 11, 2023 sa Imperva: https://www.imperva.com/blog/us-websites-targeted-by-40-of-the-bad-bot-traffic-worldwide/

Ross, B., Pilz, L., Cabrera, B., Brachten, F., Neubaum, G., & Stieglitz, S. (2019). Are social bots a real threat? An agent-based model of the spiral of silence to analyse the impact of manipulative actors in social networks. *European Journal of Information Systems*, 1 - 19.

Rozga, S. (2018). *Practical Bot: Designing and Building Bots with Node.js and Microsoft Bot Framework.* New York: Apress.

Ryan, L. (2023). *Social Networks: Relocations, Relationships and Resources.* Birmingham: Bristol University Press.

Shende, A., Vasal, D., & Vishwanath, S. (2023). A Phase Transition in Large Network. U F. Fang, & F. Shu (Ur.), *Game Theory, 11th International EAI Conference, GameNets 2022, Proceedings* (str. 265 - 277). Virtual Event: Springer.

Waghmare, C. (2019). *Introducing Azure Bot Service.* Mumbai: Apress.

Wojcik, S., Messing, S., Smith, A., Rainie, L., & Hitlin, P. (2018, 04 09). *Bots in the Twittersphere*. Preuzeto 03 10, 2023 sa Pew Research Center: https://www.pewresearch.org/internet/2018/04/09/bots-in-the-twittersphere/

GENDER DIFFERENCES IN UNEMPLOYMENT DURING THE ECONOMIC CRISIS AND BOOMS

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Abstract: In this article we focus on the development of gender differences in unemployment during various periods of economic booms and crisis in Visegrad countries. We compare unemployment as measured by both administrative data and ILO methodology. The two main studied variables are unemployment share and share of females on total unemployment. We use LFS (Labour Force Survey) data for country level analysis and the LAU1 dataset (doi:10.5281/zenodo.6165135) for county level analysis.
In many regions, the share of women on total unemployment is decreasing during economic crisis, hence women's unemployment is less affected by economic decline than men. On the other hand, during economic boom share of females is increasing – men are more likely to find jobs during economic boom than women. This correlation is visible in rural regions. More urban regions, like regions around capital cities, do not have this trend visible. Similar trends are visible when analyzing the share of low educated unemployed.

Keywords: gender differences, unemployment, crisis, Visegrad countries.

Data

We use two datasets for the analysis – labour force sample survey and administrative data. They have both advantages and disadvantages.
Labour force survey (LFS) data give quarterly information on unemployment on national level. On regional level, there is annual data only. Administrative data from labour offices provide monthly data on county (NUTS 4, LAU1), level. On the other hand, from the methodological point of view, the data is not harmonized on EU level.
The source of LFS data is Eurostat. We use tables [lfst_r_lfu3pers] and [lfsq_ugad], with age group of people over 15 years.

The source of administrative data is IZ Bratislava, https://www.iz.sk/LAU1. Data are available at county level for Visegrad countries: Slovakia, Poland, Czechia, and Hungary. Overall, there are 733 regions with monthly data starting in 1997, 2005, 2004 and 2016, depending on the country. Data on the unemployed are divided according to gender, education (low educated) and duration of unemployment (long term unemployed).

Methodology

The main topic of this paper is what groups of people are most affected by economic crisis or boom.
We identify economic crisis or boom by development of unemployment rate/share. We opted for measuring by unemployment data and not by economic data due to data availability and

mainly data granularity. Administrative unemployment data are monthly and available at county level. The disadvantage of using labour market data is that the effects of economic development on labour market are usually mild and lagging in time. However, since we analyze which groups are affected, these drawbacks are not significant. In case of economic growth, the unemployment rate is decreasing and in case of economic crisis, the unemployment rate is decreasing.

Measuring each gender's development is done by share of women on the number of unemployed. If the share of women on total unemployment is decreasing, we observe relative betterment of women compared to men. If total unemployment is decreasing but share of women is increasing, we observe economic growth that profits men more than women. On the other hand, if unemployment rate is decreasing and the share of women is decreasing, we observe economic downturn which affects men in more negative way than women.

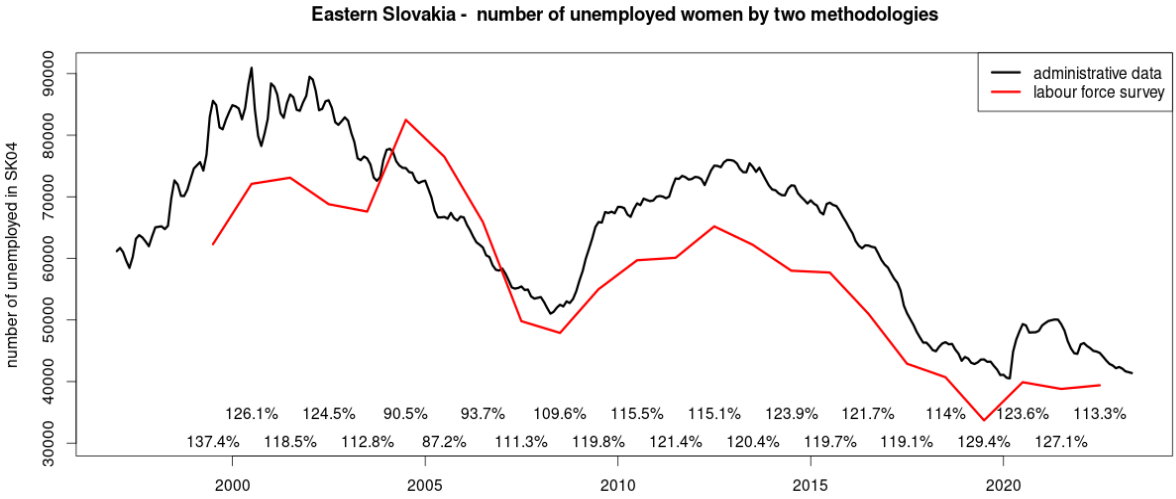
Economic development

We analyze four countries – Slovakia, Czechia, Poland, and Hungary. All of them are in central Europe, with similar economic development.

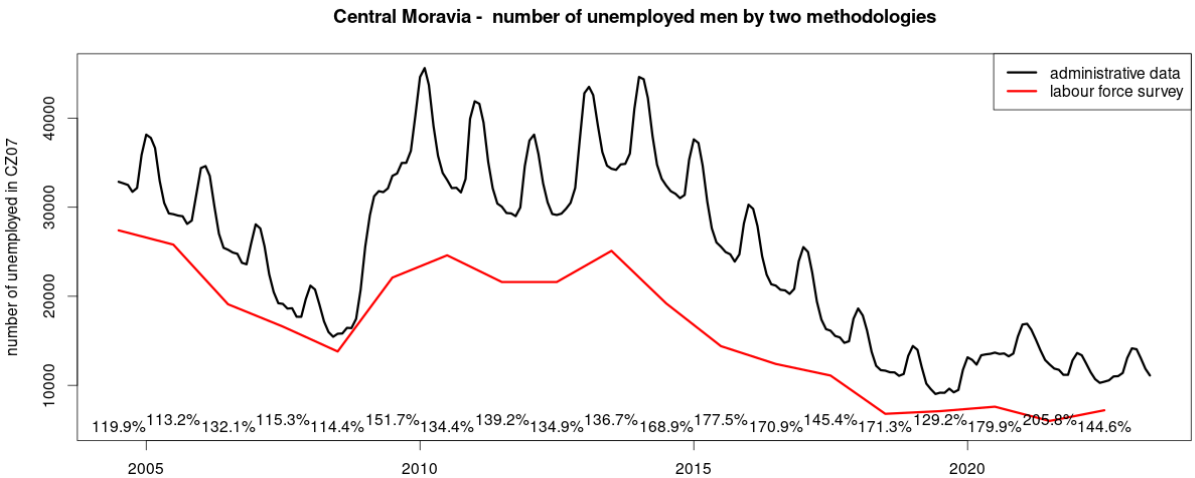
The main periods of economic decline were in 2009 (economic crisis), 2020 (covid) and 2022 (Russian war). The main economic booms were in 2004 (accession into the European Union) and post-crisis recovery (usually 2014 connected to EU funds period of 2007-2013, and briefly in 2021 connected to the end of covid and finishing of the 2014-2020 EU funds period).

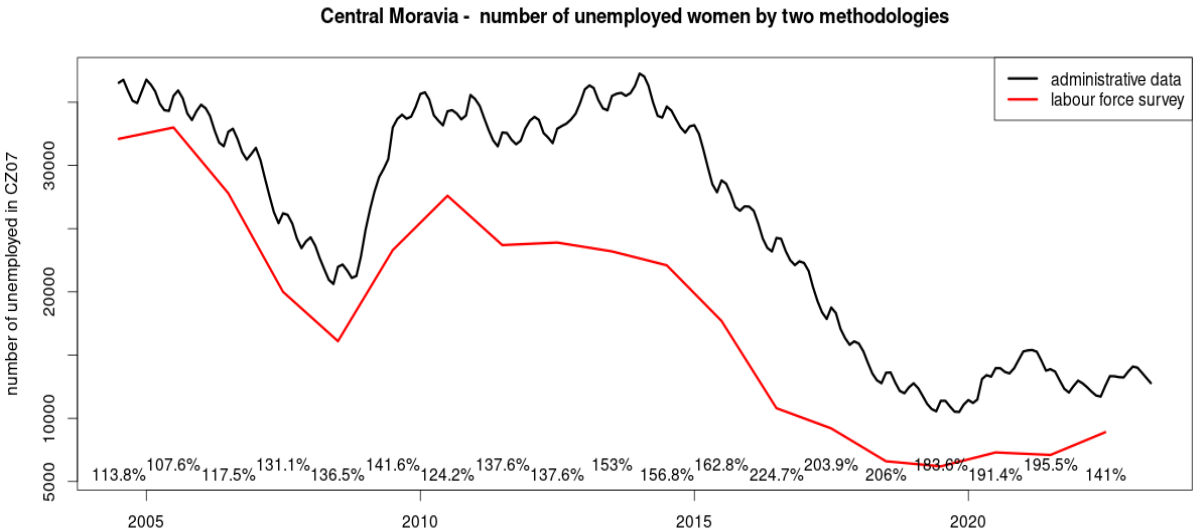
First set of graphs represent development of unemployment in Eastern Slovakia by both methodologies. Yearly LFS data corresponds with monthly administrative data. When comparing both genders, we can see that men have higher seasonal volatility than women.

This seasonality was most visible when total unemployment was higher, so in the time of economic problems.

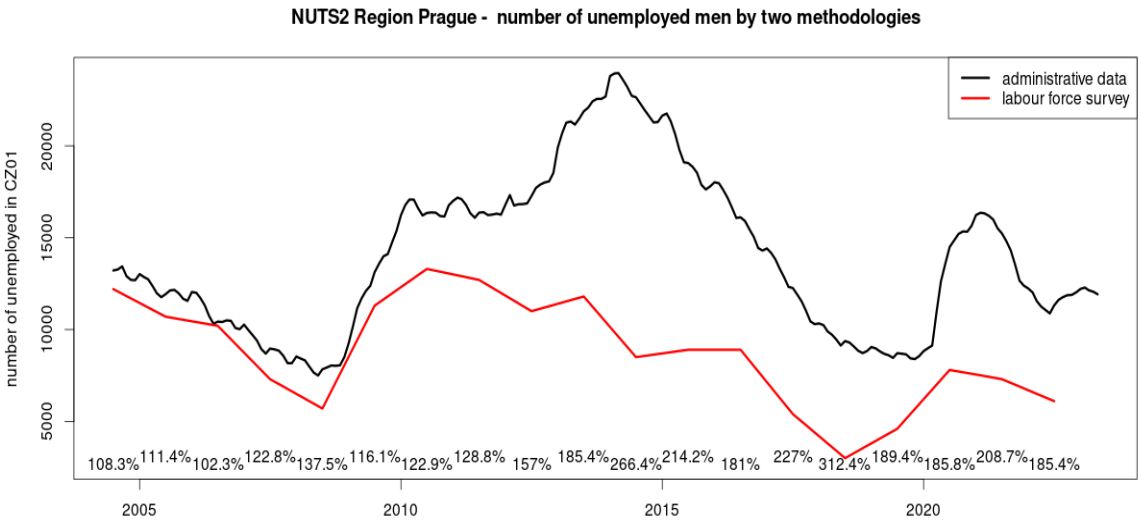


Similar development can be visible in the region of Central Moravia. Seasonality of men decreased but did not diminish.

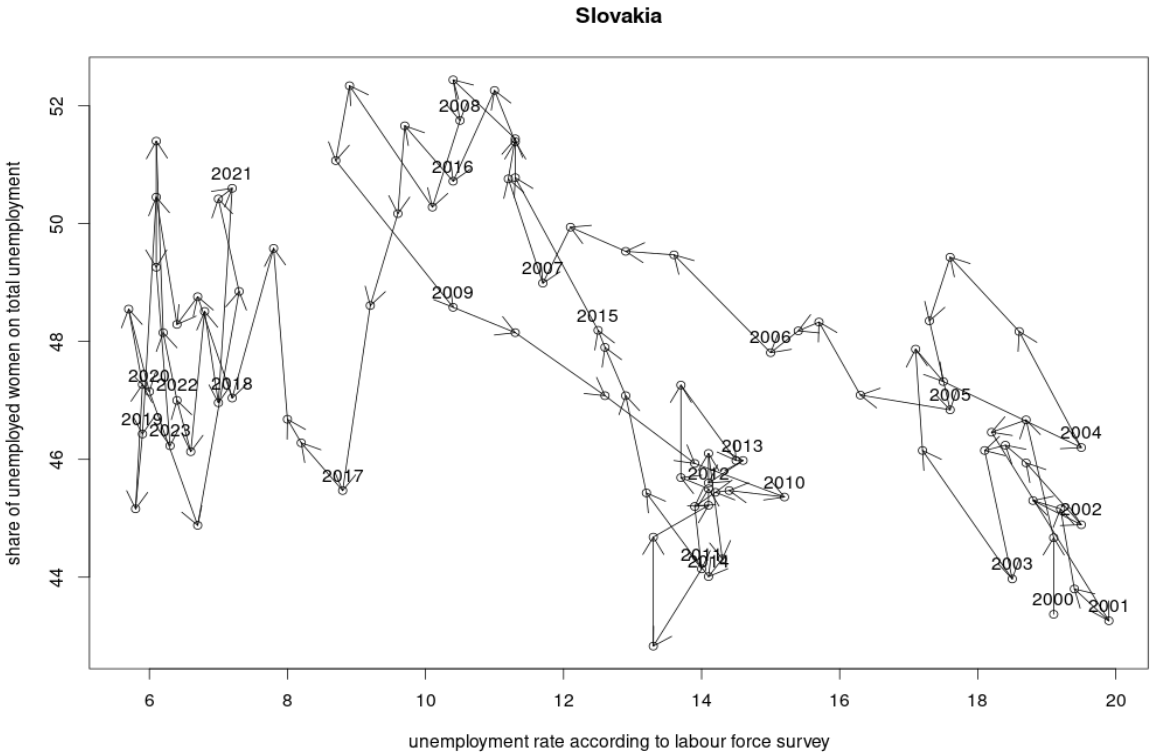




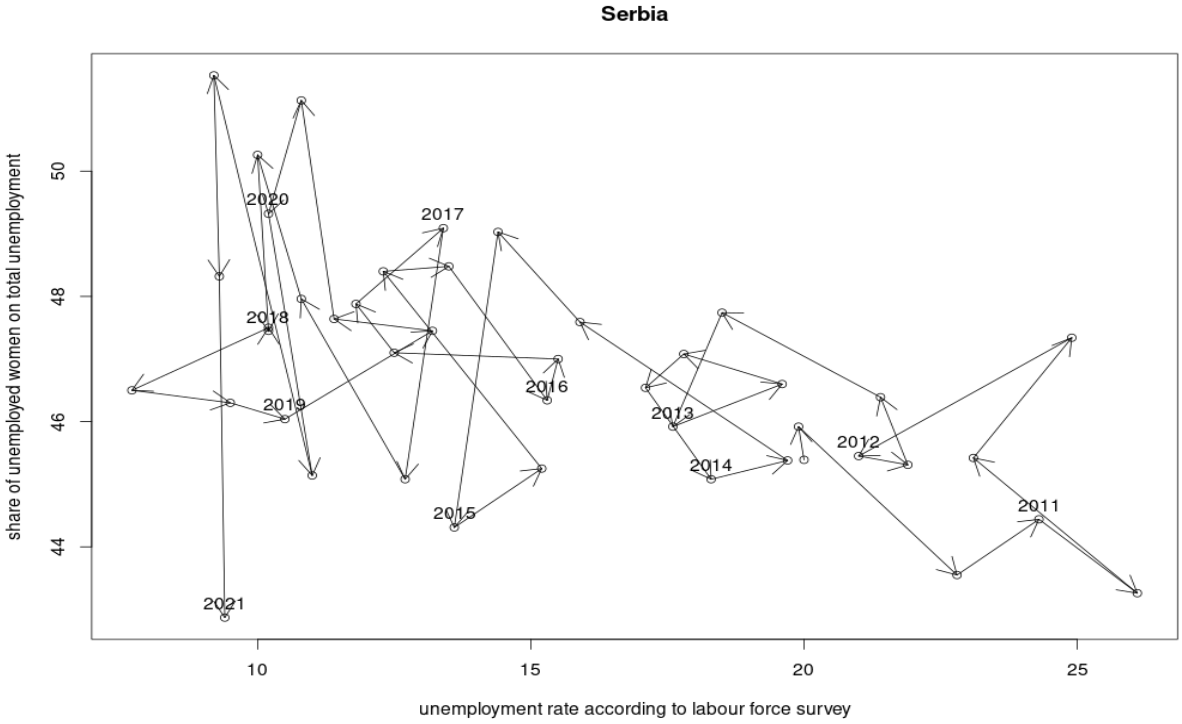
In the urban regions of Prague, men and women are not affected by seasonal development. This is due tothe different structure of employment compared to rural regions discussed above.



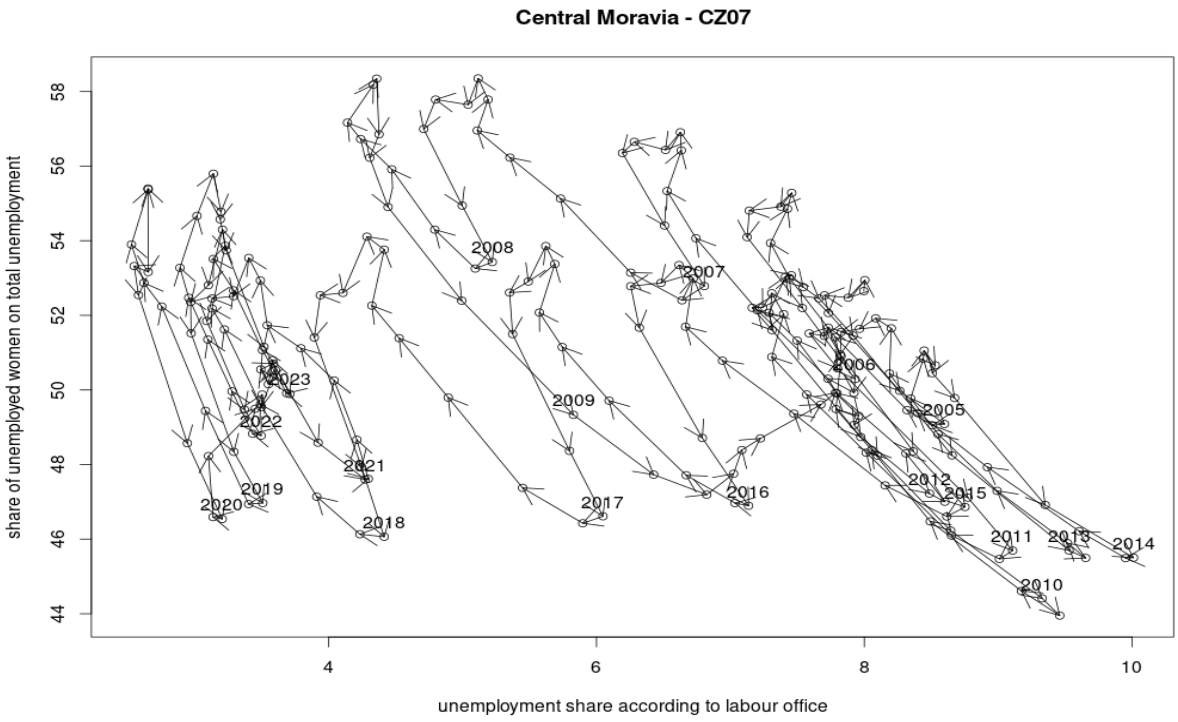
Different approach to analyzing gender differences in employment is comparing share of unemployed women on total unemployment and unemployment rate, as measured by LFS. In case of Slovakia, we can observe increasing share of unemployed women connected to decreasing unemployment rate between years 2005-2008 and 2014-2016, and reversed correlation between years 2008 and 2010. Between years 2010- 2014 and after year 2017, there is no visible connection between these two parameters.



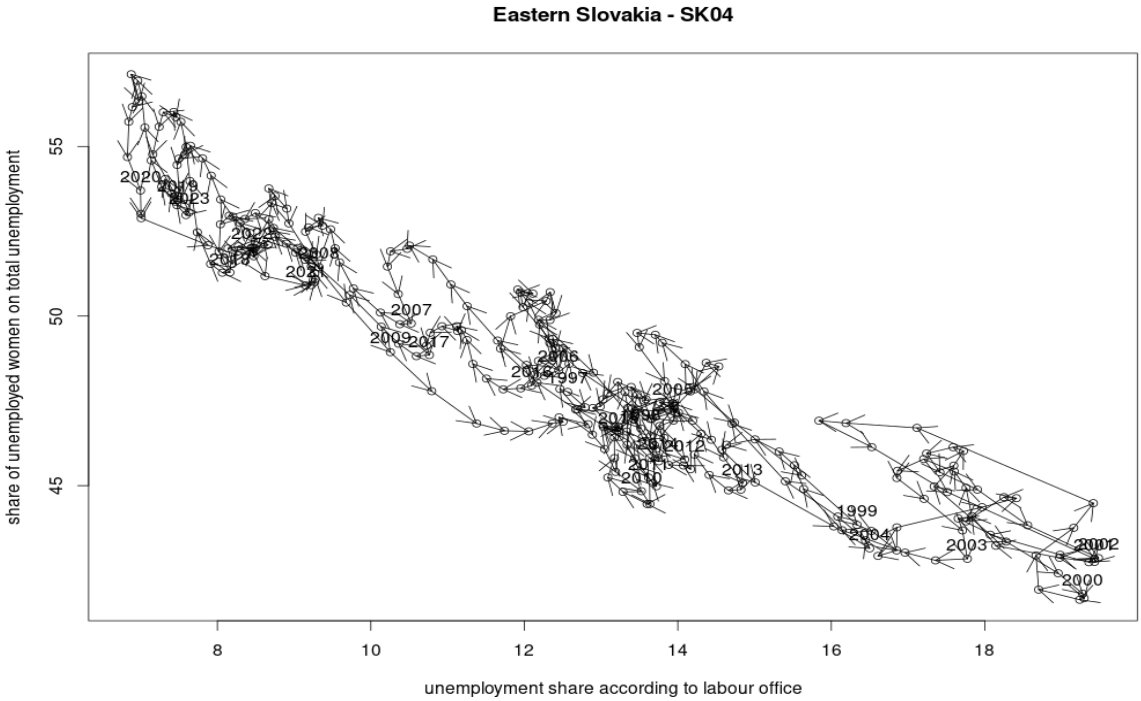
In case of Serbia the trends are not visible.



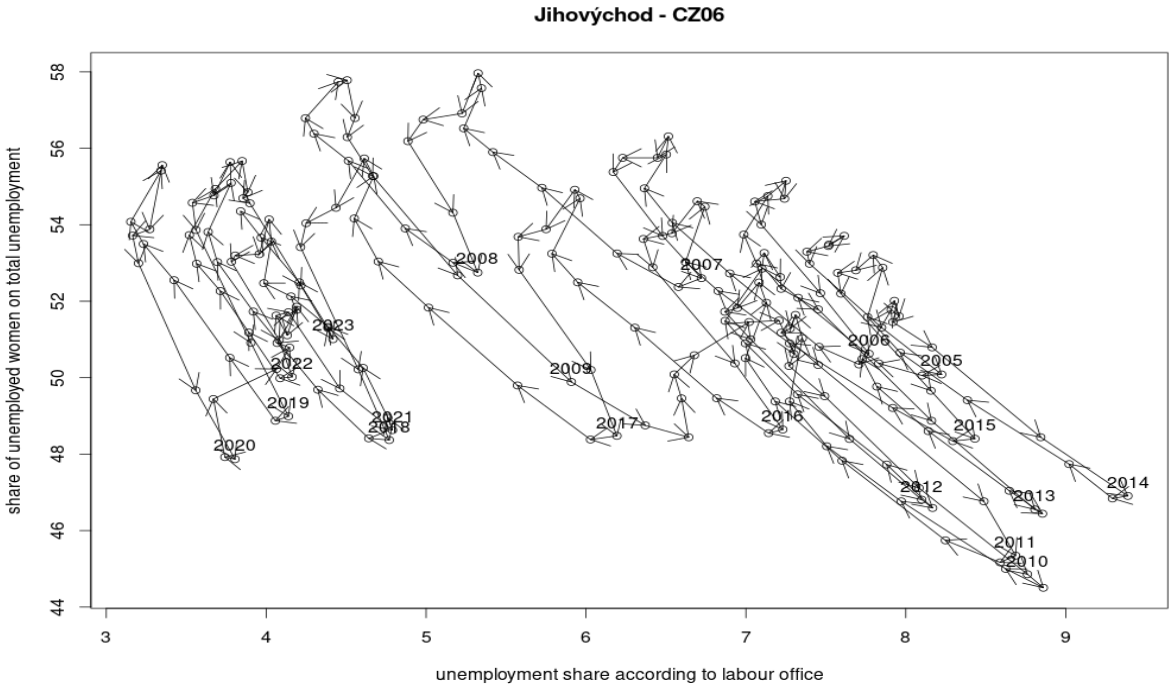
When analyzing administrative data on unemployment, which have monthly periodicity, we can observe clear trends in some of the rural regions. For example, in Central Moravia increasing unemployment is visibly connected to decreasing share of women on unemployed, and vice versa. This connection is broken only in the years 2022 and 2023.



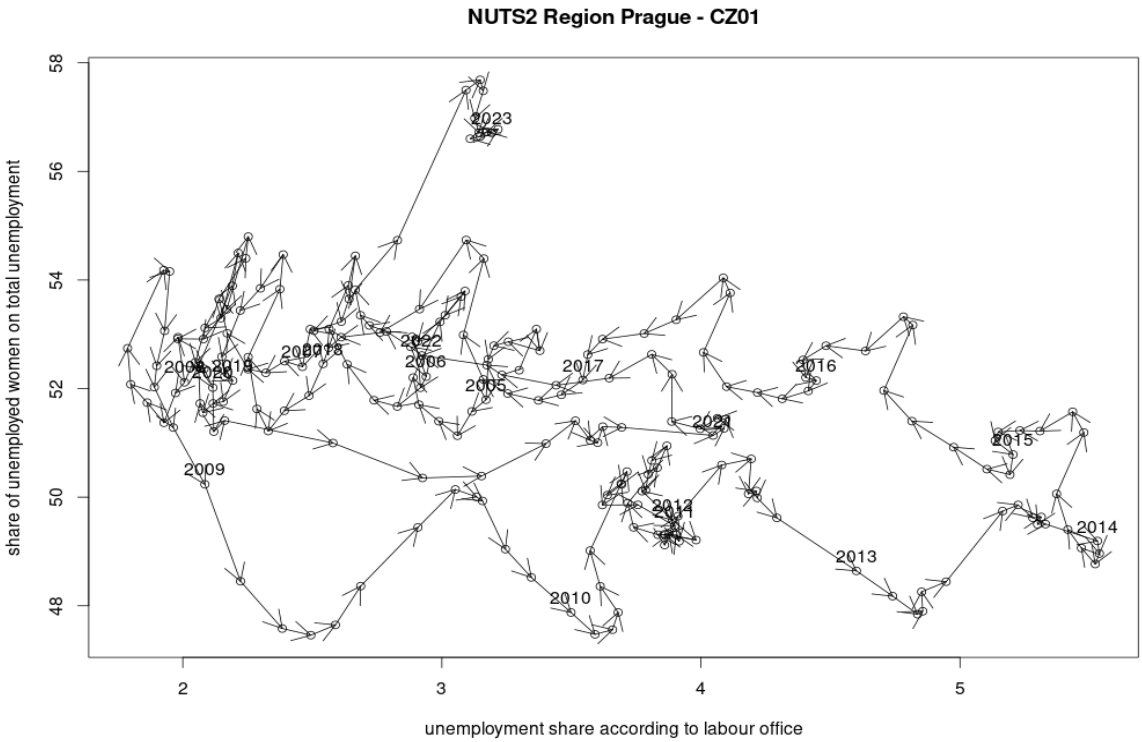
In Eastern Slovakia, the trends are even more visible. Minor changes in total unemployment do not affect the share of women on unemployed. In contrast with the Central Moravian region, change from unemployment increase to decrease changes share of unemployed women instantly.

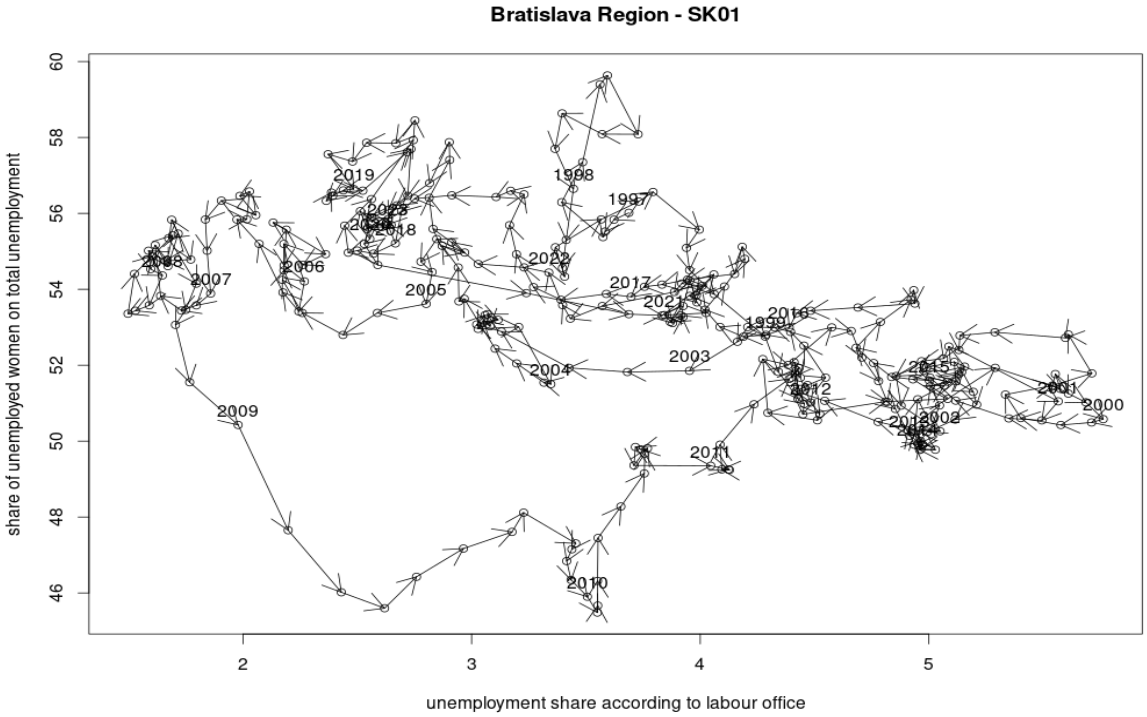


The Moravian-Silesian Region of Czech Republic had an interesting development: the connection of the two discussed variables had different strength during the time.



This connection is only visible in rural regions. If we focus on urban regions, the connection is not visible. We can illustrate this by the regions of Prague and Bratislava.





CONCLUSIONS

In this article, we analyzed the connection of total unemployment development on the genders. We can observe that in urban regions, decreasing unemployment rate benefits more men than women or that decreasing unemployment rate is driven by men rather than women. On the other hand, increasing unemployment rate affects more men than women or that increased unemployment is driven by men coming into unemployment status. These trends are also visible in seasonality of the number of men being unemployed.
This connection is not visible in urban regions (for example Prague and Bratislava), and in some of the rural regions in recent years. This would indicate urbanization of these regions or weakening of this connection when unemployment is low.

REFERENCE:

Michal Páleník: LAU1 dataset, https://www.iz.sk/LAU1, 2023, doi:10.5281/zenodo.6165135
Eurostat, tables [lfst_r_lfu3pers],[lfsq_ugad]

THE IMPACT OF PRODUCT ENVIRONMENTAL LABELLING ON CONSUMER BEHAVIOUR

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Abstract: Environmental labelling of products was created due to the growing global problems that need to be actively solved to maintain the sustainable development of society. Labelling environmental products is one of the means to point out more ecological consequences and thus provide the public with the option of choosing more environmentally friendly products. From the analysis of the current state of use of environmental labelling in the Slovak Republic, it is clear that companies prefer labels that are recognised on a transnational level, in this case, throughout the territory of the European Union. Overall, however, the number of Slovak-certified products is decreasing. This may be caused by a lower demand for such labelled products from customers and consumers than the companies expected. It is, therefore, essential to create motivating conditions for companies and ensure the support of the demand for such labelled products.The presented article aims to determine the consumer's interest in environmentally friendly products and subsequently to derive solutions to improve understanding and interest in such an assortment of products.

Keywords: Environmental labelling, sustainable development, customer, behaviour,

INTRODUCTION

The environmental labelling of products identifies the preference of a product within its entire life cycle. In a broader sense, environmental labelling can be understood as the application of labels to inform consumers, with a focus on the ecological nature of the product concerning other products within the same category. Ecolabelling is a voluntary method of certification and labelling of environmental properties applied within the global spectrum.

When solving environmental problems, new forms of preventive environmental strategy are currently being promoted. In the area of environmentally oriented product policy, it is mainly ecolabeling and ecodesign. Efforts in developing and producing environmentally friendly products should be very closely linked with marketing communication because environmentally oriented marketing can play an essential role in applying such oriented products on the market and in consumer behaviour. Preparing the needto launch a new product is a necessary process that must be repeated for each new product. In the case of ecolabelling, you can take advantage of the fact that products labelled in this way have a minimised negative impact on the environment, or enable the consumer to navigate the offer of comparable products better, thus directly influencing his purchasing behaviour. This gives the consumer a chance to express his position on issues related to the environment.

DEVELOPMENT OF ECO-LABELLING

The first environmental labelling was created in 1977 in the former German Federal Republic. Substitution systems were gradually applied in other countries. In 1994, the Global Ecolabelling Network (GEN) was established. We can distinguish environmental labelling through the credibility and amount of information that is provided to the user in this form:

- *advertising marking*,
- *the aim is to attract the attention of the consumer* and gain acceptance of the offer, information regarding environmental protection is imprecise, often unverifiable, and thus potentially misleading,
- *latent or indirect marking*– the goal is to inform the consumer about the specific properties of the product from one or several areas related to safety, functionality, harmlessness to health, toxicity, flammability, explosiveness, noise, demand for raw materials and energy resources. These marks, expressing the conformity of properties with a particular set of requirements that do not primarily concern environmental protection, speak about specific properties of the product but do not declare a comprehensive view of it in terms of its overall impact on the environment,
- *own or accuratelabelling*– the aim is to provide valid and verifiable information, guaranteed by a third party, about the effects of a product or service on the environment (Boďová, 1999).

ECOLABELLING AND THE CONSUMER

When introducing ecolabelling programs, emphasis was placed on the individual stages of production. Currently, the focus is mainly on consumption motivations. Ecolabelling participates in creating the proper relationship of market subjects to the components of the environment, their protection and creation, in increasing caution and reducing risk in decision-making processes and the prevention of damages and losses, and ultimately in improving the economic efficiency of activities and their results. The EU Environment Action Plan defines that consumers need information that would allow them to choose environmentally friendly products that could influence the market in this way.

The environmental mark symbolises:

- the given product, while maintaining its qualitative properties, unlike other substitutes, has superior ecological parameters and is more environmentally friendly,
- the certificate further demonstrated conformity and compliance with technical standards, safety, health, hygiene and other regulations, including measures related to the creation and protection of the environment relating to some stages of the product's life cycle,
- environmentally oriented consumers, who are willing to behave in this way even if the relevant product marked with an environmental label is more disadvantageous in price, can create pressure on the market and thus motivate producers and importers, can increase the profit of environmentally oriented producers and improve the competitiveness of such of the enterprise. Ecolabeling must cope with the issues of foreign trade and the rules of the international trade organisation (Rusko, Ambróš, 2002).

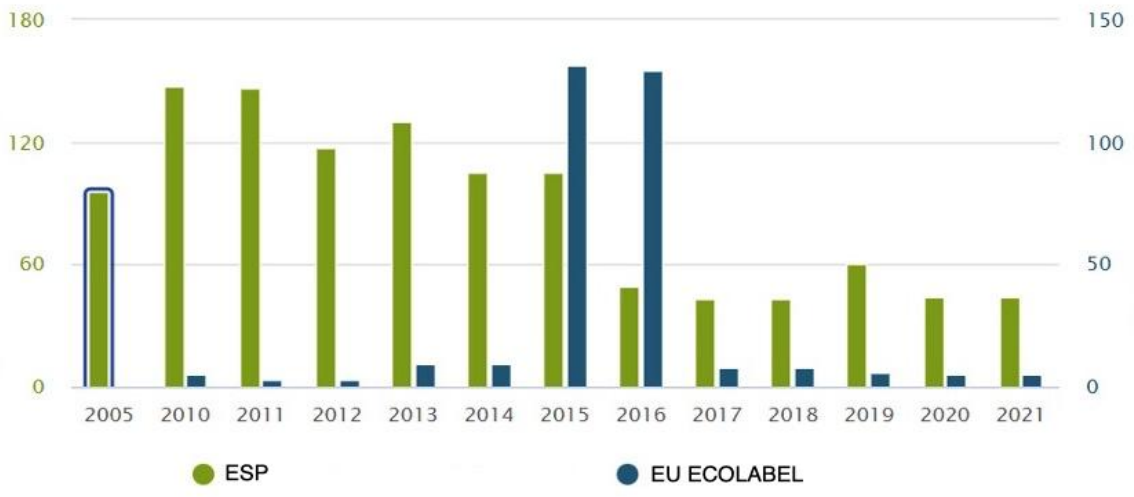
Customers are also interested in information about the conditions under which the product was created, whether raw materials and processes that do not harm the environment and employees' health were used for its production. Furthermore, how will the packaging and the product be recycled or disposed of at the end of their useful life (Kotovicová et al., 2003). The company must respect environmental laws and many other legal regulations and standards indirectly related to the environment in our country and abroad. Only businesses can best assess to what extent the legislative framework enables them to implement voluntary commitments. That's why several important companies are implementing environmental management systems as a follow-up to quality management systems. It is about implementing the elements of creation and protection of the environment into the organisation's management processes (Hyršlová, 2004).

DISCUSSION

Within the framework of the Slovak Republic, the label Environmentally suitable product (ESP) has been used since 1996 as a voluntary instrument of environmental policy to protect the environment. This label is the property of the Ministry of the Environment of the Slovak Republic. Products marked as ESP are tested for the presence of heavy metals and substances harmful to health, for the impact of the production of the product itself on water pollution, air pollution, damage to the ozone layer, and the origin of the raw material from which the product was made also taken into account. The Ecolabell label is used within the European Union.

The Ministry of the Environment of the Slovak Republic guarantees the brands (Ecolabel and ESP). A manufacturer, producer, service provider, importer, wholesaler and retailer can apply for an environmental label. Through the data obtained, the following graph shows the number of products produced in the Slovak Republic with the right to use the certified labels European flower and Environmentally suitable product.

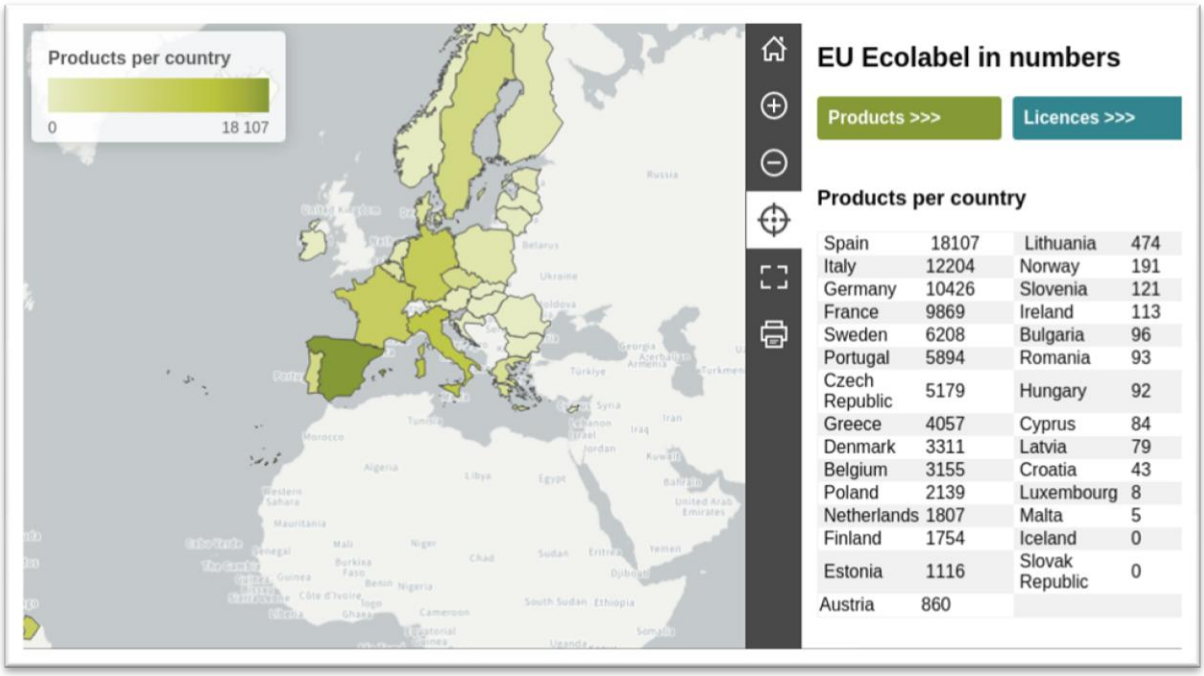
Figure 1: Number of products with the right to use the label ESP andECOLABEL



Source: SAŽP (2021).

In the following figure (No. 1), we show the use of the Ecolabel brand within the individual countries of the European Union.

Picture 1: EU Ecolabel in numbers



Source: European Commission (2022)

Since the field of environmental labelling of products is essential, but there are currently not many products on the market in Slovakia that are marked with the ESP mark, the following activities would help to improve this area:

- Creation of a common standard for environmental labelling

Currently, international trade is developed thanks to significant technological progress and transportation. Due to the global exchange of goods and services, it would be appropriate to agree on uniform and precise standards between governmental and non-governmental organisations and industrial actors, which several brands should represent. Currently, there are countless labels, but from the very principle, one values and notices what is minor. Unifying and reducing the number of brands could eliminate the chaos that the current numerous environmental labels cause. The simplicity and clarity of environmental titles guarantee higher efficiency and support for the entire ecologicallabelling system. Such a change would lead to an increase in their value. The more valuable the eco-label, the more other companies will be tempted to obtain certification for their products. An eco-brand must be as widely known as possible to become successful and recognised. People like what they see more often, and a known brand tends to be preferred because it is considered trustworthy. In the case of the existence of a large number of different designations, a competitive struggle may arise between the organisations mediating these designations. To attract new companies interested in certification, the standards of the criteria may be reduced, and, in the long term, the brand will lose its value.

Certified environmental labels should not represent an obstacle in the market or be abused for this purpose. However, the imperfection in the current system of the existence of many environmental labellingorganisations creates the conditions for such opportunities. There is a possibility that some countries will legally carry out protectionism. The unification of the system would prevent such situations, and the label could thus fulfil its purpose more effectively.

CONCLUSION

Environmental labelling of products arose because of growing global problems that need to be actively solved to maintain the sustainable development of society on Earth. Labellingenvironmental products is one of the means of pointing out more ecological consequences, engaging the consumer and thus providing the public with the option of choosing more environmentally friendly products.

Companies have or were interested in such a label. However, the number of products labelled with either the EU Ecolabel or the Slovak ESP label is decreasing. This fact is primarily caused by insufficient interest in environmental products on the part of consumers. Improvements in the given area could be brought about by the proposed measures, which we consider the most important to create a common standard for environmental labelling.

LITERATURE

Boďová, E.: Podporné nástroje budovania systémov environ - mentálneho manažérstva . Kvalita, 1999, 2, s. 16 – 19. Cascio, J., Woodside, G., Mitchell, P.: ISO 14000 Guide. New Dubnica, 2004, p. 163 – 166. Korauš, A.: Tri piliere public relations. Poistné rozhľady , 2000, 3. Korauš, A.: CustomerRelationships Management as Key.

European comission. 2019. Facts and Figures. http://ec.europa.eu/environment/ecolabel/facts-and-figures.html

Factor of Success . Eurospravodaj, 2003, 2. Kotovicová, J. a kol.: Čištčí produkce . MZLU Brno, 2003, 134 s.

Global Ecolabelling Network. What is ecolabelling? 2019. https://globalecolabelling.net/what-is-eco-labelling/

Lieskovská, Z. et al . 2017. Správa o stave životného prostredia Slovenskej republiky . Bratislava, Banská Bystrica: MŽP SR, SAŽP, 2017. 195 p. ISBN 978-80-89503-75-9.

Majerník, M. et al. 2012. Environmentálne manažérstvo v integrovanom systéme . Bratislava: Ekonomická univerzita v Bratislave, 2012. 170 p. ISBN 978-80-971555-1-3.

Office of Consumer Affairs. 2012. Environmental Labelling Programs – Ecolabels. [2012-05-04] https://www.ic.gc.ca/eic/site/oca-bc.nsf/eng/ca02742.html.

Remtová, K.: Ekodesign. MŽP ČR Praha , 2003, 15 s. Rusko, M., Ambróš, L.: Ecolabelling as a Part of the Environmentally Oriented Product Policy in the Slovak Republic . In: Třebický, V., Novák J . (eds): Visegrad Agenda 21-Transition from Centrally Planned Eco- nomy to Sustainable Society? Conference Proceedings, 2002, p. 272 – 275.

Rusko, M., Balog, K.: Ecolabelling in the Slovak Republic. Conference CO-MAT-TECH MTF STU Trnava, 2003, p. 920 – 924.

Slovenská agentúra životného prostredia . 2019. Environmentálna značka EÚ . http://www.sazp.sk/zivotne-prostredie/environmentalne-manazerstvo/environmentalne-oznacovanie-produktov/environmentalna-znacka-eu.html.

York,1996, 221 pp. Hyršlová, J. Benefits of Environmental Management Systemsin the Czech Republic . In Conference Akademická.

SHOPPING BEHAVIOR OF GENERATION Z IN THE WORLD

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Abstract: Nowadays, generations are shaping their buying behavior. The digital market and social networks are part of our everyday life. Generation Z are the best online people in the world today. They prefer to shop online, live with social media, share their content and communicate with the world through social networks. They make extensive use of social platforms, they are an ideal sales channel that influences buying behavior and decision making. They create their own view of the digital market and their opinion of the goods and services on offer. Generation Z as a consumer group is interested in a healthy lifestyle, food, the composition of products and the impact on the environment, with a focus on environmental protection.

Key words: generation Z, consumer behavior, consumer, generation impact.

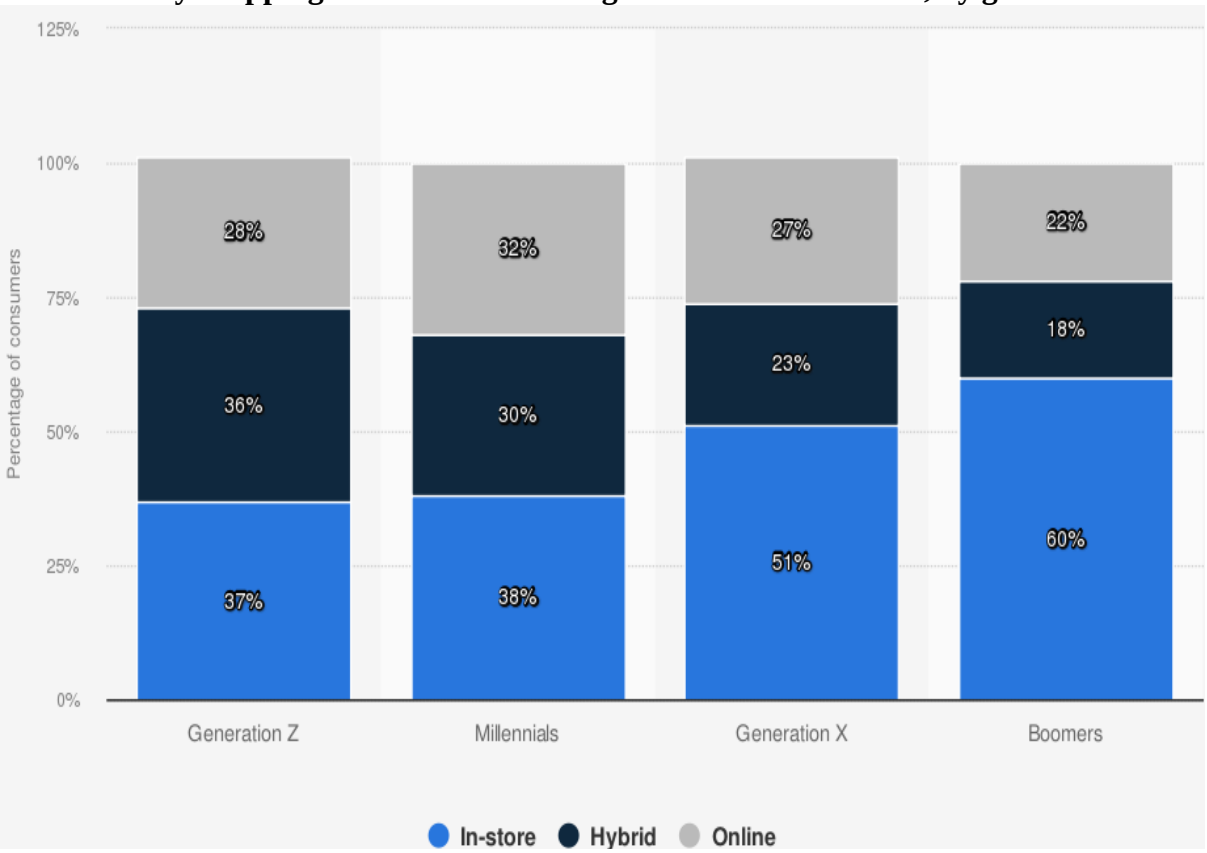
INTRODUCTION

Purchasing behavior is significantly influenced by cultural, social and personal factors, which are considered as external factors affecting the consumer and internal psychological factors. From a terminological point of view, the concept of purchasing behavior in relation to the final consumers of products or services is called the consumption behavior of an entity appearing on the consumer market (Križan, František et al. 2017). In a consumer society, consumers have to make purchasing decisions every day. What determines sales or consumer demand is mostly the price, the type of distribution, or the type of marketing communication. Based on these elements, consumers react and choose a product, brand, store or website. We can also talk about all these consumers as a consumer market.

Purchasing decisions are not only made by the individual, and thus we distinguish multiple roles related to the act of purchase. An individual can be:

- a gatherer of necessary information by asking sellers, visiting various stores, comparing products, viewing advertisements, sales support, etc.
- an influencer who recommends the purchase of goods,
- the decision maker who gives the impetus for the purchase and without whose consent the realization of the purchase is not possible,
- an obstacle to the flow of information, when a purchase cannot be made without the flow of information from a person,
- the buyer, who is involved in business relations, selects goods that he does not need to consume all and is the goal of the company in the transformation of the individual,
- the consumer who enters the consumption process
- a user who often uses the product does not have to be its buyer, as he can play the role of initiator
- customers who initiate the exchange process and express their needs,
- another person who influences the purchase and expresses his opinion (Lelková, Gburová, 2016).[1]

Primary shopping methods used among consumers worldwide, by generation



Source: National Retail Federation. (January 13, 2022). Primary shopping methods used among consumers worldwide in 2021, by generation [Graph]. In Statista. Retrieved June 05, 2023, from https://www.statista.com/statistics/1288182/shopping-methods-by-age/

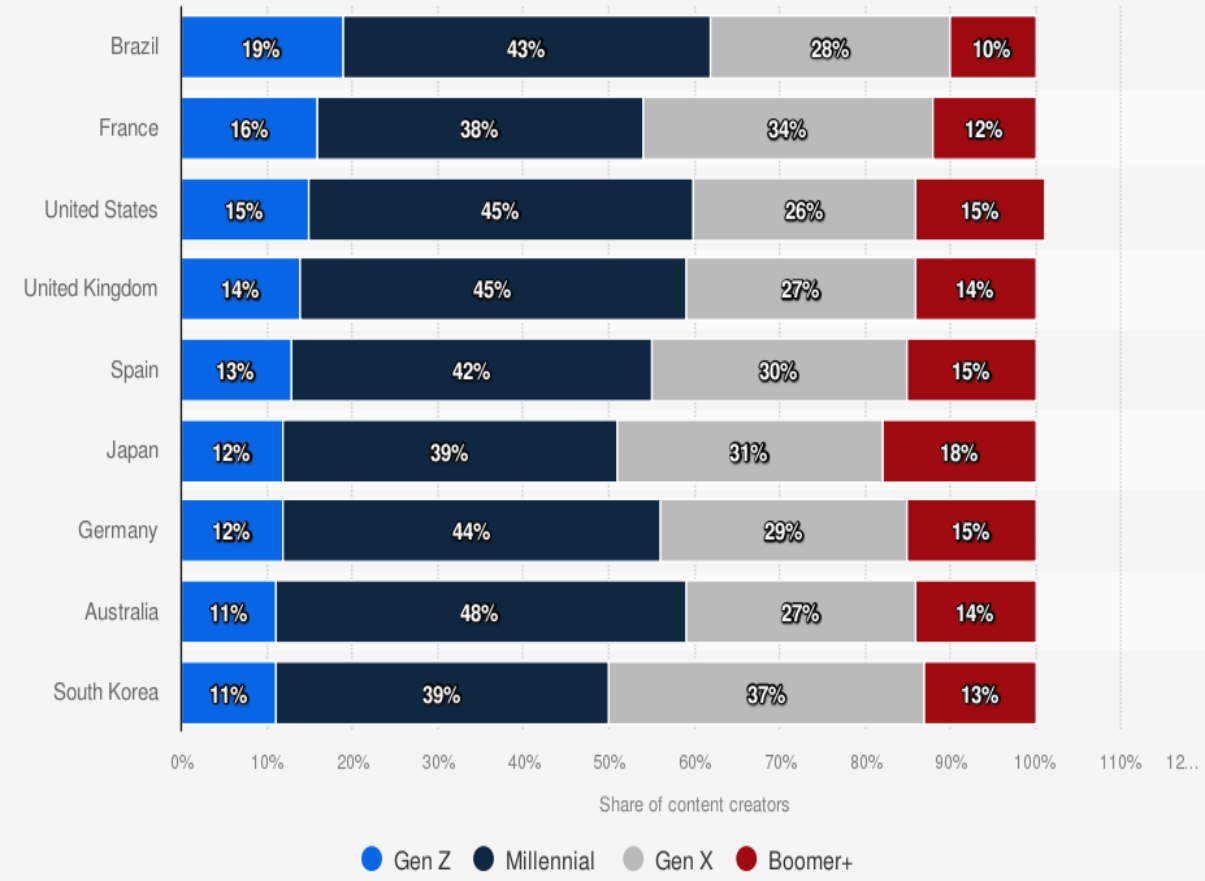
[1] LELKOVÁ A., GBUROVÁ J. Formysprávania v nákupnomprocese. Prešov : Bookman,2016. s. 34-36. ISBN 978-80-8165-206-6.

60 percent of Baby Boomers preferred in-store shopping, while only 22 percent chose online shopping as their primary method of buying. Many Millennials and Generation Z shoppers also opted for in-store shopping but showed a way greater interest in hybrid buying methods, at a rate of 30 and 36 percent, respectively.

Digital market in the world by generation

The digital market and social networks are part of our daily lives and their influence has increased enormously in recent years. They have the most effective communication method in the world with services such as: Online shopping, e-store, e-mail, file transfer and exchange, messaging, social networks (Facebook, Messenger, YouTube, Instagram and Twitter, etc.).

Number of digital content creators worldwide as of May 2022, by generation



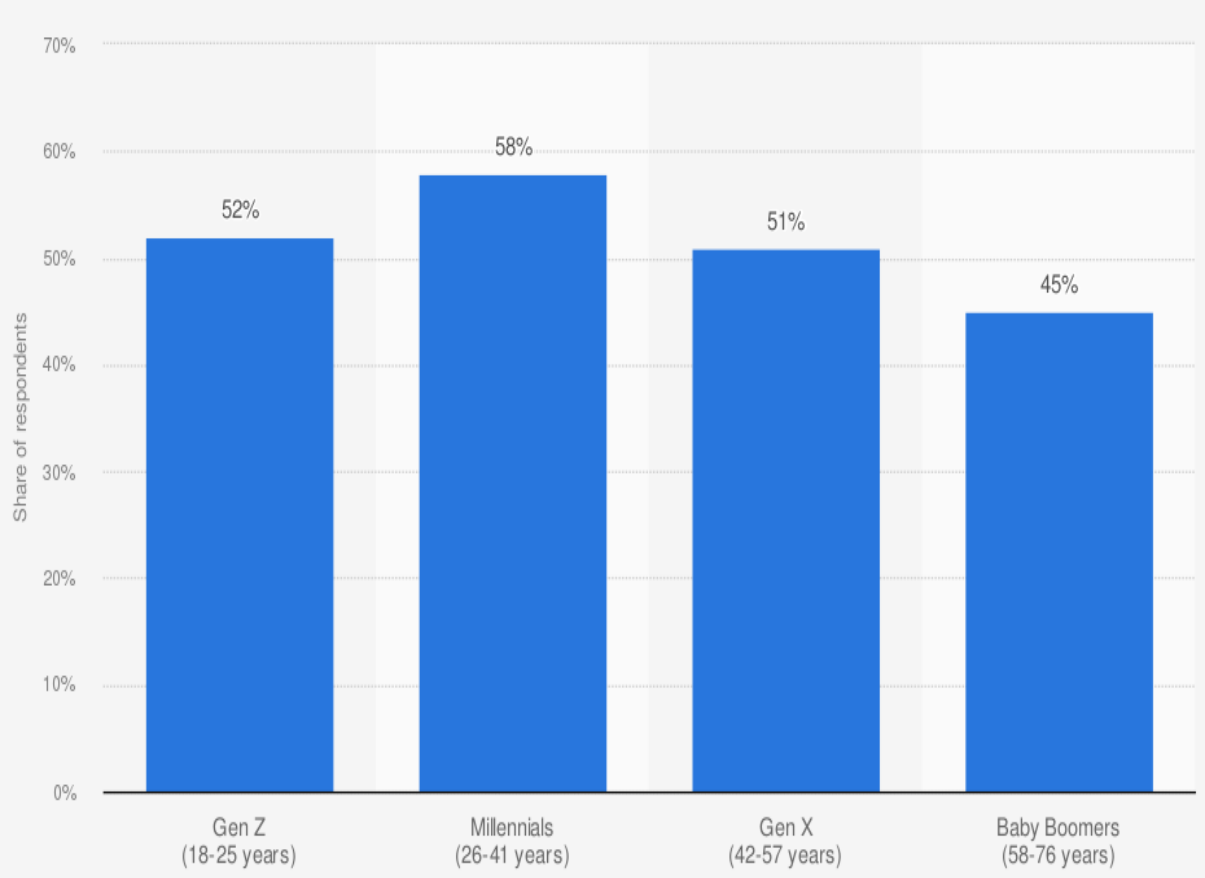
Source: Adobe. (August 25, 2022). Number of digital content creators worldwide as of May 2022, by generation [Graph]. In *Statista*. Retrieved May 28, 2023, from https://www.statista.com/statistics/1356960/digital-content-creators-by-generation/

According to a survey con content creators conducted in May 2022 in nine global markets, Millennials composed the largest group of content creators in all the examined countries. In particular, Australia, the United States, and the United Kingdom saw almost half of their content creators being Millennials. In Brazil, 43 percent of the content creators were Millennials, while 28 percent belonged to the Gen X generation, and 19 percent to the Gen Z generation (Statista 2023).

Products purchased via social media platforms worldwide by generation Z

Generation Z are the best online shoppers in the world today. They prefer to shop online, live with social media, share their content and communicate with the world through social networks. Generation Z as a consumer group is interested in healthy lifestyles, food, the composition of products and the impact on the environment, with a focus on global environmental protection.

Share of shoppers who had purchased a product directly from social media platforms worldwide in 2022, by generational cohort



Source: Klarna. (October 20, 2022). Share of shoppers who had purchased a product directly from a social media platform worldwide in 2022 by generational cohort [Graph]. In *Statista*. Retrieved May 28, 2023 from https://www.statista.com/statistics/1273928/share-social-buyers-age-group-worldwide/

According to a 2022 survey, approximately 58 percent of online shoppers between 26 and 41 years old worldwide had already made purchases directly through social networks. That makes millennials the generational group with the highest adoption of social shopping. It was followed by users aged 18-25, with more than half saying they have shopped through these platforms (Statista 2023).

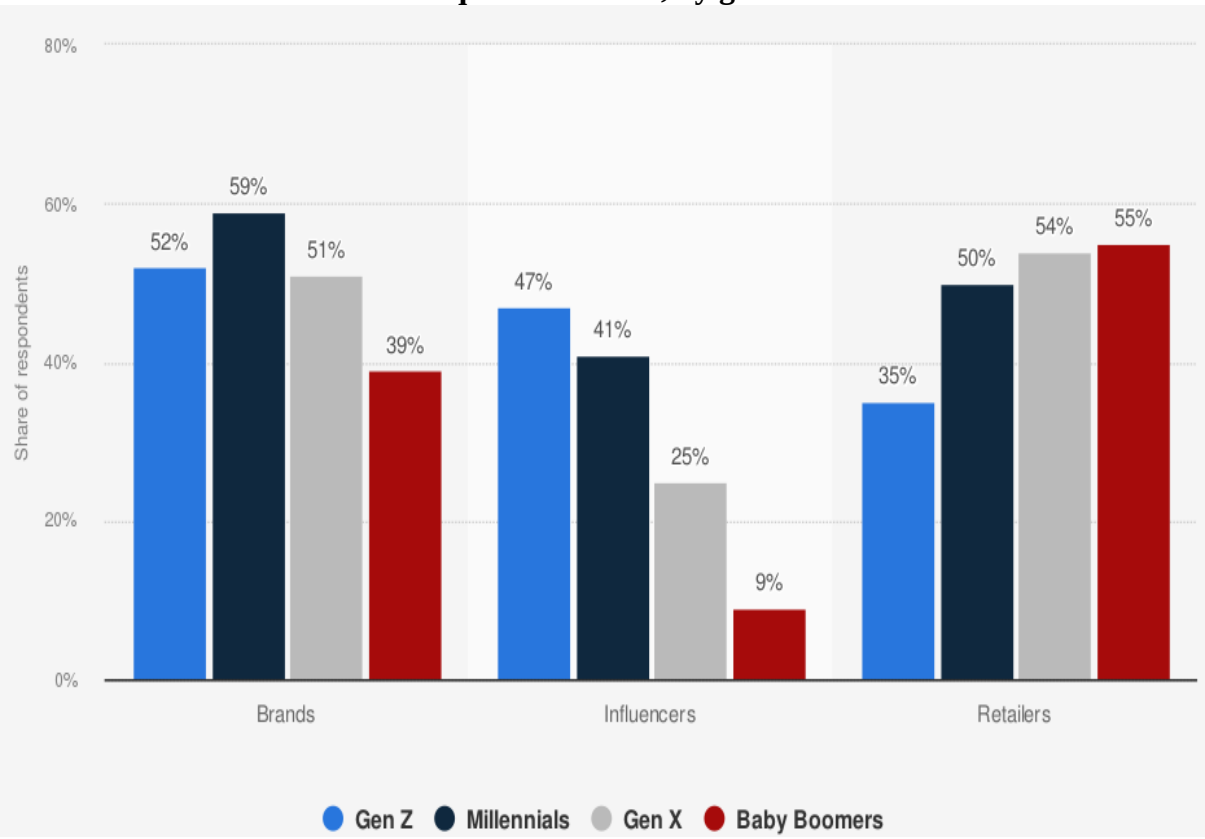
Social media has given Generation Z the opportunity and power to share their opinions, influence people and institutions outside their immediate environment, and thus challenge long-established worldviews, cultures, and authorities in a new, faster, and dynamic way.
These are several behavioral characteristics of Generation Z:

- freedom and freedom of choice,
- they have had enough of everything,
- things have to be the their way,
- they are comfortable,
- they live in integrity,
- they prefer to talk,
- scrutinize employers and the company,
- they need entertainment,
- they are fast,
- innovations are part of their everyday life (Tapscott D. 2009).[2]

They make extensive use of social platforms, they are an ideal sales channel that influences buying behavior and decision making. Generation Z and Generation Y are attractive consumer groups and have specific characteristics of buying behavior, because they are consumers who will dictate new patterns of buying behavior in the future.

[2] TAPSCOTT, Don. Grown up digital. New York: McGraw Hill, 2009. 384 s. ISBN 978-007-150863-6.

Types of social media accounts that users followed and purchased from worldwide as of the 2nd quarter of 2022, by generation



Source:Insider Intelligence. (September 12, 2022). Types of social media accounts that users followed and purchased worldwide as of the 2nd quarter of 2022, by generation [Graph]. In *Statista*. Retrieved May 28, 2023 from https://www.statista.com/statistics/1336485/global-types-social-media-accounts-followed-and-purchased-from-by-age/

According to a global survey conducted in 2022, 59 percent of Millennials followed and purchased goods from the social media accounts of brands. Overall, 47 percent of Gen Z users followed and purchased from influencers, whilst just nine percent of Baby Boomers did. Additionally, over half of respondents belonging to the Gen X age group followed and purchased from the social media accounts of retailers (Statista 2023).

When it comes to purchasing, Generation Z prefers a brand that responds immediately to the customer's needs. When comparing male and female Generation Z shoppers in terms of their brand preferences. For instance, brands such as Amazon, Walmart, YouTube and Netflix appeared on both lists, making them among the generation's most popular brands. However, preferences were far from identical: more Generation Z women liked Doritos, Oreo and KitKat, while a greater number of Generation Z men had a favorable opinion of Gatorade, PlayStation and Nike.

CONCLUSION

Generation Z lives in a globalized society, which is evident in their knowledge of social networks and media, while they know how to form their own opinions about purchases, goods and services. They are always on the lookout for the best deals on the market and know how to adapt to the current market trends in the world. Companies need to take this into account and adapt the range of goods and services to this generation. Generation Z is very interested in products that are ecological and environmentally friendly, and they prefer products that are easy to use and design.

LITERATURE

1. KRIŽAN, František et al. Maloobchod a špecifikáčasovo-priestorovéhosprávaniaspotrebiteľov. Bratislava: Vydavateľstvo UK, 2017. p. 19. IBSN 978-80-223-4434-0.
2. LELKOVÁ A., GBUROVÁ J. Formysprávania v nákupnomprocese. Prešov: Bookman, 2016. pp. 34-36. ISBN 978-80-8165-206-6.
3. TAPSCOTT, Don. Grown up digital. New York: McGraw Hill, 2009. 384p. ISBN 978-007-150863-6.
4. Statista - The Statistics Portal (2023). Retrieved June 05, 2023, from https://www.statista.com/statistics/1288182/shopping-methods-by-age/
5. Statista - The Statistics Portal (2023). Retrieved May 28, 2023, from https://www.statista.com/statistics/1356960/digital-content-creators-by-generation/
6. Statista - The Statistics Portal (2023).Retrieved May 28, 2023, from https://www.statista.com/statistics/1273928/share-social-buyers-age-group-worldwide/
7. Statista - The Statistics Portal (2023).Retrieved May 28, 2023, from https://www.statista.com/statistics/1336485/global-types-social-media-accounts-followed-and-purchased-from-by-age/

ADVANTAGES AND DISADVANTAGES OF SOCIAL NETWORKS FACEBOOK AND INSTAGRAM - HOW SOCIAL NETWORKS SHAPE ENTREPRENEURIAL BUSINESS?

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Abstract: The subject of the paper is a presentation of the connection between the social networks Facebook and Instagram and entrepreneurial business. The paper is of an overview character and provides a theoretical insight into the issues being addressed. With the development and progress of technology, the transition from classic marketing to digital and Internet marketing, entrepreneurs see their chance for growth and development in the market through the intensive use of the social networks. Analyzing the importance of using the social networks Facebook and Instagram, in the domain of development and improvement of entrepreneurship, it has been shown that social networks are a really important tool in modern business. The innovativeness of modern marketing business and the use of the Facebook and the Instagram as a modern marketing tool to achieve goals, allows entrepreneurs to gain greater visibility and popularization in the market, helping them to avoid business inequality. The paper will show the advantages and disadvantages of social networks, as well as the ways in which they contribute to the shaping of entrepreneurial business. The goal of the work is to give guidelines to the all interested parties, especially the entrepreneurs, in order to show them how to shape their business on the social networks in accordance with modern business trends and to improve their overall business.

Key words: Social Networks, Facebook, Instagram, Entrepreneurship

INTRODUCTION

The subject of the paper is a presentation of the connection between the social networks Facebook and Instagram and entrepreneurial business, that is, through the paper, we present the literature of importance for studying the issue of the usage of these social networks in the development of entrepreneurial business. Social networks have become the daily practice of many entrepreneurial businesses. One cannot imagine today's business without the use of these marketing tools. Whether it is about building a product or service brand, building an entrepreneur's identity or establishing and maintaining relationships with the customers, social

networks such as Facebook or Instagram are indispensable platforms for searching for information, entertainment and relaxation, purchasing products or services. The goal of the work is to provide insight to all interested parties, and mostly to entrepreneurs, how to conceive, shape and improve their business.

SOCIAL NETWORKS FACEBOOK AND INSTAGRAM

The most significant technological development of the last 30 years has been the Internet, which has enabled individuals to collaborate and share knowledge instantly. Technological development has introduced significant changes related to the way organizations communicate with their partners and customers (Siamagka et al., 2015). Social networks are organizational tools necessary for cooperation with other business actors (Evert et al., 2016; Galati et al., 2019; Jalonen, 2014). They can be described as "*communication systems that enable their social actors to communicate through multiple dyadic connections*" (Peters et al., 2013, p. 282). These tools allow organizations to reach their customers with relatively low costs and a high level of efficiency (Breton-Miller & Miller, 2016; Kallmuenzer et al., 2018). Businesses are increasingly using social networks as a communication channel, a phenomenon that is transforming the way businesses do business, and relate to their customers and suppliers (Pekkala & van Zoonen, 2021). Recent literature highlights the importance of the social networks by suggesting that customers consider the content of social networks when forming relationships and making purchase decisions (Pekkala & van Zoonen, 2021), and social networks also play an important role in shaping consumer culture. Entrepreneurs see their chance to gain competitiveness by promoting their business on social networks, so every day we can see on Facebook or Instagram how they try to attract their consumers and increase the visibility of their products, ultimately resulting in final sales (Gardašević, Lalović, Fimić, 2020). In order for marketing strategies to be functional and successful, it is necessary to know how to use their key factors to create a successful marketing campaign. The key factors are the need to understand different social networks and how they function, then knowing the motives for using social networks by users and understanding their preferences (Gardašević, Ćirić, Carić, 2018, p. 311). Networking has been recognized as a key entrepreneurial activity for entrepreneurs, helping them gather valuable information and advice, identify opportunities and access key resources to create, maintain, grow a business and succeed in business (Constantinidis, 2011).

USE OF SOCIAL NETWORKS FACEBOOK AND INSTAGRAM IN ENTREPRENEURSHIP

Entrepreneurship is recognized as a multidimensional concept that revolves around risk and uncertainty, innovation or value creation, which generally involves the collective idea of individuals exploiting market opportunities through innovation (Van Stel et al., 2005; Venkataraman, 1997). At the intersection of digital technologies and entrepreneurship, digital entrepreneurship requires a completely new approach to entrepreneurship theories (Zaheer et al., 2019). As an illustration, digital infrastructure, i.e. "digital technology tools and systems (e.g., cloud computing, data analytics, online communities, social media, 3D printing, digital makerspaces, etc.) that offer communication, collaboration, and/or computing capabilities" (Nambisan, 2017, p. 4) enables the entrepreneurial process, which has led to the

democratization of entrepreneurship in the past decade (Aldrich, 2014). From the organizations'point of view, social media has become a relatively cheap and effective marketing channel, and its low promotion costs which represent a real economic benefit. Economic benefits for business can also arise from the use of social media to improve communication within the organization, ie work organization, file and document sharing, online meetings, remote work support, etc. (Lupa-Wojcik, 2020). Eight key activities aimed at building marketing on social networks by entrepreneurs are shown in Figure 1. These activities include: 1. strategy, 2. selection of a social network, 3. content creation, 4. content marketing, 5. "feedback" - user response, 6. connection, 7. diversification of the use of social networks (use of at least three social networks) and 8. measurement of the effectiveness of the use of the social networks.

Picture 1. Eight key marketing activities on the social networks of importance for entrepreneurs, SMEs, organizations.

Izvor: Obermayer, Kővári, Leinonen, Bak, & Valeri, 2022.

Most companies, small and medium-sized enterprises and entrepreneurs opt for activities using micro-blogging tools such as Facebook, Twitter, Instagram, Google+, which serve them for online advertising and the creation of an effective online communication network (Gligorijevic, Leong, 2011).

The innovativeness of modern marketing business and the usage of Facebook and Instagram as a marketing channel to achieve goals, allows entrepreneurs to gain greater visibility and popularization in the market, also avoiding dealing with inequality in business. The social network Instagram, as a tool for application in business, is truly one of the fundamental internet platforms for advertising, increasing visibility, business and making profits, as well as an example of a great chance that entrepreneurs can use for their success and progress (Gardašević, Lalović, Fimić, 2020).

ADVANTAGES AND DISADVANTAGES OF USING SOCIAL NETWORKS FACEBOOK AND INSTAGRAM

From a consumer perspective, the use of information and communication technologies offers a number of advantages including efficiency, convenience, rich and participatory information, a wider choice of products or services, competitive prices, lower costs, and product variety (Bayo-Moriones & Lopez, 2007). In addition to consumers, entrepreneurs and companies also feel the benefits of the social networks. Ainscough and Luckett (1996) generally saw the benefits of the Web as benefits for publishing, online sales, market research, and customer support. Other authors claim that the advantages are reflected in brand building, generating communication between consumers, marketing and supply (Whitla, 2009). The advantage of social networks is reflected in the fact that they also represent a successful sales channel (Kondupoulos, 2011). The benefits of social networks are also ease of use, their potential for increasing knowledge and promoting internal and external relations of companies (Tiago & Verissimo, 2014). Many authors under the advantages of using social networks consider different types of advertising as a paid form of marketing communications such as banners and sponsored links, but most of them offer free advertising options such as profiles on Facebook, Twitter, Instagram, then participating in forums or posting videos on YouTube (Tomše & Snoj, 2014, p. 135). Further, about the advantages of using social networks, some authors mention a wide base of users (potential customers), the possibility of fast transmission of marketing messages, interaction with users resulting in increased loyalty, obtaining important information that can help improve business, the fact that social networks appear on search engines as the first displays, the fact that the present content attracts the attention of potential customers and increases brand awareness, the ability to respond quickly to industrial developments (which emphasizes the professionalism of the company and its employees), the ability to respond quickly to feedback and the fact that this type of communication can increase customer loyalty (Tomše & Snoj, 2014, p. 135).

Disadvantages of using social networks also exist, but they are negligible compared to all the advantages they offer. Many authors justify the lack of research on the disadvantages of using social networks as premature in light of the recent revolution of social networks as an important advertising medium. Another reason for limited research on the topic of the benefits of using social networks, primarily in the field of international advertising, is, in addition to the usual difficulties in coordinating data around the world, the excessive amount of information that should be collected, processed and analyzed, and would overwhelm all capacities for that intended (Okazaki & Taylor, 2013, p. 57). Disadvantages of marketing communication on social networks include the time required to manage a profile on a social network, a certain degree of effort and a certain level of knowledge required for this type of online communication (Zimmerman & Sahlin, 2010, p. 11). Negative feedback, lack of control over user responses and difficulty in choosing the right network to achieve goals are also cited as disadvantages of using social networks. The fact that marketing communication on social networks is sometimes seen as an intrusive and aggressive form of communication is also cited as a problem (Tomše & Snoj, 2014, p. 135).

CONCLUSION

These technologies raise knowledge and information exchange, communication and marketing to a new level and benefit both businesses and customers. They provide an excellent opportunity for high exposure at a low cost; offer the possibility of setting up interactive communication with customers and getting more information about their needs. However, in the midst of this ever-changing online environment and growing convergence, family business firms face the challenge of having to keep up with the trends. Using social networks, such as Facebook and Instagram, is not always as easy as it seems; it requires new ways of thinking, engaging and interacting. According to research, Facebook and Instagram are the most popular social networks. Today's online landscape is a point of connection. Entrepreneurs must make connections and maintain them. They have the opportunity to create long-term relationships by engaging customers in mutual interaction. This is where they target specific audiences, deliver exclusive offers, and deliver important ongoing messages to their existing and potential customers. Social networks can be a powerful tool for entrepreneurs and can support marketing communications. Social media is not the only way to sell; through them, entrepreneurs can maintain a connection with their customers and can share information and virtual experiences with potential customers.

REFERENCES

1. Aldrich, H. (2014). The democratization of entrepreneurship? Hackers, makerspaces, andcrowdfunding. Annual Meeting of the Academy of Management (Vol.10). Philadelphia.
2. Bayo-Moriones, A. and Lera-Lopez, F. (2007). A firm-level analysis of determinants of ICT adoption in Spain. Te ch no va t i o n, 27,6/7, 352—366.
3. Breton-Miller, I. L., & Miller, D. (2016). Family firms and practices of sustainability: Acontingency view. Journal of Family Business Strategy, 7(1), 26–33.
4. Constantinidis, C. (2011). How do women entrepreneurs use the virtual network Facebook?The impact of gender. The International Journal of Entrepreneurship and Innovation,12(4), 257-269.
5. Evert, R. E., Martin, J. A., McLeod, M. S., & Payne, G. T. (2016). Empirics in familybusiness research: Progress, challenges, and the path ahead. Family Business Review,29(1), 17–43.
6. Galati, A., Crescimanno, M., Rossi, M., Farruggia, D., & Tinervia, S. (2014). Thedeterminants affecting the internationalization of the Italian SMEs producingsparkling wines: An empirical study on the RBV of the firms. International Journal ofGlobalisation and Small Business, 6(2), 100–118.
7. Gardašević, J., Ćirić, M., & Carić, M. (2018). Understanding the motives for using social networks in the function of improving communication with consumers. Marketing, 49(4), 311-320.
8. Gardašević, J., Lalović, P., & Fimić, N. (2020). The importance of using the social network instagram in the development of women's entrepreneurship. Ekonomija: teorija i praksa, 13(4), 99-113.

9. Gligorijevic, B., & Leong, B. (2011). Trust, reputation and the small firm: Building online brand reputation for SMEs. In Proceedings of the International AAAI Conference on Web and Social Media (Vol. 5, No. 1, pp. 494-497).
10. Jalonen, H. (2014). Social media and emotions in organisational knowledge creation. InProceedings of the 2014 federated conference on computer science and informationsystems (pp. 1371–1379). Institute of Electrical and Electronics Engineers.
11. Kallmuenzer, A., Nikolakis, W., Peters, M., & Zanon, J. (2018). Trade-offs betweendimensions of sustainability: Exploratory evidence from family firms in rural tourismregions. Journal of Sustainable Tourism, 26(7), 1204–1221.
12. Kondopoulos, D. (2011). Internet marketing advanced techniques for increased market share. Chimica Oggi-Chemistry Today, 29, 3, 9—12.
13. Lupa-Wójcik, I. (2020). The Role of Social Media in Entrepreneurship: a Conceptual CaseStudy. Przedsiębiorczość-Edukacja, 16(2), 176-188.
14. Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective ofentrepreneurship. Entrepreneurship Theory and Practice, 41 (6), 1029-1055.
15. Obermayer, N., Kővári, E., Leinonen, J., Bak, G., & Valeri, M. (2022). How social media practices shape family business performance: the wine industry case study. European Management Journal, 40(3), 360-371.
16. Okazaki, S. and Taylor, C.R. (2013). Social media and international advertising: theoretical challenges and future directions. International Marketing Review, 30., 1, 56-71.
17. Pekkala, K., & van Zoonen, W. (2021). Work-related social media use: The mediating roleof social media communication self-efficacy. European Management Journal.
18. Peters, K., Chen, Y., Kaplan, A. M., Ognibeni, B., & Pauwels, K. (2013). Social mediametrics - a framework and guidelines for managing social media. Journal ofInteractive Marketing, 27, 281–298.
19. Siamagka, N.-T., Christodoulides, G., Michaelidou, N., & Valvi, A. (2015). Determinants of social media adoption by B2B organizations. Industrial Marketing Management, 51, 89–99.
20. Tiago, M.T.P.M. B. and Verissimo, J.M.C. (2014). Digital marketing and social media: Why bother? Business Horizons, 57, 703—708.
21. Tomše, D. i Snoj, B. (2014). Marketing Communication on Social Networks- Solution in the Times of Crisis. Marketing, 45, 2, 131-137.
22. Van Stel, A., Carree, M., & Thurik, R. (2005). The effect of entrepreneurial activity onnational economic growth. Small business economics, 24 (3), 311-321.
23. Venkataraman, S. (1997). The distinctive domain of entrepreneurship research. Advances inentrepreneurship, firm emergence and growth, 3 (1), 119-138.
24. Whitla, P. (2009). Crowdsourcing and its application in marketing activities. Contemporary Management Research, 5, 1, 15—28.
25. Zaheer, H., Breyer, Y., Dumay, J., & Enjeti, M. (2019). Straight from the horse's mouth:Founders' perspectives on achieving ‘traction’in digital start-ups. Computers in HumanBehavior, 95, 262-274.
26. Zimmerman, J. and Sahlin, D. (2010). Social media marketing for Dummies. Indianapolis, Indiana: Wiley Publishing, Inc.

PURPOSE OF THE MODEL FOR MATURITY ASSESSMENT INTRODUCTION OF THE INDUSTRY 4.0 CONCEPT

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Summary –The implementation of the Industry 4.0 concept is necessary in all companies that want to be competitive on the market in the 21st century. Practice has shown that the introduction of a modern form of business is not simple, nor is it completely transparent. Knowledge of how successful companies are in implementing the Industry 4.0 concept is provided by maturity assessment models. Literary sources show a significant expansion of these models, including a large number of variations. This paper seeks to present the variety of models that have emerged in recent years, as well as the characteristics that describe them. The aim of this paper is to point out the importance of maturity assessment models and their usefulness in the process of introducing the concept of Industry 4.0.

Keywords: *Assessment models, maturity, implementation, Industry 4.0*

1. INTRODUCTION

Tools that deal with the assessment of the company's development in a certain domain are called Maturity Models. These models were first used almost half a century ago, but the need for their application has not disappeared. Industry 4.0 is often associated with this tool, due to the need to assess the maturity of the company in introducing a modern business concept.

Maturity models, in addition to assessing the current state of success, i.e. the level of maturity, provide companies with an insight into their strengths and weaknesses in business. Also, they often contain guidelines that indicate what needs to be done to achieve a certain level of maturity. These are the features that facilitate the process of introducing the concept of Industry 4.0, because they awaken awareness of the level of maturity companies are at, and how to raise the current level of maturity to a higher level.

In accordance with the above, this paper deals with the purpose of the maturity model when introducing the concept of Industry 4.0. A large number of models in the scientific literature testify to the frequent application of the mentioned tool. In this paper, 25 models are presented and their importance, which sets them apart from others, is briefly described. The aim of this paper is to deepen the awareness of the usefulness of the maturity model, and the lack of a generally accepted model, with reliable relevance for all companies.

2. SOMETHING MORE ABOUT MATURITY ASSESSMENT MODELS

Authors Proença and Borbinha (2016) consider the term maturity as an evaluation criterion, which determines the current and desired state. The maturity stage is still associated with the perfect state (Nikkhou et al., 2016). Some authors (Schumacher et al., 2016) describe maturity models as a means of measuring and comparing the state of the company with predefined requirements, which must be met in order to reach the desired state. There is also an opinion that maturity represents something complete, perfect and ready. Santos (2018), adds that the processes, areas and certain characteristics of people evolve through the development process, and that through the model maturity can be assessed at predefined levels.

Maturity assessment models seek to assess the current level of maturity, providing guidance on how to achieve the desired rank. Every company should strive for complete maturity, i.e. maturity in all segments, in order to achieve the highest possible profit and be successful in business.

The models consist of dimensions, which represent groupings of maturity indicators according to thematic groups (Rajnai&Kocsis, 2018). In addition to the dimensions, the maturity models define the levels in which companies are classified depending on the fulfillment of the above. More on the key elements of the maturity model can be found in Sony and Naik (2020).

Assessment of maturity is carried out on the basis of self-assessment of employees or by hiring external persons. Accordingly, some authors (Jesus et al., 2022) believe that the effectiveness of maturity models often depends on the competence of company management or consultants. In terms of self-assessment, employees question themselves about how aware they are of the presence of the person whose maturity is being measured. In the case of this paper, the self-assessment is based on Industry 4.0; how employees understand and understand the 4.0 concept; what their company is doing to introduce a work system in line with the Fourth Industrial Revolution; what is the attitude of the company in this regard; and another.

Companies that meet all the requirements of the given model are considered the most mature, that is, the most advanced in that field of measurement. Companies that meet the requirements only to a certain extent are ranked in a lower level. The benefit of models in such cases is that they provide insight into the shortcomings that need to be overcome in order to reach a higher level.

3. THE PURPOSE OF USING THE INDUSTRY 4.0 IMPLEMENTATION MATURITY ASSESSMENT MODEL

Schumacher et al. (2016) explored the purpose of maturity models in relation to Industry 4.0. They found justification for their involvement in three basic reasons:

- the complexity of the concept of Industry 4.0, observed by companies, the weight of which is further deepened by the absence of strategic guidelines;
- misunderstanding of the essence of the Fourth Industrial Revolution, which leads to an increased level of uncertainty in terms of the good and bad sides of its introduction in companies;
- the limiting circumstance, that there is often an inadequate assessment of the company's readiness for the transformation that lies ahead of them, and therefore there is a lack of initiative to act in that direction.

Maturity assessment models allow businesses to locate areas where implementation is lagging behind and realize where they need to invest more resources to accelerate the transition. In support of this, the authors Comuzzi and Patel (2016) highlighted the benefits of applying maturity models when implementing digital transformation, stressing that they are very effective in providing guidelines for a cost-effective path.

Maturity models are needed by all companies (Meißner et al., 2017), because in addition to evaluating the company, they offer the users of this tool and guidelines for better business management in the future (Pöppelbuß&Röglinger, 2011). That is, by identifying the company's strengths and weaknesses, management is able to make better decisions when defining further strategy (Proença&Borbinha, 2016). Therefore, maturity models have become an important tool for transforming business models (De Jesus & Lima, 2020).

The purpose of the maturity assessment model is not to subject companies to a rigorous assessment, but to identify potentials and indicate deficiencies that need to be eliminated, in order to enable an individual transformation process. The basis of the model is to guide the organization towards improvement, providing a roadmap using key dimensions (Gökalp& Martinez, 2021).

4. VARIETY OF MATURITY ASSESSMENT MODELS AND CHARACTERISTICS THAT DISTINGUISH THEM

Hizam-Hanafiah et al., based on research on model maturity in 2020, concluded that most models were created during 2016/18. year, which indicates that the models are relatively young tools on the market. However, despite this, maturity models are considered to be the most used tools for assessing the maturity of a company (Schumacher et al., 2016). Rahamaddulla et al. (2021) also wrote about their frequent use in assessment services. Accordingly, the number of models has increased dramatically in recent years (Sony &Naik, 2020), as well as the number of non-standardized questionnaires, which are used as assessment tools (Flamini&Naldi, 2022). Some examples of maturity models are given in table 1. It is important to note that there is no universally accepted model, nor can one be singled out as ideal for all companies.

Table 1. Examples of maturity models and their distinguishing characteristics

Maturity Model Name/Characteristics:	Author(s) and year of publication:
Industry 4.0 Maturity Model Technology focused, validated in a real environment and easy to self-assess.	*Wagire et al., 2021.*
Assessing the Maturity Model of Industry 4.0 by Design Principles It is based on the basic design principles of Industry 4.0 during the development of the maturity model.	*Dikhanbayeva et al., 2020.*
Industry 4.0 Maturity Model for Machine Tool Companies An affordable and easy-to-use tool, intended for small and medium-sized enterprises, based on self-assessment.	*Rafael et al., 2020.*
Maturity model for logistics 4.0 Based on three basic macro aspects; points out the strengths and weaknesses of companies for the transition to Logistics 4.0.	*Facchini et al., 2019.*
Maturity model of logistics 4.0 Recommendations for achieving Logistics 4.0.	*Oleśków-Szłapka&Stachowiak, 2019.*
Intellectual capital maturity model A theoretical model based on two capability maturity models.	*Vaz et al., 2019.*
Digitization Maturity Model for SMEs The model analyzes the current maturity level of digitization and is part of a project to determine best practices for creating product service systems.	*Blatz et al., 2018.*
APM Maturity Model (Asset Performance Management Maturity Model) A strategic roadmap for digital production.	*Dennis et al., 2018.*
Adoption Maturity Model - AMM 4 different types of Industry 4.0 adoption revealed.	*Scremin et al., 2018.*
A preliminary maturity model for the use of digitization in manufacturing Identification of the key steps required to implement the smart factory concept.	*Sjödin et al., 2018.*
The concept of an evolutionary maturity-based model of migration Locating the current state and guidelines for achieving the future goal.	*Stefan et al., 2018.*
Maturity and readiness model for Industry 4.0 strategy It points to the importance of the maturity model.	*Ustundag et al., 2018.*
Industry 4.0 maturity assessment model Standardization in continuous benchmarking and business improvement.	*Gökalp et al., 2017.*

IoT Technology Maturity Model The model was created so that it can help businesses adopt IoT technologies more efficiently and quickly.	*Jæger&Halse, 2017.*
Digitization Maturity Model for the Manufacturing Industry Scientific development of a maturity model related to digital transformation.	*Klötzer&Pflaum, 2017.*
Industry 4.0 Maturity Index Guidelines for achieving the six stages that will enable digital transformation.	*Schuh et al., 2017.*
Maturity Model for Data-Driven Manufacturing (M2DDM) Overview of I4.0 features across multiple reference architectures and development of a maturity model for IT architectures for job-based manufacturing.	*Weber et al., 2017.*
Industry 4.0 Architecture Reference Model (RAMI4.0) The RAMI4.0 reference architecture model is proposed for standardization as DIN SPEC 91345.	*Bitkom et al., 2016.*
The three-stage maturity model The systematic implementation of the phases leads the company to their individual specific vision and the vision of cooperation between different companies.	*Ganzarain&Errasti, 2016.*
Digital Operations Self-Assessment (PvC) Blueprint for success, how to create a leading digital enterprise.	*Geissbauer et al., 2016.*
A maturity model for the Industrial Internet An explanation of how maturity models facilitate the implementation of the Industrial Internet.	*Menon et al., 2016.*
Strengthened and implementation strategy for the industry It clarifies the approach to introducing individual maturity-based methods.	*Lanza et al., 2016.*
System Integration Maturity Model Industry 4.0 (SIMMI 4.0) It enables the classification of IT systems with a focus on the requirements of Industry 4.0.	*Leyh et al., 2016.*
Maturity model for assessing the readiness of Industry 4.0 Expanding the technological focus to organizational aspects.	*Schumacher, et al., 2016.*
Affiliate Maturity Model Integrating IT and operational technology to improve performance and minimize risk.	*Automation, 2014.*

The availability of a large number of models calls into question their effectiveness. Not all models are suitable for use in every company. Scope, quality, transparency and other features vary from model to model. The attached table provides an insight into the diversity and general acceptance of the maturity model, and the results of the application point to their importance. Finding out which business areas need to be improved and in what way is extremely important information for every company. According to the importance of the introduction of Industry 4.0 in companies, one can see the importance of maturity models, which create a road map for successful implementation.

5. CONCLUSION

Due to the complexity of implementing the concept of Industry 4.0, many companies decide to apply the maturity model. This tool provides feedback to companies, what level of maturity they achieved in the previous period, in which domains of business they have the greatest difficulties and accordingly, where they have to invest the most.

The effectiveness of the application of the maturity model has resulted in the expansion of the growth of various models, which are most often created for the company's own needs. There is no one-size-fits-all maturity model that will benefit all businesses, so be very careful when selecting an existing maturity model.

LITERATURE

Automation, R. (2014). The connected enterprise maturity model. *Rockwell Automation*, *12*, 1-12.

Bitkom, E., Vdma, E., &Zvei, E. (2016). Implementation strategy Industrie 4.0: report on the results of the Industrie 4.0 plataform.

Blatz, F., Bulander, R., &Dietel, M. (2018, June). Maturity model of digitization for SMEs. In *2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)* (pp. 1-9). IEEE.

Comuzzi, M., & Patel, A. (2016). How organisations leverage big data: A maturity model. *Industrial management & Data systems*, 116(8), 1468-1492.

Dennis, M., Ramaswamy, C., Ameen, M. N., &Jayaram, V. (2018). Asset Performance Management Maturity Model Strategic Roadmap to Digital Manufacturing. *Capgemini: Paris, France*.

Dikhanbayeva, D., Shaikholla, S., Suleiman, Z., &Turkyilmaz, A. (2020). Assessment of industry 4.0 maturity models by design principles. *Sustainability*, 12(23), 9927.

Facchini, F., Oleśków-Szłapka, J., Ranieri, L., &Urbinati, A. (2019). A maturity model for logistics 4.0: An empirical analysis and a roadmap for future research. *Sustainability*, *12*(1), 86.

Flamini, M., &Naldi, M. (2022). Maturity of Industry 4.0: A Systematic Literature Review of Assessment Campaigns. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(1), 51.

Ganzarain, J., &Errasti, N. (2016). Three stage maturity model in SME's toward industry 4.0. *Journal of Industrial Engineering and Management (JIEM)*, *9*(5), 1119-1128.

Geissbauer, R., Vedso, V., &Schrauf, S. (2016). Industry 4.0: Building the Digital Enterprise. *Pricewaterhouse Coopers*.

Gökalp, E., & Martinez, V. (2021). Digital transformation capability maturity model enabling the assessment of industrial manufacturers. *Computers in Industry*, *132*, 103522.

Gökalp, E., Şener, U., &Eren, P. E. (2017). Development of an assessment model for industry 4.0: industry 4.0-MM. In *Software Process Improvement and Capability Determination: 17th International Conference, SPICE 2017, Palma de Mallorca, Spain, October 4–5, 2017, Proceedings* (pp. 128-142). Springer International Publishing.

Hizam-Hanafiah, M., Soomro, M. A., & Abdullah, N. L. (2020). Industry 4.0 readiness models: a systematic literature review of model dimensions. Information, 11(7), 364.

Jæger, B., &Halse, L. L. (2017). The IoT technological maturity assessment scorecard: A case study of norwegian manufacturing companies. In *Advances in Production Management Systems. The Path to Intelligent, Collaborative and Sustainable Manufacturing: IFIP WG 5.7 International Conference, APMS 2017, Hamburg, Germany, September 3-7, 2017, Proceedings, Part I* (pp. 143-150). Springer International Publishing.

Jesus, C. D., & Lima, R. M. (2020). Literature search of key factors for the development of generic and specific maturity models for Industry 4.0. *Applied Sciences*, *10*(17), 5825.

Jesus, C., Lima, R. M., Barretiri, L., & Lopes, S. I. (2022, June). A Maturity Model Proposal with Readiness Level Assessment for Organizational Processes Improvement. In *2022 17th Iberian Conference on Information Systems and Technologies (CISTI)* (pp. 1-4). IEEE.

Klötzer, C., &Pflaum, A. (2017). Toward the Development of a Maturity Model for Digitalization within the Manufacturing Industry's Supply Chain. In *Proceedings of the 50th Hawaii International Conference on System Sciences*, 4-7 January 2017, Hilton Waikoloa Village, HI, USA (pp. 4210-4219).

Lanza, G., Nyhuis, P., Ansari, S. M., Kuprat, T., &Liebrecht, C. (2016). Befähigungs-und EinführungsstrategienfürIndustrie 4.0. *ZeitschriftfürwirtschaftlichenFabrikbetrieb*, *111*(1-2), 76-79.

Leyh, C., Bley, K., Schäffer, T., &Forstenhäusler, S. (2016, September). SIMMI 4.0-a maturity model for classifying the enterprise-wide it and software landscape focusing on Industry 4.0. In *2016 federated conference on computer science and information systems (fedcsis)* (pp. 1297-1302). IEEE.

Meißner, A., Glass, R., Gebauer, C., Stürmer, S., & Metternich, J. (2017). Hindernisse der Industrie 4.0–Umdenkennotwendig?.*ZeitschriftfürwirtschaftlichenFabrikbetrieb*, *112*(9), 607-611.

Menon, K., Kärkkäinen, H., &Lasrado, L. (2016, July). Towards a maturity modeling approach for the implementation of industrial internet. In *Proceeding of the 20th Pacific Asia conference on information systems (PACIS 2016)*. Association for Information Systems AIS.

Nikkhou, S., Taghizadeh, K., &Hajiyakhchali, S. (2016). Designing a portfolio management maturity model (Elena). *Procedia-Social and Behavioral Sciences*, 226, 318-325.

Oleśków-Szłapka, J., &Stachowiak, A. (2019). The framework of logistics 4.0 maturity model. In *Intelligent systems in production engineering and maintenance* (pp. 771-781). Springer International Publishing.

Pöppelbuß, J., &Röglinger, M. (2011). What makes a useful maturity model? A framework of general design principles for maturity models and its demonstration in business process management. *ECIS*.

Proença, D., &Borbinha, J. (2016). Maturity models for information systems-a state of the art. *Procedia Computer Science*, *100*, 1042-1049.

Proença, D., &Borbinha, J. (2016). Maturity models for information systems-a state of the art. *Procedia Computer Science*, *100*, 1042-1049.

Rafael, L. D., Jaione, G. E., Cristina, L., &Ibon, S. L. (2020). An Industry 4.0 maturity model for machine tool companies. *Technological forecasting and social change*, *159*, 120203.

Rahamaddulla, S. R. B., Leman, Z., Baharudin, B. H. T. B., & Ahmad, S. A. (2021). Conceptualizing smart manufacturing readiness-maturity model for small and medium enterprise (sme) in Malaysia. *Sustainability*, *13*(17), 9793.

Rajnai, Z., &Kocsis, I. (2018, February). Assessing industry 4.0 readiness of enterprises. In *2018 IEEE 16th world symposium on applied machine intelligence and informatics (SAMI)* (pp. 000225-000230). IEEE.

Santos, R. C. (2018). *Proposta de modelo de avaliação de maturidade da Indústria 4.0* (Doctoral dissertation). Universidade de São Paulo, Brazil.

Schuh, G., Anderl, R., Gausemeier, J., Hompel, M. T., &Wahlster, W. (2017). Industry 4.0 maturity index. *Managing the digital transformation of companies, Acatech–National Academy of Science and Engineering*.

Schumacher, A., Erol, S., &Sihn, W. (2016). A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises. *Procedia Cirp*, *52*, 161-166.

Scremin, L., Armellini, F., Brun, A., Solar-Pelletier, L., &Beaudry, C. (2018). Towards a framework for assessing the maturity of manufacturing companies in industry 4.0 adoption. In *Analyzing the impacts of Industry 4.0 in modern business environments* (pp. 224-254). IGI Global.

Sjödin, D. R., Parida, V., Leksell, M., &Petrovic, A. (2018). Smart Factory Implementation and Process Innovation: A Preliminary Maturity Model for Leveraging Digitalization in Manufacturing Moving to smart factories presents specific challenges that can be addressed through a structured approach focused on people, processes, and technologies. *Research-technology management*, *61*(5), 22-31.

Sjödin, D. R., Parida, V., Leksell, M., &Petrovic, A. (2018). Smart Factory Implementation and Process Innovation: A Preliminary Maturity Model for Leveraging Digitalization in Manufacturing Moving to smart factories presents specific challenges that can be addressed through a structured approach focused on people, processes, and technologies. *Research-Technology Management*, *61*(5), 22-31.

Sony, M., &Naik, S. (2020). Key ingredients for evaluating Industry 4.0 readiness for organizations: a literature review. *Benchmarking: An International Journal*, *27*(7), 2213-2232.

Stefan, L., Thom, W., Dominik, L., Dieter, K., & Bernd, K. (2018). Concept for an evolutionary maturity based Industrie 4.0 migration model. *Procedia Cirp*, *72*, 404-409.

Ustundag, A., Cevikcan, E., Akdil, K. Y., Ustundag, A., &Cevikcan, E. (2018). Maturity and readiness model for industry 4.0 strategy. *Industry 4.0: Managing the digital transformation*, 61-94.

Vaz, C. R., Selig, P. M., &Viegas, C. V. (2019). A proposal of intellectual capital maturity model (ICMM) evaluation. *Journal of Intellectual Capital*, *20*(2), 208-234.

Wagire, A. A., Joshi, R., Rathore, A. P. S., & Jain, R. (2021). Development of maturity model for assessing the implementation of Industry 4.0: learning from theory and practice. *Production Planning & Control*, *32*(8), 603-622.

Weber, C., Königsberger, J., Kassner, L., &Mitschang, B. (2017). M2DDM–a maturity model for data-driven manufacturing. *Procedia Cirp*, *63*, 173-178.

PRINCIPLES OF NEURO LEADRSHIP

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Abstract: Neuro leadership is an emerging area that combines neuroscience, psychology and management studies. This topic is relatively new to observe, as the recent ten years brought the biggest contribution. This paper aims to outline the main principles and benefits of the application of neuropsychology fundamentals into leadership and serves as a research basis for further examination. It also puts an emphasis on the importance of implementing principles of neuro leadership to the managerial activities and even to educational processes.

Keywords: neuro leadership, neuroscience, leadership, management, managerial behavior

INRODUCTION- NEURO LEADERSHIP

The field of science is in a constant state of evolution, continuously expanding our understanding of the world around us and especially us ourselves, our behavior, motivation and performance. Technology advancements have had a profound impact on society, particularly in the realm of the understanding of the human brain. This remarkable organ serves as a repository of memories, pushing us to surmount obstacles and seek nonstandard solutions and innovations to achieve predefined goals. However, we shall contemplate the following query: Is it enough to allow our brain to naturally flourish, relying solely on charisma, innate potential and personal experiences? Or can we further enhance our own growth and sustainable progress towards shared goals?
This uncertainty leads us to a field of study we know as neuro leadership, psychology of leadership in other words or the art of synchronizing the science of the brain with leadership behaviors as mentioned in the article of Tobias Kiefer (Kiefer, 2011). Ever-increasing body of literature shows that neuro leadership science observes the brain and analyzes its effects on leadership abilities of managers, team leaders, mentors, or even professors and coaches, or any other person who has a superior position and influential access to a specific group of people (Norlund& D´Amato, 2018, p. 2400).

Neuro leadership theory relates to numerous managerial disciplines, such as personal growth, training, management of changes, productivity and perseverance, education, consulting and coaching. This interdisciplinary approach offers valuable insight on how the brain reacts in relation to leadership impulses, motivation, emotions, or cognitive processes. Furthermore, this approach transforms theoretical observations into practical application with the objective of empowering leaders to optimize their performance and positively impact individuals and groups they lead. This includes exploring how leaders can create positive working environments that promote effectiveness, trust, and employees' well-being (Norlund& D´Amato, 2018, p. 2400).

IMPORTANCE OF NEURO LEADERHSIP

Following the globalization tendencies, market competitiveness and series of global crises, economies tend to work on sustainable growth, fair opportunities, inclusion, and foremost increasing revenue and performance. Satisfaction and employees' happiness leading to productivity and efficiency, is the fundamental cornerstone for sustainable growth and achieving the organizational goals and objectives.

Leader stands up for an essential role for implementing necessary organizational changes and strategies. Their main responsibility stands on the pillar of transformation from formal (task-oriented) workspaces to happier and more productive working environments (people-oriented). One example of fulfilling happiness and satisfaction at the workplace is leaving workers to react, express their ideas and innovation and brainstorm on shared values and strategies. Latest studies proved that the workers are keener to succeed and be promoted when the manager helps them and leads them to find their strengths rather than focusing on their weaknesses (Ruiz-Rodríguez et al., 2023).

The approach of neuroscience is suitable for use in various areas of our professional lives, not solely in leadership, but in education, business, politics and sociology as well. 21st century research proves that happiness is one of the means to increase productivity, driving innovation, competitiveness and other creative strategies followed by potential positive organizational changes in different institutions across borders (Dela Rosa, 2023).

Notwithstanding, it is now firmly established in various studies that a thoughtfully selected management style and an inclusive approach to leadership can unequivocally enhance workplace morale, satisfaction, efficiency and even productivity and organizational performance. The field of neuro leadership specifically seeks to develop assessment tools for effective leadership, enhance leadership capabilities, and uncover subconscious influences on behavior (Kuhlmann& Kadgien, 2018).

KEY PRINCIPLES OF NEURO LEADERSHIP

Neuro leadership is the means of connecting a team with their leader and vice versa. It tends to set a meaningful and respectful communication within teams. Techniques of this approach include verbal expressions and nonverbal elements, active listening and observation. The principles of neuro leadership embrace a set of key concepts and strategies applied.

By establishing a so-called modern *learning organization* supported by following neuro leadership principles, leaders may improve learning skills, and help their company to maintain a leading position in the market and set the market trends:

- **Every brain is unique**: Embracing individuality and understanding the variety of reactions and behaviors is the key advice when debating on neuro leadership. We might discuss the general premises to maintain high effectiveness at work, however there will always be individuals with different ways of thinking that need individual approach which is more appreciated than group coaching or team leadership (Goswami, 2020).

- **Trust and collaboration**: Building trust is one of the most critical challenges in leadership. Lack of respect and trust may lead to rudeness and disrespect, low performance, but the opposite case of immense respect is dangerous too as it might cause a fear to speak and collaborate. It is therefore desirable to find a way to gain trust and thus support cooperation within the team. The element which plays another
- significant role in building a functional collaborating team is safety. To collaborate, contribute to discussions and problem-solving processes, a person must feel that the working environment is safe and fair (Saxena, 2023).
- **Regulate emotions**: Emotions are a subconscious element of our reactions and play an important role in the way we think and make decisions. In this case, it is not important to work on self-awareness and to learn how to calm our irrational emotional reactions only, but foremost to understand and predict the emotional reactions of the other team members as well. Another extreme is the lack of emotional expression. In this case, the team members might have the impression that the leader relies solely on professional goals and not on people which can cause disrespect and relief (Graph& Dimovski, 2014).
- **Reward system**: As with many areas of human growth, we are allowed to push ourselves to achieve better results, productivity, or effectiveness by stepping out of our comfort zone. Driven by our brain and consciousness, we naturally seek rewarding situations more than punishment. Following this, we can train and motivate our brain to perform by reinforcing positive behavior which is more likely to repeat (Graph& Dimovski, 2014).
- **Self-awareness and growth mindset**: By encouraging the team members to enhance the growth mindset might lead to new skills development or improve the ability to adapt. Part of the growth mindset is formulation of feedback and constructive criticism. The feeling of success might lead to another positive behavior in the future and to enhancing an open approach to potential future changes (Saxena, 2023).
- **Problem solving and decision making**: Every brain has its own limitations. Neuroscience helps to work on the specific skills to embrace the change and react. Decision making process in the realm of neuroscience is characterized by an out of the box way of thinking and finding nonstandard solutions. The brain is thus able to be trained and the limits further with the aim of finding creative solutions, and we can know the term as brainstorming (Trepel ett al., 2005).

PRACTICAL USE AND EXPERIMENTAL CASE STUDIES

Based on above mentioned argumentation, we can assume few essential abilities and skills necessary for a leader. First of all, leaders should engage, show respect and interest in their co-workers. Secondly, leaders should emphasize individual motivation. As motivation is what drives our performance, a leader's responsibility is to get to know the team and act according to individual needs, rather than focusing on corporate goals and financial results only. Leaders might focus on building connections, a safe environment for team interactions in a friendly atmosphere. The 21st century also highlights the necessity to adapt and the flexible process of problem-solving tactics (Gkintoni et al. , 2022, p. 894).

Mary Slaughter, specialist on Behavioral Change, culture and leadership, pushed the term of neuro leadership even further. She approaches this concept as a cultural component of society. By stating that culture is about sharing everyday habits, she emphasizes the need for a consistent approach to neuro leadership. Other than habits being contagious, she also stresses the fact that the integration of neuro leadership practices are essential for building a functional and healthy growing organization. She encourages the leader and directors to include a neuro leadership approach in the company's value and identity (Slaughter, 2018).

Australian neuroscientist, Dr. David Rock, also known as the pioneer of the term neuro leadership, points out that the approach is relatively new, but it does not take years to implement it and try to seek results. In his book *Your Brain at Work* presents instructions on how to take care of our brains so that it achieves high performance and fulfils its potential. This publication provides methods and advice on how to optimize the way we think. The fundamental concepts presented in this book are regularly published in the form of articles in the blog bearing the identical name as the book does (Rock, 2014).

His projects lead under the Neuro Leadership Institute provides numerous case studies to demonstrate that these principles have a real impact on the companies. They observe the impact of neuro leadership practices on the improvement in manager behavior, and they cover the fields such as stress effects on brain's capacity, coaching of young workers, corporate jargon and communication, multitasking, corporate diversity, layoffs, working from home obstacles, transparency and many more. One of the latest studies they executed in 2022 shows the influence of napping on leaders' performance and normalizing their brain activity (Cassiday, 2022). This study was based on experimental meta-data analysis of Frédéric Dutheil, and proved that it enhances performance, memory and ability to learn. A total of 381 participants helped to confirm that the balance for improving brain performance can thus be achieved by short naps lasting up to 20 minutes (Dutheil, 2021).

In 2017, Dr Paul Zak performed a study published in *Harvard Business Review* on how to boost employee effectiveness based on a neuroscience strategy implemented by managers related to building trust. This study is developing a framework for culture dominated by trust and happiness in the working environment. Paul Zak considers the oxytocin as the molecule of trust, essential in the leadership processes. By monitoring the level of oxytocin at the participants and by stimulation of oxytocin production, Paul Zak concluded that the increased level of trust, conjunct by an increased level of oxytocin, is the core element of increasing effectiveness, performance and the satisfaction at the workplace (Zak, 2017).

A fascinating examination led by Jeffrey L. Fanning went even further. He performed an experiment on 125 subjects for 12 months aiming to understand how subconsciousness controls our behaviors in life. EEG technology, brain mapping and neuro feedback showed the influence of the brain functioning on decision making processes, creativity, emotional intelligence, and resilience. This research helped to understand the leaders' need to improve their self-awareness to boost performance and optimize the strategy used in business and education (Fannin, 2012). Another research study using EEG technology performed by Waldman, Balthazard and Peterson from 2011, showed brain activity in regards to charismatic leaders. They found out that the charismatic leaders use both sections of their brains and act based on neuroscience principles (Boyatzis, 2014).

CONCLUSION

To sum up, Neuro leadership is a science of the human nervous system, brain and behavior in order to achieve effectiveness and performance successes by improving leadership skills. Neuro leadership has gained significant attention and recognition. Nowadays, there are plenty of organizations, science research, papers and forums dedicated to exploring and disseminating knowledge in the realm of neuro leadership and to share personal experience, to discuss findings, or to identify challenges and formulate recommendations. Interdisciplinary approach of neuro leadership is now applied to various areas, for example to education and training, coaching, mentoring or consulting, politics, sociology and management.

The ultimate goal of the neuro leadership research is to provide examples on how to improve practices, change management, promote out of the box thinking and employee engagement and their satisfaction. Understanding neuro leadership means understanding the impact of our emotions, reactions and behaviors and the art of manipulating people to increase motivation and performance. Neuro leadership can be understood as the constant training opportunity, which facilitates the process of implementing changes, creating successful strategies and learning adapting by the time.

The existing approach describes the importance, field of use and benefits of neuroscience, its basic characteristics and recommendations for persons in leadership positions. The current state of knowledge would benefit from focusing on practical use, highlighting real examples and activitely presenting them to leaders who could contribute to the growth of the organizations where they operate. The issue remains in the area of conceptualizing the common understatement of the leadership role and neuro leadership effects on effectiveness and performance.

Several studies demonstrated that the impact of neuro leadership must be seen as a constant building element for modern organizations. Companies should get eager to learn and to push their limits towards happiness, satisfaction and effectiveness at work rather than focusing solely on results and financial growth.

REFERENCES:

BOYATZIS, R. E. (2014). *Possible Contributions to Leadership and Management Development From Neuroscience.* In *Academy of Management Learning & Education.* URL: https://doi.org/10.5465/amle.2014.0084

CASSIDAY, L. (2022). *The Neuroscience of Napping.* In *NeuroLeadership Institute.* URL: https://neuroleadership.com/your-brain-at-work/neuroscience-of-napping

DELA ROSA, J. A. R. (2023). *Neuroleadership in Transforming Educational Leaders*. In *EAJMR*. URL: https://doi.org/10.55927/eajmr.v2i5.3984

DUTHEIL, F. et col. (2021). *Effects of a Short Daytime Nap on the Cognitive Performance: A Systematic Review and Meta-Analysis.* In *IJERPH*. URL: https://doi.org/10.3390/ijerph181910212

FANNIN, J. L. (2021). *Neuroscience Reveals the Mind/Brain Interface and How It Controls Our Behaviors and Our Lives.* URL: https://subconsciouschange.com/wp-content/uploads/2012/07/tca-action-jeff-fannin-gift-2.pdf

GKINTONI, E., ANTONOPOULOU, H., HALKIOPOULOS, C. (2022). *Neuroleadership as an Asset in Educational Settings: An Overview.* In *Emerging Science Journal.* p. 894. URL: https://www.ijournalse.org/index.php/ESJ/article/view/792

GOSWAMI, U. (2020) *What is neuroscience?*. In *British Academy.* URL: https://www.thebritishacademy.ac.uk/blog/what-is-neuroscience/

GRAPH, B. DIMOVSKI, V. (2014) *Neuroleadership and an Advanced Learning Organization*. http://www.g-casa.com/conferences/milan/paper/Grah.pdf

KIEFER, T. (2011). *Neuroleadership - Making change happen.* In *IVEY Business Journal*. URL: https://iveybusinessjournal.com/publication/neuroleadership-making-change-happen/

KUHLMANN, N., KADGIEN, C. A. (2018). *Neuroleadership: Themes and limitations of an emerging interdisciplinary* field. URL: https://doi.org/10.1177/0840470417747004

NORLUND, O. N., D'AMATO, R. C. (2018). *Neuroleadership.* In *Encyclopedia of Clinical Neuropsychology.* Springer, p. 2400. URL: https://doi.org/10.1007/978-3-319-57111-9_9155

ROCK. D. (2014). *Your brain at work.* HarperCollins e-Books. ISBN 9780061943546

RUIZ-RODRÍGUEZ, R., ORTIZ-DE-URBINA-CRIADO, M. RAVINA-RIPOLL, R. (2023). *Neuroleadership: a new way for happiness management.* In *Humanities and Social Sciences Communications.* URL:https://www.nature.com/articles/s41599-023-01642-w

SAXENA, M. (2023). *3 Ways to leverage Neuro Leadership.* URL: https://www.linkedin.com/pulse/3-ways-leverage-neuro-leadership-mudit-saxena

SLAUGHTER, M. (2018). *Why NeuroLeadership Is Moving from 'Leadership and Change' to 'Culture and Leadership'.* URL: https://www.linkedin.com/pulse/why-neuroleadership-moving-from-leadership-change-mary-slaughter

TREPEL, CH., FOX, C. R., POLDRACK, R. A. (2005). *Prospect theory on the brain? Toward a cognitive neuroscience of decision under risk.* In *Cognitive Brain Research.* URL: https://doi.org/10.1016/j.cogbrainres.2005.01.016

ZAK, P. J. (2017). *The Neuroscience of Trust.* In *Harvard Business Review*. URL: https://hbr.org/2017/01/the-neuroscience-of-trust

SOME ISSUES IN CONTEMPORARY PSYCHOLOGY

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Abstract: Psychology as a science is faced with numerous challenges of understanding humans in an ever-changing environment, which is becoming more complex on a daily basis. People are proactive beings who change their environment and adapt it to themselves. Since humans are inseparable from their environment, by changing their environment, they irreversibly change themselves. We are witnessing global changes that are mainly the result of human activity. One of the most evident changes in recent years is the use of digital technology that has become ever-present in all segments of human existence. However, the use of technology is a good example of how the achievements of the advanced society can, actually work against humankind if not used purposefully. Psychology, just like any other science, aims to discover, explain and predict phenomena, and its ultimate purpose is to improve human life. In accordance with radical perspectives in Psychology, over the recent years, Psychology as a science has been criticized because of its subject-matter and method. The critics of so-called positivist psychology are asking whether Psychology as a science provides better understanding of people or misuses knowledge to obscure the human essence and support the objectives of contemporary consumer society. According to one of the major criticisms, Psychology is a strong proof of the thesis that science reflects values and interests of the scientists involved in it, and that it is not a strictly objective, value-free science, as perceived by positivists. Some of the criticisms made are not recent, but the needs for their consideration may have been increasingly actualized, especially when having in mind the contemporary society. Do the people of today tend to easily accept the determination of their existence imposed by the contemporary society and easily give up their own freedom and responsibility? What is the role of Psychology as a science in this process? These are some of the issues in relation to which Psychology as a science should position itself, as well as to aim to conform the purpose of its future actions as much as possible to the essential characteristics of people.

Keywords: Psychology, positivism, radical perspectives in psychology

INTRODUCTION

People of today are faced with incredibly rapid changes that condition their everyday functioning. Often, confusion or fear of rapid change leads to euphoric happiness or obsession due to having mastered a skill in the contemporary world, which is again a sudden shift in the emotional tone to which we are not accustomed. The question arises*: What is the role of Psychology in this process*? Psychology as a science that arose from a combination of philosophical questions about the human soul and the accurate nature of physiology to fully describe processes in a human being, at one point of its activity started facing the expansion of contemporary society and the challenges imposed by it.

Transparency, availability and the speed with which information provokes our cognitive, emotional and affective systems at all times have not reached their peak because constant changes keep us in the position of passive observers, always expecting something better and more perfect to happen. To present-day people, a change of state has been imposed as an imperative that they should strive for and with which they should live regardless of being ready or not. Hence the need to strengthen our affective and emotional capacities for the upcoming changes through positive psychology which we released into the world of psychology at the beginning of this century. Hence the improvement of the cognitive psychology that, in its infancy, actually was intended to improve and stabilize artificial intelligence and satisfy the principles of robotics.

In this paper, we therefore want to address more elaborately the knowledge we have gathered so far regarding the globalization and modernization of society in order to try, at least partly, to understand and clarify what is the current position of Psychology as a science in the contemporary society.

THE PARADIGM OF A CONTEMPORARY SOCIETY: DIGITALIZATION AND TECHNOLOGY

Monetarization, commercialization, privatization and consumerism marked the end of the last and the beginning of the new millenniums. Since the end of the last millennium, and particularly after the beginning of the new millennium, changes have been taking place at the global level, due to enormous impact of humans. The globalized consumer society is forcibly redefining class, racial, sexual, gender and ethnic identities (Pilkington, 2005; according to Čičkarić, 2011).

Mass digitization is also something that characterizes contemporary society. Digitalization is most often defined as "the process of converting data from an analog form to a digital one" (Frančula, 2005). Thus, today we can talk about different types of digitization, such as mass digitization of books, whereas the main motive is to create a better and easier access to various information. Also, the digitization of books makes it possible to share a single document with numerous people simultaneously. However, there are also certain shortcomings in the digitization of books, such as potential changes to the content of the text, etc. (Šapro-Ficović, 2008).

In recent years, the digitalization of teaching has been increasingly gaining popularity. Using digitalization makes students more motivated to study, it creates additional interest, more dynamics and fun. However, it turns out that teachers still more often choose older teaching methods, believing that only the use of textbooks is sufficient to successfully master the subject of study (Gjud & Popčević, 2020).

In addition to the digitization of books and the digitization of teaching, we can also talk about the digitization of the economy, the digitization of cultural heritage, etc. Digitization, therefore, permeates every aspect of contemporary life of people.

Speaking of contemporary society, we cannot help but notice the rapid progress of technology, which makes the human existence much easier. Technology is defined as "the science of technical procedures for the purpose of processing raw materials into products" (Šarić, 1997). Similarly to digitalization, technology is an important factor in human life today. Therefore, we need to understand it and to implement it adequately in order to be able to use everything that it can provide. For example, one of the pre-requisites for achieving success in the global market is to apply information technology appropriately (Šuber, 2005). Also, nowadays, information and communication technologies play a major role in healthcare, by simplifying the use of services (Ostojić & et al., 2012). Today, we can also talk about concrete technology, transport technology, assistive technology, etc. Technology, like digitalization, permeates all spheres of contemporary human life, and that is why it is often said today that "everything has become technology" (Šarić & Čatić, 1998). However, we cannot be exactly sure in which direction technological progress will take us. Undoubtedly, however, it brings forth huge positive effects, but we must be also aware of the underlying negative effects.

Furthermore, some authors believe that this progress brings us more harm than good (Davčev & Ačkovska-Leškovska, 2007).

Something that we want to highlight in particular is the relationship between psychology and technology. We have already talked about digitization, and in particular, about the digitization of books. However, modern technology is also changing the manner in which we learn. Therefore, the relationship between the psychology of education and technology is often being emphasized at present, and the study of this relationship can lead to some new discoveries and facilitations in the field of learning (Salomon & Almog, 1998).

Technology also plays a major role in psychological research. A large number of researchers use laboratories and create artificial situations in order to be able to better examine a psychological phenomenon (e.g. perception, memory, etc.). However, whenever we try to artificially induce some phenomena in the laboratory, by that we actually always risk losing environmental validity (Loomis, Blascovich & Beall, 1999). Herein, we can see that technology and its application in psychological research can be a double-edged sword.

Psychotherapists, in their work with clients, also use technological facilitations (e-mail, electronic health mail box, etc.) to a large extent. However, in one study (Van Allen & Roberts, 2011) psychotherapists providing online services were asked to answer the question of how certain technological advances might have affected client privacy. Twenty-eight psychotherapists took part in this research. It turned out that they were very concerned about their clients and their privacy (e.g. they were concerned about potential unauthorized access to clients' electronic data).

The development of technology has changed the work and working environment of people in many aspects. The relationship between technology and organizational and industrial psychology is particularly evident here (Turnage, 1990). The task of organizational and industrial psychologists would precisely consist in studying the relationship between technologies in the workplace on the one hand, and people and their productivity, emotions and mental health on the other.

Thus, technology finds a connection with psychology and its various fields, but, as we could see, in addition to all the positive effects that technology brings forth, it can often have negative effects.

PARADIGM OF POSITIVE PSYCHOLOGY: POSITIVE AND NEGATIVE CONSEQUENCES AT THE INDIVIDUAL AND COMMUNITY LEVELS

In regards to positivist psychology, one of the criticisms directed at it concerns both the orientation to the pathology and to the negative aspects of human nature. Humanistic psychology is a school that emphasizes human strengths, not weaknesses. The term "positive psychology" was first coined by Abraham Maslow in 1954. In his book, he points out that psychology as a science, since its inception, has been significantly more successful in studying the negative aspects of human nature and behavior than the positive ones. According to him, much has been revealed about people’s flaws, diseases, their sins, but little about human potentials, virtues and achievable aspirations. (Maslow, 1954, p. 354). More than 40 years later, Martin Seligman re-popularizes the term and claims that psychology is "halfway to achieving its goal" and that more attention should be paid to the good in people and in the world. The new brand of positive psychology made a clear promise: by using the same techniques and tools that psychology used to explain weaknesses and prevent or cure diseases, we could improve our understanding of human virtues and improve their overall well-being (Gallagher & Lopez, 2020). That said, the focus of positive psychology is on the study of positive emotions, strengths of character and well-being. Its goal is to promote happiness, self-actualization and flourishing in individuals and communities. Thirty years since its existence, it is time to raise the question of which are the positive and which are the negative consequences of respecting the principles and practices of positive psychology as a scientific paradigm at the individual and community levels.

First, and most obviously, the application of the principles of positive psychology has led to an improvement in the mental health and general well-being of the population (Bohlmeijer & Westerhof, 2021). Positive psychology focuses on improving individual well-being and life satisfaction. By applying its principles at the social level, the chance of improving general well-being among the population and preventing and reducing the prevalence of mental health problems such as depression, suicide, addiction diseases, etc. has increased. These positive changes have contributed to the redefinition of health by the World Health Organization, so that it is no longer deemed to be merely the absence of disease but also the realization of one's own abilities, successful coping with normal life stresses, productive work and contribution to one's community (WHO, 2014). However, their impact does not stop there, but is also reflected upon to general physical health and longevity (Aspinwall & Tedeschi, 2010; Park et al., 2016). The principles of positive psychology are associated with benefits of improved physical health and prolonged lifespan.

Positive emotions and optimism are associated with improved immune system functioning, reduced risk of cardiovascular disease, and better overall health behavior. By applying these principles at the societal level, there is potential to promote healthier lifestyles and reduce the burden of the cost of treating chronic diseases. Then, a positive psychological paradigm led to increased productivity and performance at the individual and collective levels (Kour, El-Den & Sriratanaviriyakul, 2019). Namely, positive psychological interventions can increase individual motivation, engagement and overall performance. When these principles are implemented at the level of the society, it can lead to higher productivity in different domains such as education, work and creative endeavors. Fourth, positive psychology has strengthened interpersonal relationships and community (McNulty & Fincham, 2012). Positive psychology emphasizes the importance of positive relationships and social connections. By fostering positive interpersonal interactions, empathy, gratitude and kindness, societies can experience improved social cohesion and a sense of community. This leads to the strengthening of social support networks, the reduction of social isolation and increased cooperation between individuals. Also, the paradigm of positive psychology has led to an increase in general resilience and readiness to deal with negative life experiences, i.e. positive psychological interventions focus on building resilience and effective coping strategies. By teaching individuals and communities how to recover from adversity, cope with stress, and make sense of challenging situations, societies can become better equipped to cope and recover from hardship, including natural disasters, economic crises, or social challenges (Yates, Tyrell & Masten, 2015). In the end, this paradigm led to the creation of positive environments in the field of organizations/work and education. Principles of positive psychology can be applied in organizational and educational settings to create positive work and learning environments. This can result in increased job satisfaction, motivation, and engagement among employees, as well as improved academic achievement, creativity, and student well-being (Meyers, van Woerkom & Bakker, 2013; Seligman et al., 2009).

In regards to negative effects, unrealistic expectations and the pressure that the positive psychological paradigm exerts through promoting the idea of constant positivity and happiness can create unrealistic expectations in society (Norem & Chang, 2002). Individuals may feel pressured to maintain a positive attitude at all times, leading to feelings of failure, inadequacy, or guilt when experiencing normal mood fluctuations or encountering challenging circumstances. Also, an exclusive focus on positive emotions and experiences can inadvertently create a culture where individuals feel compelled to suppress or deny negative experiences, such as grief, trauma, or personal struggles. Contemporary society, especially through social networks, imposes the imperative of constant positivity, misrepresentation and perfection. The message is often sent that an individual is to blame if they are not happy and that they "have to look for happiness in themselves" using the widely misused motto "what you radiate, you attract". This may prevent individuals from seeking appropriate support, processing their emotions, and accessing the necessary resources for healing and growth (Held, 2004). Furthermore, positive psychology often places emphasis on individual responsibility and personal activity in pursuit of happiness and well-being (McDonald & O'Callaghan, 2008). Although personal commitment is important, it is important to recognize that social and systemic factors significantly affect individual experiences. Putting excessive emphasis on personal responsibility without addressing wider societal issues can lead to the neglect of systemic factors that contribute to inequality, injustice and barriers to well-being. Third, positive psychological interventions and principles are often rooted in Western cultural perspectives and values (Christopher & Hickinbottom, 2008). When applied in different

cultural contexts, there is a risk that culturally specific beliefs, practices and social norms relating to well-being are overlooked or underestimated. It is important to adapt positive psychological approaches to respect for and inclusion of cultural diversity and context. In the end, the popularity of positive psychology led to the commercialization and oversimplification of interventions and strategies. Positive psychology has been embraced by the self-help industry, leading to the proliferation of many self-help books, courses, and programs that promise happiness and success.

This commercialization can sometimes simplify or distort the concepts and findings of positive psychology, turning them into quick solutions or marketing tools that may not always be based on scientific evidence (Friend, Johnson, Luthans, & Sohi, 2016).

THE PARADIGM OF MODERNIZATION OF SOCIETY: ROBOTICS, ARTIFICIAL INTELLIGENCE AND THE IMPACT OF DIGITALIZATION ON THE HUMAN COGNITIVE SYSTEM

The use of modern technologies is increasingly supported by the internet as the sum of almost all information. Although AI initially seemed to be a useful solution, we have already reached a point when we have two distinct and opposing groups of AI users. Optimal use seems a common-sense solution, but it raises the question of its limits. The superiority of the human mind is one of the current issues for psychological activity.

Among the first indicators of different life goals of young people, the results of PISA testing stand out, which indicate that young people are increasingly leaving high school, believing that they will adequately manage without formal education (Gulić, 2023). The correlation between absence of school education and social exclusion leads to the orientation towards modern and quick solutions to problems. According to fundamental theoretical assumptions, if social exclusion is also complemented by an absence of family values, that can result in delinquency, and in particular in the development of some form of addiction (Ajduković, 1999). As today's environment for growing up is moved to virtual reality, there is an increasing number of forms of digital violence. The consequences of too frequent use of modern technology have been proven by research, and the dominant one is the lack of physical activity, which leads to a lower life satisfaction, and the absence of numerous pleasant affective states (Vučić, 2023). In addition to being easily accessible, information is interwoven into everyday functioning and is increasingly considered a desirable relief by young people. Instead of cognitive engagement, people tend to be oriented towards minimal effort, even in fairly demanding activities, such as driving a car. Planning the most efficient path in relation to obstacles, observing the situation in traffic, predicting the behavior of drivers, who are both behind and in front, are some of the segments, which are rapidly improving in digitized cars. As predicted, a car driver would have more of a co-driving role in self-driving cars (Meštrović, 2023).

In addition to smart cars, smart homes are also a current phenomenon. Concerns and dilemmas are diminishing, as the system itself ensures that everything in the home is functioning, while certain commands can be set via smartphones. Solving ongoing problems in functioning, which are generally not of a physical nature, can be successfully performed by artificial intelligence.

The secret to knowing the process is in the number of information collected. The more information there is, the better the system itself can recognize the similarities and differences, but also the principles of connection, so based on these, it "makes a decision", instead of a person (Bugarin, 2022).
Acquiring a product for oneself or for one's home is also increasingly becoming less subject to complex cognitive processes, because the search engine, based on previous queries or interactions, profiles the users, offering them what they would gradually search for. In addition, the product or service can be delivered to the buyer's address, with the possibility of paying with virtual money. In summary, the purposes of using artificially intelligent systems

in marketing, which is marketed via the internet, are: data collection, detailed insight into user data (understanding user behavior, recognizing their actions and indications), predicting users' next steps and making automated decisions, which affect reduced marketing efforts (Jöhnk, Weißert & Wyrtki, 2020). Marketing strategies in the past used to require a fundamental preparation for the future period, and teams of experts comprising dozens of individuals. In addition to releasing designed marketing strategies, online platforms also offer ready-made visual brand solutions, based on artificial intelligence, after the user, in just a few sentences, has described his/her ideas or just typed in the area of their activity. The previous lines testify to the negative impact of artificial intelligence on the human cognitive system. The space for manifesting individuals' creative potentials has also been reduced, especially bearing in mind that once these potentials were actually helpful to some individuals to land jobs. The taking over of jobs by artificial intelligence has befallen many industries. While initially it was deemed suitable for taking on monotonous and uneventful jobs by robots, artificial intelligence is now playing an increasingly important role in the modernization process. An increasingly important issue is the principle of functioning of future generations. Relying too much on AI for simple tasks such as calculations, memorizing numbers or other data can negatively affect, in the long term, people in their daily activities that require more complex memory and analysis processes (Madhugiri, 2023).

The preservation of mental health and the adequate functioning of the individual is increasingly important, especially knowing that the relevance of certain information or solutions offered is questionable. Artificial intelligence does not involve an emotional component, so individuals are then left to themselves. It is important to point out the equal importance of positive and negative emotions, i.e. experiences, with reference to reason, when in contact with artificial intelligence.

CONCLUSIONS

This paper presents reviews given on specific questions and circumstances of contemporary life to which Psychology as a science should provide answer or position itself and preserve its integrity. Undoubtedly, changes affecting the entire civilization necessarily change people as well. Psychology faces the challenge of striking a balance between traditional theories and seeing individuals in a completely new light of contemporary phenomena. The task of Psychology is to incorporate the achievements of modern technologies into its theories and methods, but also, at the same time, to protect and preserve human essence despite constant and upcoming changes that do not bypass any person.

REFERENCES

Ajduković, M. (1990). *Stil odgoja u obitelji kao faktor delinkventnog ponašanja djece*, Primijenjena psihologija, 11, 47-54.

Aspinwall, L. G., Tedeschi, R. G. (2010). The value of positive psychology for health psychology: Progress and pitfalls in examining the relation of positive phenomena to health. *Annals of behavioral medicine*, *39*(1), 4-15.

Bohlmeijer, E., Westerhof, G. (2021). The model for sustainable mental health: future directions for integrating positive psychology into mental health care. *Frontiers in psychology*, *12*, 747999.

Bugarin, M. (2022). *Model pametne kuće* (Diplomski rad). Rijeka: Sveučilište u Rijeci, Tehnički fakultet.

Christopher, J. C., Hickinbottom, S. (2008). Positive psychology, ethnocentrism, and the disguised ideology of individualism. *Theory & psychology*, *18*(5), 563-589.

Čičkarić, L. (2011). Globalne promene-lokalne interpretacije-identitet mladih u rizičnom društvu. Beograd. Institut društvenih nauka.

Davčev, V., Ačkovska-Leškovska, E. (2008). Tehnologija kao oblikovateljica ljudske kulture: društvene i psihološke posljedice. *Filozofska istraživanja*, *28*(1), 75-82. https://hrcak.srce.hr/file/36483

Frančula, N. (2005). Ekranska digitalizacija?. *Geodetski list*, *59*(1), 85-86. https://hrcak.srce.hr/file/419637

Friend, S. B., Johnson, J. S., Luthans, F., Sohi, R. S. (2016). Positive psychology in sales: Integrating psychological capital. *Journal of Marketing Theory and practice*, *24*(3), 306-327.

Gallagher, M. W., Lopez, S. J. (2020). Strengthening positive psychology. *The Oxford handbook of positive psychology*, 3-7.

Gjud, M., Popčević, I. (2020). Digitalizacija nastave u školskom obrazovanju. *Politehnika i dizajn*, *8*(03), 154-162. https://polytechnicanddesign.tvz.hr/index.php/ojs/article/view/360/319

Gulić, S. (2023). *Socijalna isključenost kao čimbenik delikvencije i radikalizacije mladih u odabranim državama EU-a* (Završni specijalistički rad). Zagreb: Sveučilište u Zagrebu, Pravni fakultet.

Held, B. S. (2004). The negative side of positive psychology. *Journal of humanistic psychology*, *44*(1), 9-46.

Jöhnk, J., Weißert, M., & Wyrtki, K. (2020). *Ready or Not, AI Comes— An Interview Study of Organizational AI Readiness Factors*. Business & Information Systems Engineering, 63(1), 5–20.

Kour, J., El-Den, J., Sriratanaviriyakul, N. (2019). The role of positive psychology in improving employees' performance and organizational productivity: An experimental study. *Procedia Computer Science*, *161*, 226-232.

Loomis, J. M., Blascovich, J. J., & Beall, A. C. (1999). Immersive virtual environment technology as a basic research tool in psychology. *Behavior research methods, instruments, & computers*, *31*(4), 557-564. https://link.springer.com/article/10.3758/bf03200735

Madhugiri, D. (2023). *Advantages and Disadvantages of Artificial Intelligence (AI)*. Preuzeto 6.7.2023. sa https://www.knowledgehut.com/blog/datascience/advantages-and-disadvantages-of-artificial-intelligence

Maslow, A. H. (1954). *Motivation and personality*. Waltham, MA: Brandeis University

McDonald, M., & O'Callaghan, J. (2008). Positive psychology: A Foucauldian critique. *The humanistic psychologist*, *36*(2), 127-142.

McNulty, J. K., & Fincham, F. D. (2012). Beyond positive psychology? Toward a contextual view of psychological processes and well-being. *American Psychologist*, *67*(2), 101.

Meštrović, N. (2023). *Utjecaj umjetne inteligencije na čovječanstvo* (Završni rad). Zagreb: Sveučilište u Zagrebu, Filozofski fakultet

Meyers, M. C., van Woerkom, M., & Bakker, A. B. (2013). The added value of the positive: A literature review of positive psychology interventions in organizations. *European Journal of Work and Organizational Psychology*, *22*(5), 618-632.

Norem, J. K., & Chang, E. C. (2002). The positive psychology of negative thinking. *Journal of clinical psychology*, *58*(9), 993-1001.

Ostojić, R., Bilas, V., Franc, S. (2012). E-zdravstvo–unapređenje zdravstvenoga sustava primjenom informacijske i komunikacijske tehnologije. *Društvena istraživanja: časopis za opća društvena pitanja*, *21*(4 (118)), 843-862. https://hrcak.srce.hr/95287

Park, N., Peterson, C., Szvarca, D., Vander Molen, R. J., Kim, E. S., & Collon, K. (2016). Positive psychology and physical health: Research and applications. *American journal of lifestyle medicine*, *10*(3), 200-206.

Salomon, G., Almog, T. (1998). Educational psychology and technology: A matter of reciprocal relations. *Teachers college record*, *100*(2), 222-241. https://doi.org/10.1177/016146819810000201

Seligman, M. E., Ernst, R. M., Gillham, J., Reivich, K., & Linkins, M. (2009). Positive education: Positive psychology and classroom interventions. *Oxford review of education*, *35*(3), 293-311.

Šapro-Ficović, M. (2011). Masovna digitalizacija knjiga: utjecaj na knjižnice. *Vjesnik bibliotekara Hrvatske*, *54*(1-2). https://www.hkdrustvo.hr/datoteke/1154/vbh/God.54(2011),br.1-2

Šarić, L. (1997). Tehnika i tehnologija. *Jezik: časopis za kulturu hrvatskoga književnog jezika*, *45*(5), 195-197. https://hrcak.srce.hr/file/305170

Šarić, L., Čatić, I. (1998). Raznoznačnost naziva tehnika i tehnologija. *Mehanizacija šumarstva*, *23*, 3-4. http://www.migdakta.com/wp-content/uploads/2017/07/RAZNOZNA%C4%8CNOST-NAZIVA-TEHNIKA-I-TEHNOLOGIJA.pdf

Šuber, B. (2005). Unapređenje poslovnih procesa pomoć informacijske tehnologije. *Ekonomski vjesnik: Review of Contemporary Entrepreneurship, Business, and Economic Issues*, *18*(1-2), 97-105. https://hrcak.srce.hr/file/294161

Turnage, J. J. (1990). The challenge of new workplace technology for psychology. *American psychologist*, *45*(2), 171. https://psycnet.apa.org/doi/10.1037/0003-066X.45.2.171

Van Allen, J., Roberts, M. C. (2011). Critical incidents in the marriage of psychology and technology: A discussion of potential ethical issues in practice, education, and policy. *Professional Psychology: Research and Practice*, *42*(6), 433. https://psycnet.apa.org/doi/10.1037/a0025278

Vučić, D. (2023). *Povezanost vremena provedenoga u igranju online igara s kineziološkim aktivnostima, samoprocjenom zadovoljstva životom i intenzitetom emocionalnih stanja* (Disertacija). Zagreb: Sveučilište u Zagrebu, Kineziološki fakultet.

World Health Organization. (2014). Social determinants of mental health. In *Social determinants of mental health*.

Yates, T. M., Tyrell, F. A., & Masten, A. S. (2015). Resilience theory and the practice of positive psychology from individuals to societies. *Positive psychology in practice: Promoting human flourishing in work, health, education, and everyday life*, 773-788.

THE IMPORTANCE OF THE APPLICATION OF THE ENTREPRENEURIAL APPROACH IN THE TOURISM AND HOSPITALITY SECTOR

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Abstract: The concept of a green economy has become very relevant in the last few years in terms of environmental protection. This economy is directed towards the need to preserve natural resources, reduce pollution, and destruction the environment, as a consequence of production processes. When it comes to the tourism and hospitality sector, the issue of applying an entrepreneurial approach occupies an important place within the world economy for the purpose of sustainable development. In the modern business environment, the main goal of capital owners is to increase profits. This business goal can be achieved with the request for environmental protection and the application of the concept of sustainable development. The use of renewable energy sources will be an example of an entrepreneurial approach in tourism and catering. The main goal of the work is to point out the importance of an entrepreneurial approach in the application of a sustainable, green economy in tourism and hospitality. In this paper, the positive and negative effects of tourism development on the environment will be analyzed and the potential for the use of renewable energy sources in tourism will be presented.

Keywords: *entrepreneurship, green economy, sustainable development, tourism, renewable energy sources.*

INTRODUCTION

In recent decades, sustainable development has become a key objective in many industries, including the tourism and hospitality sectors. The question of the importance of the role of the entrepreneurial approach in achieving sustainable development and environmental protection in the tourism and hospitality sector is a very important and current topic today. The tourism and hospitality sector has been experiencing constant growth over the past few decades, which is directly dependent on the environment. Also, it is recognized as a significant energy consumer and source of harmful gas emissions. It is a significant direct user of the natural elements of the environment and as such is responsible for their protection for future generations. Therefore, the organization of tourism development especially in protected areas is a very sensitive task, because as an activity it is significantly different compared to other destinations. That is why special attention should be paid to protected natural areas as one of the most current tourist destinations in the modern tourism business, and national parks are certainly among the most important types. One of the key elements of the entrepreneurial approach, which aims to reduce negative impacts on the environment, is the application of renewable energy sources. The application of renewable energy sources, such as solar energy, wind energy or hydropower, allows tourist facilities and catering companies to increase their sustainability and environmental responsibility, reduce costs and improve their reputation and position themselves on the tourist map. As one of the key priorities of the entrepreneurial approach in those areas, it should be the development of a concept of sustainable development

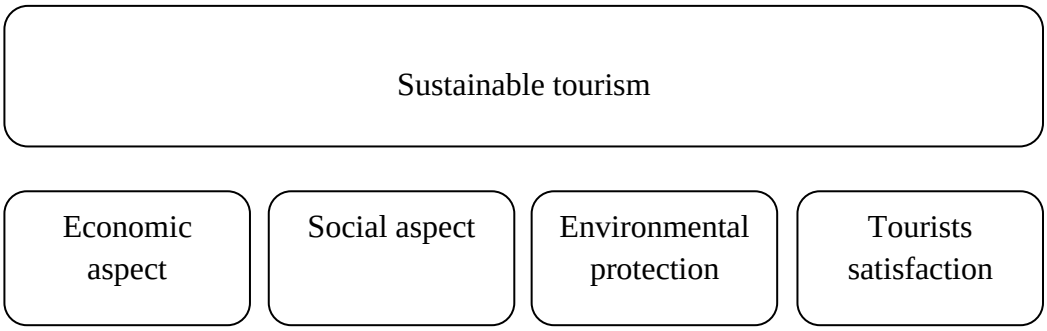
centered on the local community, which also needs to be involved in order to protect and preserve the environment for future generations and create an appropriate tourist offer.

SUSTAINABLE TOURISM AND HOSPITALITY SECTOR

At the end of 1983, the General Assembly of the United Nations established the World Commission on Environment and Development, known as the "Brundtland Commission", which included some of the world's most famous scientists and experts. from this field (Muller 1993). The World Commission gave a report called "Our Common Future", which wanted to point out the dangers caused by the policy of economic growth, while ignoring the possibility of renewing resources. This commission defined sustainable development as development that is aimed at meeting the needs of the present, without depriving future generations of the opportunity to meet their needs (Muller 1993). The term sustainable development appeared in the early eighties of the XX century (Stojanovic, 2011 199.). The definition of the concept of sustainable development includes three key dimensions: economic, social and the dimension of preservation and protection of the natural environment, which actually form the foundation (McIntyre 1993). The concept of sustainable development aims to create a better environment in the world in which economic, social, cultural and ecological factors will be balanced (Stojanovic 2011,198.). There are different definitions of sustainable tourism in the professional literature. Sustainable tourism can be defined as a concept that implies balanced economic, social and cultural development, without endangering the environment, which will enable future generations to develop through the use of resources at the same or even higher level (Stojanovic 2011, 199.). Responsible and sustainable development of tourism is a development that meets the needs of current tourists, tourist destinations and all participants in tourism, while at the same time preserving and increasing the possibility of using tourist resources in the future without jeopardizing the ability of future generations to meet their own needs, i.e. improving the quality of life (of the local population and tourists) within the possibilities of the ecosystem that surrounds us (Genov 2013). Sustainable tourism can be defined as one of the models of economic development created to improve the living conditions of the local social community, in a way to satisfy the economic, social and aesthetic needs of tourists, while maintaining the level of quality of the natural environment (Jovicic 2000).
The concept of sustainable tourism represents the development of tourism that will balance the ecological, socio-cultural and economic components of the destination, on the one hand, and the satisfaction of tourists, on the other.

This concept helps in finding the optimal form of tourism development that will not result in the degradation of resources so that future generations can satisfy their tourism needs. In the central part of the sustainable development of tourism is Agenda 21 for the tourism economy, which helps in understanding all tasks and challenges in the development of modern tourism (Dražić 2020). In order for the concept of sustainable tourism to be fully realized, it is necessary to form indicators of sustainability on the basis of which a final assessment of the achieved results of tourism development would be given (Stojanovic 2011). The main goal of sustainable tourism development is to enable people to enjoy natural resources and gain knowledge about the importance of protecting the natural, cultural and historical resources of a certain area, while preserving the integrity of the tourist site and improving economic development for the benefit of the local community (Boskovic 2008).

Figure 1. Graphic representation of the concept of sustainable tourism development



Source: *Muller, H.R. 1993.*

Figure 1 shows a graphic representation of the concept of sustainable tourism development, which should simultaneously contribute to the achievement of these 5 goals.

The concept of sustainable tourism development is based on meeting the needs of current tourists, while minimizing the negative and maximizing the positive impacts of tourism, so that all authentic natural resources remain preserved for future generations (Unković et al., 2002). According to Krippendorf, there is only one goal that needs to be achieved in order to harmonize the development of tourism with the environment, and that is sustainable development or quality growth (Krippendorf 1992).

This primarily refers to the improvement of the quality of life, economic progress and the subjective impression of well-being, which can be achieved by less use of non-renewable natural resources, as well as less pressure on the natural environment and the local population. The main goal to be pursued is the sustainable development of tourism, which is based on a comprehensive and complex approach that places equal emphasis on 5 key components, namely (Krippendorf 1992):
1) environmental protection,
2) affirmation of social integrity,
3) preservation of anthropogenic cultural values of the local community,
4) satisfaction of tourist needs i
5) realization of economic effects.

The policy of the concept of sustainable development of tourism is based on three basic principles, namely (Popesku 2011):
1) Economic sustainability - in this way, resources are managed in such a way as to guarantee their equal use for future generations;
2) Social and cultural sustainability - in this way, development is ensured that is in harmony with the cultural and traditional values of local communities and that contributes to their affirmation;
3) Ecological sustainability - in this way, harmful impacts that can disrupt vital ecological processes are minimized, and it can be determined based on the existing carrying capacity.
These three key components of the concept of sustainable development are interrelated and interdependent, and any development should be consistent with each of them.

Figure 2 shows the impact of tourism on the environment, which, depending on the type of activity, can be positive or negative

Figure 2. Impact tourism on the environment

Impact	Positive	Negative
Environmental	Develop new service Improve local infrastructure protection of cultural heritage Management strategy the number of visitors	Environmental damage Excessive number of tourists Degradation of architecture Violation of inheritance Changes in natural cycles
Socio-cultural	Increase in the level of local participation in activities and events Strengthening regional values and traditions	Commercialization of activities that are personal and emotional in nature Increase in crime Changes in population structures Exclusion of the local population from the event
Economic	Increase in work support Possibility of employment Rise in living standards Increase in investments	Not real property prices, Local inflation The outflow of money to larger centers Inadequate assessment of tourism development costs Inability to attract tourists undesirable costs, including transport, health, and education funds

Source: Author according to *Hall & Page 2014.*

RENEWABLE ENERGY SOURCES

Special attention should be paid to the use of renewable energy sources and sustainable development. The entrepreneurial approach in the tourism and hotel industry implies the application of modern technical and technological solutions during construction and furnishing, the rational use of space while respecting the carrying capacity of the tourist destination, as well as the possibility of connecting to the infrastructure network.

Renewable energy sources include: water power energy, biomass energy, solar energy, wind energy, geothermal energy, sea, and ocean energy. The term "new" renewable energy sources mean modern and sustainable forms of renewable energy, especially modern use of biomass, geothermal, thermal and electrical energy, small hydropower plants, low-temperature solar energy, wind energy, photovoltaic electricity, and sea energy (Sladoljev, 2017).

Renewable energy sources represent inexhaustible sources of energy from nature that are renewed in a certain time interval, in whole or in part. The Republic of Serbia has significant renewable resources: solar energy, water, wind, geothermal energy, and biomass. The most significant potential of renewable energy sources in the Republic of Serbia is energy from biomass, which is estimated at 3.405 million tons (tons of oil equivalent), and biomass

participates in the total RES potential with 60.3%. Currently, the highest degree of utilization of energy from renewable sources in the Republic of Serbia is from the energy of hydroflows, whose total gross potential of the water that flows in the watercourses on its territory is about 25,000 GWh (gigawatt hours) per year (https://www.energetskiportal.rs/obnovljivi-izvori-energije/).

The energy of the sun

Energy from the sun represents the majority of energy that comes from the Earth, and even the energy obtained from wind, water, biomass, and all fossil fuels actually comes from this source. The energy of solar radiation is a pure form of renewable energy that does not disturb the balance in nature. By applying appropriate technology, this so-called free, ecological, and eternal source of energy on the planet can be used. By using this energy, it is possible to provide hot water and electricity from a renewable energy source that does not emit harmful gases, and this also affects the mitigation of the resulting climate changes. The application of solar technology enables energy independence from the electrical distribution network in facilities that already have existing connections. Unlike most European countries, the Republic of Serbia has a significantly higher number of hours of solar radiation, and the best conditions are in the southeastern part of our country.

Wind Energy

Wind energy is obtained using the power of the wind-driven wind turbines, which convert kinetic energy into electricity. The amount of energy obtained depends on the strength of the wind, which is influenced by the geographical position of the terrain, relief, and climate. Wind, as an energy source, is also a cheap and very profitable type of renewable energy source that is increasingly being used throughout Europe to produce electricity. Unfortunately, the Republic of Serbia is not at the top of the list of countries that have an extremely high level of wind potential utilization.

Geothermal energy

Geothermal energy is energy that originates from the ground. There are two ways to use geothermal energy: using hot water or steam from geothermal reservoirs and using geothermal pumps. The method used to obtain electricity does not create emissions harmful to the environment. Another advantage is the available energy reserves, which are practically inexhaustible. Also, geothermal power plants occupy a small space. Geothermal power plants are built directly on the energy source and easily supply the surrounding areas with heat and electricity. According to the available data, the Republic of Serbia has as many as 360 sources of thermal and thermomineral waters (with temperatures ranging from 140C to 980C) and stands out for its significant hydrogeological and geothermal resources compared to the average values in Europe (https://www.energetskiportal.rs/obnovljivi-izvori-energije/). The total amount of heat from geothermal resources in the Republic of Serbia is about two times greater than the heat that would be generated from domestic coal reserves. Unfortunately, this potential is almost not used at all. Our country mainly uses water from geothermal sources or wells for therapeutic purposes in numerous spas and sports and recreation centers, often in an irrational and ineffective way. Hydrogeothermal energy has been used for decades, either directly for the production of heat and electricity, petrothermal has only recently been used for heating and cooling buildings.

Geothermal energy can have a wide range of applications, from the production of electricity in power plants to the heating of settlements to the heating of greenhouses and greenhouses, but also in paper production, milk pasteurization, swimming pools, the process of drying wood, animal husbandry, etc (https://www.energetskiportal.rs/obnovljivi-izvori-energije/).

APPLICATION OF THE ENTREPRENEURIAL APPROACH THROUGH THE USE OF RENEWABLE ENERGY SOURCES IN THE TOURISM AND HOSPITALITY SECTOR

In recent decades, until the outbreak of the Covid-19 pandemic, the tourism and hospitality sector recorded a positive trend of growth in the number of tourist arrivals and revenue. The significant growth of this sector in recent decades is the result of the influence of various factors, especially the development of technologies, new lifestyles, the expansion of international hotel chains, as well as the growth of low-cost airlines that have enabled international travel for the general public (Vujdinović, Vujdinović 2022, Vujdinović 2022). The development of tourism has numerous positive effects on the destination, and economic effects are often cited as the most significant, while it has a negative effect on the environment and social aspects. In the conditions of globalization, the tourism and hospitality sector has a significant role in achieving very important macroeconomic goals, such as a positive impact on GDP, NI and balance of payments of the country, a decrease in the unemployment rate, development of underdeveloped areas, as well as overall economic growth and development (Vujdinović, J., 2022, 367.). The development of the tourism and hospitality sector as an activity is important for the economy and that is why the governments of many countries are trying to develop this sector as an important economic activity in order to realize some of the benefits (Vujdinović, J. 2022, 368.). Based on the data UNWTO that the number of tourist arrivals in the world is increasing year by year, as well as the fact that there is no place on the planet where tourists have not set foot, it is clear that geographical areas and the environment are exposed to great risks due to intensive tourist development. The greatest danger arises from the constant degradation of the environment as a direct consequence of unplanned and inadequate management of tourism development. The development of entrepreneurship is the key to the sustainable development of the country, especially the development of the tourism and hotel sectors. Entrepreneurs are an important driving force of revitalization, transformation, and business development activities because they are constantly working on the development of new business ventures, which provides vitality to the market economy. One of the key tasks of modern entrepreneurs and managers is the acquisition, development, and allocation of organizational resources (Škrbić et. al 2019).

In order to use solar energy, it is necessary to install solar panels on the roof of the tourist-hotel facility, which is mainly used for heating water in swimming pools and saunas. The advantages of these panels are that it has a double function, in the winter for heating and in the summer for cooling the rooms. By using a system of photovoltaic cells, a significant amount of electricity is obtained and savings are made (Figure 3.).

Figure 3. Solar panels

Source: https://www.engineering.com/story/jamaicas-largest-solar-power-plant

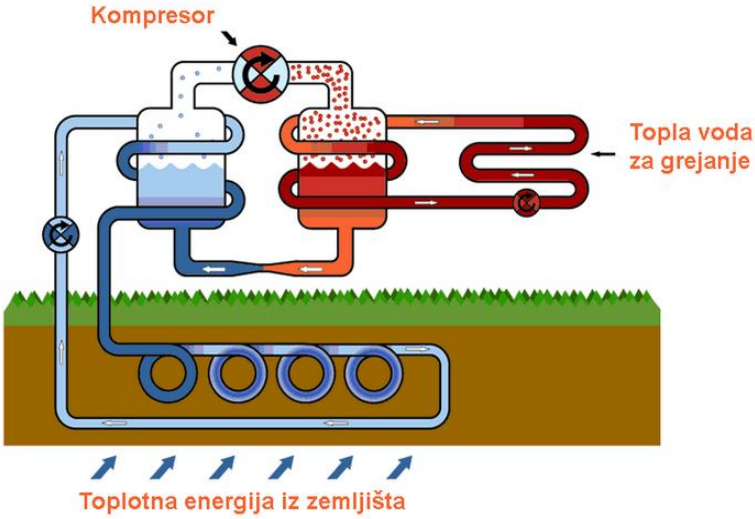
Today, hydropower is the cheapest way to generate electricity, which is also used in the tourism sector. Especially interesting small hydropower plants, suitable for remote tourist settlements and complexes in rural and mountainous areas. A small hydro system is powered by a nearby stream or river and consists of a suction pipe, a steel pipeline, and a turbine. This system provides a reliable source of energy needed for heating, cooling, and lighting, but also serves to extinguish fires and provide drinking water (Figure 4).

Figure 4. Small hydropower plants

Source: https://news.mongabay.com/2018/03/small-hydropower-a-big-global-issue-overlooked-by-science-and-policy/

By using geothermal energy, significant, almost inexhaustible reserves of energy are created. This type of energy in tourism is most often used directly in spas and recreation centers, and also for space heating and cooling (geothermal pumps Figure 5).

Figure 5. Geothermal energy (geothermal pumps)



Source: https://krov.rs/toplotne-pumpe-prednosti-i-mane/

Using biomass as an energy source has a number of environmental advantages compared to fossil fuels, primarily the reduction of carbon dioxide emissions during combustion, as well as one of the ways of recycling waste. Energy from biomass is usually obtained by simple combustion in heating plants, for the production of electricity, or in vehicles. The practice in many tourist facilities is to combine garden and kitchen waste, which is further used to make fertilizer. Also, the use of corn, straw, and other cellulose products is suitable for obtaining biogas, as well as for other purposes in tourist facilities. Systems for burning straw and corn are used for cooking and heating space and water in the building. This source of energy has also found its application in hotel vehicles, garden equipment, and boilers that use energy extracted from rapeseed oil (Figure 6.).

Figure 6. Biomass

Source: http://www.esco.rs/biomasa.htm

CONCLUSION

Tourism, as an important economic branch in the world, requires planning, development, and management in a sustainable manner in terms of effects on economic and social development, so as not to damage the natural environment and social identity, on which it essentially depends. There are numerous examples of tourism development that are purely economically oriented, in the short term they can achieve significant economic results and meet the various needs of tourists, but in the long term, they can produce a series of negative impacts on the natural environment and the life of local communities. For this reason, it is necessary to establish harmony between the tourist needs of tourists and the possibilities of all participants in the tourist market, in order to provide quality tourist services to current tourists and preserve resources for future generations. The guidelines and practice of managing the sustainable development of tourism and the use of renewable energy sources can be applied to almost all forms of tourism, in all types of destinations. The importance of environmental protection was warned by the great ecological crisis, which happened forty years ago and which sent a clear message to humanity, that the discrepancy between the level of renewable natural elements and the level of economic development cannot last long.

The concept of sustainable development is a process that enables future development without harming the natural environment or overexploitation of natural resources. This can be achieved by proper management of available resources in such a way that they can be renewed to the extent that they are used or by greater use of resources with a shorter regeneration period. With such an approach to resources, it is possible for them to serve both current and future generations equally. In the future, it is expected that only those tourist destinations will survive that will know how to adequately manage their tourist area and attractions will be able to protect the area from mass tourism development.

LITERATURE

1. Bošković, T. (2008). Sustainable tourism as a modern concept of tourism development. *Business School*, *4*, 123-127.
2. Dražić, G. (2020). *Sustainable tourism*, University Singidunum, Faculty of Tourism and Hotel Management, Belgrade.
3. Energy portal, available at: https://www.energetskiportal.rs/obnovljivi-izvori-energije/, visited: 21.03.2023.
4. Genov, G. (2013). *Management of tourist destinations*, High School of Tourism, Belgrade.
5. Hall, M., Page, S., (2014). *The geography of tourism and recreation - environment, place and space*, Routledge.
6. http://www.esco.rs/biomasa.html , visited: 18.03.2023.
7. https://krov.rs/toplotne-pumpe-prednosti-i-mane/ , visited: 18.03.2023.
8. https://news.mongabay.com/2018/03/small-hydropower-a-big-global-issue-overlooked-by-science-and-policy/ , visited: 23.03.2023.
9. https://www.engineering.com/story/jamaicas-largest-solar-power-plant, visited: 24.03.2023.
10. Jovicic, D. (2000). *Tourism and the environment: the concept of sustainable tourism*, Zadužbina Andrejević, Belgrade.

11. Krippendorf, J. (1992). *Reconciling tourist activities with nature conservation*, Council of Europe, Strasbourg.
12. McIntyre, G. (1993). *Sustainable tourism development: guide for local planners*, World Tourism Organization, Madrid.
13. Muller, H.R. (1993). Challenges in our time and their consequences for tourism management, *Research Institute for Leisure Time and Tourism*, Berne.
14. Popescu, J. (2011). *Management of tourist destinations*, Singidunum University, Belgrade.
15. Sladoljev, J., Arbutina, A., Dujić, A., Župčić, J. (2017). The importance of using renewable energy sources in order to achieve competitiveness in tourism, *Proceedings of the Polytechnic in Šibenik*, (1-2), 53-65.
16. Stojanović, V. (2011). *Tourism and sustainable development*, Department of Geography, Tourism and Hotel Management, Novi Sad.
17. Unković, S., Čačić, K., Bakić, O. (2002). *Contemporary trends in the tourist market*, Belgrade.
18. Vujdinović, J., Vujdinović, M. (2022). The impact of the 2008 and 2020 crisis on international tourism, with special emphasis on the sector of the Republic of Serbia, *XI Scientific Conference with International Participation Jahorina Business Forum 2022,"Economic lessons learned from the 2008 and 2020 crisis: experiences and recommendation for entrepreneurial nations*, Pale, 399-408.
19. Vujdinović, J. (2022). Multiplicative effects of tourism on the economy of the Republic of Serbia, Trebinje Conference, eighth international scientific meeting tourism: current problems and development perspectives – tourism economy and related topics, Trebinje, 367-374.
20. Vujdinović, J. (2022). Creating new opportunities for the post-pandemic tourism recovery, The Fourth International Scientific Conference CIBEK 2022,"Circular and Bioeconomy", Belgrade, 137-147.
21. Škrbić, I. M., Mišković, I. D., Milošević, S. M., & Nešić, M. (2019). Entrepreneur models in function of sustainable tourism. *Poslovna ekonomija*, *13*(1), 81-99.

DEVELOPMENT OF HEALTH TOURISM IN THE TERRITORY OF THE REGION OF SOUTHERN AND EASTERN SERBIA

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Summary: Health tourism is a form of tourism that has gained more and more importance in recent years. The motivation for this form of tourism is mostly individual and differs from tourist to tourist, but most often it is understood that tourist movements are caused by health needs, that is, needs that include treatment or recovery from some disease, but also health preservation and prevention. The modern way of life characterized by a chronic lack of free time, exposure to stress and daily worries have led to an increased interest in health tourism, which arose as a natural need of people to do something good for their health. In the territory of the region of Southern and Eastern Serbia, health tourism is at a significant level of development, but the existing potentials have not yet been fully utilized. In addition, the territory of the region is home to four out of eight royal spas, which are associated with certain specificities. Sedentary lifestyle and urbanization contributed to the attractiveness of this form of tourism. However, it is necessary to complete the existing offer of health tourism with new and current products, as well as to raise the quality of the service to a significantly higher level.

Keywords: health tourism, spas, health, region of Southern and Eastern Serbia, quality, development

INTRODUCTION

Health tourism, as one of the most significant selective forms of tourism, has been gaining more and more importance in recent years. The motivation for this form of tourism differs from tourist to tourist, but it is generally understood that tourist movements are motivated by health needs, that is, the need for treatment and recovery from illness, but also increasingly the need for health preservation and recreation.

Today, health tourism is one of the fastest growing trends in the modern tourist market. Factors that have contributed to the growth of interest in health tourism are the aging of the population, increasing awareness of prevention, people's desire to live longer and with better quality, as well as the desire for different tourist experiences, changes in people's lifestyles and reorientation from mass to selective forms of tourism. Those factors encouraged the development of a specific market niche known as health tourism.

In Serbia, there are significant potentials for the development of health tourism, which mainly means spa tourism, which has the longest tradition. In addition to spa tourism, health tourism includes wellness and medical tourism. Over the centuries, the trend has shifted from the classic spa to the modern concept of health tourism, which, in addition to the medical component, also includes other components such as prevention, recreation, sports, and wellness. The way of thinking has also changed, that spas are not only places where people are treated, but that they can be places of fun, enjoyment, relaxation, disease prevention and maximum use of healing factors in the service of physical and psychological well-being.

The region of South and East Serbia is rich in potentials for the development of health tourism, which have not yet been properly valorised as tourists. There is a rich and other tradition, which is indicated by the presence of royal spas in this territory and the centuries-old aspiration of people in search of health. Spas are still synonymous with treatment and recovery, but they have upgraded the existing offer through wellness treatments and medical services, all in the service of maximum relaxation.

THE TERM AND TYPES OF HEALTH TOURISM

Health has always been one of the main reasons for people to travel. There is a lot of evidence that confirms this, but in the course of history, the ancient Romans stood out, who built Roman baths throughout their empire, including numerous locations on the territory of the Republic of Serbia, where the then elite and legionnaires were provided with a variety of health services.

In the past, health tourism mostly meant the organized stay of tourists in spas and climatic health resorts, all with the aim of rehabilitation and treatment with the help of natural healing factors. Natural healing factors include healing waters, mud, gas and climate. However, the accelerated development of tourism that took place at the end of the 20th and the beginning of the 21st century and the changes that took place on the side of tourist supply and tourist demand led to the fact that health tourism went beyond the initial framework and included services such as massages, anti-stress therapies, dietary services, fitness services as well as medical services such as dental interventions, operative procedures, aesthetic interventions, in vitro fertilization, etc. It became especially popular after 2000 because society increasingly needs physical and mental relief (Roman et al. 2023, p. 4).

Different definitions of health tourism can be found in the literature dealing with health tourism. According to Jovanović (Jovanović 2013, p. 36): Health tourism is a tourist trip, a visit to selected locations for the purpose of recovery, improvement and advancement of the state of health through the use of specialist treatments, treatment, therapy, rehabilitation. On the other hand, according to Rabotić (Rabotić 2013, p. 101): Health tourism includes classic spa tourism or thermalism, medical tourism, medical wellness and wellness tourism. Spasojević and Šušić define health tourism as follows (Spasojević & Šušić 2011, p. 150): Health tourism implies a temporary change of place of permanent residence for health prevention, rehabilitation, use of various wellness treatments, as well as the most complex medical procedures.

Taking into account all the previously mentioned definitions, under health tourism we can include three types of tourism (Dimitrovski et al. 2021, p. 227): traditional spa tourism - which means the travel of people to spas and climatic spas for treatment and rehabilitation with the help of natural healing factors and certain physical procedures, wellness tourism - travel of people to certain destinations in order to achieve physical and psychological well-being with the help of nature and additional activities such as yoga, meditation, healthy diet, etc., medical tourism - travel of people abroad for treatment and complex medical interventions.

Regardless of different terminological explanations, it can be said that health tourism is an umbrella framework for all the previously mentioned activities. Therefore, health tourism is a form of tourism that is undertaken in order to promote, stabilize, and restore physical and mental well-being using natural healing factors, health services, sports-recreational and wellness facilities (Gligorijević & Novović 2014, p. 511).

It can be concluded that modern health tourism does not only contain elements of treatment and recovery from certain diseases, but health tourism includes the entire spectrum of services, starting from recreation, physical and psychological well-being, prevention and complicated medical interventions. The demand for health tourism is constant throughout the year (Gašić 2012, p. 67).

HEALTH TOURISM IN SERBIA

Health tourism in Serbia is primarily related to spa tourism, which at the same time has the longest tradition. Serbia can be said to be a "country of spas" considering the number of mineral springs, many of which are unique and very rare in the world. In relation to the area, Serbia is one of the richest in Europe. In terms of diversity in mineral composition and temperature of medicinal springs, Serbia is, next to the Czech Republic and France, the richest in this branch of natural wealth (Dašić 2018, p. 50).

On the territory of Serbia, the ancient Romans built public baths and pools at mineral water sources in order to heal and recover, and the remains of such buildings can still be found today in Sokobanja, Vrnjačka Banja, Kuršumlijska Banja and others. Later, these buildings were also used during the time of the Turks.

Spas experienced the greatest development in the period between the two world wars. Back then, vacationing in spas was a matter of prestige. A lot of villas, hotels, sanatoriums were built, all modelled on spas in Italy and France. Spas have become meeting places for famous people, where there were a lot of foreign tourists as well as domestic ones. Later, spa tourism was in constant growth, and spas developed their tourist offer, where spa therapies based on healing mineral waters stand out as a key growth factor. The Republic of Serbia has about 50 spa centers and places with a specific climate, over 1.000 springs, but also abounds in a multitude of natural mineral gases and healing mud, which as a whole represents a huge potential for the development of health tourism (Lević 2022, p. 8).

Currently, spa tourism is most developed in Vrnjačka, Sokobanja and Banja Vrdnik. These are spas that stand out both in terms of the number of domestic and foreign guests. These spas enrich their tourist offer every year and, in addition to standard physical procedures, introduce new wellness and medical services. Considerable attention is paid to improving the quality of services at all levels, so more and more high-category hotels with 4 and 5* are being opened. Among the other spas, Prolom, Lukovska and Kuršumlijska should be singled out, which, considering their location and distance from larger city centers, generate a significant number of tourists and overnight stays (Gašić et al. 2015, p. 497).

Table 1. Tourist traffic in selected spas

	Number of tourists			**Number of nights**		
Spas	In total	Domestic	Foreign	In total	Domestic	Foreign
Vrnjačka	269.117	232.548	36.569	858.867	751.673	107.194
Sokobanja	159.131	154.815	4.316	756.089	743.017	13.072
Niška	4.271	4.060	211	33.686	32.803	883
Prolom	14.609	12.854	1.755	71.586	65.567	6.019
Koviljača	18.588	14.490	4.098	119.850	75.438	44.412
Sijarinska	5.784	5.728	56	38.761	38.441	320
Vrdnik	61.838	53.545	8.293	144.035	124.415	19.620
Gamzigradska	929	910	19	9776	9489	287
Lukovska	11.121	10.431	690	75.542	72.533	3.009
Mataruška	465	461	4	5851	5818	33
Vrujci	9.678	9.266	412	45.762	43.732	2.030
Kanjiža	9.000	7.084	1.916	38.341	31.909	6.432
Atomska	7.979	7.310	669	77.332	68.347	8.985

Source: Republic Institute of Statistics, Municipalities and Regions in the Republic of Serbia 2022, Belgrade

From table 1, it can be concluded that regardless of the long tradition and potential that Serbia has in this field, domestic guests still dominate the overall structure of guests. The number of foreign guests is below 20%, which indicates the uncompetitiveness of Serbia on the foreign tourist market. For this reason, in the coming period, the priority should be attracting foreign guests. In order to achieve this, it is necessary to enrich the existing offer with entertainment and recreational facilities, with the opening of new wellness centers as well as clinics and surgeries. The combination of conditions for recreation, being in nature, visiting sites of cultural and historical heritage, manifestations, getting to know local traditions are essential values that distinguish Serbian spas from other destinations (Tončev Jovanović et al. 2015, p. 342).Entering the European and international tourist market, where a large number of competitors already exist, is only possible with the existence of a unique product that will be of high quality and different from the others and that will provide tourists with appropriate value for money (Podavac & Tončev Jovanović 2015, p. 503).

Spas in Serbia have not yet recognized the importance of medical tourism as a segment of health tourism, unlike spas in Europe, although the resource base of spas in Serbia is significantly richer and services are significantly cheaper, especially in the field of dental and aesthetic interventions. The growth of medical tourism is encouraged by four main factors (Kotler et al. 2019, p. 546): low prices, long waiting lists in the healthcare of the countries from which tourists come, the availability of medical procedures and treatments, but also the opportunity for rest and privacy. Price is the main motive.

In order to raise tourism to a significantly higher level, it is necessary to continuously research the tourist market, pay attention to international experiences and contemporary trends in the development of spa resorts in the world and the surrounding area, and concentrate on designing a quality and diversified tourist offer (Topalović 2013, p. 129).

REPRESENTATION OF HEALTH TOURISM IN THE TERRITORY OF THE REGION OF SOUTHERN AND EASTERN SERBIA

Going to places with healing springs, as a forerunner of modern spa tourism, was the most widespread in the Roman Empire. It was then that the foundations of the health-healing function, which is the oldest and most important function of spas, were laid. Traces of material culture from the Roman era were also found in the spas of the region of Southern and Eastern Serbia (Kuršumlijska, Niška, Gamzigradska and Zvonačka banja).

On the other hand, the tourist function was formed much later than the health care function. Namely, the more intensive development of the tourist function began after 1965, when free treatment in spas was abolished. The quality of the tourist function is directly related to the number, size and built tourist infrastructure.

In the territory of the region of Southern and Eastern Serbia, there are a large number of spas that are rich in healing natural factors (healing thermal waters, healing mud, gas and moderate climate), and the range of indications covered by the spas is wide and includes a large number of indications, starting with rheumatism, which is the most common indication in most spas, up to cardiovascular diseases, lung diseases, gynecological diseases, neurological, skin, diabetes and others. An overview of spas by district located in the territory of the South and East Serbia region with the indications they cover is given in the following table.

Table 2. Spas in the region of Southern and Eastern Serbia

District	Spa	Healing factors	Indications
Braničevski	Ždrelo	thermal waters, air conditioning	skin diseases, locomotor apparatus
	Palanački Kiseljak	mineral water	rheumatism, sterility, neurological diseases
Borski	Brestovačka	thermal water	gynecological, rheumatism, respiratory diseases
Zaječarski	Gamzigradska	mineral water	orthopedic diseases, post-traumatic conditions
	Sokobanja	mineral sources, gas, climate	lung diseases, cardiovascular diseases
	Jošanica	air conditioning, thermal water, mud	rheumatism, diabetes, neuroses
Nišavski	Niška	air conditioning, mud, gas, thermal waters	cardiovascular, pulmonary diseases
	Topilo	thermal water	rheumatic, nervous diseases
Pirotski	Zvonačka	thermal water	nervous diseases, rheumatism
Jablanički	Sijarinska	mineral water, mud	stomach diseases, intestinal diseases
Pčinjski	Vranjska	thermal water	rheumatic, neurological diseases
	Bujanovačka	thermal water, mud, gas	rheumatic, gynecological, skin diseases
Toplički	Prolom	prolom water, mud, climate	kidney diseases, digestive organs, skin diseases
	Lukovska	thermal springs, mud, gas, climate	rheumatism
	Kuršumlijska	thermal springs, mud	rheumatism, gynecological diseases

Source: Gašic, M. (2017): Tourism as a function of the development of rural areas of Southern and Eastern Serbia, Faculty of Economics, Niš

Spas in the region of Southern and Eastern Serbia are associated with certain specificities (Marić 2015). The Vranjska banja is the warmest spa in Europe, the Brestovačka banja has the largest forest belt in Europe, the Bujanovačka banja was declared by the Royal Medical Society of Great Britain as one of the three most important spas in Europe, while in Sokobanja, as early as 1880, an order on cleanliness was passed and the first rulebook on the use of thermal mineral waters of Serbia.In addition, four of the eight royal spas are located in the region of South and East Serbia, namely Niška banja, Sokobanja, Vranjska banja and

Brestovačka banja. There are justified doubts that the oldest spa in the world, the Viča spa, is located on the territory of the region, located not far from the Neolithic settlement of Pločnik (Maćejka 2003).

Table 3. Tourist traffic in the spas of the region of Southern and Eastern Serbia

	Number of tourists			**Number of nights**		
Spas	In total	Domestic	Foreign	In total	Domestic	Foreign
Ždrelo	-	-	-	-	-	-
Pal. Kiseljak	-	-	-	-	-	-
Brestovačka	-	-	-	-	-	-
Gamzigradska	929	910	19	9776	9489	287
Sokobanja	159.131	154.815	4.316	756.089	743.017	13.072
Niška	4.271	4.060	211	33.686	32.803	883
Topilo	-	-	-	-	-	-
Zvonačka	-	-	-	-	-	-
Sijarinska	5.784	5.728	56	38.761	38.441	320
Vranjska	2.631	2.443	188	18.209	16.645	1.564
Bujanovačka	-	-	-	-	-	-
Prolom	14.609	12.854	1.755	71.586	65.567	6.019
Lukovska	11.121	10.431	690	75.542	72.533	3.009
Kuršumlijska	-	-	-	-	-	-

Source: Republic Institute of Statistics, Municipalities and Regions in the Republic of Serbia 2022, Belgrade

Today, after numerous changes that have taken place in the tourist market, Prolom, Lukovska and Sokobanja are doing the best business, which can be concluded based on the data in the table. Unfortunately, some spas that are rich in natural healing factors are closed or have few tourists.These are: Palanački Kiseljak, Brestovačka banja, Topilo banja near Niš, Zvonačka banja, Bujanovačka banja.After sixteen years, the Kuršumlijska banja started working again and now, together with Prolom and Lukovska banja, it forms a unique spa triangle, and the municipality of Kuršumlija is the only municipality in Europe that has as many as three spas on its territory.In general, this kind of structure in Prolom, Lukovska and Kuršumlijska banja can be assessed as relatively favorable for the further development of health and rural tourism (Perić 2010, p. 59).

The key shortcomings of development in the mentioned spas, which record low tourist traffic, are inadequate tourist offer, lack of awareness of trends in health tourism, insufficient financial resources, lack of marketing sector, quality of services, unfavorable demographic trends and traffic infrastructure (Gašić 2017).

In the coming period, the demand for this form of tourism is expected to grow, and the key success factors are given in the following table. This is supported by the data on the aging of the population both in Serbia and in Europe, as well as the increase in life expectancy. It is predicted that by 2050, the share of the population over 65 years old in the total structure will be as much as 30%, while it is currently around 17% (Dašić 2018, p. 50).According to forecasts of the World Tourism Organization, the number of tourists will increase with

expectations of 1.8 billion tourists by 2030, where cultural tourism will be one of the five leading segments of the tourism market (Perić et al. 2020, p. 87). Since the region of South and East Serbia is rich in cultural potential, a logical complementarity with health tourism and their mutual connection in the coming period is imposed.

Table 4. Key success factors in health tourism

Segments	Reasons for coming	Success factors	Distribution channels
Individuals Couples without children	Rest and relaxation Healthy and organic food Body care treatments Retreat from stressful life Improvement of health condition Peace, solitude, silence	Educated personnel Polite staff A rich offer in line with world trends Quality service	Recommendations from friends Internet Tourist agencies

Source: Gašić, M. Stojković, A. Simić, J. (2013): Perspectives of tourism development in the Toplički district, Ekonomika, Niš, 59 (3), p. 192

Taking into account the key success factors listed in the table with an emphasis on the motives of arrival and distribution channels, it is necessary to define a health tourism development strategy within the Tourism Development Strategy of the Republic of Serbia, because health tourism along with cultural tourism will have a tendency of constant growth in the future.

CONCLUSION

The modern way of life characterized by a chronic lack of free time, exposure to stress, improper diet and lifestyle have led to an increased interest in health tourism, which includes spa, medical and wellness tourism. It could be said that traditional spa tourism is partially developed, as well as wellness tourism, while medical tourism is underdeveloped.

In the long term, health tourism in Serbia in general, but also in the region of Southern and Eastern Serbia, can become the leading segment of the destination, as an independent or complementary segment in relation to the overall tourism product.

Since Serbia is a country of spas and has included numerous wellness treatments and medical procedures in its offer in addition to classic physical procedures, further growth of health tourism is expected in the future. However, it is necessary to complete the existing offer with new and more current products and raise the quality of the service to a significantly higher level.

The large number of spas in the region of Southern and Eastern Serbia, the wealth of thermal springs, their quality and abundance represent a huge potential that is still not adequately valorized. Therefore, it is necessary to invest in new and more modern spa, wellness and medical services, build wellness centers as a supplement to the existing facilities and improve the traffic infrastructure in all health destinations in the region of Southern and Eastern Serbia. Each of the mentioned segments of health tourism (spa, medical and wellness tourism) has a huge potential for future development. In order to use the potential in the right way, it is necessary to carry out adequate segmentation and adapt the mentioned segments to the needs of domestic and foreign tourists.

REFERENCES

1. Dašić, D. (2018): *Menadžment zdravstvenog i medicinskog turizma – mogući pravci razvoja u Republici Srbiji*, Ekonomski signali, 13 (1), str. 41-56
2. Dimitrovski, D. Milićević, S. Lakićević M. (2021): *Specifični oblici turizma*, Univerzitet u Kragujevcu, Fakultet za hotelijerstvo i turizam u Vrnjačkoj Banji, Vrnjačka Banja
3. Gašić, M. (2012): *Ekonomsko-geografska valorizacija turističkog potencijala Topličkog okruga*, Master rad, Univerzitet u Nišu, Ekonomski fakultet
4. Gašić, M. Stojković, A. Simić, J. (2013): *Perspektive razvoja turizma na prostoru Topličkog okruga*, Ekonomika, Niš, 59 (3), str. 187-199
5. Gašić, M. Ivanović, V. Perić, G. (2015): *Materijalna baza razvoja turizma na prostoru Topličkog okruga*, Sinteza, Međunarodna naučna konferenciji iz oblasti informacionih tehnologija i savremenog poslovanja, Univerzitet Singidunum, Beograd
6. Gašić, M. (2017): *Turizam u funkciji razvoja ruralnih područja Južne i Istočne Srbije*, Doktorska disertacija, Ekonomski fakultet, Univerzitet u Nišu
7. Gligorijević, Ž. Novović, M. (2014): *Zdravstveno-rekreativni turizam u procesu razvoja banjskih i planinskih turističkih mesta*, Ekonomske teme, 52 (4), str. 509-522
8. Jovanović, V. (2013): *Tematski turizam*, Univerzitet Singidunum, Fakultet za turistički i hotelijerski menadžment, Beograd
9. Kotler, F. Bouen, Dž. Makens, Dž. Baloglu, S. (2019): *Marketing u ugostiteljstvu, hotelijerstvu i turizmu*, Univerzitet u Beogradu, Ekonomski fakultet
10. Lević, K. (2022): *Održivi banjski turizam u Srbiji*, Green European Foundation, Beograd
11. Maćejka, M. (2003): *Klima i njen zdravstveni značaj u banjama Srbije*, Srpsko geografsko društvo, Beograd
12. Marić, A. (2015): *Turistička valorizacija kraljevskih banja Srbije*, Master rad, Univerzitet u Nišu, Prirodno-matematički fakultet
13. Perić, G. (2010): *Upravljanje razvojem turizma u opštini Kuršumlija*, Master rad, Univerzitet Singidunum, Beograd
14. Perić, G. Jevtović, A. Gašić, M. (2020): *Potencijali razvoja kulturnog turizma na prostoru Topličkog okruga*, Naučno-stručna konferencija: Uticaj tradicionalnih i digitalnih medija na promociju i održivi razvoj kulturne baštine, Zbornik radova, Sremski Karlovci
15. Podavac, M. Tončev Jovanović, M.(2015): *Kompleksnost turističkog proizvoda kao faktor konkurentnosti banjskih destinacija*, Synthesis, International Scientific Conference on Information Technology and Data-Related Research, str. 499-503

16. Rabotić, B. (2013): *Selektivni oblici turizma*, Visoka turistička škola strukovnih studija, Beograd
17. Republic Institute of Statistics, *Municipalities and Regions in the Republic of Serbia 2022*, Belgrade
18. Roman, M.Roman, M.Wojcieszak-Zbierska, M. (2023):*HealthTourism—Subject of ScientificResearch: A Literature Review andCluster Analysis*, International Journalof Environmental Research and Public Health 20, 480
19. Spasojević, M. Šušić, V. (2011): *Savremene tendencije u razvoju zdravstvenog turizma u svetu i Srbiji*, Teme, 35 (1), str. 149-162
20. Tončev Jovanović, M. Podavac, M. Stanišić, N. (2015): *Kvantitativno-kvalitativna analiza tržišne privlačnosti i značajnosti banja Srbije*, Poslovna ekonomija, 9 (2), str. 341-364
21. Topalović, S. (2013): *Stanje i perspektive banjskog turizma u Srbiji*, Globus 37-38 – časopis za metodološka i didaktička pitanja geografije, Srpsko geografsko društvo, Beograd, 123-134

PROMOTING GREEN AND SUSTAINABLE PRACTICES IN MONTENEGRO'S TOURISM INDUSTRY: POLICY MEASURES FOR SUSTAINABLE GROWTH WITH THE IDEA OF ADDRESSING THE RISK OF CLIMATE CHANGE

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Abstract: This research emphasizes the importance of promoting green and sustainable practices in Montenegro's tourism industry to achieve sustainable growth and address climate change risks. The paper focuses on policy measures that can foster environmentally friendly practices and enhance resilience in the tourism sector. By analyzing the potential impacts of adopting sustainable practices and preserving cultural heritage, the study highlights the significance of stakeholder engagement and collaboration in achieving sustainable growth.
The study area, Montenegro, is blessed with diverse natural and cultural heritage, attracting a growing number of tourists. However, the tourism industry faces challenges related to environmental sustainability and climate change. To ensure its long-term viability, proactive measures are needed to promote green practices and mitigate climate change risks. The paper explores policy measures to promote sustainability, reduce carbon emissions, conserve natural resources, and engage stakeholders in achieving sustainable growth.
By adopting effective policy measures, Montenegro can position itself as a leading sustainable tourism destination. The study emphasizes the importance of encouraging environmentally friendly practices, enhancing resilience, and safeguarding natural and cultural assets. Collaborative efforts and a comprehensive policy framework are necessary to achieve a greener and more resilient future for Montenegro's tourism sector.

Keywords: Green practices, sustainable tourism, policy measures, sustainable growth, climate change risks, Montenegro.

INTRODUCTION

Tourism is the most important export sector in Montenegro, with a share of 22% of the total Gross Domestic Product (GDP) and a strong tendency toward growth (Cerović Smolović, et al, 2018; NTOM, 2017). The tourism industry in Montenegro has seen impressive growth in recent years (WTTC, 2016), becoming a significant contributor to the country's economy. However, this growth has highlighted the challenges posed by climate change and the need for sustainable practices (Jackson, 2023; AMAP, 2019; Dankers, 2008;). In this paper, we examine the importance of adopting policies that foster sustainable growth while addressing climate change risks in Montenegro's tourism industry. Sustainable tourism integrates environmental, social, and economic considerations into development, and it is crucial for

Montenegro (Galli et al, 2018), with its stunning natural landscapes and rich cultural heritage. Climate change presents significant risks to the country's tourism sector, threatening its attractions such as coastal areas, national parks, and historical sites. To mitigate these risks and promote sustainability, we explore policy measures, including reducing carbon emissions and preserving cultural heritage. Collaboration among stakeholders, including the government, tourism operators, local communities, and visitors, is vital. This study aims to highlight the benefits of green practices, provide recommendations for effective policy measures, and position Montenegro as a leading sustainable tourism destination. The subsequent sections delve into the current state of the industry, climate change risks, policy measures, and recommendations for sustainable growth. Through this paper, we hope to contribute to the discourse on sustainable tourism and inspire a greener and more resilient future for Montenegro's tourism sector.

MATERIALS AND METHODS

In this chapter, we outline the materials and methods employed in our research, including the analysis of available recent documents and reports of the international organizations, the utilization of interviews with some prominent individuals in this area of expertise, focus groups, and the application of SWOT analysis. We discuss the origins and previous applications of these methodological tools in relevant research areas.

In this study, we utilized interviews and focus group discussions as methodological tools to gather insights and capture diverse perspectives on green and sustainable practices in Montenegro's tourism industry. Interviews involved structured or semi-structured conversations with knowledgeable individuals, while focus groups facilitated in-depth exploration of specific topics, aligning with our objective of promoting sustainable growth through policy measures.

SWOT analysis is a strategic planning tool used to assess strengths, weaknesses, opportunities, and threats related to a particular subject or situation. In our research, we applied SWOT analysis to evaluate the findings from the interviews with prominent individuals in science and focus group discussions (Vanek et al., 2012; Inger, 2016; Sincy, 2016). By conducting a SWOT analysis, we aimed to systematically analyze and understand the key aspects of Montenegro's efforts in relation to the subject matter.

The PESTEL analysis is a framework used to analyze the external macro-environmental factors that can impact a business. It examines political, economic, social, technological, environmental, and legal factors to assess the potential opportunities and threats in a given market or industry. A PESTEL analysis was conducted to gain insights into the external factors influencing the research topic and to inform the selection of appropriate methodologies and strategies.

Study area

Montenegro, located in south-eastern Europe, is a country with a diverse natural and cultural heritage (Figure 1 and 2). As part of our research, we gathered relevant information about Montenegro to provide context and insights into the country's ecological sustainability and climate change initiatives.

Figure 1. Montenegro on the Global Map

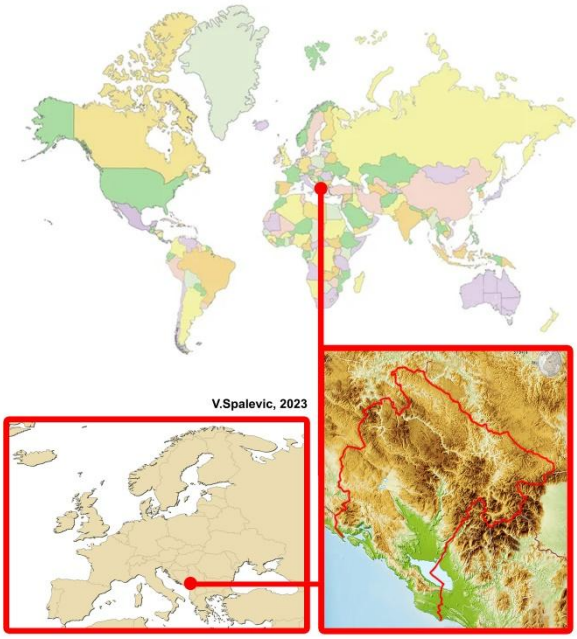

Figure 2. Map of Montenegro

Montenegro, spanning approximately 13,812 square kilometres, is blessed with geological diversity and versatile soils, contributing to its rich biodiversity and diverse ecosystems, encompassing forests, mountains, lakes, and coastal areas along the Adriatic Sea. While the country's natural beauty, including its renowned national parks, draws both domestic and international tourists, it also faces significant challenges, particularly in land degradation, with soil erosion being the leading problem (Nyssen et al, 2014; Kerckhof et al., 2016; Mickovic et al, 2020; Mijanovic et al, 2017).

By integrating information about Montenegro into our research methodology, we aimed to provide a comprehensive understanding of the country's context and contribute to the broader discussions on promoting Green and Sustainable Practices in Montenegro's Tourism Industry with specific attention to the Policy Measures for Sustainable Growth with the idea of addressing the Risk of Climate Change.

RESULTS AND DISCUSSION

Montenegro's Governments has implemented policies and regulations aimed at reducing greenhouse gas emissions and transitioning to cleaner energy sources. It has set targets for renewable energy production and has been investing in solar and wind power projects. The Governments has also been working on improving energy efficiency in buildings and transportation, aiming to create a more sustainable and eco-friendly infrastructure.

Research institutions in Montenegro have been in part involved in studying ecological sustainability and climate change. They conduct scientific research, monitor environmental indicators, and provide recommendations for sustainable practices. Collaboration between academia, Government, and non-Governmental organizations plays a vital role in generating knowledge and driving policy changes (Kafy et al., 2021).

The World Bank has released a Country Economic Memorandum for Montenegro: Towards a Sustainable Growth Strategy, urging the country to adopt a sustainable growth strategy to accelerate convergence with EU living standards. Montenegro's average income is projected to take nearly 40 years to reach the EU average if current growth rates persist. The previous growth strategy, focused on attracting large investments, lacked productivity growth and long-term benefits. The new sustainable growth model should prioritize removing regulatory barriers, leveraging trade, and unleashing human capital potential. Eliminating restrictive regulations in service sectors could boost annual growth by 0.4% and reduce the time to reach EU income levels by 13 years. Addressing income inequality through equitable access to education and healthcare can enhance future workforce skills. The World Bank offers support and expertise to help Montenegro implement structural reforms. Greening the tourism sector is crucial for sustainable growth, requiring attention to environmental degradation and climate change. Strengthening public institutions, rule of law, and enforcement mechanisms will ensure the long-term impact of the new growth strategy and improve living standards.

A sustainable growth strategy is crucial for Montenegro's tourism sector, which drives economic growth but also contributes to environmental degradation and untapped potential due to low firm productivity. Addressing challenges, strengthening linkages, minimizing environmental impact, and building climate resilience are essential considerations. Policies supporting tourism align with overall productivity, trade, and competition, but special attention is needed due to vulnerability to environmental degradation and climate change. Integration into domestic markets unlocks untapped growth. Montenegro's tourism sector is significant, accounting for almost a third of the economy, with high employment and export contributions. However, there is a need to diversify tourist origins, reduce seasonality, and improve marketing of inland attractions for greater competitiveness.

Key challenges to tourism growth in Montenegro include environmental degradation, coastal congestion, underdeveloped inland destinations, and weak enforcement of regulations. Environmental degradation poses a risk to sustainability, as it negatively impacts tourists' perceptions and satisfaction. Coastal destinations suffer from infrastructure congestion during peak summer months, leading to reduced tourist satisfaction and spending. Developing sustainable tourism in central and northern areas requires public-private coordination to improve transportation, accommodations, and marketing. Shortages of skilled labour increase costs and limit sector efficiency. Weak enforcement of spatial plans and environmental regulations results in uncontrolled land development and the growth of informal businesses. Addressing these challenges is crucial for the growth and sustainability of Montenegro's tourism sector.

Montenegro faces significant challenges in waste management, with a high percentage of municipal solid waste going to landfill, low recycling rates, and a lack of separately collected waste. The country has limited sanitary landfills operating according to EU standards and a scarcity of material recovery facilities.

Improving the enforcement of existing legislation is crucial to reduce the environmental impact of tourism in Montenegro, as the sector generates a significant amount of unprocessed solid waste, particularly plastics, leading to pollution of beaches and the sea. Montenegro's tourism destinations produce three times more waste per capita than the national average, with a substantial portion of beach litter and marine pollution associated with tourism and recreational activities.
Inadequate wastewater collection and treatment in tourist areas pose challenges for the quality of potable and bathing water. Only 61 percent of the total population in Montenegro is served by wastewater collection, with several tourism destinations, such as Bar, Kotor, and Tivat, falling below the national average. Insufficient infrastructure and treatment capacity lead to the discharge of untreated wastewater, and many tourism businesses express dissatisfaction with the municipality's wastewater and solid waste treatment services.

Tourism in Montenegro accounted for 30 percent of the country's carbon emissions in 2018, surpassing the global average by more than three times, with the accommodation sector contributing over half of the tourism-related emissions, primarily due to a lack of energy efficiency measures and reliance on fossil fuels in electricity generation, while transport emissions were mainly driven by air travel and maritime transport, exacerbated by inadequate public transport services and high-emitting vehicle fleets.

Montenegro is highly exposed to climate change risks, including floods, wildfires, extreme temperatures, and heavy rainfalls, with annual flooding affecting around 10,000 people and causing approximately US$90 million in damages, while inadequate prevention mechanisms and lack of resources further exacerbate the vulnerability to wildfires, particularly in the Skadar Lake region, the Bojana River, and the capital, Podgorica.

The tourism sector in Montenegro faces significant vulnerabilities to water scarcity, temperature increases. For Budva is projected to have an extended period of dry days during future tourist seasons and Ulcinj expected to have the highest daily maximum temperatures, while coastal destinations like Bar, Budva, Kotor, Tivat, and Ulcinj are at risk of sea level rise, necessitating the development of climate-resilient tourism assets and infrastructure, including nature-based solutions, to mitigate these impacts.

To achieve robust and sustainable growth in Montenegro, it is recommended to focus on boosting productivity and leveraging trade for sustainable growth, ensuring equality of opportunity for inclusive growth, and adopting a strategy for a green transition. This includes measures such as reducing the presence of state-owned enterprises, strengthening the competition framework, improving policy predictability, attracting foreign direct investment, reducing regulatory requirements for services trade, adopting a green transition strategy, improving trade facilitation, and reducing non-tariff measures. Additionally, efforts should be made to enhance education quality and coverage, improve the health system, strengthen social protection and labour markets, and equalize access to services, with a focus on reducing regional disparities and gender discrimination.

To foster a resilient and green tourism sector in Montenegro, targeted policies are needed. These include addressing transportation bottlenecks, expanding ferry services and public transport, imposing taxes on congested infrastructure and cruise traffic, and marketing inland attractions. Strengthening sector management involves mapping the supply chain, providing vocational training, and addressing waste management and energy efficiency. Montenegro should also raise environmental awareness, enforce regulations, adopt producer responsibility systems, and invest in climate-resilient infrastructure.

SWOT Analysis

Promoting Green and Sustainable Practices in Montenegro's Tourism Industry: Policy Measures for Sustainable Growth with the idea of Addressing the Risk of Climate Change.

Strengths:
Natural Beauty: Montenegro is blessed with stunning natural landscapes, including coastal areas, national parks, and mountains, which serve as a strong attraction for tourists seeking eco-friendly and sustainable destinations. **Cultural Heritage:** Montenegro boasts a rich cultural heritage, with historical sites and traditions that offer unique and authentic experiences for visitors interested in sustainable and responsible tourism. **Government Commitment:** The Montenegrin government has shown a strong commitment to sustainable development and has implemented policies and initiatives to support the growth of green practices in various sectors, including tourism. **Increasing Awareness:** There is a growing global awareness of the importance of sustainable tourism, and Montenegro has the opportunity to capitalize on this trend by promoting its commitment to green and sustainable practices.
Weaknesses:
Infrastructure Limitations: Montenegro's tourism infrastructure, such as waste management and transportation systems, may not be fully equipped to handle the demands of sustainable tourism, requiring investment and improvement. **Limited Resources:** The implementation of sustainable practices often requires financial and human resources, which may be limited, especially for small and medium-sized tourism businesses in Montenegro. **Lack of Awareness and Education:** Some stakeholders within the tourism industry may have limited awareness of the benefits and opportunities associated with sustainable practices, requiring educational campaigns and training programs.
Opportunities:
Market Differentiation: By promoting green and sustainable practices, Montenegro can differentiate itself from other destinations and attract environmentally conscious tourists seeking responsible travel experiences. **Eco-Tourism Potential:** Montenegro has the potential to develop and market eco-tourism products and services, leveraging its natural and cultural assets to attract niche markets interested in sustainable tourism. **Collaboration and Partnerships:** Montenegro can foster collaborations and partnerships with international organizations, NGOs, and sustainable tourism networks to access funding, knowledge, and best practices in implementing green policies and initiatives.

Threats:
Climate Change Impacts: The risks associated with climate change, such as rising sea levels, extreme weather events, and ecosystem and land degradation; pose a significant threat to Montenegro's tourism industry and its natural and cultural assets. **Competitiveness:** Other destinations may also recognize the importance of sustainable tourism and implement similar policies, increasing competition for environmentally conscious travellers. **Changing Consumer Behaviour:** Travellers' preferences and behaviours are constantly evolving, and there is a risk that the demand for sustainable tourism may not grow as anticipated, affecting the market potential for Montenegro.

By conducting SWOT analysis, Montenegro's tourism industry can identify its strengths and weaknesses, seize opportunities, and address threats. This analysis will serve as a basis for developing effective policies and strategies to promote green and sustainable practices while addressing the risks of climate change, ensuring the long-term resilience and success of Montenegro's tourism sector.

PESTEL analysis

PESTEL analysis for promoting green and sustainable practices in Montenegro's tourism industry:

Political:
Government commitment to sustainable development: The Montenegrin government has shown a strong commitment to sustainable development and has implemented policies and initiatives to support green practices in various sectors, including tourism. **Regulations and policies:** The government has implemented regulations and policies aimed at reducing greenhouse gas emissions, improving energy efficiency, and promoting sustainability in the tourism industry.
Economic:
Economic growth: The tourism industry in Montenegro has been a significant contributor to the country's economy, and promoting sustainable practices can contribute to long-term economic growth. **Investment in sustainable infrastructure:** Montenegro has the opportunity to attract investments in sustainable tourism infrastructure, such as renewable energy projects, eco-friendly accommodations, and transportation systems.
Social:
Growing awareness of sustainable tourism: There is a growing global awareness of the importance of sustainable tourism, and Montenegro can capitalize on this trend by promoting its commitment to green and sustainable practices. **Cultural heritage preservation:** Montenegro's rich cultural heritage and historical sites offer unique and authentic experiences for visitors interested in sustainable and responsible tourism.

Technological:
Renewable energy projects: Montenegro has set targets for renewable energy production and has been investing in solar and wind power projects, which can contribute to sustainable practices in the tourism industry. **Technology for energy efficiency:** Technological advancements in energy-efficient systems and practices can be adopted in the tourism sector to reduce carbon emissions and improve sustainability.
Environmental:
Climate change risks: Montenegro is highly exposed to climate change risks, including floods, wildfires, temperature increases, and sea level rise. Promoting sustainable practices in the tourism industry can help mitigate these risks and ensure the long-term resilience of the sector. **Natural resource conservation:** Montenegro's diverse natural landscapes, including coastal areas, national parks, and mountains, need to be conserved to maintain their attractiveness as sustainable tourism destinations.
Legal:
Regulatory framework: The government has implemented regulations related to environmental protection, waste management, and energy efficiency, which are relevant to promoting sustainable practices in the tourism industry. **Compliance with international standards**: Montenegro's tourism industry needs to comply with international standards and certifications for sustainable tourism, ensuring responsible practices and attracting environmentally conscious tourists.

By considering these factors in the PESTEL analysis, Montenegro can develop effective policies and strategies to promote green and sustainable practices in its tourism industry. This will contribute to sustainable growth, address climate change risks, and position Montenegro as a leading sustainable tourism destination.

CONCLUSIONS

The Country should highlight the need for a sustainable growth strategy to accelerate the convergence with EU living standards. To achieve this, Montenegro should focus on productivity, human capital gains, and the preservation of natural resources. Removing regulatory barriers, leveraging trade for market access and technology, and ensuring equality of opportunity are key areas to prioritize. Implementing these reforms can lead to a thriving private sector, job opportunities, and improved wages and benefits for all citizens. The World Bank stands ready to support the Montenegrin government in designing and implementing structural reforms. In the context of the tourism sector, addressing environmental degradation, congestion, and weak enforcement of regulations is crucial.

Montenegro should invest in waste management, wastewater infrastructure, energy efficiency, and climate-resilient tourism assets and infrastructure. Additionally, empowering public institutions, strengthening the rule of law, and enhancing enforcement mechanisms are vital for long-term impact and a higher standard of living. By promoting green and sustainable practices, Montenegro can differentiate itself, attract environmentally conscious tourists, and capitalize on the opportunities of responsible tourism. However, it should be aware of climate

change risks, changing consumer behaviour, and competition from other destinations. Conducting of SWOT analysis help us to identify strengths, weaknesses, opportunities, and threats, and such analysis is enabling the development of effective policies and strategies for sustainable growth and climate resilience in the tourism industry.

REFERENCES

Arctic Monitoring and Assessment Programme (AMAP). AMAP Climate Change Update 2019: An Update to Key Findings of Snow, Water, Ice and Permafrost in the Arctic; Arctic Monitoring and Assessment Programme (AMAP): Oslo, Norway, 2019.

CerovićSmolović, J.; Janketić, S.; Jaćimović, D.; Bučar, M.; Stare, M. (2018): Montenegro's Road to Sustainable Tourism Growth and Innovation. Sustainability 2018, 10, 4687. https://doi.org/10.3390/su10124687

Dankers, R.; Feyen, L. (2018): Climate Change Impact on Flood Hazard in Europe: An Assessment Based on High-Resolution Climate Simulations. J. Geophys. Res. Atmos. 2008, 113, D19105.

Galli, A., Đurović, G., Hanscom, L., Knežević, J. (2018): Think globally, act locally: Implementing the sustainable development goals in Montenegro. Environmental Science & Policy, 84, 159-169. https://doi.org/10.1016/j.envsci.2018.03.012.

Inger, A., (2016): SWOT Self-analysis. Nurse Educator 41, (3): 138. http://dx.doi.org/10.1097/nne.0000000000000265.

Jackson, S.T. (2023): Climate change. Encyclopedia Britannica. https://www.britannica.com/science/climate-change. Accessed 4 June 2023.

Kerckhof, A., Spalevic, V., Van Eetvelde, V., Nyssen, J. (2016): Factors of land abandonment in mountainous Mediterranean areas – the case of Montenegrin settlements. SpringerPlus 5, 485 (2016). https://doi.org/10.1186/s40064-016-2079-7.

Mickovic, B.; Mijanovic, D.; Spalevic, V.; Skataric, G.; Dudic, B. (2020): Contribution to the Analysis of Depopulation in Rural Areas of the Balkans: Case Study of the Municipality of Niksic, Montenegro. Sustainability 2020, 12, 3328. https://doi.org/10.3390/su12083328

Mijanovic, D., Brajuskovic, M., Vujacic, D. and Spalevic, V. (2017): Causes and Effects of Aging of Montenegrin Population. Journal of Environmental Protection and Ecology, 18(3): 1249-1259.

NTOM.The annual work plan of the National Tourism Organization of Montenegro for 2017. 2017. Available online: http://www.gov.me/biblioteka/Planovi (accessed on 4 December 2017).

Nyssen, J., Van Den Branden, J., Spalevic, V., Frankl, A., Van De Velde, L., Curovic, M. and Billi, P. (2014): Twentieth century land resilience in Montenegro and consequent hydrological response; Land Degradation and Development. 25 (4): 336–349. https://doi.org/10.1002/ldr.2143.

Sincy, P. (2016): SWOT Analysis in Nursing. International Journal of Nursing Care 4 (1) 34. http://dx.doi.org/10.5958/2320-8651.2016.00008.9.

Vanek, M., Mikolas, M., Zvakova, K. (2012): Evaluation Methods of SWOT Analysis / MetodyVyhodnocení Swot Analýzy. GeoScience Engineering 58 (2): 23–31. http://dx.doi.org/10.2478/gse-2014-0036.

WTTC.Travel & Tourism Economic Impact 2016—Montenegro.World Travel & Tourism Council, 2016. Available online: https://www.wttc.org/-/media/files/reports/economic-impact-research/countries-2016/montenegro2016.pdf (accessed on 19 September 2017).

CONTEMPORARY ECO TRENDS IN HOSPITALITY

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Abstract: Sustainability has become a top priority for companies in the hospitality industry in recent years. Following eco trends is about minimizing company impact on the planet, specifically addressing issues such as sustainable agriculture, carbon footprint, shortened supply chains, food waste, packaging, water and energy use, and recycling. Sustainability in hospitality means not only participating in the environment, but also giving customers the opportunity to contribute to these positive efforts. Today, people choose where to stay and eat based on corporate values. Therefore, this paper lists and emphasizes the most significant contemporary trends in this area.

Keywords: Hospitality, tourism, sustainability, eco trends

INTRODUCTION

The global hospitality industry, which includes accommodation sector (hotels, motels, etc.), as well as restaurants, bars, casinos, cruise ships, travel agencies, tour operators, and other similar companies, reached nearly 4.7 trillion U.S. dollars in 2023and it was forecast to grow to 5.8 trillion U.S. dollars in 2027 (Statista, 2023).

The tourism industry has been known for having a negative impact on environment, leading to environmental degradation. In the hospitality industry, the heavy use of energy, water and detergents in daily operations has a negative impact on the environment (Han et al., 2018). Important changes need to be made in the industry to meet growing environmental requirements and regulations. For example, in the EU, industry must respect environmental challenges of the European Green Deal (EGD), aims to achieve climate neutrality by 2050 in Europe (European Commission, 2020).

Since environmentalism has become a key value in our culture, corporations and industries have faced public pressure to become more aggressive in environmental preservation without sacrificing revenues. This has led to new types of communication, namely different discourses through which organizations promote values and actions that aim at protecting the natural environment and achieving sustainability. Over the previous few decades, there has been a rise in environmental consciousness that has dominated all public sectors, leading to a progressive greening of consumers (Hansen, 2002).

The tourist sector has not been immune to the need for environmental responsibility, and as a result, the business has taken activities that do not affect the environment, utilizing a vocabulary that emphasizes the greening of corporate awareness (Ruffolo, 2015). As a part of the tourist business, the hospitality sector has made significant efforts to address

environmental concerns; in fact, hotels are implementing environmentally friendly growth plans and employing a specialized discourse to do so (Qui, 2013). Over the past decades, encouraging eco-friendly purchasing behavior among guests has been a fundamental part of the success of eco-friendly hotel businesses (Han, 2021).

Sustainability in the hospitality industry often involves various management actions, for example saving natural resources (e.g. water, energy), reducing environmental damage (e.g. waste reduction),"green" needs of society, and environmental, social and corporate responsibility. In order to adapt to market changes, some hotels opted for environmentally friendly solutions (e.g., energy and water reduction, detergent usage, etc.) (Hsiao et al., 2014), while some hotels have also offered voluntary tools to reduce negative environmental impact (Preziosi et al., 2019). Environmental constraints have even led to a redefining of hotels' corporate social responsibility policy, in which the importance of environmental activism has increased (Úbeda-García et al., 2021).

Implementation of sustainability practices can bring solutions to business crises, particularly financial ones. Water recycling and energy management methods, for example, can help with money savings. Green techniques result in significant cost savings. This is why, following the 2007-2009 global financial crisis, organizations improved their sustainability performance in the five pillars of economic, governance, social, ethical, and environment. Furthermore, organizations began reporting their sustainability performance to their stakeholders. In 2020, 96% of the world's biggest 250 firms declared sustainable performance. In 2020, 80% of 5200 firms in 52 countries reported on their sustainability performance (Global Reporting Initiative, 2020). Furthermore, a study by Kusa et al. (2023) confirm that greening positively affects hotel performance.

Hospitality establishments are large consumers of water and electricity, produce large amounts of waste (solid and liquid), pollute the air, they are the biggest consumers of energy in the world when it comes to retail establishments, which consume almost five times more energy than any other commercial building. (Chou et al., 2012).

ECO TRENDS

Keeping in mind that hospitality sector will continue to grow, it is necessary to follow current trends and implement as many as possible within the business plans and activities. Therefore, this paper tries to point out the most important eco trends in hospitality sector. According to Trivago Business Blog (2023), these trends include:

- **Cut down on food waste**. For example, grow food onsite, source food locally, and shift social norms to ensure that "plate waste" is no longer considered acceptable.
- **Minimize water usage beyond the hotel room**. In addition to encouraging guests to be mindful of their water and towel usage, some properties are turning to innovations such as showers that filter their own water.
- **Eliminate plastic**. A step beyond recycling is to do away with single-use plastic products. This can help limit the huge amount of waste stemming from creating and discarding these items. A good place to start is by getting rid of plastic water bottles and plastic bags.
- **Conserve energy**. This "economically sustainable method" is effective and easy to apply, for example by redesigning the guest experience to encourage guests to apply adaptive

behaviors. One way is to replace the mini-fridge and coffee machine in each room with a communal amenities area in an open guest space.

- **Create a paperless hotel**. A task made easy by a modern property management system, this simplifies operations and streamlines the guest experience while reducing carbon emissions.
- **Integrate sustainability into the hotel architecture**. For the construction of new properties, there's a "three-zero-concept" approach: use local construction materials and skills (zero kilometers), prioritize energy management and lower emissions (zero carbon dioxide), and introduce life-cycle management into the building process (zero waste).

Additionally, specialized hospitality internet portal Chekin (2022) lists sustainable trends:

- **Reducing water usage**. Reduce water pressure in showers, install leak detectors and rainwater harvesters, limit water use for laundry wherever possible, and encourage guests to be more careful with towels, to avoid over-washing.
- **Reducing power consumption**. There are several ways to reduce energy consumption. Some are related to traveler accommodation, others to hotels.

-Replace small refrigerator and coffee maker in every room withstandard service. Very few guests are using these services yet, making them a very high-cost factor for hotels.
-Invest in new, more modern and efficient equipment. Today, there are many eco-friendly devices with very low energy consumption.
-Introduce an automatic energy management system to increase the energy efficiency of the building. Energy management systems can automatically reduce heating/air conditioning at certain times or adjust room temperatures to suit the time of day.
-Replace the light bulbs in your home with eco-friendly ones. They are usually more expensive than traditional bulbs, but they last longer, so you get more out of them.

While these improvements are an investment for some companies, they will pay off in the medium term. Typically pays for itself within 3 years with 5% to 15% energy savings.

- **Reducing consumption of paper and plastic**. An impressive statistic that reflects the importance of reducing paper and plastic consumption is the amount of waste generated by one hotel guest per night. A report from EHL Insight found that one guest generates about 1kg of plastic and paper waste per night.

-Software that digitizes the entire check-in process is becoming the most popular solution for reducing paper consumption.
-Recognizing the need to seek alternatives to the bottled water problem, hotels are beginning to install filtered water dispensers at strategic points within the hotel. Other eco-friendly option is refillable bottles or eco-friendly BPA-free plastic bottles available to guests.
-Room keys (cards) are made from PVC-based plastic, part of a highly toxic manufacturing process. Many hotel companies choose cards made from paper, wood and bio plastics. Not only are these environmentally friendly, they are also very durable. Other solutions have been developed on the market to replace plastic keys. One of them is the digital key. The key is integrated directly into the guest's smart phone. This will allow you to easily enter and exit the room using your mobile phone.

- **Hotel amenities**. Many hotels strive to provide their guests with bespoke amenities.

-Responsible tourism company goes one step further and offers only natural products, e.g., essential oil-based products that are individually formulated without preservatives or artificial ingredients and come in recyclable packaging. Even if the cost is higher than traditional amenities, commitment to providing healthy and eco-friendly products has a positive impact on the guest experience.

-Another trend that has proven successful is bulk product dispensers (self-service, toiletries, etc.). Also, an effective alternative to reduce plastic consumption in facility.

To become a sustainable hospitality establishment, it is necessary to first decide which certification or accreditation is desired. Each green certification has its own set of requirements. Once decided, the necessary steps to get it can be made. Otherwise, company risks investing resources in aspects that are not valued or recognized. However, this audit is performed by a third party (e.g., Greenkey, Energy Star, etc.).

Sustainability strategies that enable hospitality companies to operate more efficiently and address climate and other environmental risks in their operations are essential to maintain business continuity and remain competitive in the future. Food systems are particularly vulnerable to climate change, already disrupted by changes in temperature and precipitation, and increasingly severe extreme weather events. The food system is also a major driver of climate change, accounting for about a third of all greenhouse gas emissions. Population growth and income changes will also exacerbate the need to increase production and distribution more efficiently.

According to a survey commissioned by the Sustainable Restaurant Association, more than 80% of respondents said sustainability is an important factor when choosing a restaurant. Another survey conducted by CGA in partnership with UK Hospitality found that more than four out of five respondents (83%) expected hotel brands to commit to sustainability efforts, and 41% even said they were willing to pay more for sustainable food (Burton-Hughes, 2020). According to the same author, there are a couple of ways for restaurants to improve their sustainability (Burton-Hughes, 2020):

- Cutting down the packaging suppliers send produce in. elimination of disposable packaging and switching to reusable crates.
- Printing menus on recycled paper, digital menus od chalk boards.
- Replacing paper napkins with linen ones.
- Use of biodegradable bin bags for unavoidable waste.
- Swap out non-recyclable packaging for reusable and recyclable materials. Encouraging customers to return used containers, such as by offering them a bit of money back if they do.
- Encourage people to watch their water use.
- Cut down energy usage and timely equipment maintenance.
- Choosing suppliers and distributors who operate locally.
- Recycle, selling waste.
- Reducing food waste. Portion size management. Giving away or selling leftovers for compost production or other use.
- Adding more vegetarian, vegan or/and lovacore options.
- Switching to eco-friendly equipment and materials.
- Letting others know about “green” efforts.

CONCLUSION

Although aforementioned ecological trends in the hospitality industry have numerous positive effects, they are still not fully on the rise. Awareness about waste management, the use of purifiers, filters and recycling is still insufficiently developed. Increasingly following these trends, hospitality establishments will have to consider the concepts of green construction and design, social responsibility, environmental protection and the use of eco-materials. Although the initial investment is high, the profitability is demonstrated by consumers' willingness to pay more for "green" options and products.

In conclusion, it should be noted that many eco-trends are closely related and often interdependent with innovations and trends in nutrition, information technology and other fields. It is also important to note that a significant percentage of global consumers (around 66%) prefer green food service establishments and would pay more for products and services from companies committed to positive social and environmental impact (NielsenIQ, 2015).

REFERENCES

Burton-Hughes, L. (2020). How to Improve Sustainability in Restaurants. Available at: https://www.highspeedtraining.co.uk/hub/improve-sustainability-in-restaurants/

Chekin. (2022). The best trends and initiatives for sustainable hotels. Available at: https://chekin.com/en/blog/the-best-trends-and-initiatives-for-sustainable-hotels/

Chou, C.J., Chen, K.S., Wang, Y.Y. (2012). Green practices in the restaurant industry from an innovation adoption perspective: Evidence from Taiwan, International Journal of Hospitality Management, 31(3), 703-711.

European Commission. (2020). Tourism and transport in 2020 and beyond. Available at: https://eurlex.europa.eu/legalcontent/EN/TXT/?qid=1591191111789&uri=CELEX:52020DC050.

Global Reporting Initiative. (2020). Sustainability reporting is growing, with GRI the global common language. Available at: https://www.globalreporting.or g/about-gri/news-center/2020-12-01-sustainability-reporting-is-growing-with-gri-the-globalcommonlanguage/#:~:text=Reporting%20rates%20for%20the%20G250,trust%20in%20corporate%20sustainability%20reporting

Han, H. (2021). Consumer behavior and environmental sustainability in tourism and hospitality: a review of theories, concepts, and latest research, Journal of Sustainable Tourism, 29, 1021-1042.

Han, H., Lee, J.S., Trang, H.L.T., Kim, W. (2018). Water conservation and waste reduction management for increasing guest loyalty and green hotel practices. International Journal of Hospitality Management, 75, 58–66.

Hansen, A. (2002). Discourses of Nature in Advertising. Communications: European Journal of Communication Research, 27, 499-511.

Hsiao, T., Chuang, C., Kuo, N., Yu, S.M. (2014). Establishing attributes of an environmental management system for green hotel evaluation. International Journal of Hospitality Management. 36, 197-208.

Kusa, R., Suder, M., Duda, J., (2023). Impact of greening on performance in the hospitality industry: Moderating effect of flexibility and inter-organizational cooperation. Technological Forecasting & Social Change 190, 122423.

NielsenIQ. (2015). Available at: https://nielseniq.com/global/en/insights/analysis/2015/the-sustainability-imperative-2/

Preziosi, M., Tourais, P., Acampora, A., Videira, N., Merli, R. (2019). The role of environmental practices and communication on guest loyalty: examining EUecolabel in portuguese hotels. Journal of Cleaner Production, 237, 117659.

Qui, J. (2013). A Critical Study of English Eco-hotel Profiles-Based on Fairclough's Three-dimensional Model. Theory and Practice in Language Studies, 3(10), 1879-1886.

Ruffolo, I. (2015). The greening of hotels in the UK and Italy: A cross-cultural study of the promotion of environmental sustainability of comparable corpora of hotel websites. Procedia - Social and Behavioral Sciences, 198, 397-408.

Statista. (2023). Market size of the hospitality industry worldwide in 2023, with a forecast for 2027. Available at: https://www.statista.com/statistics/1247012/global-market-size-of-the-hospitality-industry/

Trivago Business Blog. (2023). Sustainable Hospitality: Eco-Friendly Industry Trends and Tips for Hotels. Available at: https://businessblog.trivago.com/sustainable-hospitality-trends-eco-friendly-hotel-tips/

Úbeda-García, M., Claver-Cortés, E., Marco-Lajara, B., Zaragoza-Sáez, P. (2021). Corporate social responsibility and firm performance in the hotel industry. The mediating role of green human resource management and environmental outcomes. Journal of Business Research, 123, 57-69.

FOOTBALL CAMPS AS A CONTRIBUTION TO THE DEVELOPMENT OF SPORTS TOURISM

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***Summary*:** In order for sports tourism to be successful, it is necessary to have a well-planned and coordinated tourist offer as well as promoters, who will attract tourists and satisfy their needs. The subject of the work is the research and analysis of trends in the development of football camps as a new tourist offer in Serbia with a demand and attention directed at the organization of football camps and football tournaments. The goal of this work indicates the need to present football camps and football tournaments in a modern tourist offer and bring them closer to the participants as well as the users in the simplest and most attractive way possible. Also, the aim of the work is to identify the most important characteristics of football camps that attract tourists, as well as to present the possibilities for the development of this type of tourism in the future. The tasks of the work were as follows: to present and process the concept of soccer camps and soccer tournaments, their organization, motivation and needs of tourists who choose soccer camps as their tourist destination. During the work, a descriptive method was used with the consultation of professional literature as well as certain electronic literature with videos, the success of which was greatly influenced by the author's personal experience, which is the result of the time spent in football. Also, the analytical method was used, as well as the comparative method, which is the most productive in making conclusions about a phenomenon of this kind.

Keywords: *football, football camps, sports tourism*

INTRODUCTION

In the past, tourism was available mainly to the privileged, but today it is enjoyed by all social classes. Modern tourism represents one of the basic functions of free time expression in society and is one of the main social and economic phenomena of the modern era, affirming knowledge of a different reality and way of life with which people identify. Sports activities and the search for adventure were also in the past a significant motive for travel, and in today's conditions, tourism based on this is one of the most popular forms of travel. In recent years, sports tourism has recorded an impressive growth, at an average annual rate of almost 10%. Sport makes a significant contribution to the development of tourism in destinations, in terms of economic effects, urban regeneration, infrastructure improvement, enriching the offer, as well as strengthening the tourist image. Sports tourism is a social, economic and cultural phenomenon resulting from the unique interaction of the activities of people and localities. The organization of football camps has a multiple positive role, one of which is in the direction of contributing to the development of sports tourism as one of the sectors of the economy.

SIGNIFICANCE AND ROLE OF FOOTBALL CAMPS

Tourism is an important sector of the economy that can have a positive impact on the development of local communities and beyond. However, in order for tourism to be successful, it is necessary to have a well-planned and coordinated tourist offer, which will attract tourists and satisfy their needs in every segment of the area, both in terms of sports and general tourism.

One of the ways to attract tourists and satisfy their needs is the organization of sports events, such as football tournaments and camps. Soccer is one of the most popular sports in the world, and the organization of soccer tournaments and camps can attract many tourists who are interested in this sport. However, the organization of football tournaments and camps requires expertise and experience in managing tourist activities, and poorly organized events can have a negative impact on the future of the organization of subsequent football tournaments and camps. In these planned and organized conditions, where in addition to the football competition as well as the planned football environment, a designed planned football camp where, along with these activities, the recreation of a certain number of children and parents, as well as the health services, will make a significant contribution to physical exercise. The need for movement and physical exercise is one of the most important biological needs, which can be said to have been born together with the emergence of man (Tomić, 2014).

From all of the above, there was a need to organize football camps, for the reason of recreational activity for children and their parents, as well as other structures that are significantly interested in this type of participation. Nowadays, the most popular way of gathering and organized physical exercise are soccer camp and tournament modelers, where along with the organization program and competition system for children, various soccer tournaments are also organized for parents who play soccer 3(three). Recently, more and more such camps have been organized for the purpose of developing the tourist offer, where, in addition to the primary goals, secondary goals appear, which aim to develop the tourist offer of the location where it is organized. With this approach, the basic mission of the camp organization gets its financial support, and thus independence in functioning and the possibility of survival in the long term. In order to better understand the problem of this work, there is a need to classify sports camps. The authors agreed that the basic division of camps according to the activities organized in them should be the division into camps with:

*general direction, which are (camps with a large variety of sports activities) and:

* camps with a specific orientation (these are camps with a specific sports orientation).

When talking about the structure of the participants in relation to their sports skills and talent, it is necessary to make another division or classification of camps in the service of a better understanding of the role of sports camps in the modern age, that is the division into:

*sports camps for the wider population in which there is no strict selection of camp participants and

*camps specialized for pre-selected participants that are organized with the aim of further improving the selected young athletes in the field of football.

Football, as the biggest secondary thing in the world for the largest number of people, and as a sports game with a great tradition, as well as because of its diversity, is very suitable for the organization of football camps and represents an excellent base for the development of sports and tourism. In a series of organized football camps and over a long period of organized camps, we have the positive and negative side of the organization of football camps.

The positive side can be defined through:

- increase in the number of tourists,
- increase in tourist consumption,
- improvement of the tourist infrastructure,
- improvements in the quality of services,
- offer of various attractions.

While the negative impact of badly organized football tournaments and camps on tourism are:

- dissatisfaction of participants and tourists,
- bad reviews and lack of interest in camps in Serbia i
- jeopardizing the safety of participants and tourists (Pelević, 2012).

Sports tourism through football tournaments and caps in Serbia brings numerous benefits for the development of sports and tourism and local communities. Through international connections and sporting passion, these events contribute to the creation of bridges between people and cultures around the world.

MANAGEMENT OF FOOTBALL CAMPS

The Republic of Serbia has excellent climatic and geographical conditions as well as sports infrastructure for the organization of football camps. However, in order for the camps to be successfully organized, it is not only necessary to have good conditions, it is also necessary to take into account the specifics such as the infrastructure of the facilities, then the personnel in the facility, the programs that are carried out and the organization of the camp itself. You should especially pay attention to specialized and some a modified way of organizing tournaments and football camps, where it is necessary to divide groups in a synchronized way through marketing so that all camp participants are satisfied. A special review of the organization of this type of tournament as well as football camps is planned and well-programmed communication with football schools and clubs and all this in order to football sport on the one hand and the financial part on the other. Also an important element in this space is the marketing of the digital presentation, where the first and most responsible person is primarily responsible for everything that needs to be implemented and organized in a given period (Kastratović, 2004).

In order for a football camp to be successfully organized with the implementation of its program in practice, good infrastructure conditions are needed at the location where it is held. This implies good accommodation facilities for the children who will stay in the camp, then outdoor and indoor sports facilities where the camp participants should meet their daily needs. Camps should be in locations that are well connected to nearby settlements where it is necessary to have at least a health center in order to be able to respond to sudden and unplanned situations in an efficient and effective manner. It is very important to emphasize that the accommodation facilities must meet the minimum requirements, such as a sufficient number of sanitary facilities with hot water so that the participants of the camps can regularly

and unhindered maintain their personal hygiene, then quality beds for rest so that they can rest and appear ready for the morning roll call, then good lighting and sufficient square footage so that the space in which they stay is not cramped and unventilated.

A very important factor in the organization of a camp is the staff. A larger number of responsible, highly motivated and qualified experts from various fields are needed so that each of them can implement their part of the program in the best possible way. In addition to the staff, it is necessary that all representatives of the teams as well as parents be as well organized as possible in order to level set everything as it should be. Work on the organization of the camp takes place in several stages. Among other things, it is necessary for professionals to design a program that will be implemented during the camp, however, the role of marketers, then members of the club management, workers in the bookkeeping, public relations and staff who prepare food is no less important (Szymanski, S. 2017).

When we talk about the programs implemented in the camp, the most important thing is the quality of the programs implemented. These programs should differ in relation to the age of the camp participants, then gender, affinities, quality and number of participants. It should be emphasized that the programs are conditioned by the time it takes to put the program into practice, that is, the length of the camp. In order for the program to be of high quality and successful, it is necessary to prepare it in advance, then implement it well and finally analyze it by comparing the set goals with the results obtained. It is also recommended to keep a diary, which offers specialized persons the opportunity to have complete information at any moment about the smallest details in the procedure of conducting the camp. The diaries allow a comparison of previously organized camps with the one that has just been completed. The program has a great responsibility considering that it is implemented on children and thus must be very sensitive and precisely planned (Luxbacher, J.2016).

A good organization implies a multitude of activities. The organization of the camp itself begins much earlier from the very beginning of the camp, i.e. the arrival of the children in it. It goes without saying that there are a number of activities that need to be done in order for the camp to be ready to receive children, and certain structures from the camp's organizing committee are responsible for that. Next, it is necessary to mention the set of activities that are carried out during the camp and after the camp, which have already been discussed in this paper. It is very important to approach the work seriously during planning so that it is well thought out, as this is a prerequisite for the camp to implement all the planned goals. It is necessary to hire a number of people and institutions that would participate in the organization of the camp because it is not possible for the entire organization to be carried out by just one person. It is recommended that the parents of the participants of the camp be included in the organization of the camp so that contact with them is understood. It is impossible to predict all circumstances that may occur during the implementation of the camp. It is necessary for the plan to be flexible and the organizers to be ready to react in the right way in the moments when disruptive factors appear so that the other participants do not remain without an organized program of activities. A classic example is bad weather, which is difficult to predict a few months in advance and can completely disable them from working in open areas.

FOOTBALL CAMPS IN MODERN TOURISM

It cannot be stated that Serbia does not have well-organized soccer camps, but compared to other countries, this is a small number and far from something to be proud of. In this part, the authors tried to present good examples that should be emulated. International football tournaments and camps were organized primarily by BAAP and AS football academy from Novi Pazar as well as OFS Novi Pazar in the period from 2014 to 2019, where teams from 15 countries with 184 teams and 1860 participants took part. In the framework of football tourism, it is necessary to mention the MINI MAXI CAMP organized by the Children's Football Association of the Football Association of Serbia with the support of the Ministry of Diaspora and the Ministry of Education and Sports. The main goal of the camp is for the participants of the camp to become familiar with the complex content of sports activities in football with a special focus on the acquisition and improvement of specific football skills. The goal is broader sports and theoretical education, then socializing, fun and competition. When it comes to infrastructure, it should be mentioned that the last camp was held in the "Junior" hotel, which is located in the eastern part of the Kopaonik National Park in a beautiful valley at an ideal altitude of 1070 m. It is 270 km from Belgrade and 101 km from Niš. This modern, recently completely renovated 3-star hotel has 110 rooms and 4 luxuriously equipped suites. In the hotel complex there are two grass football fields with lighting, then 7, also lighted sports fields for small sports, a jogging track, as well as a modern gym. The hotel has a restaurant, bar, pizzeria, disco, internet club and business center, as well as a TV and billiard room. It also includes a conference hall, an infirmary, a shop, an ATM and an exchange office. The staff of the camp consisted of prominent football coaches and professors in the field of physical education. Programs are unique, based on the most modern methods of learning and acquiring football skills, adapted to the specifics of individual age categories, as well as the requirements of modern football technique and the model of the modern game. The plan and program was developed separately for each age category of participants during the seven-day work.

"Milan Junior Camp" has been held in Serbia for several years. The last time it was held on the grounds of the "Vujadin Boškov" Sports Center in Novi Sad and on the grounds of the Železničar Football Club in Niš. It is very interesting that participation in this camp was free thanks to a good organization and donors who covered the costs of potential participants, and this gesture was an excellent prerequisite for increasing the number of participants. This unique event provided young footballers with valuable experience and the opportunity to select the three best passers who will get the chance to travel to Milan and play at the famous "San Siro" stadium. The special guest of the last camp was the most successful Milan player of all time and the coach of the junior selection, Franco Baresi, whose presence particularly captured the attention of both the participants of the camp and the wider audience. The weekly program of the camp combined the course of modern football in the best way with numerous fun activities, which allowed the participants to have a unique and unforgettable experience. Highly qualified trainers selected by the administrative structures of the club were in charge of training in the camp. Everyone who participated in the camp had to have an ISEF (Italian Football Federation) diploma, then have a diploma from one of the Faculty of Sports and Physical Education, meet the conditions for teaching young footballers required by ISEF or be prominent former footballers(Szymanski, S. 2017).

As can be concluded from the previous examples, there are excellently organized camps in Serbia. However, compared to countries where summer camps are a tradition and a matter of prestige, such as the USA, Serbia lags far behind, and if it wanted to develop this form of sports tourism, it would have to improve the content offer and offer better programs with a special focus on marketing activities. Such activities would create the conditions for bringing both children from different parts of the country and children from abroad, which would have a very positive effect and improve the tourist offer.

CONCLUSION

These events always attract the attention of a large number of scouts and talent-scouting agencies who are looking for promising players for professional football clubs or national teams. Modern tourism implies the increasing inclusion of sports activities in the contents of the tourist offer, so it is concluded that the organization of football camps could find its place in this area. As already mentioned, Serbia has excellent climatic and geographical conditions for the development of sports tourism, however, there are many facilities that should be renovated in order to adapt the infrastructure to modern needs for the organization of football camps in other sports branches. In addition to all of the above, we should also mention the football tradition that the game of football has in Serbia and a large number of prominent football players who, with their popularity and sports authority, should help improve the offer in the field of sports tourism.

REFERENCE:

1. Blagajac, M. (2004). *Teorija sportske rekreacije. Fakultet za menadžmenti i sport*. Beograd: DATA status.
2. Kase, K., Gomez, S., Uruttia, I. & Marti, C. (2000-2006). *Real Madrid – Barcelona BusinessStrateguvs Sport Strategu.* University of Navara IEAS Business school.
3. Luxbacher, A. J. (2016) *Fudbal-koraci do uspeha*, Beograd: Datastatus.
4. Mašić, B., &Nešić, S. (2014). Savremena teorija menadžmenta: Fakultet za menadžment, Beograd, 14-19.
5. Pelević, B. (2012). *Menadžment sportskih događaja:* Fakultet za menadžment i sport, Beograd.
6. Kastratović, E. (2004). Osnove menadžmenta sa menadžmentom u sportu. Fakultet za menadžment, Beograd, 75-92.
8. Rottenberg, S. (1956). The Baseball Players Labor Market. *The Journal of Political Economy*, 246-258
9. Szymanski, S. (2017). *Insolvency in English professional football, Irrational exuberance or Negative Shocks.* Handbook on the Economics of professional Football, Cheltenham: Edvard Elgar PublishingLimited.
10. Sajmon, R. (2016). *Fer pley- etika sporta.* Beograd: Službeni glasnik.
11 Tomić, M. (2014). *Menadžment i marketing u sportu*. Beograd: Astimbo.
12. Šurbatović, J. (2016). *Menadžment u sportu*. Fakultet za menadžment, Beograd: Datastatus.

ENVIRONMENTAL STANDARDS AND SUSTAINABILITY IN SPORT: CURRENT STATE AND FUTURE TRENDS

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Abstract: This paper provides an overview of *eco* standards and sustainability in sports, through examples of environmental programs adopted by sports organizations around the world with special reference to the current state and future trends.As environmental awareness grows, sustainable sports offer a platform to address these issues and contribute to a sustainable future.

Key words*: green economy, sustainable development, ECO standards, sports organizations, case studies.*

1. INTRODUCTION

The green economy is the result of efforts to make the economy more ecologically responsible and more advanced, creating a balanced and positive impact on society and the environment. It contributes to the preservation of the quality of the environment through the efficient use of resources (protection of biodiversity, air quality, land, water and reduction of greenhouse gas emissions) while simultaneously reaping economic benefits. EU legislation sets over 130 separate environmental goals and objectives to be achieved by 2050, with the aim of moving Europe towards a green economy. According to the International Olympic Committee (*IOC*), the environment fully deserves to be considered the third pillar of Olympism after sports and culture. **[1]**

Environmental conservation trends in modern sport can be guided in several directions, taking into account the complexity of sport, its widespread use, and the multifunctionality of its development, survival, and performance in society.Sport leaves its impact on the environment in all stages. It is difficult to estimate the harmful impact of one sport event. Big world events (Olympic Games, World and European Championships...) unite the entire planet, but one could say that they are actually devouring it alive? The most successful sports organizations rely their on a large number of *ECO* standards and some other standards and actively participate in their creation, revision and improvement. While introducing environmental standards, sports organizations must implement and apply the following elements: use of eco products for cleaning and maintaining hygiene, monitoring water consumption (using flow regulators on faucets and showers in all locker rooms and bathrooms), saving electricity (installation of solar panels, use energy-saving light bulbs, minimization of electricity loss, *LED* lighting in stadiums), recycling, minimal use of products that impact atmospheric pollution, reducing noise levels, maintaining air quality levels in closed rooms, etc. *K. Burkart* suggests 6 priority areas:

Picture 1. Green Economy Framework,

GREEN ECONOMY	**01**	**green construction**
	02	**renewable energy**
	03	**land management**
	04	**waste disposal**
	05	**water use and management**
	06	**sustainable/clean transport**

Author: Karl Burkart

2. SPORTS AND THE ENVIRONMENT

Both winter and summer sports will be affected by climate change (there was no snow at the Vancouver 2010 Olympics; the Tokyo 2020 marathon was postponed due to heat, and polluted waters in Rio de Janeiro 2016 made it unsafe to spend time in the water. At the FINA World Cup, several swimmers were treated for heat exhaustion. During the Doha Marathon, extreme heat caused a number of competitors to collapse. Sport may be falling victim to climate change, but it is also part of the problem. Climate change will affect all sports, from elite, international to the basic, local level in communities around the world, and will disproportionately affect countries that are less developed. The Winter Olympics (Beijing, 2022) relied 100% on artificial snow. However, there are examples of benefits from sporting events to host cities and the region. According to a survey report on existing barriers (Green Sport Hub Europe Project, 2022), sports organizations have several reasons that prevent them from working on their sustainability, the three main ones being costs, time and lack of knowledge on the subject. According to a recent survey of athletes from 89 countries, 77% of them are very or extremely concerned about climate change, and 76% are ready to change their lifestyle to reduce their impact on the environment (World Athletics, 2021) **[2]**. The EU is also committed to green sports. From 2019, as part of the Green Deal, the European Comission, through the sports section dedicated to the Erasmus+ program, added environmental sustainability to its list of priorities for grants for European projects. There are already many initiatives to make the sports community greener, but the path to green sports is a "journey", because there is still some room. The representatives of the company "Sport Time", the exclusive distributor of the Nike brand in Serbia, showed that ecology and sport can be closely connected and that this connection can give a successful result in practice, as part of its new campaign "Move to zero". From 20,000 recycled old sneakers, a surface for a basketball court, a children's playground and an open-air gym was made using special procedures, which were given as a gift to the residents of Belgrade, but also to all sports fans who come to our capital. **[3]** The 2023 Australian Open was affected by extreme weather conditions due to extreme heat followed by heavy rain. Meanwhile, in Europe, the Alpine Skiing World Cup (Italy, Switzerland and Austria) was canceled due to abnormally warm weather. There is a widespread belief that sport is slow in solving social and environmental issues. Research conducted by Global Sustainable Sport (GS Sport) on major international sporting events held in 2021 showed that only 20% had social or environmental programs. Over one billion active sports participants and between 4 and 5 billion sports fans worldwide

can play a major role in adopting a more sustainable approach to their activities. Over 850 sports organizations have been identified that are actively implementing sustainability programs and developing their own sustainability programs. **[4]** Traditionally, sustainability has been discussed in terms of economic, social and environmental aspect, which has recently been extended to the ESG framework - environment, society and governance, whereby the economic part is combined with governance. **[5]** The super typhoon that led to the cancellation of matches at the Rugby World Cup and the bushfires in Australia forced sports organizations to adapt to the impacts of climate change so that participants could continue to train and compete. Sportsmen such as Lewis Hamilton, Héctor Bellerín, Novak Djokovic are already campaigning and talking about the issues of the environment. Norwegian professional soccer player Morten Thorsby even started his own movement: "We play green". In sports, some may feel that the sole purpose of a club is to win. Sustainability is one way organizations can return to the core value of sport, to inspire people of all ages and backgrounds and create a true community and cohesive bond. Sports organizations have great influence, and with that comes great responsibility. **[6]**

3. WHY CHOOSE A SUSTAINABLE SPORT

Sport has the power to change the world. Sustainable sport is the way forward to a better world. Sport is essential for physical and mental health. Sport can contribute to sustainable development and the achievement of the *17 Sustainable Development Goals (SDGs)*: **[7]**

Source: https://sdg.indikatori.rs/sr-Latn/o-ciljevima

Sport affects the ŽS, consuming resources, land, energy and water, creating waste. Therefore, in addition to taking care of our health, we should also take care of the health of the planet! Are you aware that golf, although it looks like one of the greenest sports, is one of the worst for ŽS. Those huge, green streams need to be maintained, which can harm the ecosystem. According to the American Golf Association (*USGA*), in addition to large amounts of irrigation water, they use various chemicals (herbicides, pesticides and fertilizers) to spray. These dangerous toxins then run off and pollute nearby waters. But it's not just golf. Consider skydiving: using airplanes and their fossil fuels to get into the air makes it less environmentally friendly than many other sports. And what about the pollution produced during car racing? Football, one of the most popular sports in the world, burns large amounts of fossil fuels. Fans use a lot of plastic in stadiums (cups, straws, flags, for example). All sports clubs need to reduce their impact and respect the principles of social responsibility. The

Friend of the Earth Sport certificate is designed to bring together the good practices of key players in the sports movement: from federations, teams, fans, sports equipment manufacturers and sports facility operators to sponsor partners, environmental organizations and policy makers, to highlight innovative solutions that improve environmental and sustainable sports performance. After the II UN Conference on Sports and Development, the development of appropriate sustainable development strategies for the construction and management of sports facilities began, with the application of ecological knowledge, principles and standards, which would have minimal impact on the disturbance of the biosphere and the ecological cycles of biotopes and biocenosis. In all phases, sports facilities must comply with environmental standards and procedures that include various international standards such as the *ISO 14001* standard. The main impacts of sports facilities on ŽS include: air, water and soil pollution, waste generation, health risks and excessive consumption of resources and energy. The sports stadium industry, although slow, is adapting to the trend of adopting the *ISO 50001* standard. Recycled and energy-efficient stadiums are a novelty in modern construction and architecture. Recycling in sports started with equipment and props, but it has come to the point that entire stadiums are also recycled, including all the materials from which they are made. There are various building tools for certifying the greenness and environmental friendliness of constructions (*LEED* and *BREEAM* certificates). Some of the measures used in the construction and renovation of the stadium for football competition purposes are: (1) the principle of energy efficiency and economy of resources, (2) natural lighting, (3) installation of curtains and thermal protection zones between external and internal walls and fences, (4) protection from the sun in offices, (5) roof coverings in light colors for better reflection of the sun's rays, (6) construction with environmentally friendly materials (usually of regional origin, produced near the construction site), (7) prefabricated structures, (8) application of systems to reduce noise and vibration levels from ventilation equipment, and (9) "conservation" of water and the like.

	Staff. Your current, but even more so your future workforce will be very sensitive to the topic of sustainability. Make sure you address their concerns, needs and wants. Position yourself as an employer who cares about ŽS and society, who considers himself a member of the community and truly lives in the spirit of "doing good".
	The fans. If the sport wants to continue to attract new audiences, if clubs want to make sure their stadiums are full for years to come, they need to listen to what their fans want. Take for example the fans of FC St.Pauli, who demanded that their club switch to producing their own, more sustainable line of clothing (jerseys).
	Sponsors. 6 of the 10 largest sports sponsors publish sustainability data. So if the rights holder does not act sustainably, it will lead to controversy with their sponsors. It is a danger that rights holders may not feel today, but it is very likely to appear very soon
	New business opportunities. Sustainability has a reputation. Consider the potential of finding new sponsors who are actively seeking platforms to showcase their own sustainability efforts. Think about the savings potential if you are more careful about resource consumption and if you find new ways to introduce circularity.
	It is the right thing to do. If they want society to progress, sports organizations must be more responsible, that is, only if they lead by example and convey messages that others could not convey. That's the only thing to do.

	Social Responsibility. Sport not only improves people's health, but manages to help overcome political conflicts, unites different cultures and teaches some basics of common life: respect, tolerance, fair play, equality...
	Environmental responsibility. There is an interesting relationship between sports and the environment. If sport is to continue to be an important factor in people's lives, it needs to look at this potential area of conflict.
	Economic responsibility (management). No business can survive if it does not behave economically responsibly. You cannot spend more than you earn.

4. GREEN CHAMPIONS

Certain sports organizations have recognized the direct connection and influence of factors related to the environment and have rightly called themselves "**green champions**". Some of them are: **[8]**

Forest Green Rovers. It is the greenest and most sustainable club in football. The wooden stadium is powered by 100% green energy, right down to the completely vegan food served on match day. Carbon neutrality is embodied in the 5,000-seat space, called Eco Park.
Juventus FC. The stadium fulfills the conditions stipulated by the Kyoto Protocol, namely: reduction of gases that cause greenhouse effects; minimal risk of fire; minimal air pollution; connection to district heating; collection of waste at the source; exploitation of solar energy through solar devices; no production of chemical and acoustic emissions; use of rainwater, reduction of the need for field irrigation (min. 50%). It provides a comprehensive overview of sustainability - financial, social and environmental. It also includes gender equality.**[9]**
Atatürk Olympic Stadium (*Instanbul****).*** The design of the stadium is designed to enhance the relationship between the crowd and the players on the field with acoustics unmatched by any other stadium in the world. New facade covered with white *GRC* ecoskeleton with generators to convert wind power into electricity. It has video walls on the facade and inside. The so-called The Tunnel Club offers dinner to fans with more expensive tickets. **[10]**
A.C. Milan and Arup. Together with a hotel, a sports college, restaurants, a children's playground, green areas and spaces open to the public, it provides a unique experience for spectators, using the most modern technologies including an ecological aspect. Arup's software guarantees the best possible visibility from every seat in the stadium. It contains a movable roof that reduces noise from the environment, as well as a commitment to the social and spatial needs of users. **[11]**
Amsterdam Arena. Home to AFC Ajax, it is powered by more than 4,200 solar panels and one wind turbine. The main building consists of an impressive energy-generating escalator, and the stadium has also installed an energy storage system powered by second-life batteries from used electric vehicles. Rainwater from the roof is collected and reused to water the lawns, significantly reducing the consumption of valuable fresh water. The residual heat is used to separate the frost from the playing field, a move that does not require additional energy consumption. Fans are encouraged to reduce emissions when traveling by using active mobility, electric vehicles or trains. The parking lot offers free charging, and every visitor is entitled to discounts on train tickets. It has found a sustainable way to replace (made from 100% recycled plastic, 10% retrieved from the ocean) its 53,000 seats. The club's pitch is powered by solar panels and has an electric car charger, water recycling, an electric lawnmower, an organic pitch and a completely vegan menu for players and fans. Now they have plans for a new stadium built entirely from sustainable local wood.

Estádio Mineirão, has received international recognition thanks to its care for the environment. Solar panels are on the roofs of the stadium - Belo Horizonte, and it can collect about 698,000 liters of rainwater for reuse.
Aviva Stadium (Dublin, Ireland) has implemented the *ISO 50001* standard. This has led to a significant reduction in energy consumption and carbon emissions, significant financial savings and increased awareness and engagement among numerous users. Set sustainable goals are reviewed annually in accordance with the requirements of the *ISO 20121* standard - Event sustainability management systems. **[12]**
2022 FIFA World Cup Qatar. All 12 pitches (9 new and 3 renovated) had zero carbon emissions, which was a mandatory requirement of FIFA to host the tournament. Solar energy converts the sun into energy and this energy is converted into cold air. Air is then circulated around the stadium to keep the comfort of players and spectators. During testing, outside temperatures reached 44°C. But inside the stadium the temperature was a chilly 23°C even with the roof open.**[13]**
Golden 1 center. In 2017, the home of the Sacramento Kings was awarded the greenest and most technologically advanced sports and entertainment facility in the world. The facility meets 100% of its electricity needs through solar energy. Water conservation practices are especially important for California, due to the water shortages the region has faced in recent years. The circular economy is also part of the team's core values.
Instead of a huge amount of waste, practically by recycling the stadium, a significant amount is obtained for the construction of a new one (all the material or the part that remained from the ruins is recycled; by burning the material, ash was obtained which was used as a substitute for cement; recycling of tires, bricks, steel, etc.) Some of them are: London Olympic; Arena Fonte Nova, Salvador da Bahja-Brazil; Apogee Stadium; Met Life Stadium; Vancouver Stadium; Itaipova Arena Perhambuco; Empire field stadium; Fenway Park... **[14]**
Sports complex and stadium ***Antalya Arena (Turkey)*** was built on an area of 96,000 m2. The roof is covered with enough solar panels for that sports center, while excess electricity is also supplied to the city grid. **[15]**
The Comité Olímpico Español (COE) is among the most advanced of all National Olympic Committees. When it comes to sustainability COE includes: managing waste and eliminating plastics from the workplace.
World athletics. It has partnered with the UN forthe environment and the Climate and Clean Air Coalition (CCAC) to better understand the effects of air pollution on human health. They help runners and study the correlation between air quality and athletic performance.
Mercedes Benz Stadium. It is home to the Atlanta Falcons (US Football League - NFL) and United FC and Atlanta United FC in Major League Soccer (*MLS*). It is the first professional sports stadium to receive Platinum certification for Leadership in Energy and Environmental Design (*LEED*), a global standard for measuring the sustainability of buildings. Energy consumption is 29% lower than the average stadium consumption, due to energy efficiency and renewable energy projects. The stadium has a stormwater management system, preventing flooding in the surrounding areas. Promotes cycling programs, as well as accessible charging stations for electric vehicles.
Levi's Stadium. The home of the San Francisco 49ers has two *LEED* certifications. The stadium has built-in innovative sustainability elements (over 1,000 state-of-the-art solar elements, including three pedestrian energy bridges and one roof deck with solar panels - the NRG Solar Terrace). It has a "green roof". Due to its sustainable program of purchasing materials and cleaning products, disposable paper products and garbage bags, it meets the strict criteria of sustainability and commitment to fight climate change.
Olympic Games: *Lillehammer 1994* (Norwegians have a strong nature culture and a powerful

environmental lobby with the public opinion behind (environmental issues: bird sanctuary, deforestation and air pollution); *Nagano 1998* (numerous green activities and strategies: use of low-emission vehicles and on natural gas, electric cars and hybrid buses; recyclable printer cartridges and packaging materials and the introduction of box recycling; *Sydney 2000* (We all share the same sun, the same dream, the same earth, the same air – the official motto of the Games. The core of environmental program was the green regeneration of the main Olympic site, once home to slaughterhouses, factories and industries, landfills (450 ha of parks, 50 ha of forest and 40 km of pedestrian and bicycle paths, more than 100,000 bushes and 7,000 trees). Recycled building materials were used extensively , water purified and recycled for use in toilets, etc. The Olympic Village became the world's largest solar-powered suburb; *Athens 2004* (innovative technology and environmental planning were used to minimize the impact on the environment; *Torino 2006* (the ISO 14001 certificate was implemented. It considers climate change issues and the compensation of greenhouse gas emissions by investing in afforestation, energy efficiency and renewable energy projects. *Beijing 2008*.The Games were a catalyst in bringing the concept of environmental sustainability. The priority was especially on water, air pollution, and waste management. All major rivers in Beijing have undergone environmental regeneration, including the introduction of aquatic plants and animals to perform natural purification, and 10 water recycling plants have been built in lakes and rivers to improve water quality. Air quality was a big problem (over 200 measures were introduced, such as: more than 300,000 high-emission vehicles used in public transport were replaced or scrapped; polluting factories were relocated; household heating systems were converted from coal to cleaner natural gas with desulfurization); *Vancouver 2010* (became a leader in energy and environmental design (*LEED*) - green building certification system. It has a roof with beehivesfor 60,000 bees and it is planted with more than 400,000 individual plants and grasses from 19 native species selected to attract insects and birds. A marine habitat is built into its foundations, ideal for mussels, seaweed, starfish, crabs and fish. The zero solid waste management strategy and composting included all participants of the Games); *London 2012* (One Planet Living, aims to raise sustainability in the following five key areas: climate change, waste, biodiversity, inclusion and healthy living. It inspires people to do sport and develop a more active, healthy and sustainable lifestyle. It encourages people to walk or cycle; *Tokyo 2020* (Let's be better, together! These are the most sustainable organized games ever. The athletes' village is built from locally sourced wood and event vehicles were powered by hydrogen fuel cells. Electricity comes from renewable sources (on-site solar generation), and 99% of everything used during the event will be recycled. Except for drinking water, all water used at the games will be either rainwater or recycled); Eco-conscious partnerships and initiatives are being established for *Paris 2024* (organizers aim to reduce carbon emissions by 50%).
The Ocean Race. Taking action to improve the marine environment includes various initiatives, and understanding ocean health and the effects of climate change. It`s racing boats are research vessels at the same time, collecting data on sea surface temperature, microplastic concentrations and ocean acidity as they travel through some of the most remote parts of the planet.
Helsinki International Horse Show. Over 135t of manure collected from horses was used to produce 150 megawatt hours of electricity.
Super Bowl. It has a new score that also measures how much waste generated in the game is recycled. All food served to fans during the Minnesota Vikings Stadium game came in compostable containers. Waste that could not be recycled was sent to a garbage-to-energy plant (steam was produced to heat buildings in downtown Minneapolis).
World Surf League (WSL). By 2050, there could be more plastic than fish in the ocean. That stark projection motivated WSL to go beyond the usual beach cleanup and carbon offset

initiatives to help tackle the problem directly by funding scientific research. It brings together activists, artists, athletes and academics to promote awareness and advocacy. The *WSL* has shown true leadership in working to bring together an environmentally conscious surfing community. That community scored a notable victory when Norwegian oil company Equinor postponed plans to drill in the Great Australian Bay after loud opposition from surfing enthusiasts and some of the sport's biggest names.
ABB FIA Formula E. Synonymous for sustainable innovation is Formula E, the racing championship for all-electric vehicles and alternative energy solutions. It has an *ISO 20121* certificate. The sustainability strategy includes three key pillars - ecological, social and economic. It works with host cities to reduce carbon emissions and air pollution, as well as reduce waste (it recycles all lithium-ion batteries and hybrid tires used during the races). Suppliers must demonstrate that they offer sustainable products or services as part of their tender applications.
World Sailing. Improving water quality is understandably a pressing concern for any ocean-based sport. Nowhere is the scourge of plastic pollution more evident than in the ocean, and no athlete appreciates the magnitude of the problem more acutely than a marine sailor. World Sailing's Sustainability Agenda 2030 sets out an ambitious sustainability strategy detailing an extensive list of goals, standards and requirements that span the breadth of its operations, events and venues. They are taking measurable steps to reduce the impact on the environment. They use reusable products, organic clothing and vegan offerings. They reduce the carbon footprint and preserve marine biodiversity. They include the display of at least one non-fossil fuel powered boat during the event.**[16]**

5. THE RACE TOWARDS A SUSTAINABLE FUTURE IN THE WORLD OF SPORTS

Is it even possible for modern sports to be sustainable? What do we know about sports and sustainability? It is known that sustainability was one of the three pillars of The Olympic Agenda 2020. Sport and sustainability include individuals, organizations, institutions, policies, economies, technologies and nature. However, research on sport and sustainability lacks a theoretical basis. *McCulloughet al.* (2016) provide a comprehensive review of current research on environmental sustainability in sport, with a focus on sport organizations. *Barker et al.* (2014) are of the opinion that elite sports and sustainability are incompatible and contradictory. The academic literature on sport ecology has focused on either the impact of sport on the environment or the impact ofthe environment on sport (*Orr & Inoue*, 2019). For example, *Parkin* (2000) estimates that there are over 200 definitions of sustainability. Despite the large number of definitions, sustainability is based on three dimensions: (1) the natural environment, (2) the economy, and (3) social relations. Also known as the "three pillars" of sustainability (*Wilkinson & Iencken*, 2000). The latest information from the Government of Nepal shows that the ascent of Mount Everest has turned into a garbage dump (11 t, 2019). At the 2019 London Marathon, participants left behind 350,000 plastic bottles scattered along the city's roads. In motorcycling, Formula 1, Dakar Rally..., over 100 t of waste is generated. It is estimated that fans traveling to just one UEFA Champions League match produced almost 5,600 tonnes of CO2 per year. Here are a few examples under the UN Program for the environment: (1) OG: The IOC has committed to eradicating single-use plastics at all its events; (2) Volvo Ocean Race: commitment and progress, which includes reducing the impact of climate change and ocean plastic pollution; (3) Major League Soccer (MLS): American soccer league clubs play with shirts made from ocean plastic; (4) Indian Premier League (IPL): A cricket stadium has implemented a zero waste policy for its spectators; (5)

Twickenham Stadium: The iconic home of English rugby has pledged to refund drinks sold at matches. Global manufacturers of sports equipment (Patagonia, Lily Lotus, Adidas, The North Face) have joined the movement of sustainable sports with clothes, shoes made of recycled plastic, natural fibers like organic cotton or without it. **[17]**

Picture 1. How much CO2 do major sporting events generate?

Source: *https://www.iberdrola.com/social-commitment/sustainability-in-sports*

As the world warms, more and more sporting organizations are recognizing the need to be more sustainable in line with the 2015 Accord de Paris (to limit global warming to below 2°C) and the 2021 Glasgow Climate Pact. The Royal & Ancient Golf Club (R&A), golf's governing body, has warned that wetter winters and coastal erosion threaten the future of golf. The *IOC* has put sports and climate responsibility at the core of its Olympic agenda until 2025. Hundreds of sports organizations have committed to aligning sports with the goals of the Accord de Paris 2015 as part of this UN campaign. Among them are the *IOC*, *FIFA*, the World Rowing Championship, the English Premier League... Organizations are now facing the challenge of reducing emissions by 50% by 2030 at the latest and achieving zero emissions by 2040. The extreme weather conditions already occurring have the potential to affect the sports industry over the next 30 years: (1) 1/4 of England's football pitches will be at risk of flooding each season; (2) one in three UK golf courses will face damage from sea level rise; (3) 1/2 of the former *WOG* host cities will no longer be able to offer safe and reliable conditions for snow sports; (4) test cricket matches will become impossible in drought-ridden India and South Africa. This level of disruption will have a huge impact on the sports industry's bottom line. The sports industry (including apparel, equipment, and health and fitness spending) generates as much as $700 billion annually, or 1% of global GDP. When we consider that sponsorship, broadcasting contracts and ticket sales are also affected by climate change, there is a huge financial impact of doing nothing.

6. CONCLUSION

Sport has the power to change the world. It has the power to inspire. It has the power to unite people in a way that little else does. Speak to the youth in a language they understand (N. Mandela). It is a power that neither art, nor film production, nor music have on such a consistent and global basis. *However, with great power comes great responsibility.* All sports organizations today must be aware of their social, environmental and economic responsibility. Or to put it more simply: their responsibility to people, planet and profit. The listed and displayed sports organizations/sports events/facilities are examples of good practice of economic and environmental sustainability. Sport is exceptionally followed, and therefore represents an important global media tool for the presentation of positive environmental attitudes, examples, i.e. improving the overall environmental awareness of athletes/citizens. Sports organizations must implement and maintain regular monitoring and measurement procedures, critical to their operations, which can have a significant impact on the environment.

LITERATURE

1. *IOC, 2005: https://olympics.com/ioc/news/ioc-commissions-for-2005*
2. *https://worldathletics.org/*
3. *https://www.telegraf.rs/vesti/beograd/3393174-teren-napravljen-od-20000-starih-patika-predstavljen-u-bloku-70*
4. *https://www.globalsustainablesport.com/how-sustainable-is-sport/*
5. *https://www.forbes.com/sites/jonquilhackenberg/2021/09/09/why-we-need-to-make-sport-more-sustainable/*
6. *https://strive.earth/blog/sustainability-in-sports/*
7. *https://sdg.indikatori.rs/sr-Latn/o-ciljevima*
8. Turčinović, Ž. (2023). Koliko je sport održiv? XXV Naučno - stručni skup, Sistem kvaliteta uslov za uspešno poslovanje i konkurentnost, Zbornik radova, Kopaonik, 17–19. 05.2023. str. 231-239.
9. Radaković, M. (2015). Modeli upravljanja u uspešnim fudbalskim klubovima, doktorska disertacija. Novi Sad: Fakultet za sport i turizam, Univerzitet Edukons.
10. *http://energis.ba/turski-stadion-za-euro-2024-pretvara-energiju-vjetra-u-struju/W5SpahEmrIU/*
11. *https://www.arhitektura.rs/rubrike/projekti/aktuelni-projekti/881-novi-stadion-milan/*
12. Byrne A., Barrett M., Kelly R. (2014). Implementation of ISO 50001 Energy Management System in sports stadia, SDAR* Journal of Sustainable Design & Applied Research, Vol. 2, Iss. 1, Art. 1.
13. *https://www.thesustainabilitycoach.ch/post/sustainability-in-sport*
14. Mašić Z., Radotić F. (2018). Primena reciklaže na sportskim stadionima, 4. Međunarodna konferencija: Sport, zdravlje, životna sredina, Fakultet za sport, Beograd.
15. *http://www.trt.net.tr/bosanski/sport/2015/10/24/antalyaspor-protiv-besiktasa-igra-na-novom-stadionu-55281/*
16. Turčinović Ž. (2018), Eko standardizacija sportskih objekata, XX Nacionalni i VI međunarodni naučno stručni skup: Sistem kvaliteta uslov za uspešno poslovanje i konkurentnost, Kopaonik, 28.11. – 30.11.2018.
17. *https://www.iberdrola.com/social-commitment/sustainability-in-sports*

CHALLENGES IN THE WASTE MANAGEMENT SYSTEM IN THE TRANSITION PROCESS TOWARDS THE CIRCULAR ECONOMY IN BOSNIA AND HERZEGOVINA

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Abstract: Large production of waste has become one of the world's environmental problems. Inadequate treatment of residential, commercial and industrial waste damages people's health and creates significant pressure on the environment, and valuable resources are irretrievably lost. A circular economy in which materials circulate and where the so-called zero waste has numerous advantages over the linear model, which is wasteful of natural resources. Policy makers and society in every country are called upon to face these challenges and develop solutions that are both technically appropriate and economically viable. Case studies in many countries show that an advanced waste management sector is able to meet these challenges. However, in Bosnia and Herzegovina (BiH), the linear model of the economy is dominant compared to the circular model, and the development policy has not yet sufficiently recognized the circular economy as a possibility for future development. By signing the Sofia Declaration on the Green Agenda for the Western Balkans, Bosnia and Herzegovina committed to achieving climate neutrality by 2050, and accepted development and cooperation items that include circular economy. In the waste management system, as a key pillar of the circular economy concept, the linear approach of collection and disposal still dominates in BiH, instead of an integrated sustainable waste management system based on circularity. Most of the waste accumulates in landfills (over 90%) or ends up being burned in the open. The paper analyzes the main problems of establishing a sustainable waste management system in Bosnia and Herzegovina, and includes the identification of problematic issues and the setting of future goals in the process of transition to a circular economy, with special reference to the issues of adapting human capital. Finally, we have provided some effective measures to further improve the waste management system in accordance with the principles of the circular economy.
Keywords: waste management, circular economy, environment, sustainable development, human capital

INTRODUCTION

The problem of waste is a global issue that affects all countries of the world, both developed and developing countries. Waste is produced as a consequence of numerous human activities, and the increase in waste production is associated with the development of the economy, increased consumption, population growth and an increase in the standard of living. It is created from several sources such as commercial, agricultural, communal, industrial and other

activities. Since the industrial revolution, economic activities have developed a growth model based on the principle of "take, make, consume, throw away" — ie. a linear model that is based on the assumption that resources are abundant, available, and can be easily extracted and cheaply disposed of. In circular economy systems, resources are retained in the economy after the end of the product's useful life in order to be productively used multiple times and thus create new value. If the linear economy uses resources indefinitely to produce products that will be discarded after use, the circular economy, in contrast, follows the "reduce, reuse and recycle" model, encouraging the reuse of products and raw materials and preventing the release of waste into the environment as much as possible. (Preston, 2012). More efficient use of resources in the circular economy concept can bring great economic benefits.
Implementing a circular economy in developing countries can help promote sustainable economic growth and development, reduce poverty and inequality, and conserve natural resources. However, the scientific component of the circular economy concept, as well as the possibility of its application, is largely unexplored in Bosnia and Herzegovina. The contribution of this paper is that this is the first study that points to the analysis of the challenges of implementing the CE concept in Bosnia and Herzegovina. The most urgent challenge for Bosnia and Herzegovina lies in waste management, which requires radical changes - that is, abandoning old practices and focusing on separate waste collection. For this reason, the paper analyzes the main problems of establishing a sustainable waste management system, and includes the identification of controversial issues and the setting of future goals in the process of transition towards circular economy.

Ever since the publication of The Limits to Growth (Meadows et al., 1972) by the Club of Rome in 1972, there has been a global debate about the extent to which global population growth, increasing wealth and associated consumption behavior are compatible with the Earth's limited resources. Since 1980, consumption of natural resources worldwide has more than doubled, and has increased tenfold since 1900 (McCarthy et al., 2018). According to the International Panel on Resources, which was launched by the United Nations Environment Program (UNEP) in 2007 to encourage more sustainable use of natural resources, due to continued population growth and the economic emancipation of least developed countries, total resource use is expected to double again by 2050. (UNEP, 2017).

Waste is a significant problem if not managed effectively (Wilson et al., 2015). Case studies in many countries show that an advanced waste management sector is able to meet these challenges. So, for example, Germany, China and many other developed countries, especially in the EU, have embarked on the path to a modern circular economy. The circular economy represents a new approach to resource management that aims to reduce the amount of waste generated and ensure the sustainability of the economy. Nothing is thrown away, because the product is designed so that it can be repaired, disassembled and reused. In circular economy systems, the value of the product is retained as long as possible and no waste is created. This idea refers to an economic system that prioritizes environmental friendliness and resilience and tends to preserve the value of products so that they can be reused by reducing waste to a minimum. The idea of a circular economy aims to minimize waste, production and consumption and increase resource efficiency (Ogunmakinde, 2019).

LITERATURE REVIEW

Circular economy as a concept has been around for several decades and comes from different schools of thought. Environmental economists Pearce and Turner (1989) primarily introduced the concept of a circular economic system that is built on some previous studies by an environmental economist Boulding (1966). Bolding's idea of the economy as a circular system is considered a precondition for sustaining human life on Earth (a closed system without practical exchange of matter with the external environment).

A Swedish architect named Walter R. Stahel (1982) also influenced CE by questioning the sustainability of the existing linear economic model in the fambience of increasing amounts of waste and limited resources. This author discussed the extension of the useful life of goods to transition to a sustainable society and proposed a 'performance economy' based on a system of spiral loops that "minimizes matter, energy flow and environmental degradation without limiting economic growth or social and technological progress".

The concept "cradle to cradle" (C2C for short) developed by the German chemist and visionary Michael Braungart and the American architect Bill McDonough (2002) has a great impact on CE. Instead of the traditional linear cradle-to-grave model where products are produced, used and then end up as waste, the cradle-to-cradle concept promotes the idea that materials and resources should be continuously recycled and reused. According to this concept, products are designed to be composed of materials that can be easily separated and recycled, without qualitative loss. Today, it is applied in various industries, including product design, construction and waste management, with the aim of creating a more sustainable and environmentally friendly world.

Although the concept of CE initially used to focus on the problems of waste recycling, scientists have begun to think about reconsidering the strategic goals of production and consumption at multiple levels (Kirchherr et al., 2017) and evaluate the effectiveness of progress in achieving circularity through variousindicators. Recycling is only the last stage in the life cycle of a product, and the CE concept implies the prevention of waste and pollution in all stages of its life cycle. The term "circular economy" has been associated with a range of meanings and associations by different authors, but what they generally have in common is the concept of a closed-loop cyclical system. In practice, this means that the circular economy turns end-of-life goods into resources for other goods, closing loops in industrial ecosystems and minimizing waste (following the logic that dictates: reuse what you can, recycle what can't be reused, fix what's broken, remake what can't be fixed).

The Ellen Macarthur Foundation (EMAF), i.e., a business development agency, founded in 2010, with the aim of accelerating the transition to a circular economy, has made the biggest contribution to promotion, theoretical and applied research related to the circular economy so far. Since it was established, this organization has been raising awareness of this idea among producers and policy makers around the world.

The concept of circular economy is based on three principles (EMAF):
(1) abolition of waste generation and pollution,
(2) using products and materials in a circular way and
(3) restoration of nature and its resources.

Meyer (2011) estimated that resource efficiency improvements in different value chains could provide raw material savings in Europe of 17–24% and cost savings of around €630 million. Based on product-based modelling, EMAF (2012) suggested that strengthening circular

economy business models could increase EU GDP by 3.9% by 2030. The transition to a circular economy requires changes in the entire value chain, from product design to new business and market models, from new ways of converting waste into resources to new ways of a consumer's behavior. According to the findings of Plastinin et al. (2019), the government must formulate industrial waste management policies using the LCA (life cycle analysis) method to assess the economic efficiency of production activities at different stages of waste recycling, taking into account the externalities of waste generated. The application of the concept of circular economy with indicators of municipal solid waste per capita, municipal waste recycling rate, packaging waste recycling rate by type of packaging, organic waste recycling rate and e-waste recycling rate can stimulate inclusive economic growth, reducing the consumption of natural resources and strengthening environmental protection (Grdić et al., 2020).

The idea is to create a regenerative system in which products, components and materials are maintained at their highest value for as long as possible, and resources can be productively recovered and reintegrated into the economy or provide nutrients to natural systems (Webster, 2015).

As it is known, it refers to the separation of economic growth from the extraction and consumption of limited natural resources, i.e. scarce resources with negative prints, such as fossil fuels or metals and minerals that are difficult to recycle, where dependence creates a competitive disadvantage. Instead, circular approaches keep resources in productive use in the economy for as long as possible. According to Lacy &Rutqvist (2015), the transition to a circular economy can be the biggest revolution in the way of organizing production and consumption in global economy. According to them, it is about a radical change in the relationship between markets, customers and resources, changing the way we produce and consume through innovative business models, technologies and engineering.

This study is a continuation of research in the field of waste management in Bosnia and Herzegovina (Pešević&Crnogorac, 2008; Pešević&Marković, 2018; Topić et al., 2013; Pešević, 2018).

TRANSITION TO CIRCULAR ECONOMY IN EUAND IMPACT ON HUMAN CAPITAL

The EU's efforts towards a sustainable, low-carbon, competitive and resource-efficient economy are closely linked to the concept of a circular economy. In 2015, the European Commission adopted the Circular Economy Package, which contains an action plan and proposals for adapting the legislation to this concept. The first action plan of the circular economy deals with the production, consumption and recirculation of materials that are at the end of the life of products in the economy, emphasizing the need for design that enables repairs, upgrades, durability and the possibility of recycling products, parts and materials, which are addressed in other EU directives. With the first action plan for the circular economy in 2015, the European Commission adopted measures related to the improvement of waste management: reducing waste disposal in landfills and increasing preparation for reuse and recycling of key waste streams, such as municipal waste and packaging waste, encouraging the necessary investments in waste management, promoting economic incentives and improving the extended producer responsibility scheme. In March 2020, the Second Circular Economy Action Plan was adopted as one of the main blocks of the European Green Deal, the new European agenda for sustainable growth. The new circular economy action plan highlights waste prevention measures as a top priority. The introduction of a sustainable products policy and its translation into specific legislation will be the key to achieving

progress in the prevention of waste generation, while in the following period, new goals related to waste reduction for certain streams will be presented, as part of a wider set of waste prevention measures, as well as specific targets for reducing food waste and residual waste streams.

The establishment of circular economy should increase the competitiveness of the EU on the global scene, encourage sustainable economic growth and enable the opening of new vacancies. The idea behind the circular economy concept is to keep the value of the materials and products as long as possible. The circular economy introduces the concept of "closing the loop" of the life cycle of materials and products from extraction, production and use through disposal and waste management to the market for secondary raw materials and reuse. The emphasis is placed on avoiding waste production through better product design (eco-design), which leads to a more durable product that is easier to disassemble, repair and, ultimately, recycle. The aforementioned measures are complemented by measures in the area of energy efficiency, and through the improvement of production processes, the production of waste and the use of resources are reduced.

Transition to a circular economy has significant economic impacts – previous research shows that there is a positive impact on GDP and employment, but also on other macroeconomic variables (Laubinger, Lanzi & Chateau, 2020; Cambridge Econometrics; Trinomics; ICF, 2018; ILO, 2018). For example, quantitative estimates show that the effect of wider acceptance of the circular economy principles could have a positive impact on employment in EU countries, whereby the increase in employment would amount to about 2% by 2030, with an average increase of about 700,000 jobs (0.3%) (Cambridge Econometrics; Trinomics; ICF, 2018). However, since this impact is not the same for all economic sectors, the final effect of the transition to the circular economy on the labour market will largely depend on the economic structure of a particular country. For example, while employment in mining and extraction of coal, petroleum and natural gas is expected to decrease, on the other hand, employment in activities in waste management and some services sectors (repair, rent) should rise due to wider implementation of circular economy principles (MitrovićiJandrić, 2021, ILO, 2018). Impact on employmentis most evident in activities such as collection, treatment and disposal of waste; reuse of waste materials; sanation, recultivation and other services in the field of waste management. Besides, other economic sectors are also directly or indirectly affected (construction, manufacturing, retail trade, etc.).

In addition to the impact on the number of employees, there are also qualitative aspects of the impact on the labour market. First, since the structure of the economy changes, there is also a significant redistribution of employment between different sectors of the economy. At the same time, there are qualitative changes in the working processes, which implies the need for adjustment of knowledge and skills of the workforce. An additional aspect is the potential occurrence of precarious work which is often a characteristic of some activities related to circular economy, such as waste management.

The estimated effects on employment also depend on the degree of automation of jobs that are affected by the transition to circular economy principles. The transition to a wider acceptance of circular economy principles is not an independent phenomenon - it takes place together with other macro trends, such as digitization and automation and demographic changes (ageing of the population and strong migration flows).

It is expected that the joint influence of these interconnected processes will lead to an increase in the gap between required and available knowledge and skills in the labour market if there are no appropriate adjustments in the education and training system. This calls for a strong policy action, in domains such as lifelong learning, general education systems and active labour market policies. Having in mind the existence of precarious work in activities related

to waste management in some countries, labour market institutions' response is also needed. Due to diverse drivers of labour market changes and the complex impact on human capital, there is a need for a coherent response from policymakers, since a lack of labour force adaptability could be a bottleneck in the transition to the circular economy.

A large number of developed countries have begun active consolidated work on the transition to circularity: laws are adopted, government programs are developed, roadmaps are approved and platforms are created at the international level. Although the circular economy goes beyond waste management, the European Commission recognizes that waste infrastructure is a key element to reduce linear patterns of production and consumption. The circular economy is based on the idea that waste, in the classical sense of the word, does not exist but only raw material that can be reused for the same or other production processes. In the circular economy narrative, environmental "problems" become "opportunities", waste is turned into a resource of recycled primary materials, rare earth metals and fuel for energy production. The legislative proposals on waste in the EU include long-term goals for reducing waste disposal in landfills and increasing preparation for reuse and recycling of key waste streams such as municipal waste and packaging waste. With the help of these goals, member states should gradually equalize the levels of best practice and encourage the necessary investments in waste management.

EXISTING SITUATION IN THE WASTE MANAGEMENT SYSTEM IN BIH

Bosnia and Herzegovina is a country with a small number of inhabitants, where about 3.5 million inhabitants inhabit an area of 51,200 km². According to the Constitution, BiH administratively consists of two entities - the Federation of BiH (FBiH) and Republika Srpska (RS) and one district - Brčko District (BD). With four administrative levels (BiH, entities, cantons, municipalities), administration in the environmental sector, and thus in the field of waste management, is very complex, especially considering that it is a country with a small population. Entity governments of FBiH and RS and the government of BD are responsible for drafting and passing their own laws on waste. In this sense, there are no umbrella laws on waste at the state level. From this it is clear that management structures are complex and that there is not always a clear demarcation of responsibilities between organizations operating at the state, entity and local levels.

The absence of a coordination mechanism with clear powers, and a clear demarcation of responsibilities and obligations between the state, entities, cantons and municipalities, the absence of a harmonized methodology for data collection and processing, i.e. domestic standards in accordance with EU norms, the lack of by-laws and the lack of funding for some important measures for the implementation of environmental protection policy, can be recognized as basic obstacles that can slow down the implementation of environmental reforms (MVTEO, 2012). Environmental management and waste management services are inefficient and uneconomical, even at the entity level, despite the fact that responsibilities and functions are fairly well defined.

The Federation of Bosnia and Herzegovina is administratively divided into 10 cantons and 79 municipalities. At the cantonal level, there is no sole form of organization of ministries that deal with environmental protection issues, so in some cantons the area of environmental protection, and thus waste management, is under the responsibility of the Ministry of Spatial Planning, while in some cantons this area is under the responsibility of the Ministry of Trade and tourism or Traffic and Communications. Republika Srpska is territorially organized into 10 cities and 54 municipalities. Municipalities are responsible for the development of

municipal waste management plans and the organization of waste collection and disposal activities.

In order to approach the policies of the European Union (EU), BiH started the reform of the municipal waste management sector in 2000. As part of the Reform, the Waste Management Strategy in Bosnia and Herzegovina was drafted, but was never formally adopted at the state level (although that Strategy established the basis for planning at the entity level). After that, both entities, as well as Brčko District, prepared Waste Management Strategies, and the entities also adopted Waste Management Plans as its implementation documents. Through the municipal services for spatial planning and communal affairs, the municipality hires utility companies to perform certain tasks in waste management at the municipal level. Although efforts have been made to collect data in the past few years, the data are still mostly based on estimates made using indirect measurement methods, such as surveys.

Figures from the Agency for Statistics should be taken with some caution because:

1. approximately 35% of the population is not covered by regular waste collection services and these quantities are estimated by the Agency and
2. only regional landfills have weighbridges and volumes at remaining landfills are estimated based on truck size and number of daily disposals.

The dominant method of final disposal of waste in Bosnia and Herzegovina is land filling. Currently, there are 7 active regional sanitary landfills in Bosnia and Herzegovina that cover a certain geographical area. A total of 53 out of 143 municipalities in Bosnia and Herzegovina are currently included in the concept of regional disposal, of which 28 in FBiH and 25 in RS (Figure 1), while all others use municipal landfills for which no disposal fee is paid. Municipal landfills generally do not comply with the most important environmental criteria in the sense that they do not have an impermeable bottom, systems for gas collection and leach ate treatment. Therefore, despite the agreements, only 37% of municipalities use regional landfills due to the additional costs of transportation and disposal at sanitary landfills. There are also 4 active inter-municipal landfills that are not of a sanitary nature.

Figure 1. Current status of waste disposal in each region in Bosnia and Herzegovina

Waste collection, transport and management of landfills are carried out by utility companies that mostly use old equipment. Urban parts of municipalities and suburban settlements, unlike rural parts of the municipality, are very well covered by the waste collection system despite the lack of modern vehicles for waste collection and insufficient capacity of containers, as well as problems with financing (Topić et al., 2013). There is no additional funding from the state, entity or cantonal level, except for some grant funds from the Environmental Protection Fund for specific investment projects.

Data on waste from production activities were collected by the BiH Statistics Agency (ASBiH) and published in the Annual Report on waste generated in production activities. These data on the amount, type and flow of waste generated in the "production process in industry, trade and other processes" still do not give a full picture of the generation and flow of waste in Bosnia and Herzegovina. There is a lack of information on other industrial waste or waste originating from sources other than households. Waste collection, transport and management of landfills are carried out by utility companies. Waste collection is mainly done using 1,100 liter containers, while some municipalities also use 120/240 liter containers for door-to-door collection and large containers (5-8m³) for non-hazardous industrial waste collection. The percentage of the population of Bosnia and Herzegovina covered by public

waste collection services has slightly increased in the last 10 years, from 65% to 74% (BHAS, 2021). Collection coverage in urban areas is over 90%, and in rural areas it is 40% on average. Waste that is not collected contributes to the occurrence of illegal landfills and a negative impact on the environment. According to some estimates, around 1,200 locations are covered by illegally dumped waste, which does not include smaller locations that can be seen in numerous places. According to the data of the BiH Agency for Statistics (BHAS, 2022), the estimated amount of municipal waste produced in 2021 is 1,228,915.9 tons, i.e. 356 kg per inhabitant per year, or 0.98 kg per inhabitant per day, which is significantly less compared to the EU (530 kg per inhabitant in 2021)1. According to these data, in 2021, 940,405 tons of municipal waste were collected by public collection, of which 81% came from households, 16% came from production and service activities, and less than 3% came from communal services (BHAS, 2022). According to EU statistics, 95% of municipal waste is disposed of in landfills in Bosnia and Herzegovina. By comparison, in the EU in 2021, 49% of municipal waste was recycled or composted.

There are no reliable data on the composition of the municipal waste stream, because data on waste generation are not based on actual measurements.
As already mentioned, municipalities in Bosnia and Herzegovina are responsible for the organization of waste collection and disposal activities. For the existing waste management system, there is no additional funding from the state, entity or cantonal level, except for some grant funds from the Environmental Protection Fund for specific investment projects. The distribution of these funds is based on a public call for project submissions. Otherwise, municipalities must pay for their investments.

In BiH, there are no facilities for mechanical-biological treatment (MBO) of waste or for thermal treatment of waste.
The process of joining BiH to the European Union is one of the main drivers of reforms in the field of the environment, which mostly refers to the harmonization of domestic legislation with EU law.

BOSNIA AND HERZEGOVINA IN THE TRANSITION PROCESS TO CE

The basis for developing the future circular economy policy in Bosnia and Herzegovina is the Green Deal for the Western Balkans, which requires action regarding the introduction of a circular economy (sustainable production and consumption). The circular economy is one of the five key areas in the European Green Plan, which have been transferred to the Green Agenda for the Western Balkans, with special reference to waste, recycling, sustainable production and efficient use of resources.
By signing the Sofia Declaration on the Green Agenda for the Western Balkans2, Bosnia and Herzegovina committed to achieving climate neutrality by 2050, and accepted development and cooperation items that include the circular economy, aware of the need for the research and innovation system to support this transition (Declaration, 2020). With the aim of

[1]https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Municipal_waste_statistics
[4]Regional Cooperation Council: Action plan for the implementation of the Sofia Declaration on the Green Program for the Western Balkans https://www.rcc.int/files/user/docs/cb61b1e081ff4b568618c6ff799e67c5.pdf Accessed 04.05.2023
[5] Council, R. C. (2021). Action Plan for the Implementation of the Sofia Declaration on the Green Agenda for the Western Balkans 2021-2030. Sarajevo, Bosnia and Herzegovina.

contributing to environmental protection and minimizing the amount of waste generated in the region, the following actions are planned:

1. Integrating the Western Balkans, and thus BiH, into the industrial supply chains of the EU through:
   - Taking decisive actions to improve the sustainability of the primary production of raw materials;
   - Applications of the industrial ecosystem approach to achieve ecologically sustainable, balanced economic recovery, especially for key industrial ecosystems, such as renewable energy, digital energy, mobility;
2. Development of circular economy strategies by taking into account product life cycle, waste prevention, modern waste management and recycling, reuse, repair and remanufacturing;
3. Improvement of waste management infrastructure;
4. Raising citizens' awareness of waste, separate collection and sustainable consumption;
5. Reaching an agreement on preventing plastic pollution.

These commitments emphasize the need to create clear guidelines that will show what changes are needed to achieve these ambitious goals.

Waste management and recycling, as key pillars of the CE concept, are still dominating over the linear approach of collection and disposal instead of an integral sustainable waste management system based on circularity. Introducing the concept of integral waste management implies the development and implementation of technologies that have a minimal negative impact on the environment.

Progress in compliance with waste management legislation, including recycling, plastics, chemicals, eco-design and other provisions related to the circular economy, is rather slow and limited, while full implementation of existing legal and policy frameworks is an even greater challenge[5]. The European Green Deal and the new Circular Economy Action Plan bring greater demands that will need to be incorporated into national legislation. In addition to the creation of institutional and political-legal assumptions, the practical application of the adopted mechanisms of control and monitoring of implemented activities on these issues is also necessary.

The introduction of the extended producer responsibility system for packaging and packaging waste in FBiH and RS, as well as electronic and electronic waste in FBiH, represents the first step in the transition to a circular economy in BiH.

Although there is no systematic approach to CE in Bosnia and Herzegovina, recently there has been an evident increase in initiatives to promote and encourage CE, including the creation of a strategic-regulatory framework. The Environmental Protection Strategy of the Republika Srpska and the Federal Environmental Protection Strategy (for the period 2022 - 2032) aim to integrate the concept of circular economy, primarily focusing on waste management - waste selection and recycling.

This will enable sufficient quantities of recyclable materials for sustainable production in various sectors (industry, agriculture, etc.) and efficient use of resources. The goals of waste management are listed in the waste management strategies of various entities in Bosnia and Herzegovina. However, in the Federation of Bosnia and Herzegovina and the Brčko District, CE principles have not yet been introduced into the strategic framework of waste management. Existing strategies in the waste sector in FBiH, RS and BD contain quantitative

goals related to increasing recycling and reuse for specific categories of waste, as well as reducing the amount of waste for final disposal with more efficient use of resources.

Table 1. Overview of the most significant documents adopted in Bosnia and Herzegovina to encourage CE

Institution	**Document**
Government of Republika Srpska	Waste Management Strategy for the period 2017–2026
Ministry of Spatial Planning, Construction and Ecology of the Republika Srpska	Republic Waste Management Plan in the Republika Srpska
Government of Republika Srpska	Environmental Protection Strategy of Republika Srpska for the period 2022-2032
Government of Republika Srpska	Industry Development Strategy of Republika Srpska for the period 2021-2027
Government of Republika Srpska	Program of economic reforms of the Republika Srpska for the period 2022-2024
Government of the Federation of Bosnia and Herzegovina	Development Strategy of the Federation of Bosnia and Herzegovina 2021-2027
Government of the Federation of Bosnia and Herzegovina	Federal Environmental Protection Strategy 2022 - 2032.

In the Republic of Srpska, the strategic framework areas of action include the integration of the circular economy concept, and the promotion of eco-design rules in accordance with the Rulebook on Eco-design of products that use energy in the Republic of Srpska ("Official Gazette of the Republic of Srpska", number 74/16). It is necessary to implement the promotion of eco-design measures and rules towards the business sector. The need to introduce a circular economy is also recognized by the Republican Waste Management Plan in the Republika Srpska, in which one of the goals is the achievement of ecologically sustainable use and preservation of natural resources, the reduction of the total amount of waste that is disposed of, the reduction of emissions and the reduction of threats to human health and lithe environment through:

• prevention of construction waste, packaging waste, various waste streams (EEO, tires, plastic bags, etc.);

• development of food waste management, household composting, "green" public procurement, public awareness;

• promotion of sustainable construction, eco-design, environmental protection.

In the strategic document entitled "Industrial Development Strategy of the Republika Srpska for the period 2021-2027. year" within the strategic goal "Reduce harmful effects on the environment" the following priorities are defined:

• Application of ecological standards in industry (transition to the green economy), and the following measures are mentioned: support for the construction of infrastructure for environmental protection and support for the introduction of ecological standards;

• Efficient use of resources in industry (transition to a circular economy) and within the same measure: development of an efficient system of using raw materials and waste management and increasing energy efficiency in industry.

Activities for the realization of this strategic goal, priorities and measures are elaborated in detail in the Action Plan for the implementation of the Industry Development Strategy of the Republic of Srpska for the period 2021-2027.

In the Program of Economic Reforms of the Republic of Srpska for the period 2022-2024. it is stated that a new reform measure will be implemented in the following period, i.e. transition of industry towards green and circular economy. The measure includes the provision of appropriate financial support for the implementation of projects in industry that have an impact on environmental protection, and are related to the reconstruction/innovation of existing technological processes, more efficient use of raw materials and energy in the production process, development of products with reduced harmful impact on the environment, introduction of standards for management of environmental protection, reduction of waste generation, recycling, energy efficiency and use of renewable energy sources in industry and the like, as well as the implementation of activities to promote the production and use of products with a reduced harmful impact on the environment.

The above-mentioned documents are important for the preparation of a clear policy for the implementation of the circular economy. However, many of the goals in the existing strategies and plans are very ambitious and do not take into account the current situation and achievements so far. In the planning and strategic documents of Bosnia and Herzegovina, there are no clearly defined activities that would prevent the generation of waste. The introduction of the extended producer responsibility system for packaging and packaging waste in the Republika Srpska represents the first step in the transition to a circular economy.
Composting in households has been identified in some municipal PUOs as a measure to prevent waste generation, and in this direction it is proposed to carry out campaigns to raise public awareness about composting in households as well as training in local communities (especially in rural areas).

Current estimates of the European Commission are that the process of transition from a linear to a circular economy in the countries of the Western Balkans, which includes Bosnia and Herzegovina, is taking place slowly. BiH has not yet adopted the Circular Economy Roadmap as a necessary framework for a rapid transition to a circular economy. The roadmap should identify key drivers, opportunities and obstacles, priority sectors and necessary administrative capacities, as well as bodies for coordinating their implementation.
The framework areas for creating assumptions for the transition to the circular economy include the development and adoption of the Roadmap and the Action Plan for the introduction of the circular economy at the entity level (matched with the Roadmap at the BiH level), the removal of legal obstacles and the introduction of stimulating instruments for green business, encouraging the application of green public procurement in public institutions and in the private sector, drafting regulations for eco-design products, and ensuring financial support for strengthening voluntary instruments for the introduction of green business.
A national strategy for waste management, especially taking into account the context of the circular economy, the EU Plastics Strategy and the Single-Use Plastics Directive, has yet to be prepared. In order to comply with the Landfill Directive, the country needs to close or remediate non-compliant landfills. Awareness raising measures are needed to reduce waste generation and promote reuse and recycling. Furthermore, alignment with the EU acquis on sewage sludge, batteries, packaging, polychlorinated biphenyls/polychlorinated terphenyls and waste vehicles is needed.

According to German experts for the circular economy, based on the long-term experience of Western European countries, five phases have been defined in the introduction of the circular economy from the aspect of improving the waste management system (BMUB, 2016).

Phase 1: Disposal of waste in uncontrolled landfills
Phase 2: Systematic waste collection and improvement of the landfill
Phase 3: Separate collection and sorting of waste
Phase 4: Expansion of the recycling industry
Phase 5: Circular economy - waste as a resource
Phases 3 - 5 represent the transition from waste disposal to a circular economy. In these stages, the goal of resource efficiency, through the use of waste as a material and energy resource, increasingly becomes a priority (Figure 2).

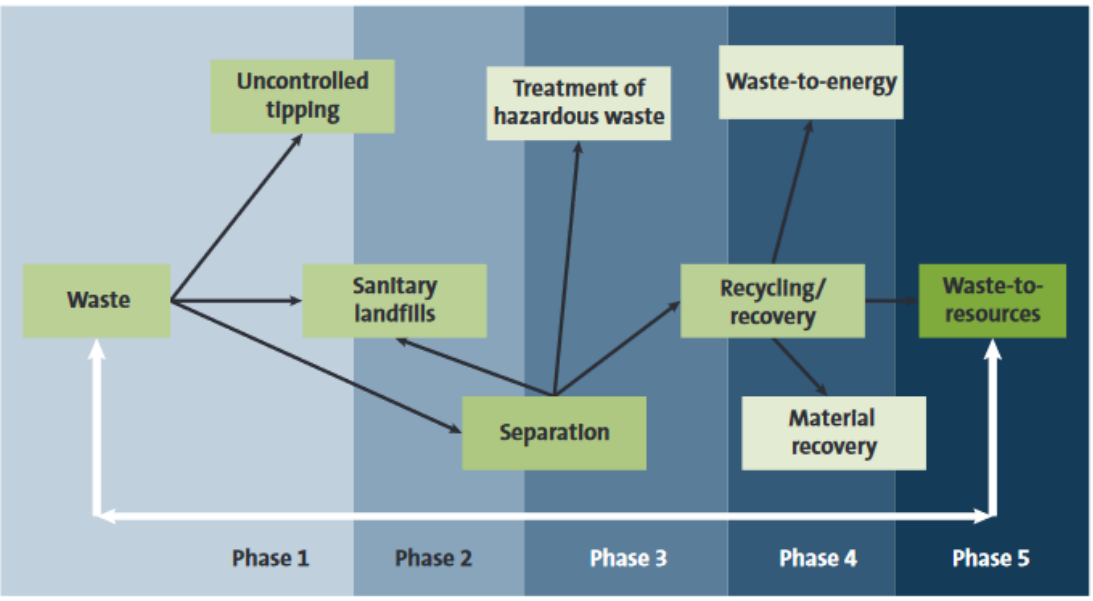

Figure 2. Five stages for the introduction of circular economy (BMUB, 2016)

In accordance with the aforementioned division, the waste management system in BiH is currently between the first and second stage, depending on the geographical location, but in general, the introduction of separate waste collection and sorting is not yet widespread. There are legal entities that deal with the purchase of certain types of waste such as cardboard and plastic, but the system of separating waste by household has not yet taken root. Elements of the circular economy can be implemented even at this early stage, for example with separate collection and manual sorting of recyclable materials. Separation and collection in several containers form the basis of high-quality sorting and high-quality recycling processes (Pešević, 2022). Simple facilities for composting waste from parks and markets, using mobile equipment, mark the beginning of organic waste recycling.
The introduction of systematic, regulated and reliable collection and establishment of sanitary landfills is the first step in the development of the waste management sector. In the system of regional waste management, as represented in Bosnia and Herzegovina, conveniently located transfer stations facilitate the cost-effective transport of waste. It is of crucial importance that collection is done efficiently because it is the most expensive element of waste management. However, along with sorting processes, it also offers the greatest potential for employment. It is important to identify the "right" collection system for each city or community and its particular circumstances.

In phase 5 (Circular Economy - waste as a resource) waste is predominantly recycled or subjected to energy recovery; untreated household waste no longer goes to landfill. The high recycling rates achieved result in a functional circular economy. Only small amounts of residual waste are disposed of in landfills and do not harm the environment. Preventing waste and looking at the life cycle are fundamental principles in all production processes and many consumer choices. That is the goal we should work towards.
Bosnia and Herzegovina will have to implement efficient separation and collection of waste, at least paper, then metal, plastic, glass and bio-waste, which are key to quality recycling and the establishment of economic incentives for reducing waste generation and better waste treatment (e.g. fees for land filling/incineration), as well as effective extended producer responsibility schemes.
All in all, technological solutions already exist; they simply need to be adapted to specific local circumstances. Recyclable materials can be recovered from waste by separate collection or by using sorting and separation technologies. Experience shows that the best results for recycling and the environment are achieved through separate collection. Keeping waste fractions separate at source and collecting them separately is the first step towards recovering secondary resources. Plastics, glass, paper, metals, organic waste and minerals can best be reused if they are clean and unmixed. The processing of mixed municipal waste is much more complex.

We should bear in mind that the introduction of circular economy is neither simple nor cheap. Not only are investments required to purchase the appropriate technology and build management facilities, but ongoing costs are primarily incurred in the collection of waste and recyclable materials and in the operation of the facilities. Compared to them, the costs of raising social awareness and further education and training of technical staff are small. Building an advanced waste management sector must not represent an excessive financial burden for the poorer sectors of society. The products of advanced waste management systems generate income in the form of secondary resources, energy and soil improvers. Calculations show that revenues from these products can cover a third or more of total costs. With the right policy framework, an advanced waste management sector is far cheaper than a conventional sanitary landfill (BMUB, 2016).

Separately collected organic waste is treated with biological treatment and is suitable for material recovery. Depending on the composition, it can be composted or used to produce biogas in fermentation plants. Proper processing turns fermentation residues into a valuable soil conditioner and fertilizer, similar to compost, for agricultural and horticultural use. Liquid fermentation residues can be used as agricultural fertilizer in a similar way to liquid fertilizer.
In FBiH and RS, there is a limited number of financial mechanisms that support the transition to a circular economy. Among those mechanisms may be fees paid for not achieving recycling and reuse targets for some specific waste categories.
In order to introduce a circular economy, it is necessary to improve the legal and strategic framework in the area of waste management with EU principles, as well as to introduce economic and financial instruments and mechanisms that will affect the reduction of the amount and increase of the degree of utilization of all categories of waste.

CONCLUSION

The circular economy represents a model of an economic system in which the amount of waste and pollution is minimized, and instead the reuse and recycling of resources is promoted. In Bosnia and Herzegovina, the circular economy is still not sufficiently developed, but there are initiatives that deal with this topic. However, there is a need for further development of the circular economy in Bosnia and Herzegovina, which would imply greater cooperation between the government, the economy and the civil sector. One of the key challenges in the implementation of the circular economy in Bosnia and Herzegovina is the lack of infrastructure and technology for efficient recycling and reuse of resources. Also, it is necessary to improve the legal frameworks that regulate waste management and to provide adequate resources for its efficient processing and recycling.
The circular economy as a topic is particularly important for developing countries because it can help solve many of the economic, environmental and social challenges these countries face. The application of the circular economy model affects the reduction of the negative impacts of beer industry and society on the environment by reducing the exploitation of limited natural resources, as well as by reducing the amount of waste. The concept of circular economy is relatively new in Bosnia and Herzegovina, and therefore still abstract for many citizens, business owners, and decision makers. Neither the Road Map nor the Action Plan was adopted, nor was financial support provided for the strengthening of voluntary instruments for the introduction of green business. In order to protect the environment and enable the transition of industry to a circular and green economy, it is necessary to improve the waste management system, especially the management system for special categories of waste, in order to build the infrastructure for recycling and the use of useful components of waste, and to promote the use of secondary raw materials. BiH is faced with a great challenge in terms of developing the appropriate infrastructure for waste management according to modern European standards. The existing waste management system in terms of waste collection and disposal is inadequate in most municipalities. Separate collection of recyclable waste from households, including packaging waste, is practically not implemented in Bosnia and Herzegovina. It is necessary to introduce economic and financial instruments and mechanisms that will affect the reduction of the amount of waste and the increase in the degree of utilization of all categories of waste.

In order to improve integrated waste management and the system of circular economy, it is necessary to improve the system of records and reporting on waste, to improve the system of municipal waste management, as well as special categories of waste. In order to establish advanced systems for waste management, it is necessary to take into consideration elements such as legal regulations, social factors, available technologies, then financial aspects and market conditions. It is necessary to emphasize the role of citizens when it comes to reducing waste generation, separating and recycling waste, changing consumption patterns, which can have a significant effect on reducing the impact on the environment of Bosnia and Herzegovina.
The aforementioned organizational challenges point to the need to think about a more efficient way of managing waste in an ineffective system such as is in place in Bosnia and Herzegovina due to the fragmentation of institutions. In the coming period, it is necessary to significantly change the waste management system and establish measures to achieve the goals of reuse and recycling of waste in accordance with EU Directives and recommendations for the establishment of a circular economy

It is important to emphasize that the application of the circular economy in Bosnia and Herzegovina is important not only because of environmental protection, but also because of the potential economic benefit it can bring, including the creation of new vacancies and increasing the competitiveness of the economy. In this sense, it is necessary to consider the need for adapting the education system, both formal and informal, which would not only help in reinforcing the adaptability of the workforce but also strengthen awareness of the importance of the circular economy concept.

From all of the above, we can conclude that BiH has the potential for inclusion and progress towards the circular economy, but this will only be possible by integrating circular economy practices into all sectors of the economy and at all levels, while simultaneously raising general awareness of this concept and the advantages it can bring.

REFERENCES

1. BHAS (2021). Questionnaire to Western Balkan countries for providing information regarding municipal waste management and waste prevention — Bosnia and Herzegovina, Agency for Statistics of Bosnia and Herzegovina.
2. BHAS (2022). Javni odvoz i odlaganje komunalnog otpada. Agency for Statistics of the Bosnia and Herzegovina, https://bhas.gov.ba/data/Publikacije/Saopstenja/2022/ENV_01_2021_Y1_1_BS.pdf
3. BMUB (Bundesministeriumfür Umwelt, Naturschutz, Bau und Reaktorsicherheit) (2016).Modern Waste Goals and Paths – Germanys' expertise for an advanced circular economy, Federal Ministry forthe Enviornment, Nature Conservation, Building and Nuclear Safety.
4. Boulding, K. E. (1966). The Economics of the Coming Spaceship Earth, in Jarrett, H. (ed.), Environmental quality in a growing economy: Essays from the sixth RFF forum, New York, RFF Press, pp. 3–14.
5. Cambridge Econometrics; Trinomics; ICF. (2018). Impacts of circular economy policies on the labour market. Final report and Annexes. Luxembourg: Publications Office of the European Union.
6. Ellen MacArthur Foundation: https://www.ellenmacarthurfoundation.org/circular-economy/overview/concept
7. EU statistika: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Municipal_waste_statistics
8. Grdic, S., Krstinic Z., Nizic, M., &Rudan, E. (2020). Circular economy concept in the context of economic development in EU countries. Sustainability, 12(7), 3060.
9. ILO. (2018). Greening with jobs – World Employment and Social Outlook 2018. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_628654.pdf
10. Kirchherr, J., Reike, D., Hekkert, M. (2017). Conceptualizing the circular economy: an analysis of 114 definitions. Resour. Conserv. Recycl 127, 221e232.
11. Lacy, P., &Rutqvist, J. (2015). Waste to wealth: The circular economy advantage (Vol. 91). London: Palgrave Macmillan.
12. Laubinger, F., Lanzi, E., & Chateau, J. (2020). Labour market consequences of a transition to a circular economy: a review paper – environment working paper No 162.
13. McCarthy, A., Dellink, R. &Bibas, R. (2018). The macroeconomics of the circular economy transition: A critical review of modelling approaches.

14. Mc Donough, W., Braungart, M. (2002). Cradle to Cradle: Remaking the Way We Make Things; North Point Press: New York, USA.
15. Meadows et al. (1972). The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind, New York: Universe Books 1972.
16. Meyer, B., 2011. Macroeconomic modelling of sustainable development and the links between the economy and the environment, ENV.F.1/ETU/2010/0033, http://ec.europa.eu/environment/enveco/studies/modelling/pdf/report/macroeconomic.pdf
17. Mitrović, Đ., Jandrić, M. (2021). Tranzicija ka cirkularnoj ekonomiji i promene na tržištu rada, In: Praščević, A., Fabris, N. (urednici) Stanje i perspective ekonomske misli – uticaj ekonomskih recesija u prvim decenijama XXI veka, tematski zbornik radova, p. 151-167., Beograd: Univerzitet u Beogradu, Ekonomski fakultet
18. MVTEO (2012). Izvještaj o stanju životne sredine u Bosni i Hercegovini, Ministarstvo vanjske trgovine i ekonomskih odnosa, Bosna i Hercegovina, http://ba.one.un.org/content/unct/bosnia_and_herzegovina/en/home/publications/state-of-environment-report-in-bih-2012.html
19. OECD and Eurostat, 2019, Municipal waste reporting — Data quality/methodology report, Organisation for Economic Co-operation and Development and Eurostat.
20. Ogunmakinde, O. E. (2019). A review of circular economy development models in China, Germany and Japan. Recycling, 4(3). https://doi.org/10.3390/recycling40300
21. Pearce, D. W., & Turner, R. K. (1989). Economics of natural resources and the environment. Johns Hopkins University Press.
22. Plastinina, I., Teslyuk, L., Dukmasova, N., &Pikalova, E. (2019). Implementation of circular economy principles in regional solid municipal waste management: The case of Sverdlovskaya Oblast (Russian Federation). Resources, 8(2), 90.
23. Pešević, D. & Crnogorac, Č. (2008). Izbor lokacije deponije čvrstog otpada i uticaj na životnu sredinu na primjeru deponije, "Ramići" kod Banjaluke. Herald, 12, 89–107. https://www.gdrsbl.org/wp-content/uploads/2020/04/HERALD12.pdf
24. Pešević, D. & Marković, M. (2018). Uloga lokalne samouprave u uspostavljanju integralnog sistema upravljanja otpadom u Republici Srpskoj, Lokalna samouprava u planiranju i uređenju prostora i naselja, 529-535.
25. Pešević, D. (2018). Banjalučka regija – životna sredina i problem održivog razvoja, Geografsko društvo Republike Srpske, knjiga 42, 1-336
26. Pešević, D. (2022). Upravljanje otpadom. Prirodno-matematički fakultet, Univerzitet u Banjoj Luci. 1-384.
27. Preston, F. (2012). A global redesign? Shaping the circular economy. Chatham House.
28. Svjetska banka (2017). Bosna i Hercegovina: Analiza sektora upravljanja čvrstim komunalnim otpadom: Analiza sistema produžene odgovornosti proizvođača u Bosni i Hercegovini za ambalažu, ambalažni otpad i EE otpad. https://unija.com/wp-content/uploads/2019/04/Analiza-sektora-produzene-odgovornosti-proizvodaca-u-BiH.pdf
29. Solid Waste Management Country Profile: Bosnia and Herzegovina. https://www.waste.ccacoalition.org/sites/default/files/files/country_profile_bosnia_and_herzegovina_final.pdf
30. Stahel, W. R. (1982). The product life factor. An Inquiry into the Nature of Sustainable Societies: The Role of the Private Sector (Series: 1982 Mitchell Prize Papers), NARC, 74-96.

31. Topić, M., Preradović, L., Stanković, M., Zimmermann, F., Fischer, W., Preradović, G., Pešević, D. & Topić, D. (2013). Upravljanje otpadom u Republici Srpskoj: Analiza postojećeg stanja sa posebnim osvrtom na komunalna preduzeća. Međunarodno udruženje naučnih radnika-AIS, Banja Luka; Institut za geografiju i regionalno istraživanje Karl Frances, Grac.
32. United Nations Environment Programme (UNEP) (2017). Assessing global resource use.
33. Vasilkov, Z., Petrović, S., Vuković, J., Lazić, D., & Damnjanović, A. (2021). Zeleni dogovor Evropske unije i Zelena agenda za Zapadni Balkan: nove smernice za suočavanje sa izazovima zaštite životne sredine. Ecologica, 28(104), 494-502.
34. Vlada Republike Srpske (2022). Program ekonomskih reformi Republike Srpske za period 2022-2024. godine
35. Vlada Republike Srpske (2021). Strategija razvoja industrije Republike Srpske za period 2021–2027. godine
36. Webster, K., 2015. The Circular Economy: A Wealth of Flows. EMF.
37. Wilson, D. C., Ljiljana, R., Modak, P., Soos, R., & Carpintero, A. (2015). Global Waste Management Outlook. In United Nations Environment Programme.

PERSPECTIVE AND DEVELOPMENT OF GREEN ECONOMY

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Abstract: Green economy is a quite new concept of modern economy, and its task is to ensure sustainable development and at the same time to ensure economic development of every country whereas a big emphasis is put on the protection of the environment.
The aim of green economy is to use natural resources of every country more effectively, to minimize the pollution of environment, to ensure economic growth, to decrease poverty and unemployment. Investments into green economy can lead to the creation of new work positions, creation of revenues, development of new markets with the lower emission production.
The World Bank puts big emphasis on green economy and finances by its activities the green growth in the amount of more than 200 billion dollars. European green agreement represents the plan of European Commission that focuses on ecological transformation of economy of European Union in the future and the main goal is to become climatically neutral by 2050. Slovakia is also involved in the development of green economy through the program of the recovery plan that has five key components.

Key words: green economy, green growth, sustainable development, support.

INTRODUCTION

Green economy is a quite new concept which originated as a reaction for the negative development trends connected to the economy as well as to the environment. Economic growth, development and profit are often more important for economic subjects than the protection of environment. More significant burden of environment began with the industrial revolution and following development of world economies. Green economy can be defined as a modern economy which has a role to ensure sustainable development and at the same time the economic growth of every country while the biggest emphasis is put on the protection of environment. Investments into green economy are very attractive for companies and entrepreneurs. In today's global economic crises, green economy has gained the attention as the concept that could overcome connotation of environment protection as a cost factor slowing down the economic development and bringing environment to the positive relationship as well as to be the new driving force of economic development. In the era of

globalization and mass production there is more attention paid to depletion of natural resources, pollution of environment and its consequences as it is for instance global warming. These problems are necessary to be solved and one of the solutions for these contemporary economic, ecological and social problems is just the green economy concept that is not focused on the economic growth in its common understanding but on sustainable development.

Green economy supports investments into particular fields that are generally called ecological fields which renew and sustain natural resources and enhance effectiveness of its use. Investments into green economy can lead to creation of new work positions, creation of revenues, development of new markets with lower degree of productions of emissions and pollution of environment in every country.

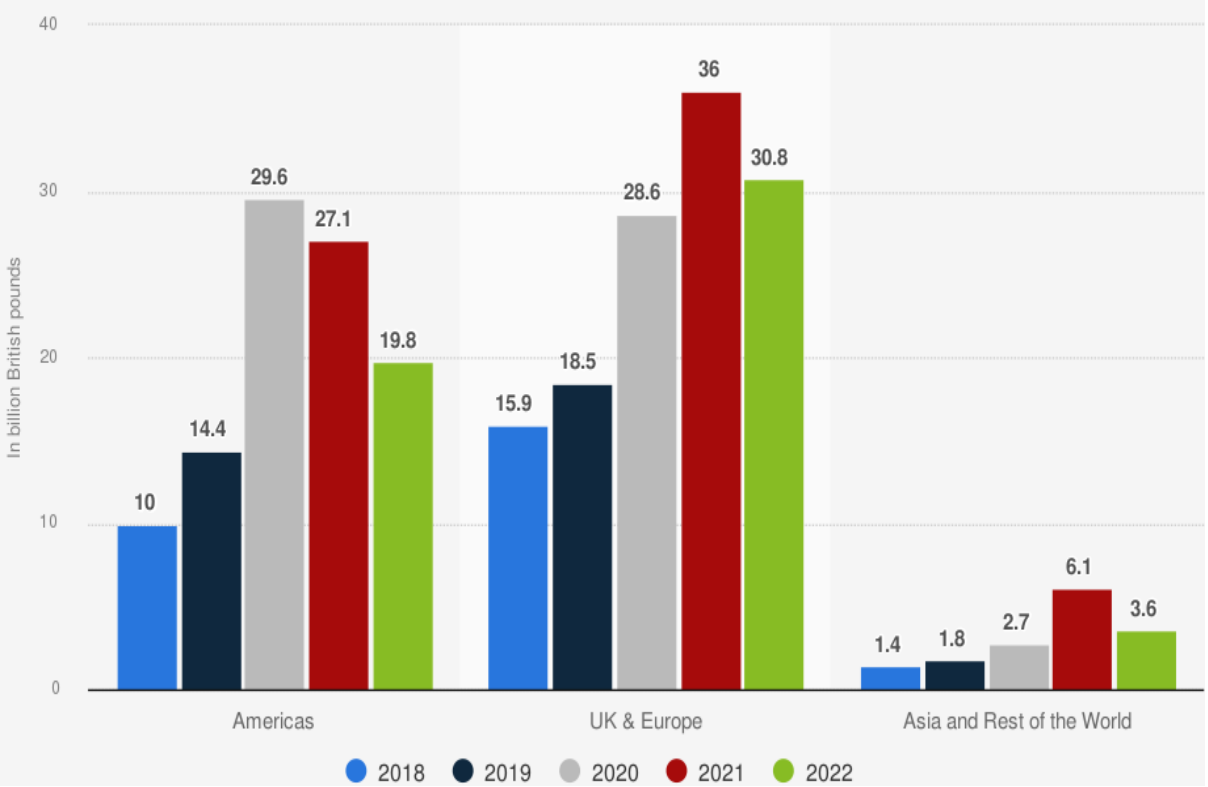
Economic sectors of green economy

- transport
- all type of industries
- energetics
- tourism
- agricultural performance

WORLD BANK AND GREEN ECONOMY

World Bank emphasizes and finances the green growth as the growth that uses effectively natural resources and minimizes environment pollution while takes into account natural resources, the role of environmental management and natural capital in prevention of physical catastrophes. World Bank distributes resources in the amount of 200 billion dollars for green economy which plans to put into projects focused on fight against climatic changes in developing countries. Over the past years, a number of the world's largest banks have made commitments to contributing towards a more sustainable future. Each bank that made such commitments did so in varying degrees. On a broad scale, these commitments are focused in three main areas covering environment, society and governance and mainly follow the guidelines set out in the 2015 Paris Agreement (Statista 2023).Except of World Bank, some other countries are increasing their investments into so-called Green Climate Fund which supports projects in the field of renewable energy and resistance against climatic changes in developing countries.

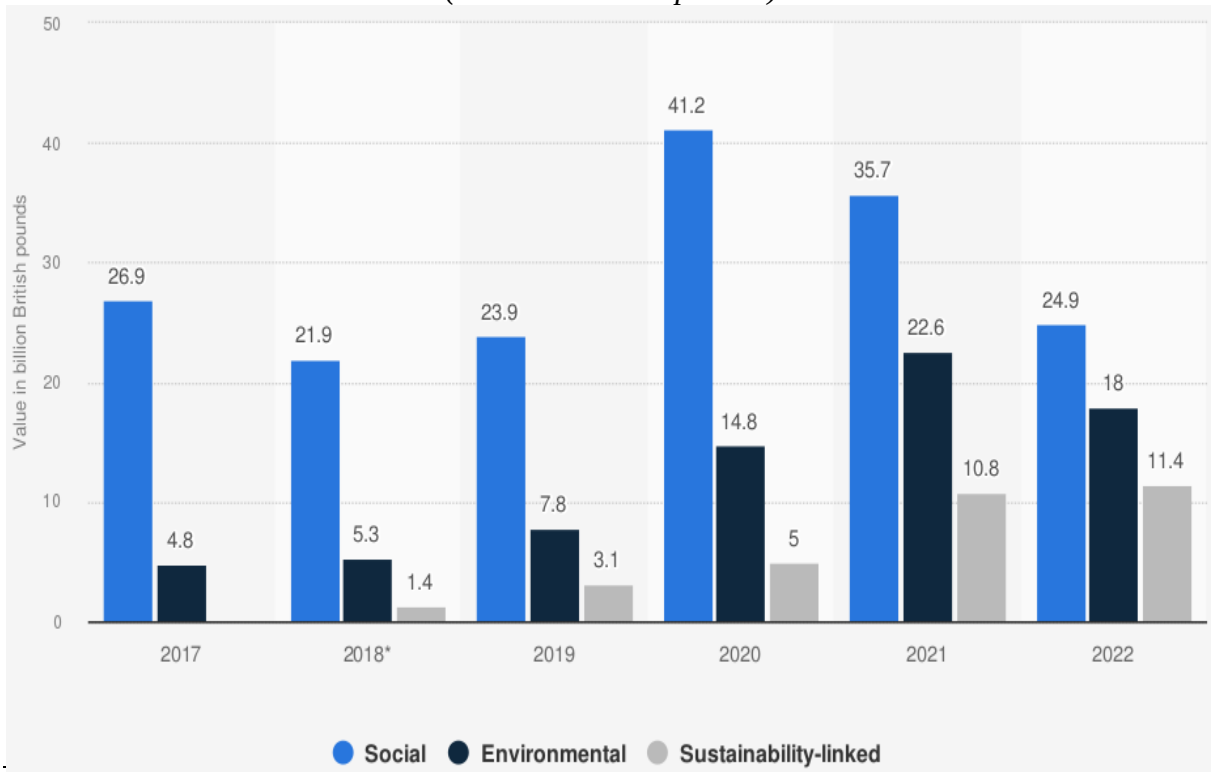
Value of social, environmental, and sustainability-linked financing by Barclays PLC worldwide from 2018 to 2022, by region
(in billion British pounds)



Source: Barclays. (February 15, 2023). Value of social, environmental, and sustainability-linked financing by Barclays PLC worldwide from 2018 to 2022, by region (in billion British pounds) [Graph]. In *Statista*. Retrieved March 05, 2023, from https://www.statista.com/statistics/1089396/share-of-sustainable-finance-by-barlcays-plc-bank-worldwide/?locale=en

According to the World Resources Institute (WRI), "Barclays PLC committed to facilitating 150 billion British pounds of social and environmental financing by 2025, including funding for sectors such as renewable energy, clean technology, education, affordable housing and national and supranational development institutions." Barclays first set out their financial commitment in 2019, which was to be achieved by the year 2025. In 2021, Barclay's achieved the highest value yet in sustainable financing. Barclays have actually been publishing their sustainable financing results through a Environmental Social Governance report (ESG) since 2016. Prior to announcing their commitment, the bank has facilitated almost 90 billion British pounds in social and green financing. From 2018 to 2021, the bank distributed the majority of its sustainable funding in the UK, Europe and the Americas (Statista 2023).

Value of sustainable financing by Barclays PLC from 2017 to 2022, by type
(in billion British pounds)



Source: Barclays. (February 15, 2023). Value of sustainable financing by Barclays PLC from 2017 to 2022, by type (in billion British pounds) [Graph]. In Statista. Retrieved March 05, 2023, from https://www.statista.com/statistics/1109680/value-of-sustainable-finance-by-barlcays-plc-bank-by-type/

In 2022, Barclays plc facilitated more social project financings than environmental or sustainability-linked projects, just as in the previous years. The value of sustainable financing decreased in both the social and environmental category, while the value of sustainability-linked financing increased (Statista 2023).

EUROPEAN GREEN DEAL European Green deal represents the plan of European Union which focuses on ecological transformation of economy in EU in the future. One of the main goals of EU is to become climatically neutral until 2050, what means that the economy will consist of zero emissions of greenhouse gases i.e. member states of EU will produce zero emissions of greenhouse gases. EU and public sector of every member state but also entrepreneurship sector have to invest into it dramatically.

Climate change and environmental degradation are an existential threat to Europe and the world. To overcome these challenges, the European Green Deal will transform the EU into a modern, resource-efficient and competitive economy, ensuring:

- no net emissions of greenhouse gases by 2050
- economic growth decoupled from resource use
- no person and no place left behind

The European Green Deal is also our lifeline out of the COVID-19 pandemic. **One third of the €1.8 trillion** investments from the Next Generation EU Recovery Plan, and the EU's seven-year budget will finance the European Green Deal (European Commission 2023).

The relationship between environment and economic growth uses the expression sustainable development which is the basic and general goal of EU. The European Green Deal will improve the well-being and health of citizens and future generations by providing:

- fresh air, clean water, healthy soil and biodiversity
- renovated, energy efficient buildings
- healthy and affordable food
- more public transport
- cleaner energy and cutting-edge clean technological innovation
- longer lasting products that can be repaired, recycled and re-used
- future-proof jobs and skills training for the transition
- globally competitive and resilient industry (European Commission 2023).

The deal contains various items among which the increase of EU ambitions in the field of climate for years 2030and 2050 belongs. This will create new opportunities for innovation and investment and jobs, as well as:

- reduce emissions
- create jobs and growth
- address energy poverty
- reduce external energy dependency
- improve our health and wellbeing

At the same time, it will ensure there are opportunities for everyone, supporting vulnerable citizens by tackling inequality and energy poverty, and strengthening the competitiveness of European companies (European Commission 2023).

DEVELOPMENT OF GREEN ECONOMY IN SLOVAKIA

Slovakia has from its beginning as a state tried to involve actively in implementation of measures for sustainable growth or in protection of environment. The support of green economy was visible also in the period 2014 - 2020. The main document for the development of green economy in the conditions of Slovakia and also EU is Strategy Europe 2020. European Funds should finance the support of green economy and green solutions in Slovakia. The total financial need till 2025 for the green economy will be around 16 billion euros.

RECOVERY PLAN OF SLOVAKIA

In the field of green economy, there are 5 key components that include reforms and investments in the recovery plan.

Programs	Investments
1. Renewable resources of energy and energetic infrastructure	• Investments into building of new sources of energy from OZE • Investments into modernization of existing sources of energy from OZE • Investments into the increase of flexibility of power systems for higher integration of OZE
2. Renovations of buildings	• The improvement of energy efficiency of family houses • Renovation of public historical and listed buildings
3. Sustainable transport	• Development of infrastructure of low-carbon transport • Support of ecological personal transport • Development of intermodal goods transport • The support of building of infrastructure for alternative drive
4. Decarbonization of industry	• Decarbonization of industry • Arrangement of functioning of processes of Slovak Inspection of environment connected to decarbonization
5. Adaptation to climate change	• Region adaptation to climate change with the emphasis on the protection of nature and development of biodiversity.

Source: recovery plan, own processing (https://www.planobnovy.sk/kompletny-plan-obnovy/zelena-ekonomika)

Waste management, provision of protection of natural eco-systems and stable quality of air belong into the biggest problems of Slovakia in the field of environment in the last years. Slovakia is lagging behind the average in EU mostly in the field of environment and waste

CONCLUSION

Green economy can be understood in the future as the concept of solutions for the essential global problems, climate changes, energetic, food and finance crisis. That is why the world, EU and Slovakia will have had to invest till 2050 into green economy. The aim of green economy is then the change of usual energetic system, as well as more efficient use of natural resources of every country. Countries, citizens and investors are beginning to feel the need for movement of green economy to higher development to be able to help more to our environment.

LITERATURE

1. Statista - Barclays (2023). Value of social, environmental, and sustainability-linked financing by Barclays PLC worldwide from 2018 to 2022, by region (in billion British pounds), from: https://www.statista.com/statistics/1089396/share-of-sustainable-finance-by-barlcays-plc-bank-worldwide/?locale=en
2. European Commission (2023). Retrieved from: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en#documents
3. European Commission (2023). Retrieved from: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en#documents
4. European Commission (2023). Retrieved from:https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en
5. Recovery plan (2023). From https://www.planobnovy.sk/kompletny-plan-obnovy/zelena-ekonomika

THE PHENOMENON OF LOGISTICS 5.0 AND THE DIFFERENCE IN RELATION TO LOGISTICS 4.0

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Abstract: The main purpose of this paper is to present, i.e. explain the phenomenon of Logistics 5.0, and to make a comparison with the current approach of Logistics 4.0, and in the context of the supply chain, through relevant and available information. Somewhere around 2020, we were introduced to Logistics 4.0, part of the fourth industrial revolution, however, the global market gained a strong momentum and soon we are entering a new era, the era of Logistics 5.0. The term Logistics 5.0 is used to describe the next generation of logistics, which is characterized by the integration of new technologies such as AI, IoT, Blockchain, but also the application of robots in logistics. Logistics 5.0 is about creating a seamless and interconnected supply chain that uses the previously mentioned technologies to optimize processes, increase efficiency, reduce costs and ultimately, improve customer satisfaction. Logistics 5.0 is based on the concept of Industry 4.0, which was based on integration, automation and data exchange in real time, in connection with production technologies.
However, while Industry 4.0 focuses primarily on production and related processes, Logistics 5.0 focuses on the entire supply chain, from the procurement of raw materials to the final delivery of finished products to the final consumer.
Generally speaking, Logistics 5.0 should provide a major shift in the logistics industry, with the potential to significantly improve the performance of the entire supply chain and customer satisfaction. In this paper, in addition to clarifying the phenomenon of Logistics 5.0, we also want to identify the key advantages brought by Logistics 5.0, which will very soon find application in real life.

Keywords: Logistics 5.0, Supply chain, Performance.

I. INTRODUCTION

The transport and logistics sector plays a vital role in globalization. We now have better and improved ways of moving goods, services, and solutions across the globe. New technologies and improved transportation infrastructures have turned the world into one globalized market. The global market trend has become more apparent than ever. Logistics processes are one of the key parts of manufacturing, along with technology and organizational processes. The Logistics 5.0 era is considered a new era of digital transformation, which is unavoidable for every member of the supply chain, including manufacturers, suppliers, vendors, distributors, logisticians, and even customers. Businesses are getting ready for this new wave of change by fulfilling their software requirements inside this framework. Logistics 5.0 aims to realign systems – right from procurement of raw materials to last-mile delivery – by integrating digital innovations such as AI, the Internet of Things (IoT), robotics, and big data brought about by Industry 4.0 into the logistics value stream. These technologies are now a part of Logistics 5.0, and their effective use will bring about radical, positive changes in industry. [1]
If Logistics 4.0 includes the revolutionary IoT, Big Data, BI & Cloud Computing, then Logistics 5.0 will emphasize reconciling the human & machine, which will further enable the industries to improve the means and efficiency of production. The concerns of humans and society in the industrial transition led to the emergence of Industry 5.0, which was raised by Michael Rada [2] in 2015 to put forward the concept of "Industrial Upcycling". This idea emphasizes the corporation between human and new technologies, i.e., industrial robots, 3D printers, etc., in production with the purpose that "we use these tools as tools, do not give them the function and brain to WORK FOR US, but WORK WITH US" [2]. This concept is closely linked to the technological pillars that have already been employed, and thus studies are carried out to distinguish the scopes, goals, and approaches of Industry 5.0 as a new stage of the industrial revolution. Following the footprints of this paradigm shift, the Japanese government proposed "Society 5.0" based on the high digital transformations in society. This concept aims at protecting societal and environmental benefits along with the direction of Page 8 of 113 economic growth by taking the advantage of technological improvements [3, 4]. It attempts to turn the novel solutions around for the benefits of society and humans' life. In this regard, the European Commission (EC) officially defined the concept of Industry 5.0 in January 2021 [3], which presented a systematic approach in the context of technological and methodological improvements. It establishes a synergy between the main technological drivers and societal development in Industry 5.0, and six major categories are identified including human-machine interaction, bioinspired technologies and smart materials, digital twins and simulation, big data analytics, artificial intelligence, and energy efficiency and renewable energies.

II. THEORETICAL REVIEW

Industry 5.0 is a term used to describe the next phase of industrial development that builds upon the foundation of Industry 4.0. While Industry 4.0 is characterized by the integration of advanced digital technologies into industrial processes, Industry 5.0 aims to combine these technologies with human creativity and innovation to enable more personalized and sustainable manufacturing.

At its core, Industry 5.0 aims to create a more human-centered approach to manufacturing that focuses on customization, sustainability, and social responsibility. This means that manufacturing processes will be optimized for both efficiency and social impact, with an emphasis on reducing waste, improving energy efficiency, and promoting social well-being. [5]
Logistics 5.0 is the proposed solution for the Industrial Revolution 5.0 model. Like Industry 5.0, Logistics 5.0 also focuses on knowledge and sustainability. This is a transition that focuses on workers and minimizes the impact on the environment.

The key idea of Logistics 5.0 is to prioritize the environment while integrating it with technological innovations. This concept requires the logistics industry to move in three directions: prioritizing the human factor, ensuring resilience, and enhancing sustainability. In other words, Logistics 5.0 will allow companies to make the change from full automation to a combination of this process and human effort while not affecting their competitiveness and profitability. Employees are considered an investment in the long term. Their health and qualifications are of vital concern to the company. Technology will need to be replaced, supplemented, and adjusted to the needs and requirements of employees, ensuring that the company benefits can attract the talent to work and maintain its services over the long term. These clearly show that the Logistics 5.0 model is more concerned with improving and enhancing the ecological and social benefits than Logistics 4.0, which mainly depends on technology. As logistics is an integral part of Supply Chain and Industry 5.0, we can draw parallels in the development of industry and logistics. Looking at the historical industrial evolutions in the logistics industry from past to present, logistics 1.0 brought with it the innovation of “mechanization of transportation” upon the invention of water and steam-powered machines. With Logistics 2.0, the time and staff involved in loading and unloading operations were significantly reduced by using the “mechanization of cargo handling”. In the era of Logistics 3.0, which started with the use of Warehouse and Transport Management System applications, customs systems such as DAKOSY, NACCS, ITDS were developed.
We have passed the eras of logistics 1.0, logistics 2.0 and logistics 3.0. With the era of Logistics 4.0, which the industry has just started to adapt to and will move to the next stage shortly, logistics operations have been moved to another dimension with tools such as the Internet of Things, machine learning and artificial intelligence. Logistics 5.0, which will come to life with the effective use of Industry 5.0 technologies and will cause radical changes in the logistics industry shortly, will restructure all processes from raw material procurement to consumer delivery by integrating digital innovations such as the Internet of Things (IoT), AI, big data and robotics brought by 4.0 into the logistics value stream. With Logistics 5.0, logistics companies will now offer “Customized Logistics Solutions” consisting of different scenarios for each customer with different demands.[6] Logistics 5.0 is the proposed response and solution to the 5.0 industry model. And just like Industry 5.0, Logistics 5.0 also focuses on knowledge and sustainability. This is a transition centered on workers and minimizing environmental impact. Logistics 5.0 has enabled companies to undertake the change from digital automation to a collaboration of digitization and human effort without compromising or neglecting competitiveness and profitability in their businesses.
The idea of Logistics 5.0 prioritizes the environment while integrating it with technological innovations. This concept requires the logistics industry to move in three directions [7]:

- Human factor
- Resilience
- Sustainability

The incorporation of novel technologies in this context developed smart logistics; however, scholars raised the concerns about socio-economic aspects of these improvements. Industry 5.0 as a value-driven paradigm, in this regard, initiated the trinary concept of sustainability, resilience, and human-centricity to put forward the technological and conceptual developments of industry according to this framework. Given the recency of this industrial revolution, not many research works have focused on the implication of Industry 5.0 for smart logistics.[8]

According to Guilherme F. Frederico [9] Supply Chain 5.0 is extended Supply Chain 4.0, and it can be presented as in figure 1.

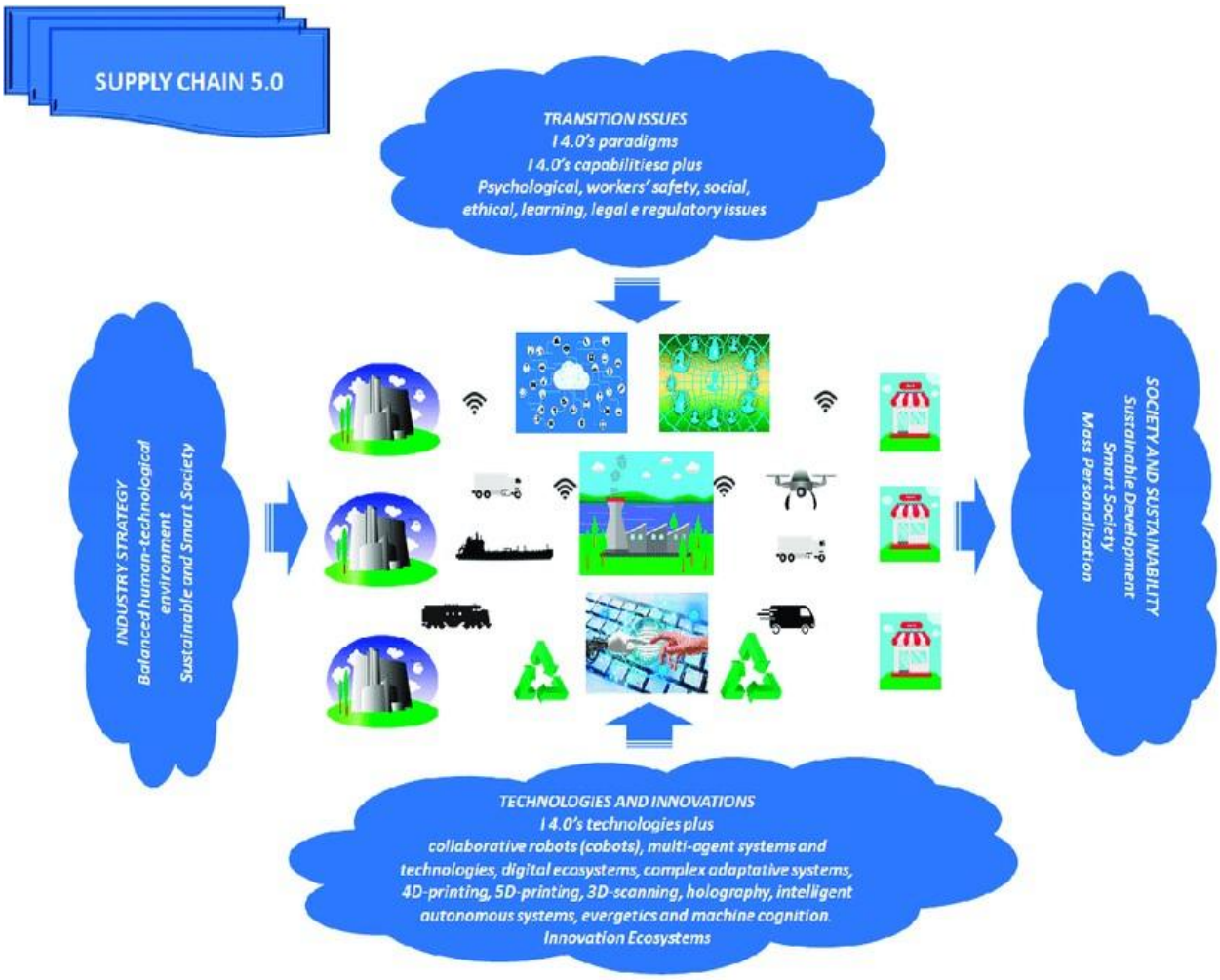

Figure 1. Supply Chain 5.0 framework and concept

Therefore, based on Figure 1, Supply Chain 5.0 involves an industry strategy that pursues a balanced human–technological environment and a sustainable and smart society. This strategy is supported by technologies and innovation that include Industry 4.0 technologies and other emergent technologies as well as an innovation ecosystem. A Supply Chain 5.0 strategy also has some transition issues related to Industry 4.0 paradigms, Industry 4.0 capabilities, and other issues such as psychological, workers' safety, social, ethical, legal, and regulatory. As

the main purpose, in terms of social and sustainable aspects, Supply Chain 5.0 aims to allow a more sustainable, smart society. It also creates a mass personalization in terms of products and services of the supply chains.

Inger, A. [10], explained, that Logistics 4.0 is complemented by the three characteristics of logistics 5.0: the human factor, resilience and sustainability. 5.0 brings 4.0 together, all digital ecosystems are combined with human power. Priority is given to integrating the environment with technological innovations.

The collaboration of robots with human workers in warehouses is an example of this: where robotization was central in 4.0, collaboration with the human factor is central in 5.0. Employees are a long-term investment, and their well-being and education play an important role. We go one step further: technology is being adapted to the needs and demands of employees. In 4.0 the step was made to technology, and now we are taking it a step further. But artificial intelligence and big data are not forgotten either. In your warehouse you collect a lot of invaluable data. Learn how to use and analyze this data and find the bottlenecks in your own supply chain process.

According to Maja, T. [11],Logistics 5.0 has folowing elements, which are divided into five groups:

- Green transport
- Green warehousing
- Green packaging
- Infrastructure
- Organization and human resources

Green transport, warehousing, and packaging are related to the ‘green’ and ‘sustainable’ components of Logistics 5.0 and the transformation of ‘traditional’ logistics elements in this direction. Infrastructure is related to digital enablers for the Logistics 4.0 concept, and organization and human resources deal with the human component, which is a progression from Logistics 4.0 to 5.0.The impact of transport on the environment is likely visible to everyone. Transport is the main source of particulate emissions and NOx and SO2 emissions.

Industry 5.0 paves the way to extending this framework by considering both resilience and human-centricity. Romero and Stahre [12] introduce the concept of ‘Operator 5.0′ as “a smart and skilled operator that uses human creativity, ingenuity, and innovation empowered by information and technology as a way of overcoming obstacles in the path to create new, frugal solutions for guaranteeing manufacturing operations sustainable continuity and workforce well-being in light of difficult and/or unexpected conditions. In the context of Industry 5.0, this paradigm encourages technological development in two main directions: self-resilience and system resilience. Self-resilience emphasizes human sustainability from biological, physical, cognitive, and psychological dimensions and focuses on human-centricity in the technological transition, i.e., work ethics, social impacts, legal issues, etc. [13][14][15][16]. System resilience, however, signifies the functional collaboration between humans and machines in terms of sharing and trading control [17].

CONCLUSION

Logistics 5.0 is still a visionary concept which aims to include the human, social, and sustainability aspects amid the current and highly focused technological scope of Industry 4.0. Although the literature is still scarce, there is a growing trend towards Industry 5.0 discussions by the academic and practical audience. Logistics 5.0 is upon us, and it's time for businesses to adopt this concept to stay relevant in the global market. This new era of logistics promises higher efficiency and transparency and increased customization options for consumers. It will also pave the way for remarkable errors, time, and cost reductions and create a sustainable and better logistics industry. Based on the technological breakthroughs in Industry 4.0, the emerging concept of Industry 5.0 has put forward the research frontier from technology-driven to human- and society-driven paradigm changes that will potentially and drastically influence many industries. Embedding human-centricity, resilience, and sustainability in smart logistics requires a rethinking and reconsideration of the technology matches, and in this regard, the role of the human in the technological transition needs to be predominantly focused on to ensure sustainable development in economic, environmental, and societal dimensions.

To understand the implications of the coming Industry 5.0 for smart logistics, this paper presents selected scientific and practical materials in the area of Logistics 5.0. Logistics industries will focus more on automation, labor shortage and real-time tracking for efficient supply chain management. Adopting new technologies like autonomous vehicles will be critical for logistics companies to remain competitive globally, where every other company wants to outdo the other. In addition, organizations will need to focus on sustainability and environmental initiatives to ensure the industry's long-term health and commitment to preserving nature. Logistics industry is a global and complex business, and it is the backbone of every economy and expected to grow in size and significance in the coming years.

The future trend in logistics is the future of our business. The right strategy can help us thrive, while the wrong one will leave us behind. Companies that succeed in this environment and beyond will embrace a combination of the top logistics industry trends, becoming better equipped and resilient to supply chain shocks.

REFERENCE

[1] Aniruddha, K., Shreya,M. (2023). Logistics 5.0: Difference with a Human Touch, Available online:https://www.aranca.com/knowledge-library/articles/business-research/logistics-5.0-difference-with-a-human-touch#:~:text=Logistics%205.0%20aims%20to%20realign,into%20the%20logistics%20value%20stream(accessed on 04 April 2023).
[2] Rada, M. INDUSTRY 5.0-from virtual to physical. 2015; Available online: https://www.linkedin.com/pulse/industry-50-from-virtual-physical-michael-rada/andhttps://ecoametsolutions.com/industry-5-0/(accessed on 01 April 2023).
[3] European Commission, Industry 5.0: towards a sustainable, human-centric and resilient European industry. 2021: Publications Office.Available online: https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/industry-50_en

[4] Saptaningtyas, W.W.E. and D.K. Rahayu. A proposed model for food manufacturing in smes: Facing industry 5.0. in Proceedings of the International Conference on Industrial Engineering and Operations Management. 2020
[5] Yvonee, B., (2023), Implementing Industry 5.0 and its impact on Supply Chain, Available online: https://www.linkedin.com/pulse/implementing-industry-50-its-impacts-supply-chain-badulescu-ph-d/(accessed on 04 May 2023).
[6] (2023).The Era Of Logistics 5.0 In The Supply Chain, Available online: https://globelink-unimar.com/the-era-of-logistics-5-0-in-the-supply-chain/(accessed on 04 May 2023).
[7] Naveen, J., Shreya, M. (2023).Logistics 5.0: The Final Piece In The Supply Chain Optimization Puzzle?, Available online:https://www.forbes.com/sites/naveenjoshi/2022/03/26/logistics-50-the-final-piece-in-the-supply-chain-optimization-puzzle/?sh=2f80a0ed833c(accessed on 05 April 2023).
[8] Jafari, N., (2022), page 4, Available online:https://munin.uit.no/handle/10037/25771(accessed on 05 April 2023).
[9]Guilherme, F., (2021), From Supply Chain 4.0 to Supply Chain 5.0: Findings from a Systematic Literature Review and Research Directions, 14-15.
[10] Inger, A., (2022), Logistics 5.0: Power to the People, Available online:https://www.boltrics.com/en/2022/06/02/logistics-5-0-power-to-the-people/(accessed on 02 April 2023).
[11] Maja. T., (2022), Logistics 5.0 Implementation Model Based on Decision Support Systems, MDPI, Sustainability. 2-3.
[12]Romero, D.; Stahre, J. Towards the Resilient Operator 5.0: The Future of Work in Smart Resilient Manufacturing Systems. Procedia CIRP 2021, 104, 1089–1094.
[13]Demir, K.A.; Döven, G.; Sezen, B. Industry 5.0 and Human-Robot Co-working. Procedia Comput. Sci. 2019, 158, 688–695.
[14]Resende, A.; Cerqueira, S.; Barbosa, J.; Damásio, E.; Pombeiro, A.; Silva, A.; Santos, C. Ergowear: An ambulatory, non-intrusive, and interoperable system towards a Human-Aware Human-robot Collaborative framework. In Proceedings of the 2021 IEEE International Conference on Autonomous Robot Systems and Competitions, ICARSC, Santa Maria da Feira, Portugal, 28–29 April 2021.
[15] Welfare, K.S.; Hallowell, M.R.; Shah, J.A.; Riek, L.D. Consider the human work experience when integrating robotics in the workplace. In 2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI); IEEE: Piscataway, NJ, USA, 2019.
[16] Hol, A. Business Transformations Within Intelligent Eco-Systems. Lect. Notes Netw. Syst. 2021, 149, 275–284.
[17] Inagaki, T. Adaptive automation: Sharing and trading of control. Handb. Cogn. Task Des. 2003, 8, 147–169.

INDUSTRY 5.0: HUMANIZATION AND SUSTAINABILITY

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Abstract: Industry 5.0, a new industrial paradigm, appeared very soon after Industry 4.0, as an extension of Industry 4.0 with social and environmental dimensions. Therefore, it can be defined as an open and evolving concept, focused on collaboration between humans and smart systems and breaking down the barriers between the real and virtual world. Industry 5.0 is more scalable and human-centric, in comparison with the previous ones. The main goals of this Industry are waste reduction and the promotion of systems with renewable energy, as well as the reduction of costs and the increase in work productivity.
Research on Industry 5.0 is still in the early stage, especially when it comes to developing countries. Currently, there is insufficient research dealing with the topic of Industry 5.0. Thus, this paper addresses this knowledge gap. This research intends to achieve a better understanding of the appearance of Industry 5.0.
Humanization and Sustainability are fundamental Industry 5.0 elements. There is a need to consider sustainable development and the key role of man in the future development of the industry. Industry 5.0 focuses on barriers and guidelines for achieving sustainable development, as the sustainability values of Industry 5.0 are widely acknowledged. In this research, we aim to identify areas related to the Humanization and Sustainability of Industry 5.0. Through a critical analysis of the literature, we arrive at the presented research results. In the end, potential future research directions are highlighted.

Keywords: Industry 5.0, Humanization, Sustainability.

1. INTRODUCTION

Industry 5.0 is not just the chronological continuation of Industry 4.0. Industry 5.0 is considered a socio-economic structural shift toward a sustainable future industry, involving other business sectors such as agriculture or healthcare. Protecting the environment and society is strongly valued by the Industry 5.0 concept, which can be seen in its socio-environmental dimensions[1][2].Instead of denying digitizing societies, economies, and industries, the new Industrial revolution extends it with social and environmental aspects[3][4].There are numerous benefits that Industry 5.0 brings, such as productivity, agility, profitability, and change readiness. Open-minded and forward-thinking employees are more than welcome by the concept of this industry. Through the literature review, we noticed a deeper explanation of fundamental Industry 5.0 elements - Humanization and Sustainability needed to understand the concept of this industry. Thus, the goal of this research is to gain insight into these key elements and highlight directions for future research.

2. INDUSTRY 5.0

Industry 5.0, as a global phenomenon, promotes resilience, socio-environmental sustainability, and human-centricity [3]. There is a lack of studies explaining the core principles and functionality of Industry 5.0. Additionally, the connection between Industry 5.0 and promoting sustainable development, as well as humanization, is still a subject that requires more research. This research strives to address these gaps. Industry 5.0 is taking a step forward from previous industrial revolutions. This industry, as a socio-technological phenomenon, systematically shifts classic profit and consumption-driven economic models to circular, regenerative, sustainable, and resilient value-creating economic models. One of the ways to define Industry 5.0 can be as an extension of the Industry 4.0 paradigm to prioritize emerging socio-environmental needs [1].
Research shows that Industry 5.0 complements Industry 4.0 and addresses the socio-environmental concerns of the ongoing digital industrial transformation while promoting sustainable development. Still, Industry 5.0 differs from Industry 4.0 in many manners. Some of them are listed below [2]:

- Industry 5.0 values productivity-driven competitiveness and
- sustainable development;
- Industry 5.0 empowers the human workforce by promoting human-centric approaches to technological development;
- Industry 5.0 advances technological innovation in the realm of environmental sustainability;
- Industry 5.0 promote stakeholder primacy in technology governance, innovation growth, and sustainability performance management;
- Industry 5.0 draws on certain technologies and functional principles to expand the scope of corporate responsibility to the entire value chain.

The approach of Industry 5.0 is considered ethical, and it subordinates technology to the human worker. The focus is on what technology can do for us. Industry 5.0 aims to work on technology adaptation to human workers, following important ethical aspects[5].The fifth industrial revolution will likely bring better integration, enabling faster, better automation combined with the power of human brains[6]. The transition from Industry 4.0 to Industry 5.0 means combining the best of the human and machine worlds, leading to increased

productivity [7], [8][9]. Recent research emphasizes the key roles of sustainability and human beings in future development of the industry[9].Moving forward to more advanced human-machine interfaces, as one of the Industry 5.0 visions, brings an improved integration and better automation of robots paired with the power and creativity of human brains. Furthermore, it is leading to improved productivity. Efficient synergy between humans and technology will affect the economy, ecology, and the social world, accompanied by a waste prevention perspective [10].

2.1 **Society 5.0**

Society 5.0, developed in Japan, is a core concept, vision, and growth strategy for a sustainable future. The purpose of the Society 5.0 concept is to contribute to sustainability by integrating Industry 4.0 innovations into businesses and societies [11].
A sustainable Society 5.0 organization is based on the synergetic effects of collaboration between smart machines and humans, to provide an opportunity for all. This innovative organization simultaneously [12], [13]

- Harmonizes operational efficiency with strategic effectiveness,
- Satisfies tangible and intangible organization's and stakeholders' needs,
- Sustains human-centricity

Society 5.0 promotes using intelligent technologies to connect people by sharing knowledge and information to create new social and business chains. Society has the goal of freeing humans from exhaustive routine work and improving available information[14], [15][3].
Society 5.0 is defined as a human-centered society characterized by a higher level of integration. It could also be called a super-intelligent society or a creative society [14], [15][3].

3. SUSTAINABILITY

Industry 5.0 is considered an enabler in achieving sustainable development in terms of resilience, environmental sustainability, and human-centricity. Industry 5.0 stakeholders are required to simultaneously pursue various sustainable development objectives. Sustainable development presents one of the main Industry 5.0 objectives. This objective includes economic, environmental, and social factors of sustainability [2]. Synergetic complementarity among the Industry 5.0 values is key to pursuing various sustainable development objectives. Economic, environmental, and social sustainability values of Industry 5.0 are presented in Table 1[2].

Table 1. Sustainability values of Industry 5.0

	OBJECTIVES
ECONOMIC SUSTAINABILITY	Business, supply chain, and economic resilience
ENVIRONMENTAL SUSTAINABILITY	Preserving Earth's ecological and resource integrity, promoting the circular economy, carbon neutrality, renewable integration, and resource efficiency
SOCIAL SUSTAINABILITY	Promoting human-centric approaches to place fundamental human needs and rights at the heart of the industrial economy, promoting social development, employment, equality, and human agency

Sustainability emphasizes that business focused solely on profit is increasingly challenging to sustain in a globalized and unpredictable environment. Nonetheless, the industry must include social, environmental, and societal aspects to achieve prosperity. Industry 5.0 combines the achievement of business goals with social goals in the workplace and outside the workplace [16][9]

4. HUMANIZATION

Human centricity consists of elements such as employment growth, workplace dignity, employee autonomy, and job satisfaction [1]. Improving working conditions, employment, and productivity through synergetic human-machine integration is promoted by Industry 5.0. Data sharing and transparency, sustainable innovation, up skilling and reskilling, employee technical assistance, and service orientation and personalization are only some of the human-centricity objectives of Industry 5.0[2].The socio-technical theory can be used to explain how the human and technological interplay serves to address the internal issues of the organizations. Humanization of the workplace and the development of a sustainable world are essential for job satisfaction and, efficient and clean production, overall, better quality of life [17].The humanization of the Industry 4.0 technological environment presents one of the first factors in the evolution of Industry 4.0 toward Industry 5.0. In its early phase, Industry 5.0 focuses on greater human involvement and creating interaction in the human–machine system [18][3].In human-machine integration, it is crucial to develop competence and knowledge in new technologies and the trend of talent management. Thus, the future is based on investment in employee retraining and the lifelong learning process, as well as promoting social goals in the workplace [16][3].

5. CONCLUSION

Considering this topic is new and evolving, literature on Industry 5.0 is in its early phase. Industry 5.0 sustainability functions are expected to grow in the future considerably. The Industry 5.0 concept is closer to sustainable development and considers society's needs. This research explained how Industry 5.0 could function in promoting humanization and sustainable development. The literature analysis shows the need for the humanization of the industry in the future. Despite our efforts, much is unknown about how this phenomenon will unfold in the future. Thus, future research is invited to extend our work. We can say that in some industries, robots appear to be replacing humans. The findings of this research show that people will always be the main drivers of production system activities. Using robots as collaborators and executors of commands rather than competitors can be a part of the Industry 5.0 vision for the future. Future research is required in the domains of adaptation of technology to humans.

REFERENCES

[1] Maija. Breque, Lars. De Nul, Athanasios. Petridis, and European Commission. Directorate-General for Research and Innovation, *Industry 5.0 : towards a sustainable, human-centric and resilient European industry*.

[2] M. Ghobakhloo, M. Iranmanesh, M. F. Mubarak, M. Mubarik, A. Rejeb, and M. Nilashi, "Identifying industry 5.0 contributions to sustainable development: A strategy roadmap for delivering sustainability values," *Sustain Prod Consum*, vol. 33, pp. 716–737, Sep. 2022, doi: 10.1016/j.spc.2022.08.003.

[3] S. Saniuk, S. Grabowska, and M. Straka, "Identification of Social and Economic Expectations: Contextual Reasons for the Transformation Process of Industry 4.0 into the Industry 5.0 Concept," *Sustainability (Switzerland)*, vol. 14, no. 3, Feb. 2022, doi: 10.3390/su14031391.

[4] M. Doyle-Kent and P. Kopacek, "Industry 5.0: Is the Manufacturing Industry on the Cusp of a New Revolution?," 2020, pp. 432–441. doi: 10.1007/978-3-030-31343-2_38.

[5] M. C. Zizic, M. Mladineo, N. Gjeldum, and L. Celent, "From Industry 4.0 towards Industry 5.0: A Review and Analysis of Paradigm Shift for the People, Organization and Technology," *Energies*, vol. 15, no. 14. MDPI, Jul. 01, 2022. doi: 10.3390/en15145221.

[6] F. Aslam, W. Aimin, M. Li, and K. U. Rehman, "Innovation in the era of IoT and industry 5.0: Absolute innovation management (AIM) framework," *Information (Switzerland)*, vol. 11, no. 2, Feb. 2020, doi: 10.3390/info11020124.

[7] M. D. Di Nardo, D. Forino, and T. Murino, "The evolution of man–machine interaction: the role of human in Industry 4.0 paradigm," *Prod Manuf Res*, vol. 8, no. 1, pp. 20–34, Jan. 2020, doi: 10.1080/21693277.2020.1737592.

[8] J. Nelles, S. Kuz, A. Mertens, and C. M. Schlick, "Human-centered design of assistance systems for production planning and control: The role of the human in Industry 4.0," in *Proceedings of the IEEE International Conference on Industrial Technology*, Institute of Electrical and Electronics Engineers Inc., May 2016, pp. 2099–2104. doi: 10.1109/ICIT.2016.7475093.

[9] S. Grabowska, S. Saniuk, and B. Gajdzik, "Industry 5.0: improving humanization and sustainability of Industry 4.0," *Scientometrics*, vol. 127, no. 6, pp. 3117–3144, Jun. 2022, doi: 10.1007/s11192-022-04370-1.

[10] D. Paschek and A. Draghici, "INDUSTRY 5.0-THE EXPECTED IMPACT OF NEXT INDUSTRIAL REVOLUTION."

[11] V. Tornjanski and M. Čudanov, *Anticipation of project management and organizational change management integration View project Multidisciplinarity and econodisciplines View project PaKSoM 2021 Towards Society 5.0 Era: Organisational Empowerment of the Sustainable Future*. [Online]. Available: https://www.researchgate.net/publication/358271052

[12] V. Tornjanski and M. Čudanov, "Shaping a new business landscape by empowering collective intelligence: Synergetic effects of open innovation, human and artificial cognitive and emotional intelligence Anticipation of project management and organizational change management integration View project Technology Entrepreneurship, Ecosystem, and Policy View project." [Online]. Available: https://www.researchgate.net/publication/364835306

[13] V. Tornjanski, S. Knezevic, S. Milojević, and S. Knežević, "SYNERGETIC EFFECTS OF INTEGRATED COLLABORATION BETWEEN HUMANS AND SMART SYSTEMS IN BANKING: AN OVERVIEW Anticipation of project management and organizational change management integration View project Machine learning and artificial intelligence for efficient and effective risk prevention in financial services View project SYNERGETIC EFFECTS OF INTEGRATED COLLABORATION BETWEEN HUMANS AND SMART SYSTEMS IN BANKING: AN OVERVIEW." [Online]. Available: https://www.researchgate.net/publication/344787764

[14] Y. Shiroishi, K. Uchiyama, and N. Suzuki, "Society 5.0: For Human Security and Well-Being," *Computer (Long Beach Calif)*, vol. 51, no. 7, pp. 91–95, Jul. 2018, doi: 10.1109/MC.2018.3011041.

[15] Y. Shiroishi, K. Uchiyama, and N. Suzuki, "Better Actions for Society 5.0: Using AI for Evidence-Based Policy Making That Keeps Humans in the Loop," *Computer (Long Beach Calif)*, vol. 52, no. 11, pp. 73–78, Nov. 2019, doi: 10.1109/MC.2019.2934592.

[16] V. Gorodetsky, V. Larukchin, and P. Skobelev, "Conceptual Model of Digital Platform for Enterprises of Industry 5.0," 2020, pp. 35–40. doi: 10.1007/978-3-030-32258-8_4.

[17] E. Gabriel Margherita and A. Maria Braccini, "Socio-technical perspectives in the Fourth Industrial Revolution-Analysing the three main visions: Industry 4.0, the socially sustainable factory of Operator 4.0 and Industry 5.0," 2021. [Online]. Available: https://hal.science/hal-03442406

[18] V. Özdemir and N. Hekim, "Birth of Industry 5.0: Making Sense of Big Data with Artificial Intelligence, 'The Internet of Things' and Next-Generation Technology Policy," *OMICS*, vol. 22, no. 1, pp. 65–76, Jan. 2018, doi: 10.1089/omi.2017.0194.

APPLICATION OF THE PANEL REGRESSION APPROACH IN DETERMINING THE RELATIONSHIP BETWEEN THE CIRCULAR ECONOMY AND ECONOMIC DEVELOPMENT

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Abstract: The circular economy model is based on the corresponding feedback effects in economic processes instead of the one-way effect typical of the classic linear economic model. In this regard, it can be expected that through an additional contribution to the development of the circular economy, a regenerative system will be created that will enable a longer product life cycle and increase the operational efficiency of the entire economy. T
he aim of this paper is to determine the interdependence and causality of the circular economy and economic development as a whole in certain countries of the European Union and the Republic of Serbia. In the analysis of the results, a panel regression analysis was used on a sample of annual data for 21 countries of the EU zone and the Republic of Serbia in the period from 2016 to 2020. As indicators of the circular economy, the municipal waste recycling rate, share of energy from renewable sources, resource productivity, as well as private investments, jobs and gross added value related to the circular economy were used.
The basic hypothesis is that all the mentioned indicators have a statistically significant influence on the level of economic development measured by gross domestic product per capita.

Key words: Circular economy, economic development, panel regression analysis.

1. INTRODUCTION

Circular economy provides efficient production of economic value-added while reducing the level of waste and contributing to a better economic and social environment. The linear model usually implies that products are thrown away or stored after the end of their life cycle. Therefore, long-term development implies that society and the economy are in harmony with resources in order to adapt to new restrictions as efficiently as possible, and at the same time so that people's well-being is not endangered in the transition period.

Resources are limited, but not our appetites for them (Fan and Fang, 2020). Therefore, in order to offer solutions to figures from the previous passage, a circular economic system concentrates on forming the resource flowloop in order to achieve sustainability (van Capelleveen et al., 2021).In our current linear economy, the production process extract resources from the Earth, use them to make products, and then dispose of them as waste.
There are wide social and economic differences between European countries, and no less difference can be expected when it comes to circular economy and management performance. Furthermore, the results in practice indicate a perpetual battle between economic growth, environmental protection and resource recycling (Sun et al., 2019, Lacko et al., 2021).
Thee circular model is promoted by the EU governance and implemented on national level to replace the linear economic model. The transition towards circular economy reduces environmental degradation, improves the effectiveness and security of raw materials supply, while innovation and economic growth is stimulated, which leads to better competitiveness and more jobs options (Georgescu et al. 2022).

In this paper we analyze the interdependence and causality of the circular economy and economic development as a whole in certain countries of the European Union and the Republic of Serbia. In the analysis of the results, a panel regression analysis was used on a sample of annual data for 21 countries of the EU zone and the Republic of Serbia in the period from 2016 to 2020.The basic hypothesis is that circular economy indicators (the municipal waste recycling rate, share of energy from renewable sources, resource productivity, generation of municipality wastes per capita, as well as private investments, jobs and gross added value related to the circular economy) have a statistically significant influence on the level of economic development measured by gross domestic product per capita.

2. THEORETICAL BACKGROUND

The generic term circular economy means the process of an industrial economy that efficiently uses natural resources without negative environmental effects. The circular economy represents a reduction, reuse and recycling-based system since waste becomes a valuable resource (Kirchherr et al. 2017).
In the circular economy model, economic growth can be accomplished by decreasing the application of natural resources through recycling the materials, already within the system and the lower use of natural resources (Esposito et al., 2015). Therefore, circular economy contributes effectively to sustainable economic development process (Androniceanu, etal., 2021).
Some studies display that the European Union has disparate results regarding the transition to the circular economy. For instance, some countries have demonstrated transitional circular developments while many countries are still lacking a national circular economy strategy. Empirical results imply that there is a great potential to develop and be competitive through employment of the circular economy model (Haller, 2020). Androniceanu et al. (2021) evaluate the correlation between circular economy indicators and economic development. The findings show that economic development is heavily associated with recycling waste rate and generation of municipal waste per capita. It is also worth mentioning that Busu and Trica (2019) concluded that the circular economy indicators have a strong influence on economic growth. The same authors emphasize that resource productivity and municipality waste recycling rate have the greatest influence on economic growth.

The panel data approach was preferred to the cross-section and time series approaches because economic development varies over time and over country (Jaligot and Chenal, 2018). The same authors emphasize a few advantages of panel data approach to cross-section and time series approaches: the model parameters can be estimated with a better accuracy due to the more degrees of freedom of panel data models; the dynamics of the social and economic determinants is better reflected by such models; the heterogeneity taken into account by panel data approach is more realistic unlike the homogeneity contained in cross-sectional data.

3. DATA AND METHODOLOGY

Annual data for 21 EU countries and Serbia in the period from 2016 to 2019 were used for regression analysis. The data sample was created based on the availability of data for individual countries when it comes to the circular economy. A non-negligible percentage of data for the variables listed in Table 1 are not available on the Eurostat website which in a certain way affected the creation of the sample. However, a corresponding panel data set was created, consisting of a certain number of entities (countries) in a defined period of time. The effects that cannot be detected in cross-section or time-series data are better identified by panel data (Georgescu et al. 2022).

Table 1. The list of potential variables

Variable	Description
GDP	Gross domestic product per capita
WRR	Municipal waste recycling rate
SRR	Share of energy from renewable sources
RP	Resource productivity
PI	Private investments, jobs and gross value added related to circular economy per capita
GW	Generation of municipality wastes per capita

Taking into account that the main goal of this paper is to consider economic development in relation to the development of the circular economy, GDP per capita appears as the dependent variable, while the independent variables are prominent indicators of the development of the circular economy. From an econometric point of view, the panel model should be set up as follows:

$$GDP_{it} = \alpha + \beta_1 WRR_{it} + \beta_2 SRR_{it} + \beta_3 RP_{it} + \beta_4 PI_{it} + \beta_5 GW_{it} + \varepsilon_{it}$$

Where i represents cross section unit, t shows period of time, α is intercept coefficient, β is vector of coefficients estimated on the independent (explanatory) variables and ε is error term variable.

Using a panel regression model asks the question of implementing a model with fixed or random effects. In such situations, the application of a specification test based on the differences between the fixed effects and random effects estimators, known as the Hausman test, is suggested. If the null hypothesis is true, the fixed effect estimator is not efficient under

the random effect specification because it counts only on the within variation in the data series.

4. RESULTS AND DISCUSSION

In order to understand the relationship between dependent and independent variables and possibly avoid the problem of multicollinearity of the regressors, it is necessary to analyze the correlation matrix. The results are presented in Table 2.

Table 2. Correlation matrix

Variable	GDP	WRR	SRR	RP	PI	GW
GDP	1					
WRR	0.6480	1				
SRR	0.4904	0.0516	1			
RP	0.7344	0.6502	-0.0364	1		
PI	0.9499	0.6252	0.5727	0.6741	1	
GW	0.7349	0.3964	0.3677	0.4650	0.7246	1

Source: Authors calculation

Table 3. Results of the panel model

Variables	*Coefficients*	*t Stat*
Intercept	-965.1452	-0.5288
WRR	48.2453	2.1252*
SRR	80.4104	2.2147*
RP	3082.1095	3.5705**
PI	74.1757	9.3239**
R-Squared	0.9206	
Hausman test	35.2248	

Source: Authors calculation
Note: ** and * indicate significance at the level of 1% and 5%, respectively

Table 3 contains the results of the fixed effect panel regression model. In Table 3, the result attained from Hausman test propose that null hypothesis is excluded and the fixed effect model is suitable. The variable generation of municipality wastes per capita did not show statistical significance over the estimated coefficient, so it was therefore excluded from the regression model. The R-squared coefficient shows a high explanation of the dependent variable based on the structure and quantity of the set independent variables. In other words, the selected circular economy factors significantly describe the movement of GDP per capita.
Observing the coefficients and their statistical significance, it should be noted that the variables waste recycling rate, share of energy from renewable sources, resource productivity and private investments, jobs and gross value added related to circular economy per capita show a positive and statistically significant influence on the movement of GDP per capita. The emphasis is certainly on economic growth, and these results emphasize once again the importance of the development of the circular economy for the general well-being of the entire economy. At the same time, such findings encourage economic policy makers to highlight the importance of the circular economy to every single market participant and/or

investor. What additionally encourages the economic policy makers through the findings of this model is that further economic development does not necessarily lead to an increase in the generation of municipality wastes per capita, but that the majority of countries from the observed sample are directed towards sustainable development.

5. CONCLUSION REMARKS

It is necessary to highlight the importance of such papers on the development and social recognition of the circular economy in the future. The last few years have brought increasing attention directed towards the circular economy and the quantification of the results that are realized and/or expected through its application.

An economic model set up and estimated in this way can have a strong impact on the sphere of society, economy and ecology. It is also worth noting the interactivity between certain factors of the circular economy. Decision makers must consider which value sources and policies are appropriate for certain specific objectives. Otherwise, policies may have the contradictory effect (Knable et al. 2022).

Finally, the findings derived from this work suggest possibilities for further progress and new lines in researching the relationship between the circular economy, sustainable development and economic growth. What could certainly improve further research on this topic is a better coverage and unification of the available data. A large number of European countries, several of which are EU members, do not have data available when it comes to the circular economy and its effective implementation.

REFERENCES

Androniceanu, A., Kinnunen, J., &Georgescu, I. (2021). Circular Economy as a Strategic Option to Promote Sustainable Economic Growth and Effective Human Development. Journal of International Studies, 14(1), 60–73. https://doi.org/10.14254/2071-8330.2021/14-1/4

Busu, M. &Trica, C. L. (2019). Sustainability of Circular Economy Indicators and their Impact on Economic Growth of the European Union. Sustainability, 11(19), 5481.https://doi.org/10.3390/su11195481

vanCapelleveen, G.; Amrit, C.; Zijm, H.; Yazan, D.M.; Abdi, A. (2021). Toward Building Recommender Systems for the Circular Economy: Exploring the Perils of the European Waste Catalogue. Journal of Environmental Management, 277, 111430. DOI: https://doi.org/10.1016/j.jenvman.2020.111430

Esposito, M., Tse, T., &Soufani, K., (2015). Is the Circular Economy a New Fast-Expanding Market? Thunderbird International Business Review, 59(1), 9–14. https://doi.org/10.1002/tie.21764

Fan, Y., Fang, C. (2020). Circular economy development in China-current situation, evaluation and policy implementations. Environmental Impact Assessment Review, 84, 106441. DOI: https://doi.org/10.1016/j.eiar.2020.106441

Georgescu, I., Kinnunen, J., Androniceanu, A. (2022). Empirical Evidence on Circular Economy and Economic Development in Europe: A Panel Approach. Journal of Business Economics and Management, 23(1), 199-217. https://doi.org/10.3846/jbem.2022.16050

Haller, A. (2020). From Classical and Neoclassical Economic Growth to Degrowth in Europe. Challenges for Public Administration. Administratiesi Management Public, 34, 150–170. https://doi.org/10.24818/amp/2020.34-9

Jaligot, R., &Chenal, J. (2018). Decoupling Municipal Solid Waste Generation and Economic Growth in the Canton of Vaud, Switzerland. Resources, Conservation and Recycling, 130, 260–266. https://doi.org/10.1016/j.resconrec.2017.12.014

Kirchherr, J., Reike, D., &Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. Resources, Conservation and Recycling, 127, 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005

Knable, D., Puente, E., Perez-Cornejo, C., Baumgartler, T. (2022). The impact of the circular economy on sustainable development: A European panel data approach. Sustainable Production and Consumption, 34(1), 233-243. https://doi.org/10.1016/j.spc.2022.09.016

Lacko, R., Hajdukova, Z., Zawada, M. (2021). The Efficiency of Circular Economies: A Comparison of Visegrád Group Countries. Energies 2021, 14(6), 1680

Sun, J., Li, G., Wang, Z. (2019). Technology heterogeneity and efficiency of China`s circular economic systems: a game meta-frontier DEA approach. Resource, Conversation and Recycling, 146(1), 337-347. DOI: https://doi.org/10.1016/j.resconrec.2019.03.046

HEAT PUMPS IN THE FUNCTION OF SUSTAINABLE DEVELOPMENT

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Abstract: Increasing energy efficiency is the fastest and cheapest way to meet the growing demand for energy, while at the same time meeting the environmental and economic challenges that arise with its consumption. The heat pump is notable as one of the solutions for these needs. Beside other advantages, heat pump is characterized by economic and ecological characteristics such as lower price of heat energy and strengthening the ecological profile.

Key words: *geothermal energy, heat pump, sustainability, ecological, economical.*

INTRODUCTION

Geothermal energy can be used for heating residential and commercial buildings, greenhouses and greenhouses, for balneological and recreational needs, technological processes and for the production of electricity. This type of energy cannot meet the needs of high-temperature processes, but it can meet up to 80% of the total heat needs.
The most important limitation in the use of geothermal energy is related to economic profitability. Unlike the costs of using most other energy sources and heating systems, in this

case the operating costs are significantly lower than the investment costs of building wells, networks and installations at consumers.
District heating, heating of apartments and preparation of domestic hot water is the most representative example of application of thermal geothermal energy. The components of a geothermal district heating plant are heat exchangers, submersible pumps that draw warm underground water from the depths (in case their pressure is not enough) and pipelines. Apart from the direct use of geothermal energy, application in heat production can also be achieved by using heat pumps [1].
Renewable energy sources and a heat pump form an optimal combination that enables obtaining heat energy for a wide range of applications. The coupling of low-temperature renewable energy sources (the sun, surface water or earth) - natural sources with a heat pump, enables obtaining heat energy at higher temperatures, suitable above all for heating residential and commercial spaces [2].
So far, the reasons for less use of heat pumps in smaller, but also in larger buildings lie primarily in the price, lack of adaptation to previous classic solutions, as well as lack of information and technical illiteracy of investors and designers. Until ten years ago, in addition to the high costs of installing a heat pump, the operating parameters did not justify them economically. However, the existing solutions of both small and larger heat pumps, due to mass production and an increased number of manufacturers and better technical solutions of components, have led to their greater placement, so heat pumps today are produced from several kilowatts to several megawatts of heating power. With the correct selection of air conditioning, heating and cooling systems, the heat pump in terms of its technical and operational parameters is increasingly becoming competitive with classic boiler systems in heating systems. If there are requirements for both cooling and heating of the space, the heat pump is practically an irreplaceable solution, provided that the heat sources and primary energy supply for the drive are provided [3].

1. METHOD OF APPLICATION OF HEAT PUMPS

A heat pump is a device that raises thermal energy from a lower (heat source) to a higher temperature level (heat sink), while consuming work [2].
Heat pumps "use" groundwater in several ways:

- The most energy-efficient way is to take water from a well, because the temperature of that water is constant throughout the year;
- Using the probe. Economically speaking, this solution represents a more expensive investment that provides greater reliability and is easier to manage than the solution mentioned above;
- Energy collector. A cheaper solution than probes, but the disadvantage is that the efficiency of the system decreases at the end of the heating period [4].

1.1.Heat pump water-water

From a thermodynamic point of view, water-to-water heat pumps have the best properties and the best heating coefficients. The problem with this type of pump is in securing the water source of the heat source. However, despite these problems, these heat pumps are widely used in areas where groundwater is very high, or near surface water.
What is of particular importance when determining the possibility of using groundwater or surface water is its composition and the presence of coarse particles. In certain solutions, the

heat pump evaporator is designed so that it requires very clean water, even for example. drinking water quality. Therefore, it is necessary to clean the water beforehand to the quality required by the evaporator [2].

These heat pumps require a constant flow of water as a source of energy.
This type of heat pump is equally effective at any outside temperature.

1.2.Heat pump brine-water

A heat pump through whose evaporator the brine circulates, i.e. a mixture of water and antifreeze, are used to connect to a heat source, whose temperature during operation may drop below 0 [°C] in the liquid heat carrier in the evaporator circuit. In order to prevent the liquid from freezing and thereby damaging that part of the installation, the mixture that ensures the smooth operation of the evaporator is used.
Heat pumps with brine are most often used when the earth is used as a heat source.
The brine is also used for heat pumps whose heat source is the sun [2].

1.3.Heat pump air-air

These units do not have a high heating coefficient at outside temperatures.
Such heat pumps have found greater application in rooms with large volumes and high heights, where air ducts could be placed. Placing a heat pump in a system in which there was air heating proved to be the most practical solution, which is why such heat pumps are combined with a classic source of heat energy and air heating.
Air-to-air heat pumps can also be used in the operation of a bivalent system, when the working fluid of the supplementary source is hot water[2].

1.4.Hteat pump air-water

An air-to-water heat pump provides a combination of a cheap and generous heat source and water, as the fluid used in most heating installations. Although air as a heat source is not coherent with heat losses, this type of heat pump is often found in mild climates as an independent heat source for heating, while in continental - harsher climates, this type of heat pump is used in bivalent coupling with other heat sources[2].
Seen from the investment aspect, these heat pumps are the most affordable.

1.5.Heat pump ground-water

The earth-water system uses a plate heat exchanger that transfers the cold energy of freon to a mixture of glycol and water, which circulates in a closed pipe system with the help of a circulation pump.
This type of heat pump has a slightly lower evaporation point compared to water-to-water heat pumps, and therefore a lower degree of usefulness.
Unlike air-water heat pumps, ground-water heat pumps have much more stable operating conditions, because the freon vapor does not fluctuate in the ground temperature [5].
This type of heat pump is equally effective at any outside temperature.

2. SUSTAINABILITY OF HEAT PUMPS

2.1.Ecological sustainability

Traditional heating methods have a very low degree of usefulness from 0.6 to 0.9, because a large part of the heat leaves with combustion products, a large space is needed for storing fossil fuels, and a huge amount of combustion products is released [6].
In addition, fossil fuels are used irrationally, and their sources are exhausted.

2.2.Economical sustainability

Dimensioning the heat pump according to extremely low temperature conditions would be uneconomical. Since the heat pump is still the most expensive heat source in terms of investment, its size should be determined according to some optimum, which must include the meterological conditions and purpose of the pump, as well as the seasonal dynamics of its use [2].

The economic evaluation of a heat pump project includes the following elements:

- Investing in fixed assets;
- Servicing and maintenance;
- The price of electricity;
- Tariff system;
- Tariff for distribution;
- Net tax on electricity.

A number of important indicators to consider discontinuous operation of the heat pump because heat pump systems require a lot of time spent before reaching the optimal operating mode, which means that it is difficult to predict the costs of starting the heat pump from a cold state. Also, for most heat pumps, the efficiency will be low during commissioning, where to a large extent the electricity consumption is used for heating the heat pump itself [7].

3. CONCLUSION

When talking about renewable energy sources and obtaining energy in a more economical way, heat pumps are not considered "permanent", the only and always the best solutions, but are "offered" as one of the solutions, which should be analyzed from an economic point of view, whenever and wherever their application is technically justified.
Dimensioning the heat pump according to extremely low temperature conditions would be uneconomical. Since the heat pump is still the most expensive heat source in terms of investment, its size should be determined according to some optimum, which must include the meterological conditions and purpose of the pump, as well as the seasonal dynamics of its use [2].
Rational consumption of primary energy, increased energy efficiency of the system, environmental protection, reduction of CO_2 emissions and protection of the ozone layer, reduction of fossil fuel consumption, as well as the cooling function are characteristics of heat pumps, which makes the aforementioned device use renewable energy sources in the most efficient techno-economic way [4].

LITERATURE

[1] Miloradović, N., O poreklu i primeni geotermalne energije, Klimatizacija, grejanje i hlađenje (KGH), Savez mašinskih i elektrotehničkih inženjera i tehničara Srbije (SMEITS), Vol. 42, No. 2, pp. 53-57, ISSN: 0350-1426 (206), Beograd, Republika Srbija, 2013.

[2] Šamšalović, S., Toplotna pumpa, Savez mašinskih i elektrotehničkih inženjera i tehničara Srbije (SMEITS), Beograd, Republika Srbija, 2009.

[3] Šamšalović, S., Matić, I., Knežević, S., Mogućnost energetskog iskorišćenja podzemnih voda u priobalju Save sa osvrtom na projekat „Beograd na vodi“, Klimatizacija, grejanje i hlađenje (KGH), Savez mašinskih i elektrotehničkih inženjera i tehničara Srbije (SMEITS), No. 2, Vol. 45, pp. 41-48, ISSN: 0350-1426 (206), Beograd, Republika Srbija, 2016.

[4] Vulić, M., Vujičin, K., Tehno-ekonomska analiza grejanja obejkta toplotnom pumpom, u bivalentnom sistemu, The Fourth International Conference on Renewable Electrical Power Sources (ICREPS 16), Serbian Union Of Mechanical And Electrical Engineers And Technicians (SMEITS), Society for Renewable Electric Power Sources, Belgrade, Serbia, 17-18th October 2016, pp. 407-411, ISBN 978-86-81505-80-9

[5] https://www.lumen.rs/

[6] Karić, M., Blagojević, R., Škundrić N., Ekonomičnost geotermalne toplotne pumpe u sistemu podnog grejanja, Savremena poljoprivredna tehnika, Cont. Agr. Engng, No. 1-2, Vol. 33, pp. 447-455, 2007.

[7] Clausen, K. S., G. Energi, D. T., Veća zastupljenost toplotnih pumpi u oblasti daljinskog grejanja - Zašto, gde, kako i kada?, Hot&Cool, 2015.

URBAN MORPHOLOGYAND ITS IMPACT ONURBAN MICROCLIMATE

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Abstract: Intensive urbanization and the effects of climate change are exerting significant impacts on the health and well-being of urban populations. Given the global shifts in climate patterns, ensuring cities' resilience to these changes is of utmost importance. The resulting macro-scale climate changes, in turn, influence the microclimates within urban areas. When combined with the urban heat island (UHI) effect, which refers to the phenomenon of higher urban air temperatures compared to the surrounding rural environment, cities are expected to experience heightened health risks, particularly during summer when temperatures rise substantially, leading to increased heat stress.Urban Green Infrastructure (UGI) is a widely adopted approach to mitigate the effects of UHI. However, effective heat mitigation strategies targeting UHI at various scales and subsequently alleviating thermal discomfort among urban residents can only be achieved through a combination of UGI and modifications to urban morphology. This paper aims to comprehend the influence of urban morphology and UGI on the external microclimate of urban developments and assess how different urban designs can minimize adverse conditions, including unfavorable microclimatic factors. The paper highlights various strategic efforts in microclimate mitigation, achieved by manipulating urban morphology through urban planning and design measures. Developing feasible urban designs that fully leverage UGI to achieve optimal thermal comfort presents a significant challenge for researchers and urban designers, particularly given the context of rapid population growth and climate change.

Key words: Intensive urbanization, Climate change, Urban heat island (UHI), Urban Green Infrastructure (UGI), Microclimate, Urban morphology, Thermal comfort

INTRODUCTION

Presently, more than half of the world's population is concentrated in cities. This is particularly the case in Europe, where approximately 74% of the population lives in urban areas (Eurostat, 2021). Currently many cities across the world are directly threatened by climate change, putting this expanding urban population at risk.

Climate change is the growing problem especially in urban environment. In cities we are already witnessing the impacts of climate change induced disasters. On one hand it is flooding, intense rainfall events or storm surge; on the other drought, water stresses in summer, and increased mean temperature that consequent urban heat island effect (UHI) (Pacheco-Torgal, 2015, Atta-ur-Rahman et al., 2016).

In addition to increased mean temperatures, climate change is likely to be responsible for more frequent heat waves, such as the 2003 European heat wave that claimed the lives of more than several thousand people (Haines et al., 2006). Heat waves have a much bigger health impact in cities than in surrounding suburban and rural areas because urban areas frequently demonstrate higher—and nocturnally sustained mean average air temperatures due

to the UHI effect (Hulley, 2012; IPCC, 2007). UHI can be defined as the warmer urban canopy layer compared was with its rural neighbourhood. It is a phenomenon that has negative implications for the thermal comfort and health of urban citizens.

UHI derives from a complex combination of different factors which lead to significant changes in the surface energy balance (Vaz Monteiro, et al., 2016). On the one hand, urban areas are exposed to significant levels of anthropogenic heat emissions (Taha, 1997). On the other, vegetative cover in cities has been extensively replaced by impermeable materials with low albedo and high heat storage capacity. Consequently, evapotranspiration within urban areas is reduced and the absorption and storage of incoming solar radiation is increased compared to rural environments (Grimmond, 2007). When UHI occurs during summer heatwaves (with low surface moisture and wind speeds (Li and Bou-Zeid, 2013), it can escalate the heatwave severity and increases health and human thermal comfort issues with intensified temperatures (Kueh et al., 2017).With the increased frequency of such events (Beniston et al., 2007), the negative impact of extreme heat on the outdoor thermal comfort (OTC) and health of urban citizens is likely to become a repeated and cumulative problem. Unlike UHI, which is derived from urban-rural temperature differences, OTC can be quantified by thermal comfort indices considering the objective assessment of microclimatic variables including air temperature (Ta), relative humidity (RH), mean radiant temperature (TMRT), and wind speed (Va), as well as a subjective assessment of individual perception (Benerjee et al., 2022).

Intensive urbanization and the compounding effects of climate change are significantly impacting the health and well-being of urban populations. However, it is important to acknowledge that diverse urban designs engender distinct micro and local climate conditions. Given the projected rise in temperatures, heightened occurrences of extreme rainfall, and the anticipated surge in the EU's urban population exceeding 80% by 2050, the imperative for cities to adapt to these impacts is increasingly pronounced. Substantial financial investments are currently being directed towards climate change adaptation in cities across Europe and worldwide. Consequently, ensuring the climate-proofing of urban areas has become a matter of critical importance in the face of global climate changes.
The outdoor thermal comfort experienced within urban environments is intricately shaped by their form and design, which exert influences on air temperature, humidity, solar radiation, wind speed, and direction. Factors such as the presence of vegetation, blue infrastructure (e.g., water bodies), urban morphology, ventilation patterns, and surface materials play pivotal roles in determining outdoor thermal comfort.
Recognizing the urgent need to address climate change challenges and enhance urban resilience, the European Commission regards urban green infrastructure—encompassing urban forests, parks, gardens, street trees, green alleys, green roofs, and walls—as a vital instrument. Incorporating these green elements into urban landscapes not only aids in tackling global climate challenges but also enhances the overall quality of life within citiesand their resilience. Unfortunately, current planning efforts at both national and local levels often lack a specific intention to accommodate biodiversity and green infrastructure. This oversight represents a missed opportunity to bolster climate regulation and promote the resilience of our urban environments.

There is now considerable evidence of the many values of bringing biodiversity and green infrastructure into urban spaces, as well as the creation of many strategies on how it might be achieved. In urban microclimate, climatic phenomena are considered at a variety of scales,

from the neighbourhood and small community scales of several kilometres to street canyons of a few meters (Yang et al., 2023).There are currently quite significant achievements in the methodologies for assessing the urban microclimate, but the implementation of the main conclusions for improving urban planning is not properly considered.

Urban designers wield significant influence over the urban microclimate, primarily through the manipulation of urban morphology, which forms the foundational structure of the city, and through the application of materialization and landscaping, which contributes to its final appearance. Consequently, it is crucial for urban designers and planners to make well-informed design decisions that consider the microclimate implications.

Materialization and landscaping techniques present valuable avenues for substantially enhancing the urban microclimate. In situations where modifications to urban morphology are challenging due to high investments and limited social acceptability in the existing urban environment, implementing changes to materials or their finishing and introducing vegetation prove to be effective measures to improve the urban climate. These strategies offer feasible alternatives for positively impacting the urban microenvironment without necessitating major structural alterations.

The aim of this paper is to understand the effect of urban morphology (defined as mass, density, and orientation of building stock in cities) and UGIon the external microclimate of the urban development and assess how the different development design can minimise adverse conditions, including negative microclimatic factors. The paper also focuses on the evaluation of appropriate and diverse range of favourable microclimatic conditions to cater for a wide range of personal preferences. Moreover, the paper provides recommendations to ensure properurban development management provides a comfortable outdoor environment through the control of climatic conditions on a micro scale.

1. GREEN INFRASTRUCTURE

Green infrastructure is recognised for its strong potential to regulate urban air temperatures and combat the UHI intensity locally (Doicek et al., 2014). Vegetation can increase evapotranspiration and shading as well as it reduces the absorption of radiation and the amount of heat stored within urban surfaces (Oke et al., 1989). During the day, but also at night air temperatures within greenspaces remaining significantly cooler than those of neighbouring built-up areas (Bowler et al., 2010; Doick et al., 2014; Oke et al., 1989).

Although, there is also some data showing the effectiveness of urban vegetation to reduce GHG emissions or concentrations of airborne pollutants, there is better evidence that vegetation through shading and transpiration can provide local cooling in hot regions, which translates into reduced energy consumption for air conditioning and subsequently urban GHG emissions and may represent an important carbon reservoir (Akbari, 2002; Velasco et al., 2016). Additionally, vegetation in urban green roofs, swales, or rain gardens provide multiple benefits, including flood risk reduction, rainfall interception, rainwater flow rate reduction, water quality improvement through filtration, groundwater recharge, evaporation encouragement and habitat improvement (Zeleňáková et al. 2017; Pearlmutter et al. 2021).

Furthermore, green infrastructure plays a vital role in achieving biodiversity goals. Through tree planting and effective greenery management, many adverse consequences of urbanization, such as habitat degradation and loss, can be mitigated. In fact, certain planned adaptation measures to address climate change may have a more substantial impact on urban biodiversity than the direct effects of climate change itself. These actions can concurrently contribute to ecosystem preservation, enhance habitats for woodland or freshwater species,

and aid in maintaining species community composition. These ecological benefits assume greater significance in the face of the current threats posed by climate change, emphasizing the urgency of sustaining and enhancing urban quality of life.
Additionally, green infrastructure not only serves as a climate change mitigation strategy but also supports provisioning services through urban agriculture or community gardening. The multifaceted contributions of greenery to the urban ecosystem extend beyond ecological aspects to encompass cultural perspectives as well. For instance, green spaces provide opportunities for recreation, offer psychological benefits, foster community engagement through activities, facilitate scientific exploration, cater to spiritual needs, promote environmental education, and encourage positive actions in response to climate change challenges. These diverse services and advantages underscore the significant role of green infrastructure in shaping urban environments in a more sustainable and holistic manner.
Moreover, green infrastructure is being advocated as a cost-effective alternative or complement to grey infrastructure and intensive land use changes in urban contexts. As climate change gradually exerts its influence on the nation's economic growth rates and the livelihoods of millions of individuals, it emerges as a progressively significant strategic economic and political concern. In-depth studies exploring the implications of climate change on human settlements underscore the potential economic repercussions of infrastructure disruptions, with a greater concentration of impact in urban areas due to the predominant location of critical infrastructure. Consequently, projected climate change effects on cities are reshaping the approach to urban infrastructure design and location, population distribution, and the organization of certain city services (Deshkar and Adane, 2016).

The integration of green and blue infrastructure design within urban planning and policy domains yields multifaceted contributions to city functionality and resilience. Such incorporation fosters adaptability in addressing region-specific challenges, encompassing issues like overheating, flooding, air pollution, public health, well-being, and biodiversity loss. Alongside these nature-based approaches to climate change mitigation, urban morphology, encompassing factors such as building density, form, and layout, also significantly influences the local climate and thermal comfort experienced by inhabitants (Zhang et al., 2022).

2. MICROCLIMATE AND GREEN INFRASTRUCTURE

In order to support the resilience of the city the report focuses on comfortable outdoor environment through the control of climatic conditions on a micro scale (microclimate). Microclimate is understood as a local set of atmospheric conditions that differ from those in the surrounding areas. Microclimates exist, within natural environment for example, near bodies of water which may cool the local atmosphere, but our focus in on urban areas where brick, concrete, and asphalt absorb the sun's energy, heat up, and re-radiate that heat to the ambient air. Some of these differences have been quantified and expressed as changes compared with surrounding countryside: air temperature is 0.7°C higher measured as the annual mean, solar radiation is reduced by up to 20%, and wind speed is lowered by 10–30% (Haughton and Hunter, 1994).

All natural ecosystems in urban areas will help to regulate or reduce these differences by generating a microclimate regulation ecosystem service. UGI has the ability to evaporate water into the atmosphere and has the potential to increase air humidity, cool and reduce temperature fluctuations or provide shade and shelter in and around towns and cities. Green

Infrastructure elements are planned and managed primarily for stormwater control, climate adaptation, less heat stress, more biodiversity, food production, better air quality, sustainable energy production, clean water, and healthy soils, as well as the more anthropocentric functions such as increased quality of life through recreation.

The cooling effect of green infrastructure is one of the most important ecosystem regulatory services in the city. On hot summer days, greenery can cool the surrounding environment better and more efficiently than air conditioners. About 120 kWh of solar energy falls on the leaves of the tree with a diameter of about 5 meters (average diameter of approximately 20 m2) during the summer. If the tree is well supplied with water, it transpires up to 80% of it, thus consuming 250 MJ of solar energy, which in turn cools the environment by 70 kWh (evaporates about 109.4 liters of water) (Prochazka, 1998). When we convert it to the price of electricity per kWh in euros in Slovakia (2018), we find that one tree with a diameter of 5m can cool the environment at 10.5 euros (1kWh = 0.15 euros). At night or in colder times, water vapor condenses again in cooler places, warming the environment and helping to reduce temperature differences (Procházka, 1998; Pokorný, 2014). The greenery in the city also has a positive effect as a filter for harmful substances, which is a function of green insulation. Nowak, et al. (2006) calculated that greenery in the US can filter 711,000 tons of pollutants per year, or 3.5 billion euros.

3. URBAN MORPHOLOGY AND MICROCLIMATE

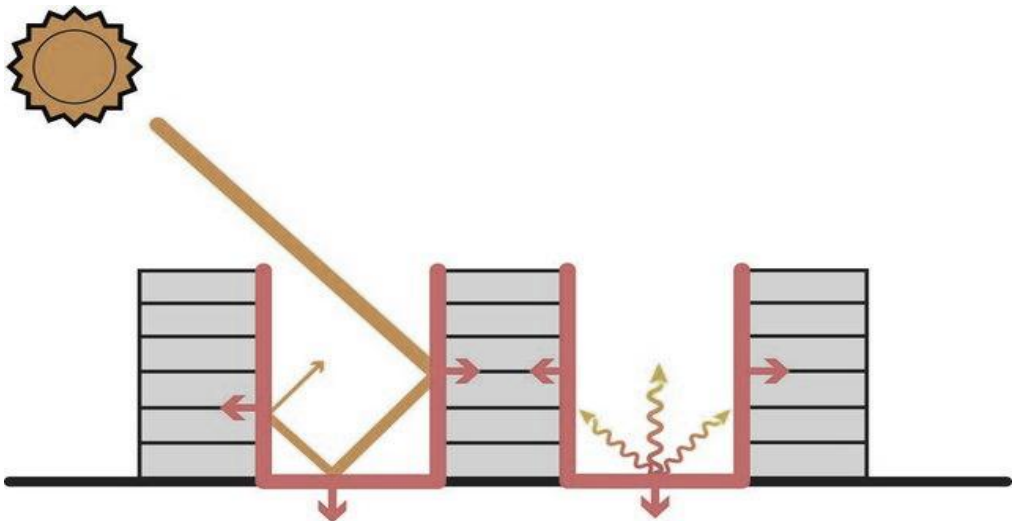
The present review encompasses a selection of studies, primarily obtained from well-known databases and publishers such as ScienceDirect and Springer, along with a few additional contributions from peer-reviewed conference proceedings. These studies center around the intricate relationship between urban microclimate and urban morphology. Notably, various urban morphological variables, including street geometry, building height, and site coverage, significantly influence the microclimatic profile, consequently exerting a considerable impact on Outdoor Thermal Comfort (OTC). The subsequent section of the review delves into the aspect of "Urban Microclimate and Current Practical Issues," focusing on practical challenges and the associated design parameters.

Within the urban environment, the microclimate, present within the spaces beneath the roof level and between buildings, exhibits remarkable variability even within short distances of a few meters. This microclimate is profoundly shaped by the city's morphology. One well-known consequence of urban morphology on its climate is the (UHI) effect, which has been described in the introduction, highlighting its effects on health, local environment, and economy, particularly energy demand.

The UHI effect decreased long-wave radiation heat loss from street canyons, caused by obstruction of the sky by buildings, trees and other objects. The heat is intercepted by the obstructing surfaces and absorbed or radiated back to the urban tissue. Moreover, it decreased evaporation from urban areas because of ‘waterproofed surfaces’ – less permeable materials, and less vegetation compared to rural areas. The influence of urban morphology extends beyond thermal aspects, impacting various components of the climate and thus affecting physical well-being.

In particular, urban morphology exerts its influence on different elements of the urban microclimate, such as solar radiation, wind patterns, and air quality. Urban areas characterized by restricted ventilation corridors obstruct the return of radiation to the atmosphere, contributing to elevated surface temperatures, as exemplified in Figure 1.The presence of tall buildings in the city alters wind speeds, leading to a diminished cooling effect and potentially poorer air quality. Increased building density and specific street canyon layouts impede air circulation, particularly influenced by wind direction, and the limited availability of green vegetation inhibits the essential evapotranspiration process, consequently contributing to atmospheric warming and heightened air temperatures (Roth and Lim, 2017).

Fig: 1. Reflections of incident short-wave (left) and emitted long-wave radiation (right) lead to trapping of heat in the urban canyon.



Source: Esch 2015

Numerous studies have examined the impact of urban morphology on UHI and OTC within cities. Specifically, researchers have explored various aspects of urban morphology, such as building porosity, mutual shading, orientation, and site design, and their implications on UHI and OTC. Several studies, including those conducted by Berardi and Wang (2016), Yuan and Ng (2014), Wai et al. (2020), Yahia et al. (2018), Acero et al. (2021), Abdollahzadeh and Biloria (2021), Ouali et al. (2020), and Gamero-Salinas et al. (2021), have contributed to this body of knowledge.

Before solar radiation reaches the Earth's surface, it traverses through the atmosphere. During this process, a portion of the solar short-wave radiation is reflected back into space by the atmosphere, while another portion is absorbed. The Earth, in turn, reflects a small fraction of this direct radiation (approximately 3%) and absorbs the rest. This absorbed radiation is subsequently emitted back into the atmosphere as long-wave radiation (heat), of which a small portion is directly transmitted to space, but the majority is absorbed by the atmosphere and re-emitted back to the Earth. The urban canyon and tissue morphology significantly influence the net all-wave radiation by either allowing sunlight to enter or obstructing it, as well as promoting or impeding the loss of long-wave radiation to the sky. Various studies have investigated the long-wave radiation emitted from building surfaces, revealing its noteworthy impact on pedestrian thermal sensation. The prevalence of vertical surfaces enhances the

reflection of short-term radiation, generating heat that is later transmitted as long-term radiation to surrounding surfaces.
An example of an engineering solution involves using cool construction materials characterized by low heat conductivity, low heat capacity, high solar reflectance, and high permeability. This approach results in reduced heat absorption and storage during the day, leading to lower heat emission at night. Since roofs and pavements (considered impervious surfaces) can cover a significant portion of urban areas, accounting for approximately 60–90% (Akbari et al., 2009; Stewart and Oke, 2012), modifying their surface characteristics, such as increasing surface albedos to reflect more light or implementing evaporative cooling using cool roofs and green roofs, proves to be a highly viable and effective option (Herath et al., 2021; Xing and Jones, 2019; Oswald et al., 2020).

In dense urban environments, natural and night ventilation is severely restricted due to the significant reduction in wind speed within urban canyons. Rajagopalan et al. (2014) conducted a study on wind flow characteristics and their influence on urban heat islands. Their findings revealed that random building configurations lead to reduced ventilation in urban canyons, resulting in elevated temperatures. The presence of tall buildings and narrow streets acts as an enclosure, trapping heat and impeding airflow, leading to higher temperatures. Lin et al. (2010) emphasized that building configurations and elevations have a noteworthy impact on pedestrian comfort, and the incorporation of open spaces like parks can aid in alleviating thermal stress. Consequently, studies on building configurations suggest that densely clustered buildings may hinder incoming airflow, exacerbating the issues of urban ventilation. Consequently, buildings tend to absorb more solar radiation and retain more heat, leading to an increase in surface temperature. In urban street canyons, the presence of high-density buildings can elevate air temperatures by as much as 3 to 7 °C (Karimimoshaver et al., 2021).

Numerous UHI mitigation strategies have been proposed in both academic literature and practical applications. Among these strategies, increasing urban greenspace emerges as the most prevalent and favored choice for providing cooling benefits to urban outdoor spaces (Aboelata&Sodoudi, 2019; Skelhorn et al., 2014; Middel et al., 2015). Various types of urban greenspace offer the potential to reduce the extent of imperious surfaces directly exposed to solar radiation through shading, as well as to dissipate heat from the air through the process of evapotranspiration (BartesaghiKoc et al., 2018; Rahman et al., 2020).

During the daytime, trees and tall bushes serve as effective shading elements that attenuate solar radiation, while during the night, they obstruct heat flow and diminish heat exchange. The presence of vegetation significantly influences ambient air temperature and humidity through the process of evapotranspiration, while simultaneously reducing wind speed due to the wind shielding effect. This interaction with vegetation has both positive and negative implications for human thermal comfort (Wang, 2016).

Numerous experimental studies have confirmed that vegetation can act as a wind shield, leading to a reduction or obstruction of outdoor air movement. The extent of wind speed reduction is contingent on the specific characteristics of the UGI, including its structure, size, and orientation (Akbari et al., 1997). Trees, when functioning as shields, have the capacity to lower wind speed, consequently diminishing air ventilation and infiltration (Akbari, 2002; Huang et al., 1987; Heisler, 1990). However, this wind shielding effect also plays a crucial

role in maintaining a comfortable air temperature, as evergreen trees reduce hot wind in the summer and cold wind in the winter. Furthermore, vegetation's evapotranspiration process contributes to ambient moisture, subsequently elevating outdoor and indoor humidity levels (Akbari, 2002; Huang et al., 1987).

Vegetation is frequently integrated into the roofs or walls of buildings, complementing adjacent greenery and exerting a substantial influence on both indoor and outdoor microclimates. Green roofs and walls are particularly effective in mitigating the heat flux through the roof, shielding the roof slab from direct sunlight, and providing evaporative cooling. These vegetated roofs demonstrate exceptional proficiency in rainwater collection, wherein the plants facilitate evapotranspiration back into the water cycle. Contemporary implementations often employ drainage layers to enhance the water retention capacity of green roofs. These accumulation/drainage layers, resembling spatially shaped plastic films reminiscent of egg wrapping, can hold considerable volumes of rainwater that subsequently permeate through the soil and vegetation layer. The cooling impact of green roofs primarily emanates from water evaporation, the shading effect of vegetation, sunlight reflection, energy consumption during photosynthesis, and the thermal accumulation of retained water.

Furthermore, green roofs effectively moderate building temperatures by several degrees Celsius directly underneath the roofs. Notably, these vegetated roofs can reduce heat transfer from the outside to the interior by over 90% (Schade et al., 2021). By maximizing the utilization of green roofs, urban development can significantly contribute to the mitigation of the urban heat island effect in the area. While numerous studies have confirmed the positive effects of green roofs and walls, it is essential to note that a sparsely covered green roof may lead to increased substrate and ambient temperatures when the substrate becomes dry and wind speed is low (Hien et al., 2007). Hence, achieving the most favorable thermal comfort and harnessing the full potential of UGI necessitates well-covered green roofs.

Moreover, various studies have explored the potential indirect impact of vegetation and urban morphology on air quality through microclimate regulation. For instance, Baik et al. (2012) examined the effects of green roofs on air quality within street canyons, utilizing a computational fluid dynamics (CFD) model (Baik et al., 2003). The findings demonstrated that green roofs generated cool air, which subsequently flowed into the street canyon, resulting in a reinforced street canyon flow. Consequently, the dispersion of pollutants was enhanced, leading to decreased pollution concentration near the road.

However, contrasting results were reported by (Vos et al., 2013) who emphasized the importance of cautious implementation of dense vegetation in street canyons, particularly in bustling areas with heavy traffic. As vegetation significantly influences wind flow, it also affects the dispersion and deposition of air pollutants. Roadside urban vegetation can elevate pollutant concentrations due to the reduction of air ventilation, which dilutes pollutants emitted from traffic. Consequently, placing vegetation along a road can lead to higher pollutant concentrations, particularly in the vicinity of the barrier, owing to reduced wind speeds. However, concentrations are markedly lower further behind the vegetation, amounting to approximately 30% of the barrier-free values for NOx and up to 50% for PMx (Hofschreuder et al., 2010). In this context, Vos et al. (2013) observed that high impermeable green barriers also resulted in a significant improvement in air quality.

Numerous studies have established a strong correlation between urban heat island and urban morphology, as evidenced by works conducted by Rogers (2018) and Zhang et al. (2018). This paper emphasizes several strategic efforts focused on microclimatic heat mitigation through urban planning and design measures that manipulate the aforementioned characteristics. In the face of rapid population growth and climate change, researchers and urban designers face the substantial challenge of finding viable urban designs that fully leverage UGI to attain optimal thermal comfort (Wang et al., 2014).Moreover, it is crucial to address the various ways through which urban planning can harness the potential of urban green infrastructure and its ecosystem services to enhance resilience and quality of life in cities. This includes identifying the socio-cultural impacts that may arise from the loss of green infrastructure. Urban planning and management should prioritize processes that value ecosystem services, as this can significantly influence decision-making situations. Raising awareness regarding non-economic values, encompassing social, cultural, and insurance values, and integrating them into economic instruments and policy measures are essential steps. Economic instruments, such as user fees to finance public utilities, can be designed accordingly to promote the preservation of green infrastructure and its ecosystem services.Furthermore, the loss of green infrastructure and its associated ecosystem services in cities may adversely impact social and cultural values, which are often overlooked at the decision-making level. Incorporating non-economic values into urban planning and management remains an understudied area, and there is a need to explore how the ecosystem services and green infrastructure approach can better integrate these values in decision-making processes.

REFERENCES

Aboelata, A., Sodoudi, S. 2019 Evaluating urban vegetation scenarios to mitigate urban heat island and reduce buildings' energy in dense built-up areas in Cairo,Building and Environment 166, 106407, ISSN 0360-1323,https://doi.org/10.1016/j.buildenv.2019.106407.

Abdollahzadeh, N., Biloria, N. 2020. Outdoor thermal comfort: Analyzing the impact of urban configurations on the thermal performance of street canyons in the humid subtropical climate of SydneyFront. Architect. Res. 10.1016/j.foar.2020.11.006

Acero, J.A., Koh, E.J.Y., Ruefenacht, L.A, Norford. L.K. 2021. Modelling the influence of high-rise urban geometry on outdoor thermal comfort in Singapore. UrbanClim., 36, 10.1016/j.uclim.2021.100775

Akbari, H., Kurn, D. M., Bretz, S. E., & Hanford, J. W. 199). Peak power and cooling energy savings of shade trees. Energy and Buildings, 25, 139–148

Akbari, H., S. Menon, A. Rosenfeld 2009. Global cooling: increasing world-wide urban albedos to offset CO2, Clim. Chang., 94 (3–4), pp. 275-286, 10.1007/s10584-008-9515-9

Akbari, H. 2002. Shade trees reduce building energy use and CO2 emissions from power plants. *Environmental Pollution*, *116*, 119–126.

Atta-ur-Rahman, Parvin, G. A., Shaw, R., & Surjan, A. 2016. Cities, Vulnerability, andClimate Change. Urban Disasters and Resilience in Asia (pp. 35-47), https://doi.org/10.1016/B978-0-12-802169-9.00003-3

BartesaghiKoc, C., Osmond, P., Peters, A. 2018. Evaluating the cooling effects of green infrastructure: A systematic review of methods, indicators and data sources, Solar Energy166, ISSN 0038-092X, https://doi.org/10.1016/j.solener.2018.03.008.

Baik, Jong-Jin&Kwak, Kyung-Hwan & Park, Seung-Bu &Ryu, Young-Hee. 2012. Effects of building roof greening on air quality in street canyons. Atmospheric Environment. 61. 48–55. 10.1016/j.atmosenv.2012.06.076.

Banerjee, A., Mo-Rigen He, William D. Musinski, Paul A. Shade, Marie E. Cox, Edwin J. Schwalbach, Kevin J. Hemker, 2022. Effect of stress-relief heat treatments on the microstructure and mechanical response of additively manufactured IN625 thin-walled elements, Materials Science and Engineering: A 846, 143288, ISSN 0921-5093, https://doi.org/10.1016/j.msea.2022.143288.

Beniston, M., Stephenson, D.B., Christensen, O.B., Ferro, C.A.T., Frei, C., Goyette, S.,Halsnaes, K., Holt, T., Jylha, K., Koffi, B., Palutikof, J., Scholl, R., Semmler, T., Woth, K., 2007.Future extreme events in European climate: an exploration ofregional climate model projections. Clim. Change 81, 71–95.

Berardi, U., Y. Wang. 2016. The effect of a denser city over the urban microclimate: the case of Toronto. Sustainability, 8 (8), pp. 1-11, 10.3390/su8080822

Deshkar, S., &Adane, V. 2016. Community Resilience Approach for PrioritizingInfrastructure Development in Urban Areas. Urban Disasters and Resilience in Asia, 245–267. doi:10.1016/b978-0-12-802169-9.00016-1

Doick, K. J., Peace, A., & Hutchings, T. R. (2014). The role of one large greenspace inmitigating London's nocturnal urban heat island. Science of the Total Environment, 493,662–671.

Esch, Marjolein.2015. Designing the Urban Microclimate. A framework for a design-decision support tool for the dissemination of knowledge on the urban microclimate to the urban design process. A+BE: Architecture and the Built Environment. 5. 10.7480/abe.2015.6.

Eurostat, 2021. https://ec.europa.eu/eurostat/databrowser/view/urt_pjanaggr3/default/table?lang=en

Gamero-Salinas, J., N. Kishnani, A. Monge-Barrio, J. López-Fidalgo, A. Sánchez-Ostiz 2021. The influence of building form variables on the environmental performance of semi-outdoor spaces. A study in mid-rise and high-rise buildings of Singapore. Energy Build., 230, 10.1016/j.enbuild.2020.110544

Grimmond, S., 2007. Urbanization and global environmental change: local effects of urban warming. Geogr. J. 173, 83–88.

Haines, A., Kovats, R., Campbell-Lendrum, D., Corvalan, C., 2006. Climate change and humanhealth: impacts, vulnerability, and mitigation. Lancet 367, 24–30

Haughton, G., Hunter, C., 1994. Sustainable Cities, Regional Policy and Development. JessicaKingsley, London 357 pp.

Heisler, G. M. 1990. Mean wind speed below building height in residential neighborhoods with different tree different tree densities. *Ashrae Transactions*, *96*, 1389–1396.

Hien, W.N., Yok, T.P., Yu, Ch. 2007, Study of thermal performance of extensive rooftop greenery systems in the tropical climate. Building and Environment 42, 1, 25-54,ISSN 0360-1323,https://doi.org/10.1016/j.buildenv.2005.07.030.

Herath, P., M. Thatcher, H. Jin, X. Bai. 2021. Effectiveness of urban surface characteristics as mitigation strategies for the excessive summer heat in cities Sustain. Cities Soc., 10.1016/j.scs.2021.103072

Hofschreuder, P., Kuypers, V.H.M., Vries, B. de, Janssen, S., Maerschalck, B. de, Erbrink, H.J. & Wolff, J. de 2010. Effect of vegetation on air quality and fluxes of NOx and PM-10 along a highway. Proceedings of the international conference on Local Air Quality and its Interactions with Vegetation, Antwerp, Belgium.

Huang, Y. J., Akbari, H., Taha, H., & Rosenfeld, A. H. 1987. The potential of vegetation in reducing summer cooling loads in residential buildings. Climate and Applied Meteorology, 26, 1103–1116.

Hulley, M.E. 2012. The Urban Heat Island Effect: Causes and Potential Solutions. In Metropolitan Sustainability; Zeman, F., Ed.; Woodhead Publishing Series in Energy: Sawston, UK, pp. 79–98.

IPCC, 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp.

Kueh, Mien-Tze& Lin, Chuan-Yao & Chuang, Y-J & Sheng, Y-F & Chien, Y-Y. (2017). Climate variability of heat waves and associated diurnal temperature range variation in Taiwan. Environmental Research Letters. 12. 10.1088/1748-9326/aa70d9.

Karimimoshaver, M., RezvanKhalvandi, Mohammad Khalvandi, 2021. The effect of urban morphology on heat accumulation in urban street canyons and mitigation approach, Sustainable Cities and Society 73, 103127,
ISSN 2210-6707, https://doi.org/10.1016/j.scs.2021.103127.

Li D., and ElieBou-Zeid. 2013. Synergistic Interactions between Urban Heat Islands and Heat Waves: The Impact in Cities Is Larger than the Sum of Its Parts. Journal of Applied Meteorology and Climatology. DOI: https://doi.org/10.1175/JAMC-D-13-02.1

Lin, T.P.; Matzarakis, A.; Hwang, R.L. 2010. Shading effect on long-term outdoor thermal comfort. Build. Environ., 45, 213–221.

Middel, A., Nalini Chhetri, Quay Raymond, 2015 Urban forestry and Cool roofs: assessment of heat mitigation strategies in phoenix residential neighborhoods. Urban For. Urban Green., 14 (1), pp. 178-186

Nowak, David J, Crane, Daniel E a Stevens, Jack C. 2006. Urban & Fischer, 2006, Urbanforestry & urban greening, s. 115-123.

Oke TR, Crowther JM, McNaughton KG, Monteith JL, Gardiner B. 1989, TheMicrometeorology of the Urban Forest. Philosophical Transactions of the Royal Society B:Biological Sciences; 324(1223):335–49.

Oswald, S.M. et al. 2020. Using urban climate modelling and improved land use classifications to support climate change adaptation in urban environments: a case study for the city of Klagenfurt, Austria. Urban Clim., 31 p. 100582, 10.1016/j.uclim.2020.100582

Ouali, K. El Harrouni, M.L. Abidi, Y. Diab. 2020. Analysis of Open Urban Design as a tool for pedestrian thermal comfort enhancement in Moroccan climateJ. Build. Eng., 28, Article 101042, 10.1016/j.jobe.2019.101042

Pacheco-Torgal, 2015, Introduction to eco-efficient materials to mitigate building coolingneeds. In eco-efficient materials to mitigate building cooling needs Design, Properties andApplications 2015, Pacheco-Torgal, F., Labrincha J., Cabeza L., Granqvist C., eds WoodheadPublishing

Pearlmutter D, Pucher B, Calheiros CSC, Hoffmann KA, Aicher A, Pinho P, Stracqualursi A, Korolova A, Pobric A, Galvão A, et al. 2021. Closing Water Cycles in the Built Environment through Nature-Based Solutions: The contribution of Vertical Greening Systems and Green Roofs. Water 13(16):2165. https://doi.org/10.3390/w13162165

Pokorny, Jan. 2014. Co umistrom. *Arnika.* [Online] 2014. http://arnika.org/co-umi-strom-2.

Prochazka, S., Machačkova, I., Krekule, J., Šebanek, J., 1998. *Fyziologierostlin.* Praha. Academie Praha, 1998. s. 52 - 88.

Rajagopalan, Priyadarsini& Lim, Kee&Jamei, Elmira. 2014. Urban heat island and wind flow characteristics of a tropical city. Solar Energy. 10.1016/j.solener.2014.05.042.

Rahman, M. A., Hartmann, C., Moser-Reischl, A., Freifrau von Strachwitz, M., Paeth, H., Pretzsch, H., Pauleit, S., Rötzer, T. 2020. Tree cooling effects and human thermal comfort under contrasting species and sites, Agricultural and Forest Meteorology 287, 107947, ISSN 0168-1923, https://doi.org/10.1016/j.agrformet.2020.107947.

Rogers, A. 2018. Cities Grab Onto Hurricanes; Buildings Make the Rain Worse. *Available: Wired https://www. wired. com/story/cities-cause-hurricanes-to-dump-extra-rain-onthem/*

Roth M, Lim VH. 2017. Evaluation of canopy-layer air and mean radiant temperature simulations by a microclimate model over a tropical residential neighbourhood. Building and Environment, 112: 177–189.

Roth, M., Vanessa Huimin Lim, 2017. Evaluation of canopy-layer air and mean radiant temperature simulations by a microclimate model over a tropical residential neighbourhood,Building and Environment, Volume 112, Pages 177-189, ISSN 0360-1323,https://doi.org/10.1016/j.buildenv.2016.11.026.

Schade, J., Lidelöw, S., Lönnqvist, J. 2021. The thermal performance of a green roof on a highly insulated building in a sub-arctic climate, Energy and Buildings, Volume 241, 110961, ISSN 0378-7788, https://doi.org/10.1016/j.enbuild.2021.110961

Skelhorn, SC., Lindley, S., Geoff Levermore, 2014. The impact of vegetation types on air and surface temperatures in a temperate city: A fine scale assessment in Manchester, UK,Landscape and Urban Planning 121, Pages 129-140, ISSN 0169-2046,https://doi.org/10.1016/j.landurbplan.2013.09.012.

Stewart, I.D. &Oke, T.. 2012. Local Climate Zones for Urban Temperature Studies. Bulletin of the American Meteorological Society. 93. 1879-1900. 10.1175/BAMS-D-11-00019.1.

Taha, H. 1997, Urban climates and heat islands: Albedo, evapotranspiration, and anthropogenic heat, Energy Build., 25(2), 99–103, doi:10.1016/S0378-7788(96)00999-1.

Vos PEJ, Maiheu B, Vankerkom J, Janssen S. Improving local air quality in cities: To tree or not to tree? *Environmental Pollution.* 2013;183:113–122. doi: 10.1016/j.envpol.2012.10.021.

Yahia, M.W. ,E. Johansson, S. Thorsson, F. Lindberg, M.I. 2018. RasmussenEffect of urban design on microclimate and thermal comfort outdoors in warm-humid Dar es Salaam, TanzaniaInt. J. Biometeorol., 62 (3)

Yuan, C., E. Ng. 2014. Practical application of CFD on environmentally sensitive architectural design at high density cities: a case study in Hong KongUrban Clim., 8, pp. 57-77, 10.1016/j.uclim.2013.12.001

Wai,K.M., C. Yuan, A. Lai, P.K.N. Yu. 2020. Relationship between pedestrian-level outdoor thermal comfort and building morphology in a high-density city. Sci. Total Environ., 708, 10.1016/j.scitotenv.2019.134516

Vaz Monteiro, M., Kieron J. Doick, Phillip Handley, Andrew Peace, 2016. The impact of greenspace size on the extent of local nocturnal air temperature cooling in London, Urban Forestry & Urban Greening 16, Pages 160-169,
ISSN 1618-8667, https://doi.org/10.1016/j.ufug.2016.02.008.

Wang, Yafei. 2016. The effect of urban green infrastructure on local microclimate and human thermal comfort. 10.13140/RG.2.1.4688.6168.

Wang, Y., Bakker, F., de Groot, R., &Wörtche, H. 2014. Effect of ecosystem services provided by urban green infrastructure on indoor environment: A literature review. *Building and Environment*, *77*, 88–100.

Xing, Y., P. Jones 2019. In-situ monitoring of energetic and hydrological performance of a semi-intensive green roof and a white roof during a heatwave event in the UK. Indoor Built Environ. pp. 1-14,10.1177/1420326X19887218

Yang, S., Liangzhu Wang, Ted Stathopoulos, Ahmed MoustafaMarey, 2023. Urban microclimate and its impact on built environment – A review, Building and Environment 238, 110334, ISSN 0360-1323,https://doi.org/10.1016/j.buildenv.2023.110334.

Zeleňakova, M., Diaconub, D.C., Haarstadc, K., 2017 Urban Water Retention Measures.Procedia Engineering 190, 419 – 42

Zhang, W., Villarini, G., Vecchi, G. A., & Smith, J. A. 2018. Urbanization exacerbated the rainfall and flooding caused by hurricane Harvey in Houston. *Nature*, *563*(7731), 384-388.

Zhang, J., Zhen Li, Dan Hu, 2022. Effects of urban morphology on thermal comfort at the micro-scale,Sustainable Cities and Society 86, 104150, ISSN 2210-6707, https://doi.org/10.1016/j.scs.2022.104150.

ENERGY EFFICIENCY OF SMART CITIES AND VILLAGES AS THE BASIS OF SUSTAINABLE DEVELOPMENT AND GREEN ECONOMY

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Summary: The hypothesis put forward in this paper is that the implementation of new technologies, such as wireless communication protocols and high speed wireless technology, not only in the green economy, but also in the entire society, represents a significant benefit for the world economy, technological progress, living standards of the population, revitalized development, protection of the environment and prevention of climate change. Of course, this hypothesis also implies corresponding obstacles and shortcomings that are largely insurmountable at this moment of technological development, such as high costs, impossibility of application in small and medium-sized companies, confusion and discomfort that the majority of the population has with new technologies, employees' fear of the thought that they will be fired because a smart machine or software will replace them in the workplace. Smart cities represent an idea, a vision of the future and future environments in which sensors, data delivery, data exchange, and mutual information connection prevail, which enables better support for various aspects of everyday life, as well as a better standard of living for every resident. Smart cities are also defined as developed urban environments that create sustainable economic development (green economy) and a high-quality standard of living through the improvement of several key areas, namely: economy, mobility, people's environment, life and government. The improvement of these key areas, that is, the sphere of human life and society, requires strong human capital, social capital, as well as information and communication technologies. Currently, urban areas are home to around 50% of the global population and produce 70% of GHGs (global greenhouse gas). Today, the construction sector represents a major problem in terms of fossil fuel energy consumption and corresponding local pollutant and global greenhouse gas (GHG) emissions. In addition, an increasing number of people live in urban areas, so it becomes a challenge to provide the necessary living space and energy for heating the fast-growing cities. The technological learning rate describes how the cost of the technology decreases as the cumulative output increases, due to factors such as learning by doing and economies of scale, i.e. the more we produce something, the cheaper the next unit, which is very important for energy efficiency. We find that homogeneity and modularity of technology are essential for high learning rates. A good proof is the growth in production costs of photovoltaic (PV) devices in recent decades, where a fairly stable learning rate of 20% has been identified.

While nuclear energy, for example, has not evolved into a homogeneous technology due to the necessary environmental adaptations caused by accidents and the lack of standardization and application of new engineering approaches. In that case, the total price increased further. One reason for the more moderate learning rates may also be the low-tech level of concentrated solar power (CSP), as this technology cannot be easily optimized compared to PV. Despite this, there is still optimism that learning rates for concentrated solar energy could reach up to 10% and could be essential for the energy transition. For wind turbines, onshore electricity generation showed learning rates of 15% between 2010 and 2019, offshore had only a 6% learning rate on total installed costs in the same period. Various technological

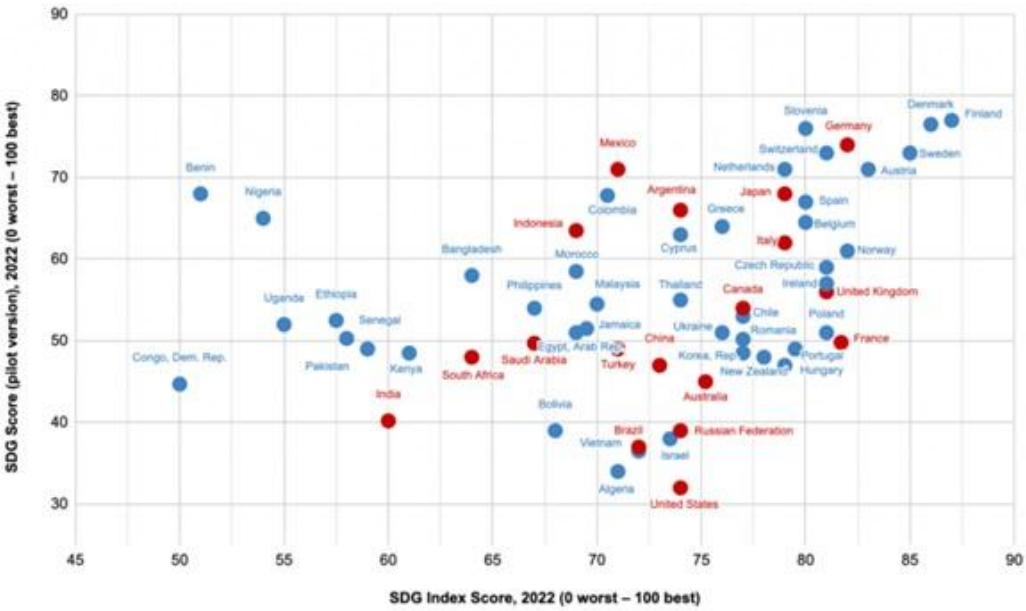
options are available to integrate an increasing share of renewable energy sources, often referred to as flexibility options. This includes, but is not limited to, various electrical energy storage technologies. Improving the lives of rural communities through the development of smart villages is analogous to a more familiar concept such as smart cities. The vision of smart villages represents a modern approach to energy and can act as a catalyst for development – in education, health, food security, productive enterprise, clean water and sanitation systems, environmental sustainability and democratic participation – which in turn supports further improvements in energy access. The key drivers of these development advantages in smart villages are the sustainability of electricity supplies and the availability of clean and efficient household cooking appliances. This is especially important due to the fact that 1.3 billion people worldwide remain without access to electricity, and especially because 2.7 billion still cook on harmful and inefficient stoves.

Keywords: energy efficiency, smart cities, smart villages, sustainable development, green economy

INTRODUCTION: PROBLEMS OF SUSTAINABLE DEVELOPMENT

The concept of sustainable development is embedded in the Sustainable Development Goals (SDGs) of the United Nations (UN). Political efforts and commitments in support of the SDGs are being implemented in various countries, including the G20 countries. The role of government is critical in setting national goals, formulating strategies and developing plans to effectively translate support for the Sustainable Development Goals into actionable plans.Graph 1illustrates that countries with a greater commitment to sustainability tend to perform better in terms of achieving the SDGs. Therefore, the role of the government in achieving the SDGs should be of great importance.

Graph 1 Certain countries and achievement of SDG

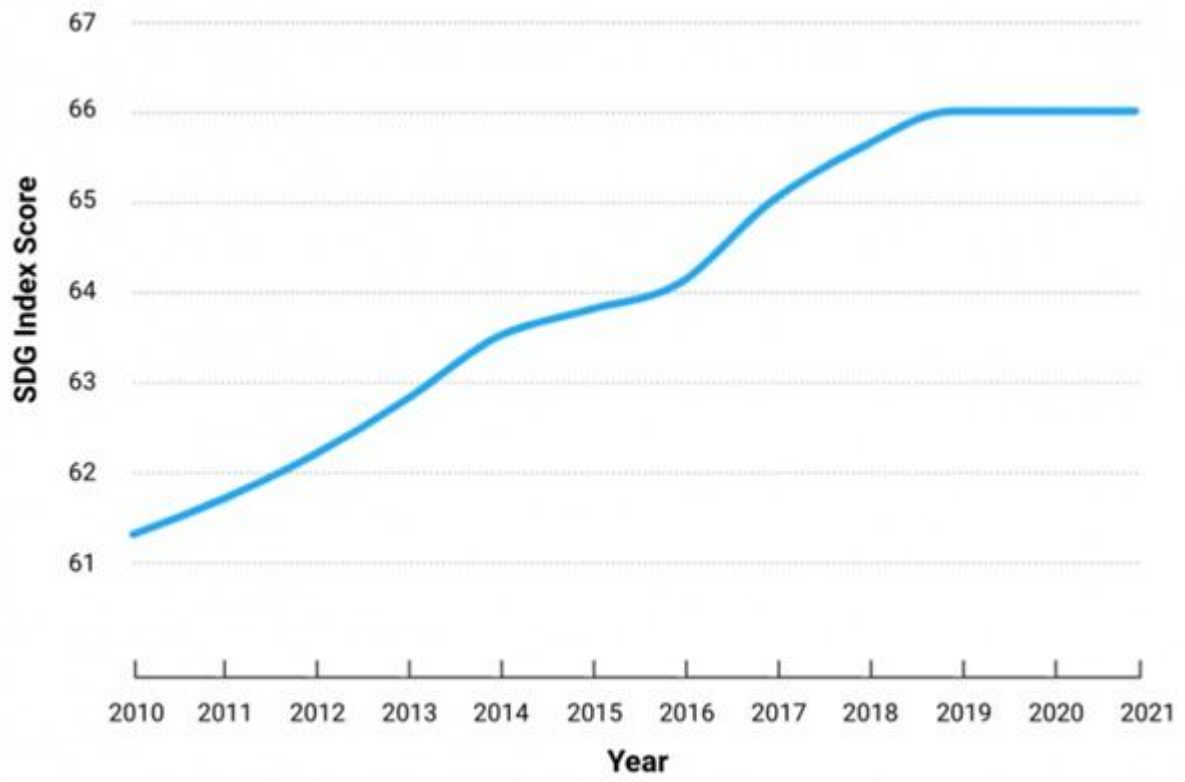


Source:[1]

Digital transformation can help accelerate progress towards each of the 17 SDGs. Significant digitization is needed to achieve the 2030 SDG agenda, which is likely to have a major impact on society and economic growth. Digitization can cover all areas, including underdeveloped ones, in order to reduce inequality [1].
Another important aspect and part of the solution for sustainable development is financial inclusion. Financial inclusion is an important aspect of the green economy and is closely related to the achievement of the Sustainable Development Goals set by the UN.
Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs, transactions, payments, savings, credit and insurance, delivered in a responsible and sustainable way [2].
Furthermore, financial inclusion plays a vital role as a catalyst for the achievement of other goals outlined in the United Nations 2030 Agenda. By promoting inclusive financial systems, we can foster better economic growth. Financial inclusion not only strengthens the stability of financial institutions and economies, but also stimulates the mobilization of domestic resources through national savings, which contributes to increasing government revenues.
In the context of green economy and sustainable development, financial inclusion plays a key role in several ways: access to finance for green initiatives, inclusive entrepreneurship and innovation (financial inclusion enables all entrepreneurs, especially those from disadvantaged backgrounds, to access the necessary capital and resources to start and develop of their green business), poverty reduction and social inclusion, climate adaptation and climate change risk reduction, consumption sustainability and consumer protection (in this way individuals can make rational decisions about their consumption, savings and investments, taking into account environmental and social effects of their choices).

The Sustainable Development Goals Report 2023: Special Edition provides a powerful call to action. Highlighting existing gaps and calling on the world to redouble its efforts, the report also highlights the enormous potential for success through strong political will and the use of available technologies, resources and knowledge. According to the aforementioned report, the impacts of the climate crisis, the war in Ukraine, the weak global economy and the long-term effects of the COVID-19 pandemic have revealed weaknesses that represent obstacles to progress towards the SDGs [3].
A fundamental shift in commitment, solidarity, funding and action is needed - to set the world on the right path. Some gender equality goals have had positive results. Access to electricity in the poorest countries was increasing, and the share of renewable sources in energy participation was increasing. Globally, unemployment has returned to levels not seen since before the 2008 financial crisis. The proportion of waters under national jurisdiction that fall under marine protected areas has more than doubled in five years. But the Sustainable Development Goals 2023 report shows that it is now clear that too much of that progress has been fragile and that much of it has been too slow. The Sustainable Development Goals are in deep trouble. An assessment of about 140 targets for which trend data is available shows that about half of these targets are moderately or severely off track; and over 30 percent either saw no movement or regressed below their 2015 baseline [4].

Graph 2 World trend of achieving SDG from 2010 until 2021



Source: [1]

Sustainable development is an umbrella term that encompasses principles and practices that aim to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. It recognizes the interconnectedness of ecological, social and economic aspects of development. Energy efficiency, green economy and renewable energy sources are key aspects of sustainable development and have become increasingly necessary in the modern world. This will be the subject of research in this paper.

Energy efficiency focuses on optimizing the use of energy resources to reduce waste and maximize production. This includes adopting technologies, practices and policies that reduce energy consumption while maintaining or improving productivity. Energy efficiency is a bedrock of sustainable development because it helps conserve limited energy resources, reduces greenhouse gas emissions, mitigates climate change, and improves energy security. By improving energy efficiency in sectors such as buildings, industry, transport and agriculture, sustainable development goals can be achieved while minimizing environmental impact.

A green economy promotes economic growth and development through sustainable and environmentally friendly practices. It emphasizes the transition towards low-carbon, resource-efficient and socially inclusive economic systems. The green economy focuses on sectors such as renewable energy sources, clean technologies, sustainable agriculture, waste management and eco-tourism. Integrating the sustainability of economic activities aims to create new jobs, increase resource efficiency, preserve the environment and promote social well-being. The green economy aligns with sustainable development by adopting the idea that economic progress must occur within the limits of the Earth's natural resources.

Renewable energy sources such as solar, wind, hydro, geothermal and biomass play a key role in sustainable development. Unlike fossil fuels, which are limited and contribute to climate change, renewable energy sources are abundant, widespread and have a significantly lower negative impact on the environment. The use of renewable energy sources helps to reduce greenhouse gas emissions, diversify energy supply, improve energy security and stimulate economic growth.

The combination of energy efficiency, green economy and renewable energy sources is vital for achieving sustainable development in the modern world. By promoting energy efficiency, we can optimize the use of resources and reduce waste. A green economy provides a framework for sustainable economic growth, ensuring that economic activity is aligned with environmental constraints and social well-being. Incorporating renewable energy sources into our energy systems allows us to move away from fossil fuels, reduce greenhouse gas emissions and mitigate the impacts of climate change.

SMART CITIES

Achieving the Millennium Development Goals, the post-2015 development agenda, and the United Nations' goal of energy access by 2030 require concerted efforts aimed at rural areas, where about 70 percent of the world's poor live[5].

Smart cities represent smart solutions for modern problems of urban areas such as mobility, safety, environmental protection, as well as human health, etc., improving the living standard of city residents, as well as the sustainability of the environment. Also, smart cities are an indispensable part of new technology in the form of the Internet of Things (IoT) and smart industry, all under the umbrella of the new industrial revolution, called the fourth industrial revolution, a turning point in the development of humanity, like the previous three industrial revolutions [7].

The initiative of the European Commission, EU Action for Smart Villages, defines smart villages: "Smart villages are rural areas and communities that build on their existing strengths and assets, as well as on the development of new opportunities", where "traditional, new networks, and services are improved using digital, telecommunication technology, innovation and better use of knowledge"[7].

The concept of a smart city is one of the most frequently mentioned and the one around which there is the greatest consensus among experts, as far as implementation is concerned, in the domain of the Internet of Things. There are different domains of the smart city, such as the monitoring and management of cars and traffic, the urban environment (street light, waste, pollution, etc.), or the end users themselves and their mobile devices.

In the case of the application examples of the Internet of Things in smart cities, it can be stated [8]:

- Traffic monitoring where road sensors can detect traffic jams, road air pollution or damaged pavements and dynamically suggest rerouting for end users who have GPS-like equipment and can receive similar informations.
- a street light that can be equipped with sensors to detect cars or people's movements, and which can then be dynamically turned on, if there is activity in the zone, or turned off otherwise. It can help save energy (and money) for the city, while ensuring safety by avoiding the creation of dark zones in certain parts of the city

- there may also be sensors to detect high levels of pollution in certain places, or early detection of high water levels or fire. In this case, early detection of an emergency situation can be used to warn people living in the area concerned (possibly asking them to close their houses or leave the place, etc.)
- there can be sensors for garbage cans, for public toilets or to detect neglected locations and then notify the appropriate service to take the right actions (clean the toilet, empty the bins, etc.). With such sensors, teams are informed to perform work only when necessary. It can help save money and optimize workflow
- for end users who have intelligent mobile devices, there may be sensors in stores or locations that can detect the presence of the end user and offer them a special offer, e.g. a discount if, for example, he is a loyal previous customer of a given store or suggest a price reduction, etc.
- city and urban planning can be based on actually collected sensor data about how people live in the city and use its resources; the evolution of the city is based on the actual use of its resources, measured by quantifying the mobility of residents and infrastructure needs. Sensors, therefore become a tool for data collection
- the supervision of infrastructure facilities answers the question of whether the roadways are correct, whether the bridge is safe. A sensor embedded in the infrastructure, i.e. in the infrastructure facility can warn of potential problems and automate maintenance
- support for autonomous or self-driving vehicles: this technology is integrated to some extent with some forms of public transport (for example, rail infrastructure), but the Internet of Things allows sensors to be placed on standard roads to assist with autonomous vehicles, for public transport, delivery, etc
- integration of services into the city itself using multiple data sources: data aggregation, data retrieval, processing and analysis of real-time conditions; for example, a database of stolen items (say bicycles in an urban environment) with a sensor and ownership information embedded in the bicycle combined along with the sensor infrastructure on the road can be used as a service to return the bicycle to its owner.

Hong Kong is among the most connected cities in the world, with 83% of homes having broadband Internet access, a 227% smartphone penetration rate and more than 39,750 Wi-Fi access points across the city, giving it what it takes for the significant application of Internet of Things technologies and the potential epithet of a smart city. The Hong Kong Science and Technology Parks Corporation ("HKSTP") is interested in driving the development of a local technological innovation ecosystem. As such, this Smart City/Internet of Things directory provides an overview of smart city technologies developed in the Science Park, which can be easily implemented in the city, home and/or industry to make Hong Kong a smart city.
An example of one such company, from Hong Kong, which deals with the development of innovations in the spheres of environment, energy, smart cities, homes, industry and the Internet of Things is CityTone Technology Limited.
CityTone Technology Limited is one of the leading IT technology companies in Hong Kong. Their main services include research and development, integration of innovative solutions and systems, and IT professional services. The focus of this company is cloud computing

technology, green technology and mobile solutions. CityTone Technology Limited uses big data analytics with cloud computing technology to collect and analyze energy data for clients, which can be commercial organizations, residential buildings or industry as such. Human resources, i.e. staff at CityTone Technology Limited have the expertise to assess the energy profile through remote energy monitoring systems and find solutions for clients to reduce their carbon footprint. They also feature barcode/RFID tag scanning technology that can be used with industrial PDAs or other handheld devices, or portable smart devices that can calculate production efficiency and other information necessary to present the performances of production and logistics industry. Their benchmark products include: Cloud Energy Management Platform (CEMP) as well as Cloud Production Information System (CPIS)[9].

SMART VILLAGES

Worldwide, 1.3 billion people remain without access to electricity, and 2.7 billion still cook on harmful and inefficient stoves. Many live in remote rural areas, and there can be no significant progress in developing and improving their lives until they have access to energy services. As Secretary-General of the United Nations, Ban Ki-moon stated: "Energy is the golden thread that connects economic growth, greater social equity and an environment that enables the planet to thrive."

Improving the lives of rural communities through the development of smart villages is an analogous concept to the much well-known concept of smart cities. The vision of smart villages is a modern approach to energy and can act as a catalyst for development, in education, health, food security, business productivity, for clean water and sanitation systems, environmental sustainability and participation in democracy, which in turn supports further improvements in access to energy.

It enables rural residents to live healthy and fulfilling lives, realize their development potential, earn a living and be connected to the world, take advantage of the many benefits of urban life while retaining the valued aspects of rural life, giving them a real choice between the route of migration to the city or life in a smart village.

Key drivers of these development advantages in smart villages are sustainable electricity supplies, and the availability of clean and efficient cooking appliances. Highly productive businesses, systems and facilities with higher energy requirements will tend to be located in local rural communities located in energy hubs, supplied from the national grid, if close enough, or for many more remote rural communities, from local mini-grids running renewable energy sources, possibly in hybrid form, with diesel generators in some cases. More dispersed communities around local rural communities located in energy hubs will typically use pico-power and stand-alone home systems to provide more basic levels of electricity supply, as long as the distribution network is not extended to them[5].

Knowledge about smart public lighting solutions, which is based on the principle of energy saving in a smart city, is starting to be applied in practice. 29% of local authorities are aware of the possibility of remote dimming and among them 25% practice it. This is the case, for example, in Saint-Omer (13,000 inhabitants, Nord-Pas-de-Calais region in France), in Tulle (14,666 inhabitants, Corrèze region in France) or in Castelnaudary (11,876 inhabitants, Midi-Pyrénées region in France) from 2014. In the second case, the city specified that it is a question of reducing public electricity bills, especially by modulating power or switching to LED, depending on the area. In Tulle, remote adjustable lighting works thanks to a connected device "box" to the city's optical network. The city is also developing a public Wi-Fi network.

The cost of the project (started in 2013) is estimated between 20 and 30,000 euros, and it is partially financed by the region under the "Very High Speed" program [10].
Risk management is not absent from thinking about the use of digital technology in rural communities. This is how the CC du Pays de Lourdes, automatic warning systems, developed as part of the prevention of the risk of earthquakes and floods with the support of the state and in cooperation with Meteo-France and researchers from the University of Pau. In 2011, for example a digital flood warning system has been deployed as part of the municipal flood protection plan. 30,000 euros have been provided in the community budget for the implementation of a digital solution. Information and alerts can be sent to residents by phone, online or directly to their mobile app. According to the CC du Pays de Lourdes, the system significantly facilitated the evacuation of 1,200 people during the June 2013 floods [10].
Obstacles and current limitations to the implementation of smart villages [10]:

1. Ignorance of digital solutions. The consequence of this lack of perception is the fact that digital strategy remains random and opportunistic.
2. Lack of visibility of cost/benefit ratios for solutions. Primarily due to budget fears.
3. Uncertainty regarding the interoperability of systems in heterogeneous environments. These are technological barriers with uncertainty, which are especially related to increasingly complex services, regarding the compatibility of developed or proposed technologies, risks of rapid obsolescence and possible interoperability problems. A particularly significant problem is the fragmentation of authority that prevents the public institution for inter-municipal cooperation or the municipality from having full control over the smart village service.
4. Resistance to change by farmers and "aversion to political risk" by municipal officials.
5. Data ownership is still questionable. There are potential risks of control of user data (personal or otherwise) by service operators or technology integrators.

INSTEAD OF CONCLUSION: THE NECESSITY OF TECHNOLOGICAL LEARNING

The conditions for future investments in renewable energy technologies in developing countries depend on a combination of factors, such as global and local technological learning processes. As the local technological learning has a significant impact on the costs of renewable energy sources, it is necessary to enable the development of conditions for its faster process [13]. Those conditions include a significantly larger number of trained workforce, a stable regulatory framework and the establishment of sustainable business models. Moreover, the participation of all stakeholders in the process, including users, suppliers, competitors, universities and regulators is crucial, because their mutual interaction is the key to the emergence of technological learning and innovation processes. Also, the acceleration of the application of renewable energy sources should be developed in parallel and in accordance with the improvement of network capacity, from the aspect of developing the capacity of technical and human capital. The term used to express the degree of experience with using technology is called technological learning rate. It is measured as the percentage by which the unit cost declines with each doubling of cumulative production, or alternatively, the fraction by which the unit cost of an energy service, such as electricity, declines with each doubling of capacity. This process is called progress ratio [14]. A progress ratio of 75 percent indicates that technology costs decline to 75 percent of the previous level after doubling the cumulative

capacity. Technological learning has some effect on cost projections, which vary non-linearly with the change in the rate of technological learning. The mentioned rate is of great importance in the application of new technology in practice, in terms of cost reduction so that both the acquisition and the implementation of new technology pay off. In this case, the technologies of renewable energy sources depend to a significant extent on the technological learning rate, because with its increase, the costs of technology equipment on the market are reduced, making it more available, more profitable, but also more acceptable as an alternative to energy sources that pollute the environment. As the progress in the development of energy technologies and their adoption intensifies, the reduction of costs is noticed earlier, and thus the total costs of the highly expansive energy sector grow at a slower rate. In this way, the given technologies of renewable energy sources are significantly available, but also more attractive for investing in the energy markets [15].

LITERATURE

[1] https://www.orfonline.org/research/ensuring-progress-on-sdgs-through-digital-transformation-and-financial-inclusion/
[2] https://www.worldbank.org/en/topic/financialinclusion#:~:tekt=Financial%20inclusion%20means%20that%20individuals,a%20responsible%20and%20sustainable%20vai.
[3] https://reliefweb.int/report/world/sustainable-development-goals-report-2023-special-edition
[4] The Sustainable Development Goals Report 2023 Special edition (2023). Towards a Rescue Plan for People and Planet. United Nations. https://unstats.un.org/sdgs/report/2023/The-Sustainable-Development-Goals- Report-2023.pdf
[5] Heap, R.B. (ed) (2015).Smart Villages: New Thinking for Off-Grid Communities Worldwide.Banson/Smart Villages Initiative, Cambridge.
[6] The World Bank, World Development Indicators 2013 (2013). Washington, DC, U.S.
[7] Lessons from Smart Cities for Smart Villages. VVSG, Presentation ENRD Working group on Smart villages. https://ec.europa.eu/enrd/sites/default/files/tg3_smart-villages_lessons-smart-cities_dumarey.pdf
[8] Mavromoustakis, C.X., Mastorakis G., Batalla, J.M. (Editors) (2016). Internet of Things (IoT) in 5G Mobile Technologies. Modeling and Optimization in Science and Technologies 8. Springer International Publishing, Switzerland.
[9] Hong Kong Science Park (HKSTP) (2017). Smart City, Internet of Things Directory.
[10] Guide: Smart city versus stupid village? (2016). Groupe Caisse des Depots, France.
[11] Shukla L.(2016). Energy and agriculture for smart villages in India. ICRISAT Patancheru. HyderabadVolume: Workshop Report 26, Page no.39.
[12] Smart Villages (2017). A Pocket guide to Rural Energy and Smart Villages. Smart Villages Initiative, Smart Villages. https://e4sv.org/wp-content/uploads/2017/06/PocketGuideweb.pdf?utm_source=Webinar+registrants&utm_campaign=d90906209d-EMAIL_CAMPAIGN_2017_06_12&utm_medium=email&utm_term=0_7ca6116540-d90906209d-502870005
[13] Huenteler, J., Niebuhr, C., Schmidt, T.S.(2016). The effect of local and global learning on the cost of renewable energy in developing countries. J. Clean. Prod., 128, pp. 6-21.

[14] Berglund, C., Söderholm, P.(2006).Modeling technical change in energy system analysis: analyzing the introduction of learning-by-doing in bottom-up energy models. Energy Policy, 34 (12), pp. 1344-1356.
[15] Handayani, K., Krozer, Y., Filatova, T. (2019). From fossil fuels to renewables: An analysis of long-term scenarios considering technological learning. Energy Policy, Volume 127, Pages 134-146.
[16] Pejanović, R. i saradnici (2020). Poljoprivreda i zelena ekonomija. Centar za razvoj agrara sa suizdavačima, Bijelo Polje, Podgorica (Crna Gora).
[17] Pejanović, R. (2013). Ogledi iz agrarne i ruralne ekonomije. Poljoprivredni fakultet, Novi Sad.