

**UNIVERSITY OF NIŠ
FACULTY OF ECONOMICS**



**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Editors:

Vladislav Marjanović

Dejan Đorđević

Niš, October 18th, 2024

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

- Proceedings of the International Scientific Conference -

Niš, 2024

Published by:

University of Niš, Faculty of Economics
Trg kralja Aleksandra Ujedinitelja 11
18000 Niš, Serbia
www.eknfak.ni.ac.rs

Publisher:

Vladislav Marjanović, PhD - Dean

Editors:

Vladislav Marjanović, PhD

Dejan Đorđević, PhD

Computer Support:

Ivana Ranđelović
Marina Stanojević

Printed by: Grafika Galeb d.o.o. Niš

Circulation: 100

ISBN: 978-86-6139-242-9

These proceedings were partly financed by Ministry of Science, Technological Development and Innovation of the Republic of Serbia

© 2024 University of Niš, Faculty of Economics

All rights reserved. No part of this publication may be reproduced or stored in the system to search or transmitting in any form - electronic, mechanical, photocopying, recording or otherwise, without written permission.

P R E F A C E

On October 18, 2024, the Faculty of Economics of the University of Niš organized its traditional conference for the 55th time, this time dedicated to the current topic of the circular economy. Entitled "CIRCULAR ECONOMY: TRENDS AND PERSPECTIVES", the conference brought together 150 participants from 9 countries, from the fields of economics, ecology and social sciences.

The conference participants were addressed by Prof. Dr. Vladislav Marjanović, Dean, and Prof. Dr. Dejan Đorđević, Vice-Dean for Science, who in their welcoming speeches emphasized the importance of this topic in the context of the global challenges we face, such as climate change and resource scarcity, and wished all participants successful work and constructive discussion.

The conference was opened by keynote speakers of European renown. Mr. Michael Dell from Austria spoke about innovation as the driving force of the circular economy and sustainability. He presented numerous examples of companies that have successfully implemented circular business models and highlighted the importance of cooperation between academia, industry and government. The second keynote speaker at the conference, Professor Eleftherios Thalassinos from Greece, analyzed the connection between corporate governance, corporate social responsibility and financial and non-financial reporting using the example of a European country. He emphasized the importance of transparency and the company's responsibility towards society and the environment.

After the introductory presentations, a panel was held on smart and sustainable cities, which are key to the transition to a circular economy. The panel was moderated by Professor Emeritus Dr. Pavle Petrović, and the panelists were eminent experts from the country and abroad. The panel participants agreed that it is necessary to invest in infrastructure development, promote renewable energy sources and encourage citizens to behave responsibly. They also particularly emphasized the importance of regional cooperation in the field of environmental protection.

The conference continued with four parallel sessions, dedicated to different aspects of the circular economy. Participants discussed new concepts of development based on sustainability, the challenges faced by small and medium-sized enterprises in the transition to circular business models, as well as the role of finance and artificial intelligence in the modern economy. Special attention was paid to educating young people in circular entrepreneurship and developing new business models that are in line with the principles of the circular economy.

The conference participants agreed that the circular economy is the inevitable future and that urgent measures must be taken to reduce the negative

impact on the environment. They also emphasized the importance of international cooperation, knowledge exchange and best practices in this area. The conference was an excellent opportunity to exchange knowledge and ideas, and lectures by eminent experts from various fields provided a comprehensive insight into the latest trends and challenges in the circular economy. The 43 papers presented at the conference were fruitful and inspiring, opening new perspectives for research and application of circular principles in practice. As a result of this successful event, a collection of papers was printed (some of them selected for publication in the Faculty's journal "Economic Themes" and University's journal "Facta Universitatis"), which will serve as a valuable source of information for all those involved in this topic.

Editors

Vladislav Marjanović, PhD, Dean
Dejan Ž. Đorđević, PhD, Vice-Dean for Science

TABLE OF CONTENTS

SESSION 1

1. Dragan Petrović, Zoran Stefanović THE CONCEPT OF CIRCULAR ECONOMY IN THE REPUBLIC OF SERBIA - INSTITUTIONAL DIMENSION AND LIMITATIONS.....	3-16
2. Igor Mladenović, Svetlana Sokolov Mladenović EFEKTI PRIMENE CIRKULARNE EKONOMIJE NA PRIVREDNI RAST.....	17-26
3. Jelena Živković, Milan Kostić INFLUENCE OF CIRCULAR ECONOMY COMPETITIVENESS AND INNOVATION ON ECONOMIC GROWTH: CASE OF EU MEMBER STATES.....	27-36
4. Vesna Petrović THE CIRCULAR ECONOMY AND INTERNATIONAL TRADE - THE CONCEPT OF CIRCULAR TRADE.....	37-48
5. Nataša Golubović, Marija Džunić SIROMAŠTVO I SOCIJALNA ISKLJUČENOST U RURALNIM PODRUČJIMA – ISKUSTVO SRBIJE.....	49-59
6. Tabish Nawab, Snežana Radukić THE LEVEL OF SOCIAL SUSTAINABILITY MEASURED BY MULTIDIMENSIONAL POVERTY INDEX IN SERBIA, NORTH MACEDONIA, AND MONTENEGRO.....	61-72
7. Mladen Anđelković, Zoran Stefanović UTICAJ EKONOMSKIH SLOBODA NA NEJEDNAKOST U RASPODELI DOHOTKA – PANEL ANALIZA BIVŠIH SOCIJALISTIČKIH PRIVREDA.....	73 -84
8. Miloš Todorović, Ivan Marković, Milan Kalinović OBNOVLJIVI IZVORI ENERGIJE ZEMALJA ZAPADNOG BALKANA	85-94
9. Đorđe Kotarac ANALIZA UTICAJA EKONOMSKOG RASTA NA PRIRODNO OKRUŽENJE KROZ OBRAČUN PRELOMNIH TAČAKA KUZNETSOVE KRIVE.....	95-104
10. Luka Marković, Irma Dedić, Marko Đogo UTICAJ CEFTA2006 SPORAZUMA NA IZVOZ BOSNE I HERCEGOVINE U ZEMLJE ČLANICE CEFTA2006.....	105-120
11. Hristo Medarov CHALLENGES AND OPPORTUNITIES TO INCREASE GDP VIA USING AI - A COMBINATION OF MICRO AND MACRO ECONOMIC PRACTICAL APPROACH IN LINE WITH THE ECONOMIC REALITIES OF THE REPUBLIC OF SERBIA AND THE REPUBLIC OF BULGARIA.....	121-129

12. Gorica Bošković, Ivana Kostadinović, Aleksandar Manasijević VEŠTAČKA INTELIGENCIJA I PAMETNI GRADOVI: KARAKTERISTIKE I PERSPEKTIVE RAZVOJA.....	131-138
13. Tatjana Stevanović, Marija Petrović-Randelović PRIMENA KONCEPTA ODRŽIVOG RAZVOJA U PROIZVODNJI KOZMETIČKIH PROIZVODA	139-152
14. Simona Muratori, Jelena J. Stanković, Marina Stanojević, Žarko Popović CIRCULAR WATER MANAGEMENT IN URBAN ENVIRONMENTS: CO-CREATING STRATEGIES AND ACTION PLANS WITH STAKEHOLDERS	153-159
15. Sunčica Stanković, Ivana Kostadinović, Dejan Đorđević PREDVIĐANJE KRETANJA INDEKSA CIRKULARNE EKONOMIJE U REGIONU EVROPSKE UNIJE PRIMENOM ARIMA MODELA.....	161-169
16. Vinko Lepojević, Vesna Janković-Milić ULAGANJE U OBRAZOVANJE I EKONOMSKI RAST: ANALIZA PANEL PODATAKA...	171-176

SESSION 2

17. Suzana Stefanović, Maja Ivanović-Đukić, Miljana Talić, Anđela Milenković THE TRANSITION TOWARDS SUSTAINABILITY THROUGH CIRCULAR BUSINESS MODELS	179-186
18. Nemanja Berber, Goran Vasić, Milica Vračarić CHALLENGES AND OPPORTUNITIES FOR CIRCULAR ECONOMY: EVIDENCE FROM DECIDE PROJECT IN SERBIA	187-196
19. Aleksandar Đolić, Biljana Đorđević, Sandra Milanović Zbiljić CIRCULAR ECONOMY AS A CHANCE FOR THE DEVELOPMENT OF GREEN JOBS	197-206
20. Danijela Stošić Panić, Aleksandra Anđelković MOTIVES OF WOMEN TO START ENTREPRENEURIAL ACTIVITY IN MANUFACTURING	207-216
21. Ljilja Antić, Tatjana Stevanović, Bojana Novičević Čečević ANALIZA PERFORMANSI MALIH PREDUZEĆA U REPUBLICI SRBIJI.....	217-227
22. Ivana Vuković, Dejan Jovanović UTICAJ KORPORATIVNOG UPRAVLJANJA NA FINANSIJSKE PERFORMANSE KOMPA NIJA	229-238
23. Aleksandra Radojević, Milan Čupić, Stefan Vržina BANKRUPTCY PREDICTION IN THE TRANSITION ECONOMY: A CASE OF NON-FINANCIAL COMPANIES IN SERBIA.....	239-248

24. Nemanja Berber, Agneš Slavić, Dimitrije Gašić TELEWORKING AND ORGANIZATIONAL OUTCOMES: THE CRANET RESEARCH RESULTS IN SERBIA.....	249-258
25. Nenad Đokić, Nikola Milićević, Ines Đokić MEDIA EFFECTS EVALUATION AND MEDIA BUDGETING	259-264
26. Ivana Simić ALGORITHMIC AND HUMAN MANAGEMENT: A COMPLEMENTARY APPROACH.....	265-271
27. Ivana Marjanović, Sandra Milanović Zbiljić, Georgios Aretoulis, Georgios Tsaples STUDENTS' PERSONALITY TRAITS AND LEARNING PREFERENCES: CASE OF SIX UNIVERSITIES.....	273-282
28. Kristina Petrović, Ognjen Obradović PRIMENA VEŠTAČKE INTELIGENCIJE U MALIM I SREDNJIM PREDUZEĆIMA: MOGUĆNOSTI I OGRANIČENJA	283-290
29. Aleksandra Stoilković Ranđelović ODREĐIVANJE OPTIMALNOG NIVOJA TROŠKOVA KVALITETA.....	291-300

SESSION 3

30. Srđan Marinković, Jelena Radojičić, Ognjen Radović HOW SUSTAINABLE ARE TRENDS ON A LOCAL HOUSING MARKET?	303-312
31. Andrijana Đurđević, Srđan Furtula FINANSIJSKA INTEGRACIJA I LIBERALIZACIJA KAPITALNOG RAČUNA: ANALIZA EFEKATA NA EKONOMIJU REPUBLIKE SRBIJE.....	313-322
32. Branimir Kalaš, Vera Mirović, Jelena Andrašić INTERACTION BETWEEN TAX REVENUES, TRADE OPENNESS AND ECONOMIC GROWTH IN SERBIA: ARDL MODEL.....	323-329
33. Jadranka Đurović Todorović, Marina Đorđević, Milica Ristić Cakić OPTIMIZING THE COORDINATION OF FISCAL AND MONETARY POLICY FOR SUSTAINABLE ECONOMIC GROWTH IN THE REPUBLIC OF SERBIA: AN EMPIRICAL STUDY	331-340
34. Marija Đurković, Jelena Radojičić IZAZOVI I PERSPEKTIVE FINANSIRANJA LOKALNIH SAMOUPRAVA PUTEM BANAKA.....	341-350
35. Filip Taskovski, Olivera Gjorgieva – Trajkovska THE ROLE OF CORPORATE FINANCIAL REPORTING IN THE FINANCIAL OPERATIONS OF BANKS IN THE REPUBLIC OF NORTH MACEDONIA.....	351-361

36. Jovana Milenović, Ljiljana Bonić IZVEŠTAVANJE O EKOLOŠKOJ ODRŽIVOSTI U KONTEKSTU AGENDE 2030	363-374
37. Aleksandra Arsenijević, Ljilja Antić, Sonja Jovanović ZELENO RAČUNOVODSTVO U FUNKCIJI NOVE AGRARNE POLITIKE EVROPSKE UNIJE.....	375-384
38. Tamara Milenković-Kerković, Ružica Petrović, Dragana Radenković Jocić PRAVNI ASPEKTI I STATUS FENOMENA VEŠTAČKE INTELIGENCIJE U PRAVU MEĐUNARODNE TRGOVINE	385-395
39. Ognjen Radović, Jelena Radojičić, Vesna Stanković VOLATILITY AND STABILITY OF STABLECOINS	397-406
40. Slavoljub Milovanović, Jovica Stanković THE POTENTIAL OF INFORMATION SYSTEMS IN IMPROVING AND REDESIGNING BUSINESS PROCESSES.....	407-416
41. Marija Petrović-Randelović, Jovanka Biljan, Miloš Cvetković ZNAČAJ VEŠTAČKE INTELIGENCIJE ZA ODRŽIVI RAZVOJ NAFTNE INDUSTRIJE.....	417-426
42. Zoran Tomić POTENTIAL FOR THE DEVELOPMENT OF THE SPACE INDUSTRY AND THE SPACE PROGRAM IN SERBIA	427-433

SESSION 1



Faculty of Economics, University of Niš, 18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**THE CONCEPT OF CIRCULAR ECONOMY IN THE REPUBLIC
OF SERBIA - INSTITUTIONAL DIMENSION AND LIMITATIONS**

Dragan Petrović, PhD*

Zoran Stefanović, PhD*

***Abstract:** In the last couple of decades, the concept of circular economy is gaining increased importance. We have witnessed that representatives of the professional public and civil society organizations are ready to point out that this is a concept that today holds the central place in the consideration of the long-term perspective of the survival and progress of humanity. As a rule, representatives of political life also agree with this point of view, so it is not surprising that many countries have expressed their willingness to harmonize their policies with the obligations in the area of circular economy arising from the provisions of numerous international documents and agreements. However, despite the proclaimed agreement on the importance of the circular economy, it still cannot be said that it is a generally accepted development and economic strategy. Accordingly, the subject of the paper are unresolved conceptual issues and dilemmas related to the full understanding of the concept of circular economy and the possibilities of its practical implementation. Starting from the fact that the Republic of Serbia, by adopting numerous normative documents, expressed a strong commitment to realizing the principles of circular economy, the paper discussed the problems and key challenges that our country faces in the implementation of this demanding work. In this regard, special attention is devoted to the consideration of possible recommendations and guidelines for the improvement of the system of integrating the principles of the circular economy into strategic planning documents and the creation of appropriate public policies on that basis.*

***Keywords:** circular economy, sustainable growth, natural resource management, waste*

* University of Niš, Faculty of Economics, Serbia; ORCID ID 0000-0001-9984-5916,

✉ dragan.petrovic@eknfak.ni.ac.rs

* University of Niš, Faculty of Economics, Serbia; ORCID ID 0000-0003-4034-7239,

✉ zoran.stefanovic@eknfak.ni.ac.rs

UDC 338.1:502.131.1(497.11)

Introduction

Environmental protection is one of the most important problems faced by public policy makers. The actualization of this issue is a consequence of the negative impact of the traditional way of organizing production on the environment. The competent state authorities in many countries of the world often did not respond in a timely and adequate manner to the process of intense environmental degradation and depletion of natural resources. In such circumstances, business entities had no motive to pay attention to the effects of their business activities on the living environment, so they based their activities on the simple acquisition of the necessary resources in order to carry out the production process, and then proceeded to unorganized and reckless disposal of used raw materials. This resulted in negative consequences for the quality of the environment, the health of the population, the depletion of resources, climate change, the rise in energy prices, etc. Over time, such unfavorable events have influenced the maturation of citizens' awareness of the necessity of changes in the field of organizing production processes that impair the quality of life. Increasingly frequent appeals and pressures on public policy makers encouraged the authorities to deal more with the issue of reducing the extraction of new resources from nature and the amount of waste generated at the end of the product's life. The development of a new economic concept known as the circular economy greatly contributed to the popularization and affirmation of determinations aimed at stopping the destruction of the ecosystem. In contrast to the traditional concept and its inherent process of continuous exploitation of new resources and disposal of used products without the possibility of their reuse, the circular economy insists on the extraction of new resources as little as possible and the use of a large number of materials obtained from products that have completed their production and life cycle.

Although numerous international organizations and the civil sector intensively affirm the concept of the circular economy, we cannot ignore the fact that there are many unresolved issues related to the practical realization of activities in this field - the role of the state and the non-governmental sector in that process, the possibilities of adapting economic actors and other social factors to the requirements arising from obligations based on this process. Hence, the subject of research in this paper is an economic analysis of the relevant theoretical and empirical aspects of the circular economy concept, along with the evaluation of different understandings about the complex consequences of actions aimed at achieving the goals of the circular economy. Consequently, the aim of the work is to point out the economic and social dimension of achieving progress in the process of realizing the circular economy concept through the analysis of positive experiences and the confrontation of key ideas and attitudes.

Given that the Republic of Serbia, through the adoption of certain regulations and normative documents, expressed its commitment to the transition to a circular economy, significant attention will be devoted to the analysis of the problems our country faces in that process, with special reference to the consideration of possible recommendations for a faster and more efficient transition to the circular economic model.

The Concept of Circular Economy

The idea of a circular economy dates back to the 60s of the last century when Boulding (1966) advocated that people must find their place in an ecological cyclical system capable of continuous reproduction of material goods. That is why he distinguishes

The Concept of Circular Economy in the Republic of Serbia - Institutional Dimension and Limitations*

between an "open" economy with unlimited input resources and outputs and a "closed" one in which resources and output products are connected and remain part of the economy as long as possible (Matić, 2019). The concept of circular economy was first mentioned in the book on environmental economics in 1989 by Pearce and Turner (Pearce and Turner 1989). The authors of that work point out that it is necessary to turn to a circular economy model, since the traditional economy does not have built-in recycling systems and as such serves more and more as a waste tank. The traditional way of production is based on the principle of "take - make - throw away", while the advantage of the circular economy is that it strives for the elimination of waste and the continuous use of resources. Thanks to the circulation of materials and products, the level of waste material that cannot be reused is reduced, natural resources such as minerals, mineral resources, energy and water are saved, and at the same time additional bio-energy is created. At the basis of this concept is a change in the way of thinking in favor of the regeneration of devastated natural resources and the longer retention of raw materials in use, which requires the application of appropriate mechanisms that allow products not to become waste that pollutes the environment at the end of their life (Maitre-Ekern, 2017; Radivojević, 2018; Shain et al., 2018).

The modern application of the circular economy implies the consideration of various policies related not only to waste management, but also those related to energy efficiency, energy conservation, water and soil management, the fight against climate change, ensuring sufficient amounts of food, reducing inequality, more transparent public finances, social citizen safety and the like. The concept of the circular economy understood in this way began to be introduced into the legislation of developed market economies during the 90s of the last century. Germany, Japan and China are the pioneers in passing regulations on the Circular Economy (Heshmati, 2015, p. 2-3), so that over time the number of countries that begin to implement measures to transform the economy in the direction of applying the principles of the circular economy increases. Today, Sweden, the Netherlands, the United Kingdom and Italy are considered to be the leaders in this field (Karman, Pavlovski, 2022, pp. 1-12), which allows other countries to be guided by their experiences to a significant extent when preparing studies on the progress brought by the Circular Economy.

Although the application of the principles of the circular economy has a large number of advocates, among representatives of the professional public the question of the real functioning of the "circular economy" causes numerous dilemmas and doubts. First of all, the question arises to what extent the circular economy will redefine the factors of economic growth and how this can be reflected in the performance of the economy. Bearing in mind that the concept of the circular economy favors activities that preserve value in terms of the production of those products that are suitable for reuse, redesign and recycling, the question that worries economic policy makers is how an economy will cope with the demands of a consumer society and the efforts of economic actors to deliver large quantities of products to the market. Attention is also drawn to the potential consequences of implementing radical changes in the market of production factors, given that the implementation of the circular economy concept minimizes the use of non-renewable resources and stimulates the use of renewable resources and energy sources. In this regard, the greatest attention is drawn to the potential trend in the labor market, considering that in the degree of adaptation of the economic structure to the requirements of the circular economy model, the loss of a significant number of jobs is expected, primarily in the sphere of single-use products - plastic bags, bottles and similar to that.

Its advocates try to explain the belief in the positive results of applying the principles of the circular economy from a long-term perspective, offering projections according to which the transition to the circular economy will undoubtedly have positive net effects in that period of time. Some of the research on the subject suggests that after the initial decline in economic activity due to the acceptance of the circular economy concept, the economy would eventually show signs of GDP recovery (Chen et al., 2020). One of the forecasts predicts that the gross domestic product in the European Union until 2030 will grow on an annual basis by almost 0.5% more compared to the status quo scenario (Impacts of circular economy policies on the labor market, Cambridge Econometrics, Trinomics, and ICF, May 2018). Bearing in mind the fact that the transition to a circular economy, in addition to changes in production processes and business models, also affects the labor market, it is a particularly sensitive issue for citizens regarding the expected changes in this field. In this regard, there are different predictions, so one credible projection predicts that thanks to the realization of the circular economy concept, employment in the world would grow at a rate of 0.1% annually until 2030, compared to the usual scenario (World Employment and Social Outlook 2018). At the same time, the anticipated growth of employment is related to different areas, so, for example, in the service sector, an increase of approximately 50 million jobs is expected at the world level, while the waste management sector would generate approximately 45 million new employees (World Employment and Social Outlook 2018). When it comes to EU countries (including Great Britain), estimates suggest that the transition to a circular economy would lead to an increase in employment of 0.3% by 2030, which means that the number of employees would increase by around 700,000. Somewhat more optimistic predictions suggest that the positive impact on employment growth could be up to about 2%, with the final effect not being the same for all EU countries (Laubinger, F., Lanzi, E., & Chateau, J., 2020).

Parallel to the mentioned research, there are studies whose conclusions are not completely categorical and with findings showing that the level of synergy between the circular economy and economic growth variables varies significantly between positive and negative (Kaivo-Oja, J., et al, 2022). Although the concept of sustainable growth is essentially related to the degree and intensity of implementation of circular economy principles (Ocolișanu, et al, 2022), this does not mean that it is advisable to ignore the high costs of switching to renewable energy sources. It is not uncommon for the planning documents that regulate the area to sometimes seem like a utopia, especially when considering the level of uncertainty that modern societies face. Frequent occurrences of natural disasters and other extraordinary circumstances such as wars, pandemics, energy crises, migrations and the like increasingly encourage the governments of many countries to reconsider official policies related to the circular economy development strategy.

Institutional Framework for the Development of the Circular Economy in the Republic of Serbia

By accepting modern standards in the field of circular economy, Serbia has the opportunity to step out of the phase of economic development it is in and move closer to modern countries and a more efficient economy with increased competitiveness, employment growth, easier access to the international market and an increase in GDP, along with environmental protection measures and a healthier and better quality of life for the population (Vasiljević, Petrović, 2020, 4). In achieving these goals, the most important role is on the state, which is expected to draft and implement appropriate rules, laws and

The Concept of Circular Economy in the Republic of Serbia - Institutional Dimension and Limitations*

other regulation. This work, however, is not at all easy to realize, considering that it is necessary to get acquainted with the current situation in that area, which requires serious work in the field in order to identify resources (human, financial, time, energy, raw materials, etc.) with which these goals can be achieved.

The institutional framework for realizing the circular economy concept in the Republic of Serbia is still in the development phase. The first document dealing with the circular economy is the National Strategy for the Sustainable Use of Natural Resources and Goods adopted in 2012 (<https://pravno-informacioni-sistem.rs>). The text of the strategy states that the sustainable use and management of natural resources (renewable and non-renewable) requires the application of three key principles: the use of renewable resources must not exceed the rate of their renewal/regeneration; the use of non-renewable resources must not exceed the rate at which these resources are replaced, the amount of substances released into the environment (pollution) must not exceed the capacity to transform polluting substances into harmless or less harmful to the living world. In addition, 25 specific principles were adopted, including those related to sustainable development, the principle of preservation of natural values, the principle of rehabilitation and remediation, etc.

In June 2019, the Strategy for Sustainable Urban Development of the Republic of Serbia until 2030 was adopted (<https://pravno-informacioni-sistem.rs>). The document lists 12 priority topics, four of which directly address areas that contribute to the circular economy: sustainable land use and nature-based solutions, circular economy, adaptation to climate change and energy transition.

The Industrial Policy Strategy of the Republic of Serbia for the period from 2021-2030 is also important for the development of the circular economy. It was adopted in March 2020 (<https://privreda.gov.rs-dokumenta-propisi-studije>). In that document, the problems of industrial production are identified, which are primarily reflected in the use of outdated technology, intensive energy consumption, the creation of a large amount of waste and inefficient use of energy. In accordance with that, the Action Plan for the implementation of the strategy was adopted in April 2021, which, among other things, defines the transformation of the industry from a linear to a circular model within the framework of the special objective number 5. The measures foreseen for reaching this goal in the future three-year period are: promotion of the circular economy and education of business entities; encouraging investments in circular and low-carbon economy solutions as growth generators; encouraging more efficient use of material resources and energy efficiency in industrial processes.

As part of the EU accession negotiations, the Republic of Serbia, through Chapter 27, has begun the process of establishing a waste management system and adapting it to the goals and acquis of the EU. As part of the implementation of those activities, based on the Law on the Planning System of the Republic of Serbia (Službeni glasnik RS/Official Gazette of RS", number 30/18) and the Waste Management Strategy for the period 2010-2019. (Službeni glasnik RS/Official Gazette of RS", number 29/10), in 2022, the Government adopted the Waste Management Program in the Republic of Serbia for the period 2022-2031. (Službeni glasnik/Official Gazette of RS, 12/2022). The program establishes strategic goals for the improvement of the waste management system and the basic principles that should guide all actors in waste management for the achievement of those goals in the Republic of Serbia for the period 2022-2031. years. The implementation of this program, in addition to reducing the harmful impact on the environment and climate change, should enable the achievement of

prerequisites for the use of waste in the circular economy, the development of goals and measures in this regard are determined in a separate program.

It should be recalled that the Republic of Serbia, in accordance with the goals of the European Green Agenda and its adaptation to different areas of Europe, signed the declaration on the Green Agenda for the Western Balkans in November 2020 in Sofia (<https://neighbourhood-enlargement.ec.europa.eu>). In that document, the countries of this region expressed their willingness to significantly contribute to the Green Agenda by supporting the efforts of the European Union in the fight against climate change, environmental protection and using the potential of the low-carbon and circular economy (<https://www.comision.europa.eu>).

In 2023, the Low Carbon Development Strategy of the Republic of Serbia was adopted for the period from 2023 to 2030 with projections up to 2050 (Službeni glasnik/Official Gazette of the RS, No. 46/2023), with the aim that our country, as a signatory to the Kyoto Protocol and of the Paris Agreement, actively participate in the fight against climate change, and in accordance with the principle of common, but divided responsibilities of member states of the United Nations Framework Convention on Climate Change.

The leading role in the implementation of circular economy principles belongs to the Ministry of Environmental Protection, which at the beginning of 2019 formed a Special Working Group for Circular Economy (Ministry of Environmental Protection, 2019, <https://www.ekologija.gov.rs>), as an interdepartmental working body, with the mandate to propose the best ways and support the introduction of the circular economy into the strategic and legislative framework of the Republic of Serbia. Thus, in May 2020, the Roadmap for the circular economy in Serbia was presented (<https://www.ekologija.gov.rs>), which aims to encourage production through the application of circular business models, to motivate the industry to create new jobs, and to improve business by finding innovative sustainable solutions for markets. The intention of this document is to encourage society to make systemic changes in thinking, culture and attitude towards resources, as well as to encourage decision-makers to make a political commitment to change public policies and dialogue in the context of the circular economy.

The special working group, apart from the Ministry of Environmental Protection, also includes the Ministry of Economy, Ministry of Agriculture, Forestry and Water Management, Ministry of Mining and Energy, Ministry of Education, Science and Technological Development, Ministry of Construction, Transport and Infrastructure, Ministry of European Integration, Agency for Life environment, Public Procurement Administration, Institute for Standardization, but also civil society organizations (Glušćević, Kaluđerović, 2019, p. 20).

Of particular importance among the aforementioned entities is the Ministry of Environmental Protection, which, in accordance with the results of the ex-ante analysis of the effects for the circular economy and the Law on the Planning System of the Republic of Serbia, initiated the development of the Circular Economy Development Program in the Republic of Serbia for the period 2022-2024. (<https://pravno-informacioni-sistem.rs>). The document covers the areas of importance for the circular economy: waste management; water management; renewable energy sources and energy efficiency; chemical management; economic policy; innovation and raising public awareness. These areas are discussed in the context of the current state and potential for the application of the circular economy. The program contains a three-year action plan in which general and specific goals are defined.

The Concept of Circular Economy in the Republic of Serbia - Institutional Dimension and Limitations*

An important role in the area of promoting the development of the circular economy is also played by the Ministry of Economy, which should deal with the strategic orientation of the economy in the direction of implementing sustainable development strategies. On the institutional level, the Chamber of Commerce of Serbia also plays an important role, which, through its Center for Circular Economy, promotes the principles of the new production model, encouraging companies in Serbia to start the transition towards a circular economy (Glušćević, Kaluderović, 2019, p. 20).

Among the subjects of importance for the development of the circular economy, we should not forget the National Alliance for Local Economic Development (NALED) (<https://naled.rs>), which, within its Alliance for Food and Agriculture, but also through certain project activities, deals with management issues of food waste. The Standing Conference of Cities and Municipalities (<https://www.skgo.org>) plays an important role in raising awareness of the need to develop a circular economy at the level of local self-government units. From this national association of all local self-government units, messages are coming more and more often that through their organs and bodies, above all the Committee for Environmental Protection and the Committee for Local Economic Development, they strive to intensify action in the area of circular economy. In this regard, local governments have the obligation to create and implement local waste management plans in accordance with the Law on Waste Management, so updating these plans represents an opportunity to expand them to other aspects of the circular economy. That is why it is necessary to encourage the adoption of local road maps for the circular economy, which, among other things, implies the implementation of the process of education of decision-makers, representatives of the economy, civil sector associations and the population at the local level (Janković, et al, 2021, p. 16).

Problems of the Republic of Serbia in the Implementation of the Circular Economy Concept

Although, according to the ambitious decisions and statements of the government representatives, it can be thought that the Republic of Serbia has ambitiously approached the implementation of the circular economy concept, the analysis of the current situation shows that our country has not made a significant step forward from the dominant linear production principle. Despite numerous normative acts, only a small number of regulations in the domain of waste prevention and environmental protection are observed (Šajin et al., 2018, p. 68). The country relies heavily on fossil fuels, especially for electricity generation, where more than 80% comes from coal, imported oil and gas. The energy strategy foresees more than 1 GW of new coal-fired power plants by 2030. This extremely high dependence on coal (lignite) for the production of electricity causes serious negative effects on agriculture, the health system and the economy in Serbia. Thermal power plants produce more than 5.5 million tons of ash per year, which creates enormous air and water pollution and soil degradation, such as acidification of agricultural and forest areas (Stančić, Živković, 2017, p. 7).

Although the amount of waste generated in Serbia, in terms of absolute amounts, does not reach alarming numbers, the disadvantage is that the rates of recycled or reused waste are negligible and barely amount to 4% of the total amount (Vasiljević, Petrović, 2020, p. 20). A special problem is represented by the quantities that are left in landfills, untreated landfills and illegal landfills without any technical prerequisites and appropriate

control, which gives us the right to state that strategic goals in the field of improving the waste management system have not been achieved.

The unsatisfactory situation in the area of transition to the circular economy is also reflected in the lower level of allocations for environmental protection compared to the average of the countries of Central and Eastern Europe. Thus, for example, in the period from 2006-2016, the Republic of Serbia allocated 0.7% of GDP for environmental protection (Eurostat and RSZ methodology), while the same indicator at the level of the countries of Central and Eastern Europe amounted to 2% (Roadmap for circular economy, 2020, p. 30). Such figures should not be surprising if it is known that in the sea of priorities, it is not easy for our country to face the high costs of switching to renewable energy sources. This is supported by the findings of several independent studies, which show that the transition to 100% renewable energy sources by 2050 will require huge investments. For example, the "Jedan stepenSrbija" organization estimates that the transition scenario for an economy with 100% renewable energy sources will cost citizens between 92 and 206 billion dollars. In that case, the annual level of investments in the period of 30 years (2020-2050) will be between 3.1 and 6.9 billion US \$ (Stančić, Živković, 2017, p. 8).

Although the problems of the circular economy have been increasingly discussed in the media in recent years, we can say that citizens and business representatives are still not sufficiently informed about the importance and economic advantages of the circular economy. Insufficiently developed awareness of the necessity of establishing a system that implies ecological sustainability is accompanied by insufficiently developed infrastructure and general ignorance of new business models and sources of financing in the context of encouraging the development of the circular economy.

The problem of the lack of developed public awareness of the economic and ecological effects of the principles of the circular economy is to a significant extent also of an objective nature, bearing in mind that the results of implementing activities on the development of the circular economy are not immediately visible and applicable for most companies and households. The unfavorable perception of citizens is also favored by the lack of implementation of appropriate campaigns aimed at the general public in order to present the long-term advantages of the circular economy for individuals and society. In this regard, the insufficiently developed capacities and appropriate infrastructure of local governments to provide support for the transition to circular economy business models are of particular concern. For example, the lack of recycling yards as a typical form of indispensable local infrastructure for the development of a circular economy often represents a key problem for the inclusion of a larger number of actors in this process.

The lack of a functional regulatory framework accompanied by an insufficiently reliable database of existing potential in all areas, weak intersectoral cooperation, hundreds of different strategies and many more laws and by-laws that are mutually inconsistent and even opposed, misunderstanding and insufficient capacities of the administration and of the economy make this area still obscured and difficult to apply in practice (Vasiljević, Petrović, 2020, p. 15). In such circumstances, economic actors have no motive and no obligation to include externalities in the analysis of costs and benefits. These are the reasons why products that cause more damage to the environment during their lifetime are usually cheaper on the market, and therefore more acceptable to the average customer. At the level of local administration, this type of barrier can be recognized in public procurement procedures in which the lowest offered price is taken as the basic criterion for deciding on the goods or

The Concept of Circular Economy in the Republic of Serbia - Institutional Dimension and Limitations *

services to be procured (Glušćević, Kaluđerović, 2019, p. 15), which is often explained by the insufficient payment power of end users. This development of events often favors the behavior of entrepreneurs who, due to the pursuit of rent and the acquisition of undeserved benefits in the market, often give preference to the acquisition of dirty technology, instead of the compatibility of technological solutions with the requirements of implementing a circular business model being their primary decision-making factor in this activity.

The insufficient agility of state authorities in creating public policies and encouraging the economy towards new investments in the area of the circular economy is particularly worrying. As a rule, there is a lack of professional staff for such activities, which, along with the lack of competent representatives of industry and economy, creates a problem in the development of the necessary indicators for measuring and monitoring the achievement of circular economy goals and the creation of desired business models. An additional problem is that the expected directions and dynamics of the introduction of circular economy principles have not been clearly seen and defined, which is why there is no continuous adjustment of the standard education system. There is still no progress in defining the necessary knowledge and skills from various fields necessary for the implementation of the entire process of transition to a circular economy. As the circular economy leads to significant changes in the labor market, the absence of a vision on how the workforce retraining system will be organized in order to meet the challenges related to the management of business and technical processes during the introduction of the circular economy concept is of particular concern. An even bigger problem is the underutilization of the research potential of the scientific community in this matter, which, along with the traditionally present disinterest of employers in the broader inclusion of employees in appropriate training in the domain of the circular economy, significantly complicates the transition to a new business model. Finally, the state has not developed an effective system of implementing measures in the field of environmental inspection and appropriate penalties for non-compliance with environmental protection standards and the like.

Recommendations for Improving the Circular Economy System in Serbia

We cannot approach the process of transition to the Circular Economy in the Republic of Serbia according to a universally provided model and procedure, but rather through a path that is specific and unique for each country individually. The transition to the circular economy is a multi-year systemic methodological approach to sustainable development, conservation of natural resources and reduction of environmental pollution that contributes to people's health (Kamberović, et al, 2020a, p. 27). In this context, the following should be considered:

- Given that the circular economy does not refer exclusively to one sector or only one area, but permeates all sectors of society, the application of the new concept should be approached from several different aspects - strategic, legislative, technical, economic, etc. In all of this, attention should be paid to the synchronization and proper sequence of appropriate moves and measures, which concretely means that it is necessary to mutually harmonize sectoral regulations, strategies, laws and by-laws, eliminate overlaps and contradictions, and supplement missing elements in order to enable a harmonized approach to the circular economy as a common framework for stimulating and growth of the economy (Vasiljević, Petrović, 2020, p. 77).

- Competent state authorities are expected to coordinate the public policies of the Republic of Serbia and develop indicators according to the EU model, which would enable qualitative and quantitative monitoring of the process of transition towards a circular economy model (Kamberović, et al, 2020a, p. 27). Although there is still no composite indicator of the success of the application of the circular economy, it is necessary to rely on the framework for monitoring the circular economy presented by the European Union in 2018, and accordingly introduce the following indicators: self-sufficiency in raw materials; green public procurement (as a financial indicator); waste food; share of recycled material in raw material needs; patents in the field of recycling and secondary raw materials as an indicator of the use of innovations (Vasiljević, Petrović, 2020, p. 27). At the same time, the very process of monitoring the mentioned indicators and monitoring and controlling the implementation of public policy implementation plans requires the establishment of an independent institution, so the best results in this respect would probably be the establishment of a special governmental agency for the circular economy or the addition of tasks from this area to one of the existing agencies (Agency for environmental protection) with extended powers (Vasiljević, Petrović, 2020, p. 76).

- Implementation of activities aimed at supporting the industry in the transformation to a circular business model, such as financial incentives, education, analysis of the situation in the domain of fiscal policy, as well as the creation of business plans and good practice guides that would serve as a positive example for companies (Mitrović, Jandrić, 2022, p. 9). The state is expected to form certain funds and programs in order to direct financial incentives to companies that have developed projects in the area of the circular economy. This practically means the reform of the subsidy system in terms of reducing and/or canceling support for environmentally harmful projects, and their redirection to programs aimed at transitioning to business based on circular economy principles (Kamberović, et al, 2020b, p. 100). In parallel with financial support, companies also expect help when it comes to preparing and submitting applications in accordance with the procedures defined by public calls. At the same time, it should be borne in mind that for more generous financing of projects in the area of the circular economy, only appropriate reliefs and subsidies from the state are not enough, but it is also necessary to include commercial banks in that process. This implies the construction of a lending system that recognizes the determination of the state to strengthen the circular economy and the formation of appropriate credit lines on that basis.

- Depending on the circumstances regarding the degree of development, urbanization and structure of the local economy, the competent authorities of the local self-governments can approach various measures and interventions in the field of creating conditions for the transition to a circular economy. First of all, it is desirable to establish economic support mechanisms for business entities that operate according to the principles of the circular economy, and to support the development of entrepreneurs, small and medium-sized enterprises that will work according to new business models - eg. work on the use of secondary raw materials, the introduction of energy efficiency and renewable energy sources, develop innovative solutions and the use of new materials, offer services instead of products, offer service and repairs, etc. (Janković et al., 2021, p. 42). In the case of limited local budgets for incentives to companies that switch to circular production, local governments can opt for some other support mechanisms. Thus, for example, it is possible to stimulate such defined economic actors by renting out land or business premises under favorable conditions, or by exempting them from some fees and administrative burdens.

The Concept of Circular Economy in the Republic of Serbia **- Institutional Dimension and Limitations***

- Competent state authorities and business entities interested in the introduction of circular business models are expected to hire professional and qualified personnel who, in accordance with the best available technologies, will be able to provide effective solutions that have long-term positive consequences for the environment and the preservation of natural resources. In parallel with the employment of educated personnel at the level of competent ministries and state bodies, it is necessary to approach the improvement of the system of professional training of employees who work on the creation of public policies in the field of environmental protection at the level of local self-government units. When employees have sufficiently mastered the methods and techniques of conducting an analysis of the improvement of the quality of the environment by applying the concept of the circular economy, then it is realistic to expect that they delegate appropriate tasks to public communal enterprises and organize information campaigns and education about the circular economy and the ways in which each individual can contribute to its development.

-Encourage the connection of actors, i.e. the creation of platforms of interested parties at the national and local level, because only through networking, cooperation and consideration of circular policies from the point of view of the economy, citizens and the public sector can we expect to make decisions that maximize efforts towards the introduction of a circular economy. (Glušćević, Kaluđerović, 2019, p. 15).

- Encourage the application of innovations and smart specialization in the development of the circular economy concept (Mitrović, Jandrić, 2022, p. 9). In order to achieve this goal, it is necessary to intensify cooperation between scientific and research organizations and economic entities in the field of innovation and production optimization. The effects of the inclusion of scientific and research organizations in the support system for increasing the innovative performance of the economy and encouraging sustainable development are best evidenced by the example of developed economies.

- Encourage the process of improving the waste management system and the realization of the so-called "green procurement". Progress in this domain assumes that an effective model of primary waste selection has been created, as well as that forms of industrial symbiosis have been established in order to optimize the use of resources and reduce the amount of waste. (Mitrović, Jandrić, 2022, p. 9).

- Encourage the establishment of stronger ties with international companies that are strongly committed to the implementation of the circular economy concept, which enables the introduction of the best available technologies, the improvement of knowledge and skills, and the facilitation of the transition to the common labor market through the employment of foreign experts and the education of domestic experts (Mitrović, et al, 2017, p. 39).

Conclusion

In recent years, there has been a growing awareness at the global level of the need to realize the concept of circular economy. The officials of many countries of the world are increasingly expressing a strong commitment to action aimed at implementing balanced changes in the field of economy, social inclusion and environmental protection. In this direction, among other things, numerous activities have been intensified in order to adopt relevant international agreements such as the Kyoto Agreement (1997), the Millennium Goals of the UN (2000), the Paris Agreement (2016), Agenda 2030, etc.

Visible progress regarding the acceptance of the circular economy concept is, unfortunately, not accompanied by a satisfactory dynamic of implementing its goals into appropriate public policies. In many countries, the process of adapting the necessary regulatory frameworks is taking place very slowly, which can be explained by the influence of a large number of factors. On the one hand, it is clear to most citizens that the world is facing numerous challenges such as the increasing degree of environmental pollution, growing waste, global warming, reduction of the ozone layer, natural disasters, etc. On the other hand, the growing awareness of the importance of preserving the environment is opposed by the real problems of ensuring energy stability in circumstances of dominant reliance on renewable energy sources, which is especially evident in extraordinary circumstances such as: wars, pandemics, migrations and the like.

The activities of the competent authorities of the Republic of Serbia in terms of creating assumptions for the realization of the circular economy concept were intensified during the first decades of the twenty-first century. Among the important actions and events in this regard, we can single out the adoption of the National Strategy for Sustainable Use of Natural Resources (2012), the Strategy for Sustainable Urban Development of the Republic of Serbia until 2030 (2019), the Strategy of the Industrial Policy of the Republic of Serbia for the period from 2021-2030(2020), the Waste Management Program in the Republic of Serbia for the period 2022-2031 (2022), the Low Carbon Development Strategy of the Republic of Serbia for the period from 2023 to 2030 with projections until 2050 (2023). etc.

Although certain processes, including the adoption of the necessary normative documents, have been initiated or implemented, it is worrying that a significant step forward from the dominant linear production model has not yet been made, and that the regulations governing the area of waste prevention and environmental protection are generally not respected. That is why competent state authorities are expected to intensify activities in the coming period to integrate circular economy goals into public policies, improve the legal framework for their achievement and establish institutional mechanisms for monitoring progress in that area. As the realization of the concept of circular economy requires radical changes in the way of thinking and behavior of people and a turnaround in the way of doing business of economic entities, it is necessary to initiate the broadest action of the state and the civil sector in order to educate the population about the benefits brought by the application of the principles of circular economy, but also to devise an appropriate system of financial support for companies that have developed projects in the area of the circular economy.

Acknowledgment:

This research is funded by the Ministry of Science, Technological Development and Innovation, Republic of Serbia, Grants: No. 451-03-65/2024-03.

References

- 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*. (pp. 3-14) Baltimore, John Hopkins University Press.
- Chen, Z., Chen, S., Liu, S., Nguen, L. & Hason, A. (2020). The effects of circular economy on economic growth: A quasi-natural experiment in China. *Journal of Cleaner Production*,271(1):122558.

The Concept of Circular Economy in the Republic of Serbia - Institutional Dimension and Limitations *

- European Green Deal. Retrieved from: <https://www.comision.europa.eu> Accessed on: 31.07.2024.
- Gluščević, M. & Kaluđerović, Lj. (2019). *Analiza kapaciteta jedinica lokalne samouprave u pogledu stvaranja uslova za prelazak na cirkularnu ekonomiju*, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.
- Guidelines for the Implementation of the Green Agenda for the Western Balkans, European Commission Retrieved from: <https://neighbourhood-enlargement.ec.europa.eu>. Accessed on: 31.07.2024.
- Heshmati, A. (2015). A Review of the Circular Economy and its Implementation, Discussion Paper No. 9611.
- Janković, E., Vukomanović, Ž., Premović, M., Cvejanov, K. & Jezdimirović, I. (2021). *Polazne osnove za tranziciju ka cirkularnoj ekonomiji*, Novi Sad: Beogradska otvorena škola i Mladi istraživači Srbije i Inženjeri zaštite životne sredine.
- Kaivo-Oja, J., Vehmas, J., & Luukkanen, J. (2022). Economic Growth and Circular Economy in the European Union: Novel Empirical Synergy Analyses Between Key Variables of Circular Economy and Gross Domestic Growth (GDP) and Gross National Income (GNI), 16th International Conference on Sustainable Development at the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) Bangkok.
- Kamberović, S, Košmir, L. G & Korpar, N. (2020a). *Mapa puta za cirkularnu ekonomiju u Srbiji*. Beograd: Ministarstvo zaštite životne sredine Republike Srbije. Sektor za strateško planiranje i projekte.
- Kamberović, S., Mitrović, S. & Bahrens, A. (2020b). GAP analiza mogućnosti za ekonomsko jačanje primenom održivih poslovnih modela nakon pandemije COVID-19 u Republici Srbiji, Beograd: OEBS.
- Karman, A. & Pavlovski, M. (2022). Circular economy competitiveness evaluation model based on the catastrophe progression method. *Journal of Environmental Management*, 303, 1-12.
- Maitre-Ekern, E. (2017). The Choice of Regulatory Instruments for a Circular Economy. In: Mathis, K. & Huber, R.B. (eds), *Environmental Law and Economics*. (pp. 305-334). Springer.
- Mapa puta za cirkularnu ekonomiju u Srbiji. Retrieved from: <https://www.ekologija.gov.rs>. Accessed on: 31.07.2024.
- Matić, J. (2019). *Priručnik za cirkularni dizajn proizvoda*, UNDP.
- Mitrović, S., Radosavljević, I. & Veselinović, M. (2017). *Cirkularna ekonomija kao šansa za razvoj Srbije*, Beograd: OEBS, Srbija.
- Mitrović, Đ. & Jandrić, M. (2022). *Tranzicija ka cirkularnoj ekonomiji i izazovi za tržište rada*, Friedrich-Ebert-Stiftung.
- Nacionalna alijansa za lokalni ekonomski razvoj –NALED – Retrieved from: <https://naled.rs>. Accessed on: 31.07.2024.
- Nacionalna strategija održivog korišćenja prirodnih resursa i dobara, Službeni glasnik RS, 33/2012; Retrieved from: <https://pravno-informacioni-sistem.rs> Accessed on: 31.07.2024.
- Ocolișanu, A., Dobrotă, B. & Agârbiceanu, M. (2022). The Implications of the Circular Economy on Sustainable Economic Growth, *Management of Sustainable Development Journal*, 14(1): 16-21.
- Paris Agreement. Retrieved from: https://ec.europa.eu/clima/policies/international/negotiations/paris_en, Accessed on: 31.07.2024.

- Pearce, D. W. & Turner, R. K. (1990) *Economics of natural resources and the environment*. New York, London: Harvester Wheatsheaf.
- Program razvoja cirkularne ekonomije u Republici Srbiji za period 2022–2024. godine. Retrieved from: <https://pravno-informacioni-sistem.rs>. Accessed on: 31.07.2024.
- Radivojević, A. (2018). Cirkularna ekonomija: implementacija i primena tehnologije u njenoj funkciji, *Ekonomске ideje i praksa*, 28: 33-46.
- Šajin, D., Petovar, T., Viduka, B., Atanacković-Jeličić, J., Maras, I., Stupar, R. & Vukotić, B. (2018). *Napredak ka cirkularnoj/održivoj ekonomiji u Vojvodini*, Novi Sad: Arhus centar.
- Stančić, Ž. & Živković, Ž. (2017) Tranzicija ekonomije na Balkanu. Promena javne politike a ne klime, Republika Srbija i opšti pogled na zelenu ekonomiju, Beograd.
- Strategija industrijske politike Republike Srbije od 2021. do 2030. godine. Retrieved from: <https://privreda.gov.rs>dokumenta>propisi>studije>. Accessed on: 31.07.2024.
- Strategija održivog urbanog razvoja Republike Srbije do 2030. godine, Službeni glasnik RS, 47/2019, Retrieved from: <https://pravno-informacioni-sistem.rs>. Accessed on: 31.07.2024.
- Vasiljević, D. & Petrović, D. (2020). *O sprovedenoj ex ante analizi efekata za oblast cirkularne ekonomije*, Beograd: Policy and Legal Advice Centre.
- World Employment and Social Outlook (2018). *Greening with jobs*. Geneva: International Labour Office.
- Zakon o planskom sistemu Republike Srbije, Službeni glasnik RS, broj 30/2018- Retrieved from: <https://pravno-informacioni-sistem.rs>. Accessed on: 31.07.2024.

KONCEPT CIRKULARNE EKONOMIJE U REPUBLICI SRBIJI – INSTITUCIONALNA DIMENZIJA I OGRANIČENJA

Rezime: Poslednjih par decenija koncept cirkularne ekonomije sve više dobija na značaju. Svedoci smo da predstavnici stručne javnosti i organizacija civilnog društva rado ističu da se radi o konceptu kome danas pripada centralno mesto u razmatranju drugoročne perspektive opstanka i napretka čovečanstva. S takvim gledištem po pravilu su saglasni i predstavnici političkog života, pa ne iznenađuje činjenica što su mnoge zemlje izrazile spremnost da svoje politike usklade sa obavezama koje u oblasti cirkularne ekonomije proističu iz odredbi brojnih međunarodnih dokumenata i sporazuma. Međutim, uprkos proklamovanoj saglasnosti o značaju cirkularne ekonomije, još uvek se ne može reći da je reč o opšteprihvaćenoj strategiji razvoja i privređivanja. U skladu s tim, predmet rada su nerešena konceptualna pitanja i dileme u vezi s punim razumevanjem koncepta cirkularne ekonomije i mogućnostima njegove praktične implementacije. Polazeći od toga da je Republika Srbija usvajanjem brojnih normativnih dokumenata iskazala snažnu posvećenost ostvarenju principa cirkularne ekonomije, u radu je bilo reći o problemima i ključnim izazovima sa kojima se u realizaciji tog zahtevnog posla suočava naša zemlja. U vezi s tim posebna pažnja je posvećena razmatranju mogućih preporuka i smernica za unapređenje sistema integrisanja principa cirkularne ekonomije u strateška planska dokumenta i kreiranja odgovarajućih javnih politika po tom osnovu.

Ključne reči: cirkularna ekonomija, održivi rast, upravljanje prirodnim resursima, otpad



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

EFEKTI PRIMENE CIRKULARNE EKONOMIJE NA PRIVREDNI RAST

Dr Igor Mladenović*

Dr Svetlana Sokolov Mladenović*

Rezime: Rad analizira uticaj cirkularne ekonomije na privredni rast, sa posebnim osvrtom na reciklažu pakovanja finalnih proizvoda u odabranim zemljama Evropske unije (Belgija, Holandija, Luksemburg, Rumunija, Malta, Mađarska) u periodu od 2002. do 2020. godine. Primenom statističke metode višestruke regresije utvrđeno je da veće učešće reciklaže ima pozitivan uticaj na realnu stopu rasta BDP-a, pri čemu je ovaj efekat izraženiji u zemljama sa višom stopom reciklaže. Rezultati istraživanja potvrđuju početnu hipotezu da primena cirkularne ekonomije doprinosi privrednom rastu.

Ključne reči: cirkularna ekonomija, privredni rast, reciklaža, Evropska unija, višestruka regresija.

1. Uvod

Cirkularna ekonomija predstavlja sveobuhvatan ekonomski model koji se sve više promovise kao rešenje za izazove održivog razvoja i zaštite životne sredine. Tradicionalni linearni ekonomski modeli, zasnovani na principima „uzmi, proizvedi, odbaci“, suočavaju se s brojnim izazovima u svetu sa ograničenim resursima i rastućim ekološkim pritiscima. Nasuprot tome, cirkularna ekonomija teži zatvaranju materijalnih tokova, ponovnom korišćenju resursa, smanjenju otpada i promovise održive poslovne modele. Istraživanje cirkularne ekonomije postaje sve aktuelnije u kontekstu globalnih izazova vezanih za klimatske promene, zagađenje i iscrpljivanje prirodnih resursa. Ključni elementi cirkularne ekonomije, poput reciklaže, ponovne upotrebe i proizvodnje, omogućavaju produžavanje životnog veka proizvoda i materijala, što doprinosi održivom privrednom rastu. Predmet istraživanja ovog rada je analiza efekata primene cirkularne ekonomije, konkretno reciklaže

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID 0000-0003-1711-3899,

✉ igor.mladenovic@eknfak.ni.ac.rs

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID 0000-0002-9367-4252

✉ svetlana.sokolov@eknfak.ni.ac.rs

UDK 330.35]:338.1:502.131.1

pakovanja finalnih proizvoda, na privredni rast u odabranim zemljama Evropske unije. Glavni cilj istraživanja je da se utvrdi da li postoji pozitivna korelacija između stope reciklaže i rasta bruto domaćeg proizvoda (BDP-a), te da se identifikuju ključni faktori koji doprinose uspešnoj implementaciji cirkularne ekonomije. Hipoteza koja se testira jeste da zemlje sa višim nivoom reciklaže ostvaruju višu stopu privrednog rasta u poređenju sa zemljama sa nižim stopama reciklaže. Ovo istraživanje pruža empirijske dokaze o značaju reciklaže kao komponente održivog ekonomskog modela. Korišćenjem statističke metode višestruke regresije rad pruža detaljan uvid u međuzavisnost između ekoloških praksi i ekonomskih performansi, sa posebnim osvrtom na zemlje Evropske unije koje prednjače u primeni cirkularne ekonomije.

2. Teorijske i konceptualne osnove cirkularne ekonomije

Ideja cirkularne ekonomije ima dva konceptualna toka, prvi koji se odnosi na protok materijala kroz ekonomiju, a drugi koji se odnosi na razmišljanje o ekonomskim uslovima koji bi mogli da donesu takav tok (Androniceanu et al., 2021). Ova dva konceptualna toka se vraćaju u rane dane modernog ekološkog pokreta šezdesetih i sedamdesetih godina prošlog veka i imaju naknadni simbiotski odnos sa njim.

Veliki broj istraživača oslanjao se na svoje dijagrame kako bi razjasnili značenje „cirkularne ekonomije“. Sve do 2017. godine Kirchherr i njegovi saradnici (2017) uspeali su da identifikuju 114 definicija cirkularne ekonomije. Jedna od značajnih definicija je ona koju je dala Fondacija Elen MekArtur: „Cirkularna ekonomija je industrijski sistem koji je restauratorski ili regenerativan po nameri i dizajnu. On zamenjuje koncept „kraja života“ restauracijom, pomera se ka korišćenju obnovljive energije, eliminiše upotrebu otrovnih hemikalija, koje narušavaju ponovnu upotrebu i ima za cilj eliminisanje otpada kroz superiorni dizajn materijala, proizvoda, sistema i, u okviru ovog, poslovnih modela“ (EMF, 2015).

Nakon pregleda 114 definicija, Kirchherr i njegovi saradnici (2017) sintetizuju ove definicije u sopstvene: „cirkularna ekonomija opisuje ekonomski sistem zasnovan na poslovnim modelima koji koncept „kraja života“ zamenjuju smanjenjem, alternativnom ponovnom upotrebom, reciklažom i oporavkom materijala u proizvodnji/distribuciji i procesima potrošnje (kompanijama, potrošačima), mikro nivou (ekoindustrijskim parkovima) i makro nivou (grad, region, nacija i šire), sa ciljem da se ostvari održivi razvoj, koji podrazumeva stvaranje kvaliteta životne sredine, ekonomskog prosperiteta i socijalnog kapitala, u korist sadašnjih i budućih generacija”.

Nadalje, EMF (2015) definicija koristi više organsku terminologiju („restorativnog i regenerativnog“) u skladu sa idejama ekologije i simbioze koje su bile u korenu koncepta u njegovim prvim danima i identifikuje neke od glavnih elemenata i ciljeva cirkularne ekonomije (obnovljiva energija, eliminacija otrovnih hemikalija i otpada, superiorni dizajn i poslovni modeli). Čak se i ne pominje reciklaža. Nasuprot tome, pomenuta definicija Kirchherr i njegovih saradnika identifikuje cirkularnu ekonomiju kao ekonomski sistem (i to ne samo industrijski sistem, kao u EMF-u), i pominje četiri od devet komponenti. Uvodi dve ključne komponente: ideju nivoa ili skale, i održivi razvoj kao cilj cirkularne ekonomije.

U pokušaju da integrišu neke od ovih različitih ideja, Blomsma & Brennan (2017) nazivaju cirkularnu ekonomiju “kišobran konceptom“ koji je u suštini ukorenjen u zabrinutostima oko resursa i upravljanja otpadom, sa strategijama cirkularne ekonomije,

Efekti primene cirkularne ekonomije na privredni rast

nazvanim strategije produžavanja života resursa „pretežno i sve više” težeći „produženju života resursa, na primer: ponovna upotreba, reciklaža, servitizacija, popravka, otpad-energija, pristup dugovečnosti proizvoda i kaskadnost supstanci (npr. transformacija materijala kroz različite faze upotrebe).” Opširnije, oni ističu: „Cirkularna ekonomija artikuliše sposobnost da produži produktivan vek resursa kao sredstvo za stvaranje vrednosti i smanjenje uništavanja vrednosti” (Blomsma & Brennan, 2017).

Sama cirkularna ekonomija može se opisati i kroz njene karakteristike. To je pristup koji je usvojio OECD (McCarthy et al., 2018) koji je identifikovao sledeće ključne karakteristike cirkularne ekonomije: povećanu popravku proizvoda i ponovnu proizvodnju, povećanu reciklažu materijala, robusnije dugovečne proizvode kroz dizajn, povećanje proizvodnje i popravku, povećanje produktivnosti materijala, poboljšanu iskorišćenost imovine i modifikovano ponašanje potrošača. Predviđeni efekti ovih funkcija navedeni su kao: smanjena potražnja za novom robom, zamena sekundarnih sirovina u proizvodnji, prošireni sekundarni sektor, izdržljiviji i popravljiviji proizvodi i proširena ekonomija deljenja i usluga.

Značajan pregled pitanja koja se odnose na ideju cirkularne ekonomije dali su autori Geisendorfa & Pietrulla (2018), koji procenjuju brojne koncepte vezane za cirkularnu ekonomiju, u odnosu na različite „kategorije i karakteristike” koje su eksplicitno identifikovane sa ovim konceptima.

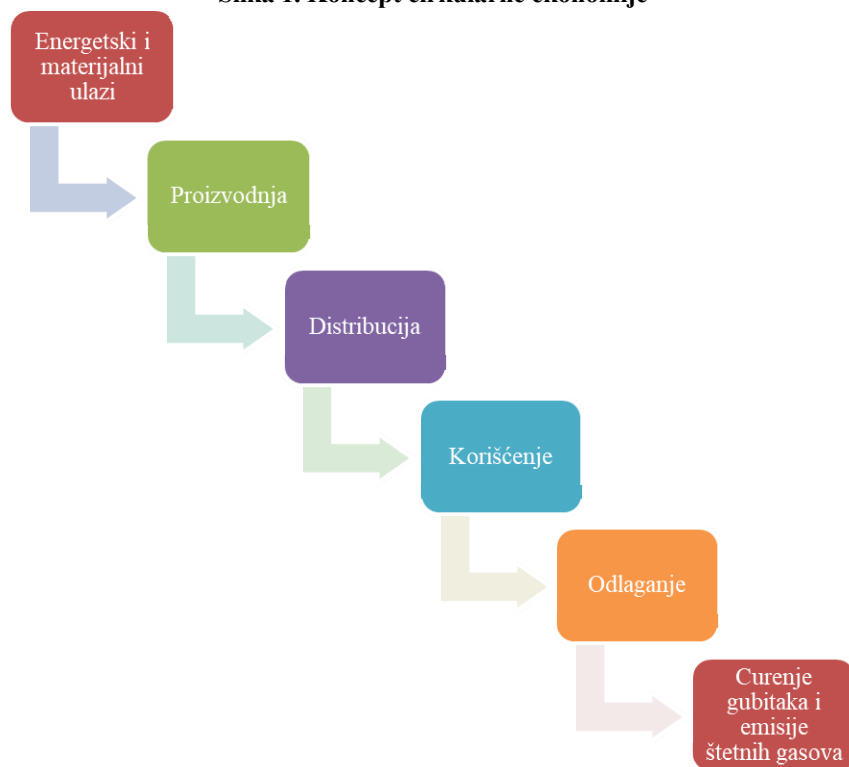
Na osnovu prethodnih definicija, može se uočiti da je svrha kretanja ka cirkularnoj ekonomiji usporavanje iscrpljivanja oskudnih prirodnih resursa, smanjenje ekološke štete od vađenja i prerade materijala i smanjenje zagađenja iz prerade, upotrebe i kraja života materijala. Glavno sredstvo za postizanje toga je povećanje efikasnosti i produktivnosti korišćenja resursa i smanjenje količine materijala koji se odlaže. To će zauzvrat zahtevati nove poslovne modele koji su deo celokupne systemske perspektive korišćenja resursa i uključiti zatvorene lance snabdevanja, regenerativni dizajn i obrnutu logistiku koja povećava životni vek proizvoda, čime se duže održava vrednost u njihovim materijalima i ukupna vrednost izvedena iz njih, tako da manji broj materijala završi kao otpad. Takvi poslovni modeli moraju da budu finansijski održivi, čije je dostignuće trenutno ograničeno mnogim barijerama. Uklanjanje tih sredstava zahtevaće fundamentalne promene u ekonomskom ambijentu u kojem posluju, promene koje će morati da se donesu kroz javne politike mnogih vrsta, kao i kroz promene u poslovnoj organizaciji.

3. Koncept cirkularne ekonomije u savremenim uslovima privređivanja

Cirkularna ekonomija je ekonomski mehanizam čiji je primarni cilj uklanjanje otpada i kontinuirano korišćenje resursa (Cullen, 2017).

Kako bi napravili strukturu zatvorene kružne petlje, ključni zadaci u cirkularnoj ekonomiji su ponovno korišćenje istog proizvoda, ponovna proizvodnja istog proizvoda, vraćanje u prvobitno stanje i recikliranje. Ključni ciljevi cirkularne ekonomije su smanjenje ulaznih resursa i gubitaka, kao i smanjenje zagađenja prirodnog okruženja i emisija ugljenika. Drugi ciljevi cirkularne ekonomije su očuvanje dobara, fabrika i infrastruktura u upotrebi za duži vremenski period. Različiti industrijski procesi treba da koriste kao ulaze otpadne materijale i naftni otpad. Kako bi generisali regenerativne resurse i uklonili energetske i materijalne gubitke, potrebno je primeniti regenerativni pristup. Cirkularna ekonomija ima pet ključnih mera koje se predstavljaju u zatvorenoj kružnoj petlji (slika 1 i 2).

Slika 1. Koncept cirkularne ekonomije



Izvor: Sauvé et al., 2016.

Slika 2. Sistem zatvorene kružne petlje cirkularne ekonomije



Izvor: Haas et al., 2015.

4. Primena cirkularne ekonomije i privredni rast u odabranim zemljama Evropske unije

Ovaj deo rada posvećen je analizi doprinosa konkretnog oblika cirkularne ekonomije, reciklaže pakovanja, realizovanim stopama privrednog rasta u odabranim zemljama EU. Koristeći relevantne podatke i adekvatne naučne metode, u ovom delu učinjen je pokušaj da se da odgovor na pitanje da li sa povećanjem procenta reciklaže pakovanja finalnih proizvoda dolazi do povećanja stope privrednog rasta.

Reciklaža pakovanja finalnih proizvoda jedan je od najadekvatnijih, ali ne i najčešće korišćenih pokazatelja primene cirkularne ekonomije. Relativno mali broj studija cirkularnu ekonomiju kvantifikuje posredstvom pomenutog pokazatelja, te je i analiza uticaja istog na privredni rast nedovoljno zastupljena u literaturi. Stoga je u ovom radu sadržano istraživanje uticaja reciklaže pakovanja finalnih proizvoda na privredni rast.

Kako su predmet analize razvijene tržišne privrede, tačnije zemlje EU, istraživanje sadržano u ovom delu ograničeno je na 3 zemlje članice Evropske unije, koje imaju najvišu stopu primene reciklaže pakovanja finalnih proizvoda. Prema zvaničnim podacima EUROSTATA, prosečna stopa reciklaže pakovanja u 2020. godini za EU-27 zemlje iznosila je 64%. U istraživanje su uključene tri zemlje Beneluksa, tačnije Belgija, Holandija i Luksemburg. Pomenute zemlje Beneluksa imale su stopu reciklaže pakovanja industrijskih proizvoda od preko 70%. Istraživanjem će biti obuhvaćen vremenski period od 2002. do 2020. godine, u skladu sa zvanično dostupnim podacima. Sa ciljem da se utvrdi da li rast učešća reciklaže pakovanja finalnih proizvoda ima pozitivno dejstvo na stopu privrednog rasta, koristiće se statistička metoda višestruke regresije. Shodno tome, kao zavisna varijabla u modelu javlja se realna stopa rasta BDP-a, dok je nezavisna varijabla učešće reciklaže pakovanja finalnih proizvoda. Pored zavisne i nezavisne, modelom će biti obuhvaćene i jedna kontrolna varijabla – bruto investicije u osnovna sredstva (kao % BDP-a). Svrha uključivanja kontrolni varijable u model jeste otklanjanje mogućnosti da se uticaj neke od izostavljenih varijabli na zavisnu varijablu pripiše nezavisnoj varijabli. Svi podaci su preuzeti od Eurostata.

„Bruto domaći proizvod predstavlja meru ekonomske aktivnosti, definisanu kao vrednost svih proizvedenih dobara i usluga umanjenu za vrednost one robe i usluga koje se koriste za njihovo stvaranje“ (EUROSTAT, 2024). Realna stopa rasta BDP-a (*Real GDP growth rate – volume*) utvrđuje se sa svrhom poređenja dinamike privrednog razvoja konkretne privrede tokom vremena, ali i poređenja privrednog razvoja različitih privreda. Realna stopa rasta BDP-a utvrđena je lančanim indeksom, kojim se BDP u tekućim cenama preračunava u cene iz prethodne godine, a zatim se utvrđuje promena u referentnoj u odnosu na prethodnu godinu. Na ovaj način se onemogućava da kretanje cena utiče na povećanje stope rasta.

Nezavisna varijabla u modelu, učešće reciklaže pakovanja finalnih proizvoda, predstavlja procenat reciklaže pakovanja finalnih proizvoda. Ovaj podatak je preuzet iz Eurostata. Kontrolna varijabla u modelu, bruto investicije u osnovna sredstva ili bruto investicije u fiksni kapital (*Gross fixed capital formation*), predstavlja investicije proizvođača rezidenata, umanjene za otuđena osnovna sredstva u određenom periodu. Ovim pokazateljem su prevashodno obuhvaćeni mašine i oprema, vozila i građevinski objekti. Bruto investicije u osnovna sredstva obuhvataju i dodatke vrednosti neproizvedenih sredstava ostvarenih od strane proizvođača i institucija. Podaci korišćeni u modelu za bruto investicije u osnovna sredstva izraženi su procentualno, kao učešće u BDP-u (EUROSTAT, 2024).

Za utvrđivanje uticaja stope reciklaže finalnih pakovanja industrijskih proizvoda na stopu rasta BDP-a koristi se statistička metoda višestruka regresija. Osnovna jednačina od koje se polazi u regresionom modelu je (Wooldridridge, 2013) je:

$$u_{it} = \beta_0 + \beta_k x_{k,it} + \varepsilon_{it},$$

pri čemu je:

i – broj zemalja koje su predmet analize (kako su istraživanjem obuhvaćene 3 zemlje, broj zemalja će biti obeležen kao $i = 1, 2$ i 3)

t – broj godina (vremenski period analize obuhvata 19 godina, što ćemo obeležiti kao $t = 1, 2, 3 \dots 19$),

u_{it} – zavisna varijabla,

β_0 – konstanta,

β_k – parametar koji ide uz nezavisnu i kontrolne varijable,

$x_{k,it}$ – nezavisne promenljive (uključujući i kontrolne),

ε_{it} – greška merenja.

Prethodno navedena jednačina može se modifikovati tako što će se greška merenja ε_{it} razložiti na dve komponente, efekat specifičnosti privreda koje su predmet analize λ_i i rezidual u_{it} . Sada regresiona jednačina ima sledeći oblik:

$$u_{it} = \beta_0 + \beta_k x_{k,it} + \lambda_i + u_{it}$$

Istraživanje sprovedeno u okviru rada realizovano je uz pomoć statističkog softvera STATA 12. Isti je korišćen kao metodološki instrument za utvrđivanje zavisnosti stope rasta BDP-a od promene stope reciklaže finalnih pakovanja industrijskih proizvoda u 3 selektovane zemlje Evropske unije u periodu 2002-2020. godine.

Model višestruke regresione analize, predstavljen u tabeli 1, dokazuje realizovani nivo značajnosti verovatnoće iz statistike t testa manji od 0,05 u slučaju nezavisne i kontrolne varijable. Preciznije, nezavisna varijabla, stopa reciklaže finalnih pakovanja industrijskih proizvoda, kontrolna varijabla bruto investicije u osnovna sredstva ostvaruju statističku značajnost za nivo greške 0,05. Ovakvi rezultati omogućavaju da se izvede zaključak o značajnom doprinosu nezavisne i kontrolne varijable predikciji zavisne promenljive. Dalje, u prilog valjanosti modela govori i nivo verovatnoće F statistike, koji iznosi 0,05. Najzad, u skladu sa inicijalnom pretpostavkom, korelacija između nezavisnih i kontrolnih varijabli, sa jedne strane, i reziduala, sa druge strane, negativna je i različita od nule. Na to ukazuje sledeća stavka iz prethodne tabele: $\text{corr}(u_i, Xb) = -0.3237$. Vrednost modelom dobijenog koeficijenta determinacije $R = 0,61$ omogućava da se izvede zaključak da prikazan ekonometrijski model može da bude primenjen na 61% observacija u selektovanim zemljama članicama Evropske unije u periodu 2002-2020. godine.

Efekti primene cirkularne ekonomije na privredni rast

Tabela 1. Rezultati višestruke regresije

R-sq		0,61			Broj observacija:	57	
					Broj grupa:	3	
Corr(u _i ,Xb)=		-0,3237			Prob>F =	0,05	
Realna stopa rasta BDP		Coef	Std.Err.	t	P>F	(95% Interval)	Conf.
Stopa reciklaže finalnih pakovanja industrijskih proizvoda		0,014	0,06	0,24	0,04	-0,13	0,10
Bruto investicije kao % BDP-a		0,37	0,19	0,19	0,05	-0,36	0,43
Konst.		0,17	0,30	0,30	0,02	-0,10	0,13

Izvor: Proračun autora

Nakon što je dokazana podobnost modela višestruke regresije, na osnovu podataka iz prethodne tabele, isti se može predstaviti putem sledeće jednačine:

$$(Realna\ stopa\ rasta\ BDPa)_{it} = 0,014(Stopa\ reciklaže\ finalnih\ pakovanja\ industrijskih\ proizvoda)_{it} + 0,37(Bruto\ investicije\ kao\ \% BDP - a)_{it} + 0,17 + \lambda_t + u_{it}$$

Prevedena na jezik ekonomije, a uz važenje klauzule *ceteris paribus*, ova jednačina omogućava da se izvede sledeći zaključak: povećanje stope reciklaže finalnih pakovanja industrijskih proizvoda za 1% u jednoj godini, dovodi do povećanja realne stope rasta BDP-a za 0,014 procentnih poena u toj istoj godini u nekoj od 3 zemalje članice Evropske unije.

Kompletno isti postupak istraživanja učinjen je i na primeru tri zemlje koje imaju najmanju stopu reciklaže pakovanja finalnih industrijskih proizvoda. To su Rumunija, Malta i Mađarska. Ove zemlje imaju stopu reciklaže ispod evropskog proseka za 20 procentnih poena. U njima se stopa reciklaže pakovanja kreće od 40% do 45%.

Rezultati višestruke regresije na primeru tri zemlje EU sa najmanjom stopom reciklaže (Rumunija, Malta i Mađarska) prikazani su u tabeli 2.

Nakon što je dokazana podobnost modela višestruke regresije, na osnovu podataka iz prethodne tabele isti se može predstaviti putem sledeće jednačine:

$$(Realna\ stopa\ rasta\ BDPa)_{it} = 0,001(Stopa\ reciklaže\ finalnih\ pakovanja\ industrijskih\ proizvoda)_{it} + 0,37(Bruto\ investicije\ kao\ \% BDP - a)_{it} - 0,09 + \lambda_t + u_{it}$$

Tabela 2. Rezultati višestruke regresije

R-sq	0,36			Broj observacija:	57	
				Broj grupa:	3	
				Prob>F =	0,29	
Realna stopa rasta BDP	Coef	Std.Err.	t	P>F	(95% Conf. Interval)	
Stopa reciklaže finalnih pakovanja industrijskih proizvoda	0,001	0,16	0,91	0,05	-0,22	0,52
Bruto investicije kao % BDP-a	0,37	0,33	1,11	0,03	-0,40	1,14
Konst.	-0,09	0,07	-1,35	0,02	-0,25	0,06

Izvor: Proračun autora

Prevedena na jezik ekonomije, a uz vađenje klauzule *ceteris paribus*, ova jednačina omogućava nam da se izvede sledeći zaključak: povećanje stope reciklaže finalnih pakovanja industrijskih proizvoda za 1% u jednoj godini, dovodi do povećanja realne stope rasta BDP-a za 0,001 procentnih poena u toj istoj godini u analizirane tri zelje.

Na ovaj način je dokazana polazna hipoteza da je primena cirkularne ekonomije, merena povećanjem stope reciklaže finalnih pakovanja industrijskih proizvoda, determinanta privrednog rasta, merenog realnom stopom rasta BDP-a. Doprinos privrednom rastu veći je kod zemalja koje imaju veću primenu same cirkularne ekonomije.

5. Zaključak

Rezultati ovog istraživanja potvrđuju početnu hipotezu da primena cirkularne ekonomije, merena povećanjem stope reciklaže pakovanja finalnih proizvoda, ima pozitivan uticaj na privredni rast. Analizom odabranih zemalja Evropske unije, pokazano je da veće učešće reciklaže značajno doprinosi rastu realnog BDP-a, posebno u zemljama koje su uspele da postignu visoke stope reciklaže. U zemljama poput Belgije, Holandije i Luksemburga, gde je stopa reciklaže pakovanja finalnih proizvoda iznad evropskog proseka, utvrđeno je da rast reciklaže za 1% može rezultira značajnim povećanjem stope rasta BDP-a. S druge strane, u zemljama sa nižim stopama reciklaže, poput Rumunije, Malte i Mađarske, ovaj efekat je manje izražen, ali i dalje prisutan. Zaključak istraživanja sugerise da je cirkularna ekonomija ne samo ekološki, već i ekonomski održiv model koji može doprineti dugoročnom privrednom rastu. Preporuke za dalju praksu i politiku uključuju potrebu za većim ulaganjima u infrastrukturu za reciklažu, edukaciju o održivim praksama, kao i unapređenje regulatornog okvira koji podržava cirkularne inicijative. Dalja istraživanja mogu se fokusirati na druge aspekte cirkularne ekonomije, kao što su ponovna upotreba i proizvodnja i njihovi efekti na različite ekonomske indikatore, što bi dodatno obogatilo razumevanje ovog važnog koncepta u savremenoj ekonomiji.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

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.
- Blomsma, F. & G. Brennan (2017). The emergence of circular economy: a new framing around prolonging resource productivity. *Journal of Industrial Ecology*, 21 (3), 603–614.
- Cullen, J. M. (2017). Circular Economy Theoretical Benchmark or Perpetual Motion Machine?. *Journal of Industrial Ecology*, 21(3), 483–486.
- EMF (2015), *Growth Within: a Circular Economy Vision for a Competitive Europe*. Ellen MacArthur Foundation, Cowes, Isle of Wight. Retrieved from: https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf. Accessed on 29 July 2024.
- EUROSTAT (2024). Retrieved from: <https://ec.europa.eu/eurostat/web/products-datasets/product?code=tec00115>. Accessed on 30 July 2024.
- Geisendorf, S. & Pietrulla, F. (2018). The circular economy and circular economic concepts – a literature analysis and redefinition. *Thunderbird International Business Review*, 60, 771–782.
- Haas, W., Krausmann, F., Wiedenhofer, D. & Heinz, M. (2015). How circular is the global economy?: An assessment of material flows, waste production, and recycling in the European union and the world in 2005. *Journal of Industrial Ecology*, 19, 765–777.
- Kirchherr, J., Reike, D. & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232.
- McCarthy, A., Dellink, R. & Bibas, R. (2018). The Macroeconomics of the Circular Economy Transition: A Critical Review of Modelling Approaches. *OECD Environment Working Papers*, No. 130, OECD Publishing, Paris.
- Sauvé, S., Bernard, S. & Sloan, R. (2016). Environmental sciences: sustainable development and circular economy: alternative concepts for trans-disciplinary research. *Environmental Development*, 17, 48–56.
- Wooldridge, J. (2013). *Introductory Econometrics: A Modern Approach*. Mason, Ohio: South-Western Cengage Learning.

THE EFFECTS OF THE CIRCULAR ECONOMY ON ECONOMIC GROWTH

Abstract: *The paper analyses the impact of the circular economy on economic growth, with a special focus on the recycling of packaging of final products in selected countries of the European Union (Belgium, the Netherlands, Luxembourg, Romania, Malta, Hungary) in the period from 2002 to 2020. Using the statistical method of multiple regression, it has been found that a higher share of recycling has a positive impact on the real GDP growth rate, with this effect being more pronounced in countries with higher recycling rates. The results of the research confirm the initial hypothesis that the application of the circular economy contributes to economic growth.*

Key words: *circular economy, economic growth, recycling, the European Union, multiple regression.*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**INFLUENCE OF CIRCULAR ECONOMY COMPETITIVENESS
AND INNOVATION ON ECONOMIC GROWTH: CASE OF EU
MEMBER STATES**

Jelena Živković*

Milan Kostić, PhD*

Abstract: Research aims to analyse relationship between circular economy competitiveness and innovation indicators and economic growth in EU member states. Analysis covered period from 2012 to 2021. Circular economy concept is new economic model which should minimize waste with long – term sustainable development and well – being. Circular economy competitiveness and innovation indicators are Private investment and gross added value related to CE sectors, Persons employed in CE sectors, and Patents related to recycling and secondary raw materials. Economic growth is measured by real GDP per capita. The correlation analysis and linear regression analysis is applied. The results of regression analysis showed that there is statistical significant impact of circular economy competitiveness and innovations on economic growth in EU member states.

Keywords: circular economy, competitiveness, innovation, economic growth, European Union

1. Introduction

An economic model known as a circular economy (CE) aims to minimize waste, retain long – term value, reduce the use of primary resources, and create closed loops for products, product parts, and materials while still protecting the environment and generating socioeconomic benefits. By severing the link between economic growth and the detrimental

* Research Assistant, Institute for Information Technologies Kragujevac, University of Kragujevac, Serbia; ORCID: 0000-0002-8670-4249, ✉ jelenazivkovic@uni.kg.ac.rs

• University of Kragujevac, Faculty of Economics, Serbia; ORCID: 0000-0003-2883-1474, ✉ mkostic@kg.ac.rs

UDC 330.35]:338.1:502.131.1(4-672EU)
330.341.1]:338.1:502.131.1(4-672EU)

effects of resource depletion and environmental deterioration, a CE has the ability to promote sustainable development. In the field of science, conceptual innovation with the goal of increasing material and energy consumption effectiveness and efficiency is not new. However, the regenerative idea, which calls for a complete transformation of the economic system, encompassing both production and consumption, is so novel that it is referred to as a paradigm shift for a beneficial reason. It is CE concept. Both at the macroeconomic and microeconomic levels, the CE has operational as well as strategic implications through the concept of 7Rs (redesign, reduce, reuse, repair, renovate, recycle, and recover). Even though recycling and reuse are crucial, a true CE cannot be centered solely on these activities. Instead, an integrated vision – one that starts with innovation and design and offers measurable, economically competitive, and sustainable solutions – is required one that also makes use of synergies across numerous industries. With the globe experiencing symptoms of resource depletion and rising volatility in the global economy, a new economic paradigm has become imperative.

The economic approach to competitiveness, which integrates economic outcomes with higher living standards and real income, includes the concept of competitiveness and innovation in CE. When an economy applies the CE principles in comparison to other economies during the development process, it can reach and maintain a competitive advantage as well as economic and social progress. This is known as CE competitiveness. One of the anticipated outcomes of such a change is still the increase in competitiveness as a result of the shift to CE. This can be great impact on countries' economic growth. The objective of this paper is to examine the impact of CE competitiveness and innovation on economic growth within European Union member states, given the prominent adoption of the CE concept in the European Union.

The paper is structured into several interconnected sections. Following the introduction, the foundational theoretical concepts of the CE will be presented. Subsequently, a description of the data and the applied econometric methods will be provided. Following the discussion of the results, conclusions will be drawn regarding the relationship between the principles of the CE and the economic growth of European Union member states.

2. Circular Economy – Theoretical approach

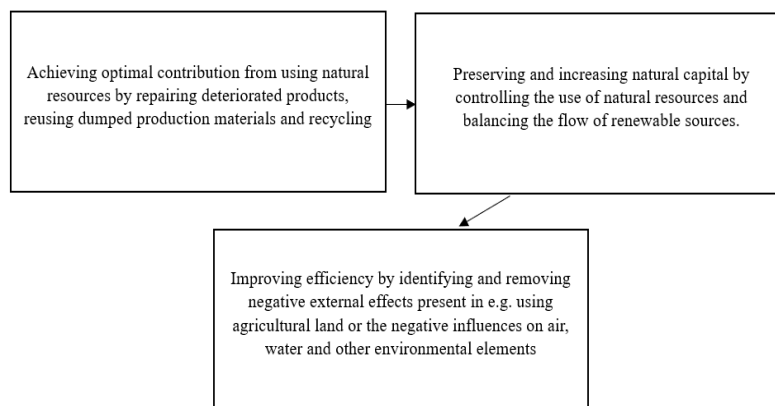
The CE model, unlike the current linear economy, is considered a sustainable economic system in which economic growth is organized through the reduction of usage and recirculation of natural resources (Korhonen et al., 2018). The more developed countries of the European Union have been increasingly moving away to this model of economy in recent years. The CE represents the concept of creating value through the rational use of resources and minimizing the negative impact of manufactured products on the environment at all stages of the product life cycle, which enable the reuse of used materials, as well as promoting the concept of mitigating the harmful impact of products produced by companies on the environment (Seroka – Stolka, & Ociepa – Kubicka, 2019).

The concept of the CE originated in the 1970s as a response to the need for reducing the use of inputs in industrial production. Major contributions have been made by Pearce and Turner (1989), who investigated how natural resources affect economic systems and how they affect both linear and open – ended viewpoints. This idea is influenced by

Influence of circular economy competitiveness and innovation on economic growth: case of EU member states

Boulding's (1966) study, "The Economics of the Coming Spaceship Earth," which accepts that the economy and environment should coexist in equilibrium and defines the earth as a closed, circular system with limited assimilative capacity. They contend that the old linear economy cannot be sustained without recycling components and that a CE must take its place. The circular approach diverges significantly from the conventional linear business model characterized by the sequence of take – make – use – dispose and an industrial system predominantly dependent on fossil fuels. In the CE, the business objective shifts from merely generating profits through the sale of products to generating profits through the continuous flow and reutilization of materials and products over time (Bocken et al., 2016). Initially, the focus was on minimizing the consumption of raw materials and mitigating waste generation within industrial processes. However, over time, the principles of the CE have been recognized as applicable beyond industrial contexts (Stahel, 2016). The CE paradigm has evolved to encompass a broader range of resources, including water, energy, and biological materials. This comprehensive approach promotes the sustainable management and regeneration of resources across various sectors. By extending the lifecycle of products, reusing materials, and recycling waste, the CE aims to create a more sustainable and resilient economic system. Consequently, the principles of CE can be effectively applied to any resource, driving innovation and efficiency in resource management while fostering economic growth and environmental sustainability. It is crucial to remember that the CE is founded on three fundamental principles. These principles are: achieving optimal contribution from using natural resources; preserving and increasing natural capital; and improving efficiency by identifying and removing negative external effects present (Figure 1).

Figure 1. Principles of CE



Source: Grdić, Z. S., Krstinic Nizic, M. & Rudan, N. (2020). Circular Economy Concept in the Context of Economic Development in EU Countries. *Sustainability, MDPI, 12*(7). p. 13.

Ghisellini et al. (2018) defines CE as a new model of economic development which promotes the maximum reuse (recycling) of materials, goods and components in order to decrease waste generation to the largest possible extent. It aims to innovate the entire chain of production, consumption, distribution and recovery of materials and energy according to

a cradle to cradle vision. Geissdoerfer et al., (2017) argue that CE is a regenerative system where energy leakage, emissions, and loss of resources are reduced by reducing speed, shutting and condensing the content as well as energy cycles. This might be attained by persistent creation, upkeep, and repair, recycling, repurposing, restoring and reusing. According to Webster (2017) the goal of a CE is “to create products, components, and materials with the highest service value over time”. The Ellen MacArthur Foundation (2015) emphasizes that CE distinguishes between technological and biological cycles and strives to maintain goods, components, and materials at their maximum utility and worth at all times. It is restorative and regenerative by design. CE is an economic system that substitutes material recovery, recycling, and reduction in manufacturing, distribution, and consumption processes for the notion of "end – of – life." Its operations are focused on achieving sustainable development, which will benefit present and future generations by fostering social equity, economic prosperity, and environmental quality at the micro, meso, and macro levels (products, companies, and consumers), as well as ecoindustrial parks. Innovative company strategies and conscientious customers make it possible.

Kirchherr et al. (2023) analyzed 221 definitions of the CE and concluded that it is essential that policymakers need a common definition of CE. It strengthens the capacity to integrate policy efforts across political jurisdictions (e.g., states, countries, and regions), industries, life – cycle stages, and other issue areas (e.g., extraction, processing, and end – of – life management). It does this by providing a common basis of assumptions and targets on which policymaking can be developed. In addition to helping businesses coordinate their CE adoption efforts with those of other suppliers and partners, a consensual understanding gives academics a foundation upon which to construct studies that engage in discursive interactions across disciplines, industries, and contexts. Since the scope of the CE transition is inherently large, it is critical that conflicting and divergent interpretations of the idea do not produce. Nobre and Tavares (2021) proposed following definition of CE: “CE is an economic system that targets zero waste and pollution throughout materials lifecycles, from environment extraction to industrial transformation, and to final consumers, applying to all involved ecosystems. Upon its lifetime end, materials return to either an industrial process or, in case of a treated organic residual, safely back to the environment as in a natural regenerating cycle. It operates creating value at the macro, meso and micro levels and exploits to the fullest the sustainability nested concept. Used energy sources are clean and renewable. Resources use and consumption are efficient. Government agencies and responsible consumers play an active role ensuring correct system long-term operation.”

As the CE is a current issue in the scientific sense, but also in a practical sense, it is necessary to provide appropriate strategies and regulations that will ensure the application of its principles. In this regard, the European Union put primacy to the CE and it's promotion. According to the CE Action Plan, which was unveiled in March 2022, the European Commission suggested the first set of steps to accelerate transition to a CE in accordance with the EU's 2050 climate neutrality goal under the Green Deal. Increasing the use of sustainable products, educating customers about the green shift, reviewing the building product legislation, and developing a plan for sustainable textiles are some of the recommendations. All actions, instruments, plans, and strategies should be systematically aligned to support sustainable development and the enhancement of economic growth. This alignment ensures that each initiative not only contributes to immediate economic objectives but also promotes long-term environmental sustainability and social well-being. By integrating these principles into policy-making and strategic planning, it can be created

Influence of circular economy competitiveness and innovation on economic growth: case of EU member states

a resilient economic framework that addresses current needs without compromising the ability of future generations to meet their own needs. Such a comprehensive approach is essential for fostering a balanced and inclusive economic growth trajectory.

2. Data and Methodology

The research analyses influence of the CE competitiveness and innovation on economic growth in 27 EU member states. Research covered period from 2012 to 2021. Data are retrieved from Eurostat database. All variables, that are included in analysis, are presented in Table 1.

Table 1. Description of variables

Variable	Description
priv_inv	Private investment and gross added value related to CE sectors
persons_ce	Persons employed in CE sectors
patents_ryc	Patents related to recycling and secondary raw materials
real_gdppc	Real gross domestic product per capita

Source: Authors

CE competitiveness and innovation have three indicators. These three indicators are model's explanatory variables. First variable is *Private investment and gross added value related to CE sectors* which covers three sectors: the recycling sector, repair and reuse sector and rental and leasing sector. *Private investment in CE sectors* is related to gross investment in tangible goods of mentioned three sectors. This investment is defined as investment during the reference year in all tangible goods. Included are new and existing tangible capital goods, whether bought from third parties or produced for own use, having a useful life of more than one year including non-produced tangible goods such as land. Investments in intangible and financial assets are excluded. *Gross added value related to CE sectors* is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. It can be calculated as the sum of turnover, capitalized production, other operating income increases minus decreases of stocks, and deducting the following items: purchases of goods and services, other taxes on products which are linked to turnover but not deductible, duties and taxes linked to production. Value adjustments (such as depreciation) are not subtracted. Second variable is *Persons employed in CE sectors* which measures number of employed in the following three sectors: the recycling sector, repair and reuse sector and rental and leasing sector. Jobs are expressed in number of persons employed and as a percentage of total employment. Number of persons employed is defined as the total number of persons who work in the observation unit, i.e. the firm as well as persons who work outside the unit who belong to it and are paid by it – e.g. sales representatives, delivery personnel, repair and maintenance teams. It excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises, as well as those on compulsory military service. Third indicator is *Patents related to recycling and secondary raw materials*. The attribution to recycling and secondary raw materials was done using the relevant codes in the Cooperative Patent Classification (CPC). The term 'patents' refers to patent families, which include all documents relevant to a distinct invention (e.g.

applications to multiple authorities), thus preventing multiple counting. Economic growth is dependent variable of the model and it is measured by *Real gross domestic product (GDP) per capita*. The correlation analysis and linear panel data regression analysis is applied.

In case of the research, regression model has the following form:

$$real\_gdppc_{it} = \alpha + \beta_1 priv\_inv_{it} + \beta_2 persons\_ce_{it} + \beta_3 patent\_ryc_{it} + \mu_{it} \quad (1)$$

where i is country as entity of observation ($i = 1, \dots, 27$), while t is time of research (from 2012 to 2021). Also, β_1 , β_2 and β_3 are coefficients associated with the independent variables of the model and μ_{it} is the random error term.

3. Results and Discussion

In this section it will be presented analysis results. In the Table 2 is presented descriptive statistics. In case of Private investment and gross added value related to CE sectors mean value for EU countries from 2012 to 2021 is 3,299.79. The maximum value has been reached in Germany in 2018. Minimum value is 33 and it is recorded in Cyprus in 2014. Germany had the most Persons employed in CE sectors in 2020, while the smallest number of workers in CE sectors was in Luxembourg in 2012. In observed period average number of persons employed in CE sectors is 137,247.50. When we talk about patents related to recycling and secondary raw materials average value is 11.97 (in table 2 11.96807). However, it is a great difference between countries with best and worst results. Specifically, there are several countries with no patents related to recycling and secondary raw materials, during the whole observed period. Some of them have no patents in the majority of the observed period. Bulgaria had no these patents in 2012, 2013, 2019 and 2020. Estonia has zero patents related to recycling and secondary raw materials only in three years during period from 2012 to 2020. Croatia has positive this indicator only in 2012 and 2016. Greece had no patents on the beginning the observed period. Cyprus has the worst score. This country has zero score almost within all period. It had score of 1 only in 2015. Other countries where the zero score is presented are: Latvia, Lithuania, Malta, Slovakia and Slovenia.

Zero score for patents related to recycling and secondary raw materials in only one year is in Hungary and Portugal. The best result for patents related to recycling and secondary raw materials has Germany with the high value. In this country is recorded maximum value of 103.78 patents. Concerning economic growth, the appropriate measure is real GDP per capita. Mean value of real GDP per capita is 25,827.98 euro. Maximum value of 84,750.00 euro is in Luxembourg in 2016. Minimum value of 5,390.00 euro was in Bulgaria in 2012.

Table 2. Descriptive statistics

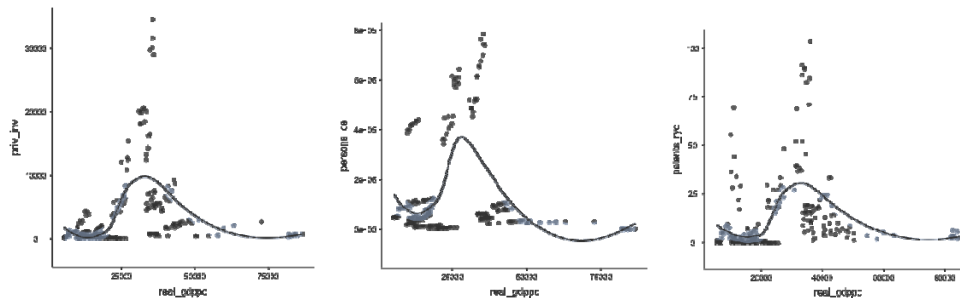
	priv inv	persons ce	patents ryc	real gdppc
Mean	3,299.79	137,247.50	11.96807	25,827.98
Median	741.00	51,855.00	3.86000	20,310.00
Maximum	34,489.00	764,770.00	103.78000	84,750.00
Minimum	33.00	1,722.00	0.00000	5,390.00
Std. Dev.	5,754.96	191,738.50	19.02613	16,844.57

Source: Authors' calculation

Influence of circular economy competitiveness and innovation on economic growth: case of EU member states

Given that the results of the regression analysis will be presented in the subsequent sections, it is essential to first provide a graphical representation of the data through scatter plots. These scatter plots serve as a preliminary step to visualize the relationship between the independent (explanatory) and dependent variables, allowing for a more intuitive understanding of the underlying patterns and correlations. By examining the scatter plots, insights can be gained into the distribution and trends within the dataset, which will facilitate a more comprehensive interpretation of the regression analysis results presented later.

Figure 2. Scatter plots



Source: Authors' calculation

Scatter plots show that there is connection between CE competitiveness and innovation indicators and real GDP per capita. The outliers that appear are the result of large differences between countries in economic growth, considering that 27 countries are included in the analysis. Due to the presence of outliers, a logarithmic transformation of the variables will be applied.

First, correlation analysis will be applied. Given that the Shapiro –Wilk test showed that the data were not normally distributed, Spearman's correlation coefficient will be applied. The results of the correlation analysis are shown in Table 3.

Table 3. Correlation matrix

	log_private_inv	log_persons_ce	log_patents_ryc	log_real_gdppc
log_private_inv	1.000			
log_persons_ce	0.765*** < 0.001	1.000		
log_patents_ryc	0.865*** < 0.001	0.692*** < 0.001	1.000	
log_real_gdppc	0.455*** < 0.001	-0.052 0.391	0.447*** < 0.001	1.000

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors' calculation

Spearman's correlation coefficient shows that there are positive statistically significant moderate correlation between Private investment and gross added value related

to CE sectors and real GDP per capita and Patents related to recycling and secondary raw materials and real GDP per capita. This indicates that variations in these variables move in the same direction. The positive statistically significant strong correlation is present between Private investment and gross added value related to CE sectors and Persons employed in CE sectors and Private investment and gross added value related to CE sectors and Patents related to recycling and secondary raw materials. Also, there is positive statistically significant correlation between Persons employed in CE sectors and Patents related to recycling and secondary raw materials. There is no statistically significant correlation between Persons employed in CE sectors and real GDP per capita in EU member states from 2012 to 2021.

Table 4. Regression analysis results

log_real_gdppc	Coef	Std. Err.	t	p-value
C	12.5078700	0.2639356	10.50	0.0000
log_priv_inv	0.4760534	0.0337509	-17.65	0.0000
log_persons_ce	-0.4760534	0.0269743	5.01	0.0000
log_patents_ryc	0.1633913	0.0326429	47.39	0.0000
F(3, 188)	136.8800			
Prob > F	0.0000			
R – squared	0.6860			
Adj R – squared	0.6809			

Source: Authors' calculation

Regression analysis results show that there is statistical significant positive influence of the Private investment and gross added value related to CE sectors on the real GDP per capita in EU member states from 2012 to 2021. When private investment and gross added value related to CE sectors increase for 1 million euro, the real GDP per capita increase for 0.48 euro per capita. On the other hand, there is negative statistically significant influence of the Persons employed in CE sectors on the economic growth in EU member states. When persons employed in CE sectors increase for 1 person, the real GDP per capita would decrease for 0.48 euro per capita. Regression analysis also showed that there is statistical significant positive impact of the Patents related to recycling and secondary raw materials on the economic growth in EU member states. When indicator Patents related to recycling and secondary raw materials increase for 1 patent real GDP per capita would increase for 0.16 euro per capita. This regression model is adequate because the R – squared is 0.6860 and adjusted R – squared is 0.6809. This means that 68.10 percentages of the variation in the dependent variable can be explained by the variation in the independent variables. In other words, 68 percentages of the variations in real GDP per capita can be attributed to variations in the specified indicators: Private investment and gross added value related to CE sectors, Persons employed in CE sectors, and Patents related to recycling and secondary raw materials. The adjusted R squared value, which accounts for the number of predictors, similarly indicates that a substantial portion of the variance is explained by the model.

4. Conclusion

The integration of CE principles into the economic strategies holds significant potential for enhancing competitiveness and driving innovation. By rethinking traditional linear models of production and consumption, the CE encourages the efficient use of

Influence of circular economy competitiveness and innovation on economic growth: case of EU member states

resources, fostering the development of innovative technologies and practices that can lead to sustainable economic growth. The evidence suggests that economies that actively pursue circularity not only mitigate environmental impact but also create new economic opportunities, improve resource efficiency, and enhance their competitive position in global markets. Therefore, the CE is not just a pathway to sustainability, but also a catalyst for economic resilience and long-term prosperity. This is particularly important for the EU because it is the one that advocates the application of circular economy principles and is directed towards strategies and tools that will contribute to the improvement of competitiveness and innovation.

Based on the presented results, it can be concluded that there is a statistically significant impact of the CE competitiveness and innovation on the economic growth of the EU member states from 2012 to 2021. There are positive impacts of the Private investment and gross added value related to CE sectors and the Patents related to recycling and secondary raw materials on the real GDP per capita. On the other hand, there is negative impact of the Persons employed in CE sectors on the real GDP per capita. This result underscores the imperative for EU countries to intensify efforts in enhancing the competitiveness and innovation within the circular economy to stimulate more robust economic growth. As the global landscape increasingly shifts towards sustainability, it becomes crucial for EU member states to leverage the principles of the circular economy as a strategic advantage. By fostering a competitive environment that encourages innovation in resource efficiency, waste reduction, and the development of circular business models, countries can not only secure their economic futures but also contribute to a more sustainable global economy. The need for policy initiatives, investment in research and development, and collaboration across industries is evident to ensure that the circular economy becomes a driving force behind economic expansion in the European Union.

Acknowledgment:

This research is funded by the Ministry of Science, Technological Development and Innovation, Republic of Serbia, Grants: No. 451-03-66/2024-03/200378.

References

- Bocken, N. M. P., de Pauw, I., Bakker, C. & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308–320.
<https://doi.org/10.1080/21681015.2016.1172124>
- Boulding, K.E. (1966). The economics of the coming spaceship earth. In: Jarrett, H. (Ed.), *Environmental Quality Issues in a Growing Economy*, Johns Hopkins University Press, Baltimore, MD, pp. 3-14.
- Ellen MacArthur Foundation (2015), *Towards a circular economy: business rationale for an accelerated transition*, available at:
<https://www.ellenmacarthurfoundation.org/towards-a-circular-economy-business-rationale-for-an-accelerated-transition>
- Ghisellini, P., Ripa, M., Ulgiati, S., 2018. Exploring environmental and economic costs and benefits of a circular economy approach to the construction and demolition sector. A

- literature review. *Journal of Cleaner Production*, 178, 618–643. <https://doi.org/10.1016/j.jclepro.2017.11.207>
- Grdić, Z. S., Krstinic Nizic, M. & Rudan, N. (2020). Circular Economy Concept in the Context of Economic Development in EU Countries. *Sustainability, MDPI*, 12(7), 1-13.
- Kirchherr, J., Yang, N-H. N., Schulze-Spüntrup, F., Heerink, M. J. & Hartley, K. (2023). Conceptualizing the Circular Economy (Revisited): An Analysis of 221 Definitions. *Resources, Conservation and Recycling*, 194(2023), 1-32. <https://doi.org/10.1016/j.resconrec.2023.107001>
- Korhonen, J., Honkasalo, A. & Seppälä, J. (2018). Circular economy: the concept and its limitations. *Ecological economics*, 143, 37-46
- Nobre, G. C. & Tavares, E. (2021). The quest for a circular economy final definition: A scientific perspective. *Journal of Cleaner Production*, 314(2021), 1-13. <https://doi.org/10.1016/j.jclepro.2021.127973>
- Pearce, D.W. and Turner, R.K. (1989), *Economics of Natural Resources and the Environment*, Johns Hopkins University Press, Baltimore, MD.
- Seroka-Stolka, O. & Ociepa-Kubicka, A. (2019). Green logistics and Circular Economy. *Transportation Research Procedia*, 39, 471-479
- Stahel W.R. (2016), The Circular Economy, *Nature* 531 (7595), 435–438. <https://doi.org/10.1038/531435a>
- Webster, K. (2017). *The Circular Economy: A Wealth of Flows*, (2nd Edition). Ellen MacArthur Foundation Publishing: Cowes, UK, 5–25.

UTICAJ KONKURENTNOSTI I INOVATIVNOSTI CIRKULARNE EKONOMIJE NA EKONOMSKI RAST: SLUČAJ ZEMALJA ČLANICA EU

Rezime: Cilj istraživanja je analiza veze između indikatora konkurentnosti i inovativnosti cirkularne ekonomije i ekonomskog rasta u zemljama članicama EU. Analiza je obuhvatila period od 2012. do 2021. godine. Koncept cirkularne ekonomije je novi ekonomski model koji bi trebalo da minimizira otpad uz dugoročni održivi razvoj i blagostanje. Indikatori konkurentnosti i inovativnosti cirkularne ekonomije su: Privatne investicije i bruto dodata vrednost u sektorima cirkularne ekonomije, Broj zaposlenih u sektorima cirkularne ekonomije i Patenti koji se odnose na reciklažu i sekundarne sirovine. Ekonomski rast se meri realnim BDP po stanovniku. Primenjene su korelaciona i regresiona analiza. Rezultati regresione analize su pokazali da postoji statistički značaj uticaj konkurentnosti i inovativnosti cirkularne ekonomije na ekonomski rast u zemljama članicama EU.

Ključne reči: cirkularna ekonomija, konkurentnost, inovativnost, ekonomski rast, Evropska unija



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**THE CIRCULAR ECONOMY AND INTERNATIONAL TRADE -
THE CONCEPT OF CIRCULAR TRADE**

Vesna Petrović, Ph. D.*

Abstract: *This paper aims to contribute to the understanding of the linkages between circular economy and international trade. The topic of the circular economy and its global challenges is a fertile ground for interdisciplinary and transdisciplinary research and this paper is a contribution to this agenda. The circular economy concept has been explored in the last decade by an increasing number of authors, governments, companies and international think tanks to stress its importance for sustainability and development at micro firm level, macro state and the globe, overall. The circular economy is expected to drive the transition towards a more sustainable economy by addressing some of the major global challenges, including climate change, resource scarcity and growing population. The paper in its introductory part deals with the origin and the concept of the circular economy, as well as other concepts of the environment economics. Then the following sections critically review its interdependency, interaction and linkages with the international trade. Circular economy cannot succeed without international trade, which secures affordable and reliable access to a wide range of different materials, goods and services. Finally, the paper focuses on the concept of the circular trade, and the framework behind this phenomenon. In conclusion it is argued that the transition from linear towards circular economy, in a challenging and complex environment requires substantial interaction and collaboration between different stakeholders on various levels in order to witness its positive impact on local, regional and global prosperity.*

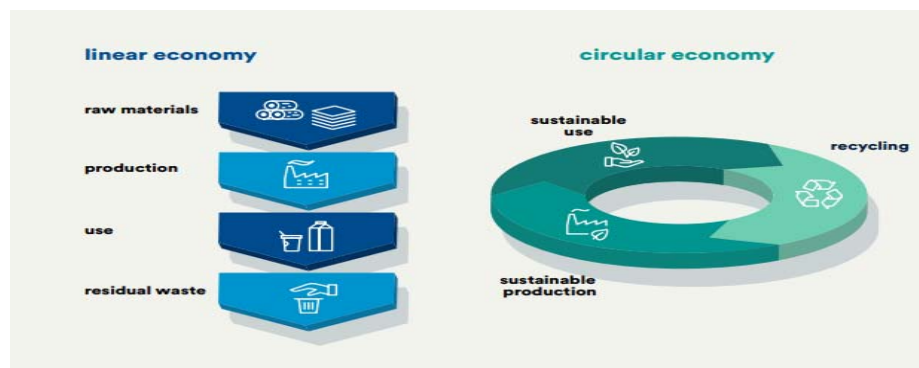
Keywords: *circular economy, international trade, circular trade, sustainability.*

* University of East Sarajevo, Faculty of Business Economics, Bijeljina, BiH;
ORCID: 0000-0002-5061-4807, ✉ vesna.petrovic@fpe.ues.rs.ba
UDC 338.1:502.131.1
339.5

1. Introduction

The circular economy is the concept that relates to sustainability at most and foremost. It is a model of resource production and consumption that advocates for zero or minimal waste, and reducing, reusing and recycling all kinds of materials and resources. Contrary to the classical or linear model of production simply described as take-make-dispose. Taking into consideration that we live in a world with mainly finite resources, products and producers would need to adopt and embrace sustainability concept in order to benefit consumers, and overall the planet. It is argued that there are infinite opportunities to make transition from a linear to a circular economy (Figure 1).

Figure 1: Linear vs. Circular economy



Source: Tomra.com

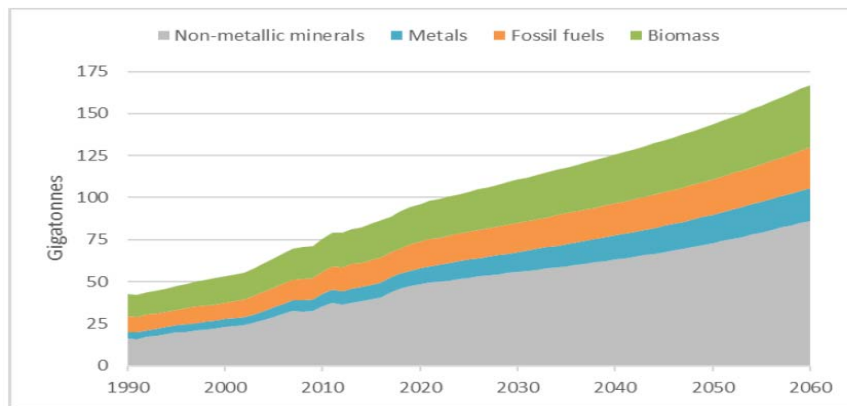
The current linear model of production and consumption is also a significant driver of social injustice, with the majority of resource consumption and wealth accumulation occurring in the developed countries, but the highest levels of environmental impact and threats to human health being experienced in the developing countries. There is an urgent need to move away from an extractive, polluting and unjust production-consumption system to one that decouples social and environmental prosperity from unsustainable resource use. The circular economy offers a value-chain approach to tackling this problem. Rather than the current linear flow of materials through the global economy, in which they are extracted, processed, manufactured, used, and finally disposed of as waste, a circular economy uses a systemic approach to decouple economic prosperity from material use by maintaining a circular flow of resources through regenerating, retaining or adding to their value, while contributing to sustainable development.

The circular economy not only encourages sustainable production and consumption, but could also contribute to tackling the 45 per cent of global emissions that cannot easily be mitigated through the shift to renewable energy and energy-efficiency measures (Ellen MacArthur Foundation, 2019) and help halt and reverse land degradation and biodiversity loss. Unsustainable use of the earth's resources is a primary driver of the triple threat of pollution, biodiversity loss and climate change. The 100 billion tons of natural resources extracted and processed every year contribute to half of all carbon emissions and 90 per cent of all terrestrial biodiversity loss (UN Environment Programme, 2019).

The Circular Economy and International Trade – the Concept of Circular Trade

Therefore, OECD (2019) has compiled a projection of global materials use to 2060 in order to illustrate intentions and necessity of transition to usage of non-metallic minerals and biomass (Figure 2).

Figure 2: Projected global materials use to 2060



Source: OECD (2019)

Therefore, the paper focuses on the concept of circular economy, but it goes into more detailed analysis of its interdependences with international trade, and arising model of circular trade. This discourse is extremely important and it also introduces the concept of trade related circular economy measures – TREM. In processing the analysed theoretical and methodological sources related to the topic of the circular economy and circular trade, the usual methods of scientific and research work were used, such as methods of analysis and synthesis, induction and deduction, generalizations and a systemic approach to research. Scientific methods of internal research (desk research) were applied, within which available secondary sources of data and information were processed, including books in the mentioned field, available articles, statistical publications, reports of multilateral and regional institutions, the compilation of which was made possible by bilateral institutions, research agencies, internet sources, etc.

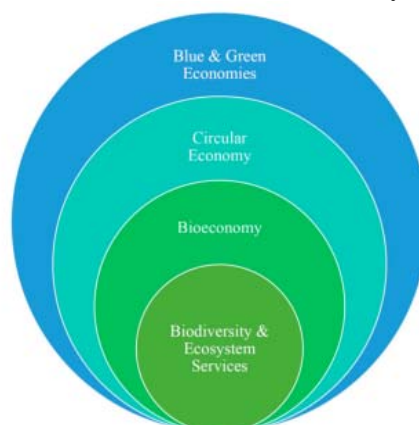
2. The circular economy

In the absence of a universally agreed definition, the circular economy essentially remains an all-encompassing concept. The Ellen MacArthur Foundation defines it as “an economy that provides multiple value-creation mechanisms which are decoupled from the consumption of finite resources” (Ellen MacArthur Foundation & McKinsey 2015). The existing circular economy definitions can be grouped into two lines of thought: those based on the definition provided by the Ellen MacArthur Foundation (EMAF, 2019) and those from other researchers. EMAF has defined a circular economy as a framework for an economy that is restorative and regenerative by design. EMAF’s circular economic model aims to create economic, natural, and social capital based on three core principles: (1) design out of waste and pollution, (2) keep products and materials in use, and (3) regenerate natural systems an industrial system that is restorative or regenerative. Among many definitions developed by

other researchers, such as from a production-consumption nexus perspective, the circular economy is defined as a “sustainable development initiative with the objective of reducing the societal production-consumption systems’ linear material and energy throughput flows by applying materials cycles, renewable and cascade-type energy flows to the linear system. Circular economy promotes high value material cycles alongside more traditional recycling and develops systems approaches to the cooperation of producers, consumers and other societal actors in sustainable development” (Korhonen et al., 2018). Chatham House defines it more as “a systemic approach to resource efficiency in which ‘end-of-life’ products and materials are recycled, repaired or reused through circular value chains with waste from one process becoming an input into other processes” (Preston et al. 2019).

The Figure 3 represents the circles of all the concepts that environment economy operates with. The most encompassing are concepts of blue and green economy, which then consists of circular and bioeconomy. The blue economy is related to sustainable use of ocean resources for economic growth (World Bank), all economic activities related to oceans, seas and coasts (EC) and economy that "comprises a range of economic sectors and related policies that together determine whether the use of ocean resources is sustainable" (UN). The role of green economy aims to improve production processes and consumption practices to reduce resource consumption, waste generation and emissions across the full life cycle of processes and products.

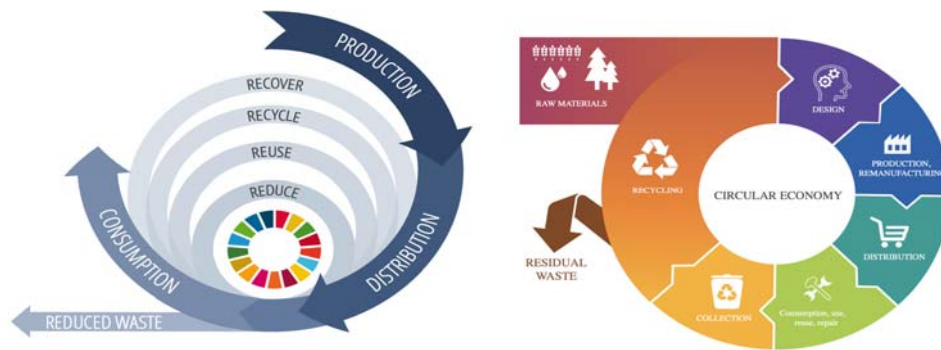
Figure 3: Circles of environment economy concepts



Source: Stephenson and Damarell, (2022) pg. 13.

The circular economy is also interpreted simply as the „4R” framework: reduce, reuse, recycle, and recovery (Lieder and Rashid, 2016), presented on Figure 4. The first three Rs relate to the reduction of resource consumption and the preservation of natural capital. The last R relates to the recovery of the resource in the form of energy (e.g., incineration of wastes for heating). It is also evident that the main focus of the circular economy appears to be on economic prosperity, followed by environment quality, and the social aspect of sustainability (i.e., human well-being) is rarely explored. The desired outcome of the CE transition is to overcome the current production and consumption model based on continuous growth and increasing resource throughput by decoupling economic growth from environmental pressure (Ghisellini, et al, 2016).

Figure 4: The „4R“framework of circular economy

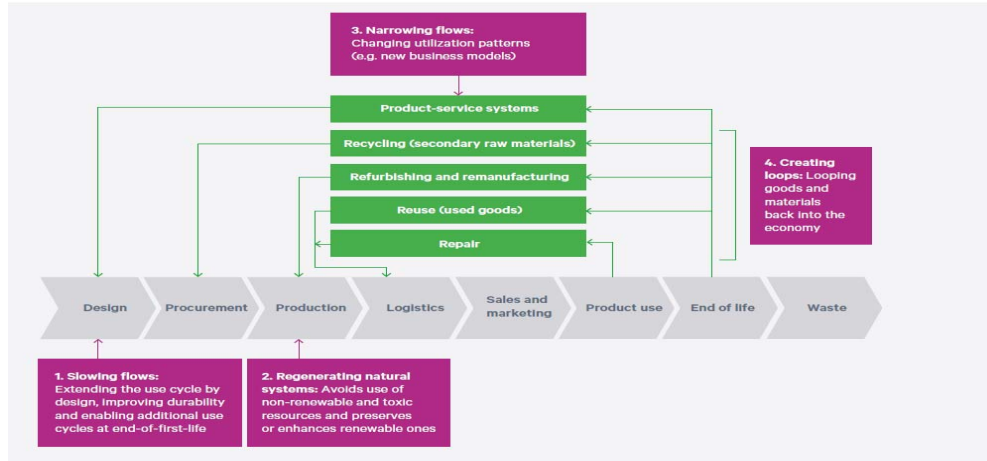


Source: Lieder and Rashid (2016)

The concept of the bioeconomy is integrated with the concept of circular economy, and it represents the multidimensional and forward-looking approach striving for an overall economic system optimization aimed at achieving sustainable development. The bioeconomy can contribute to meeting global challenges through its nature as an economy building on renewable resources, biological knowledge, innovation and knowledge generation and through holistic approaches that think along value chains and in value nets. This means that the bioeconomy does more than just follow traditional pathways of biomass production, conversion and use. First, it must lead the way towards an innovative and sustainable use of the Earth's limited resources. Second, it has to provide guidelines for the societal transition towards sustainable development (Petrović, 2023, p. 90).

An inclusive circular economy seeks to achieve absolute decoupling of resource use and environmental impact from equitable economic prosperity and human development. It does this by slowing, narrowing and looping the flow of materials through the economic system, while regenerating natural systems and designing out toxicity. By focusing equally on environmental issues, human needs, sustainable livelihoods, decent work and social justice, an inclusive circular economy can make important contributions to human development, to poverty reduction and to improved well-being around the world. While the exact definition of a circular economy remains contested, the concept is generally considered to be an economic system that achieves absolute decoupling of economic activity from environmental impact. It would fulfil this aim by: (i) slowing the rate of flow of materials through the economy (by extending the lifetime of products through designing for durability); (ii) regenerating natural systems by avoiding the use of non-renewable energy and material resources, and by preserving or enhancing renewable resources (such as using renewable energy instead of fossil fuels or returning valuable nutrients to the soil to support natural ecosystems), as well as ensuring that all materials flowing through the economy are non-toxic and safe; (iii) narrowing material flows by doing more with less (i.e. changing consumption patterns to deliver the same service with fewer materials, such as via leasing and renting or by digitizing services); and (iv) looping materials back into the economy at the end of their life cycle (through reuse, repair, refurbishing, remanufacturing and recycling – see Figure 5). (Barrie, 2022).

Figure 5. Overview of the circular economy



Source: Adopted from Prestone et al (2019)

3. The concept of circular trade

Circular trade encompasses any international trade transaction, either material or immaterial, that contributes to circular economy activities at the local, national and global levels. This includes the trade in circularity-enabling goods, services and intellectual property; second-hand goods for reuse, repair, refurbishment, remanufacturing or recycling; refurbished and remanufactured goods; secondary raw materials; and waste, scraps, and residues that can be safely recovered or valorized (Barrie, 2022). It is considered that every country needs to participate in international exchange in order to initiate and achieve some degree of a sustainable circular economy. All countries of the world are dependent on international trade to secure affordable and reliable access to a wide range of different materials, goods and services, through the process of international trade. This includes the trade in circularity-enabling goods (such as remanufacturing and recycling equipment), services (circular design skills, leasing or rental services, and repair services), relevant intellectual property rights, affordable second-hand goods, secondary raw materials and non-hazardous waste and scrap that can be recovered for use in primary production, and food and biomass regeneratively produced, diverse or upcycled. The combination of all of these types of trade flows can be considered as ‘circular trade’. Circular trade has grown strongly in value over the past two decades. For example, the value of trade in second-hand goods, secondary raw materials and waste for recovery rose by more than 230 per cent (from \$94 billion to \$313 billion) between 2000 and 2019, with the global export value of trade in goods rising by around 195 per cent over the same period.⁴ The value of trade in maintenance and repair services increased from \$74 billion to \$108 billion between 2015 and 2019 (WTO, 2020).

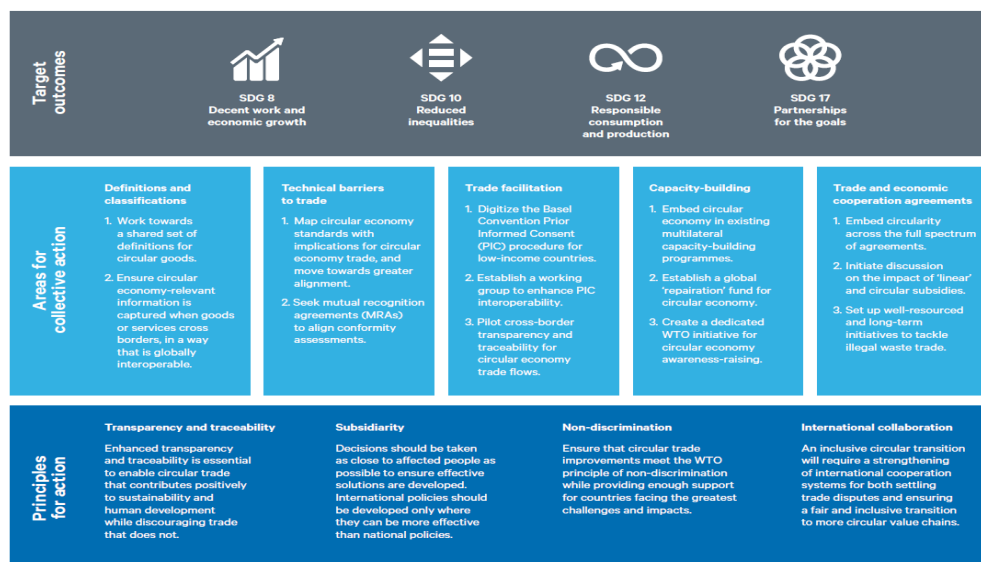
Although circular trade is a key enabler of a global circular economy, a range of regulatory and technical challenges are inhibiting its advancement. These include a lack of mutually recognized definitions, classifications, interoperable standards, regulations and conformity procedures concerning circular economic activities or goods. Furthermore, as an emerging area of activity, the circular economy has itself only been embedded to a limited

The Circular Economy and International Trade – the Concept of Circular Trade

degree in bilateral, regional and plurilateral trade and economic cooperation agreements. This restricts the scope and potential for collaboration around transboundary issues such as illegal waste, supply-chain transparency and traceability, investment or the issues pertaining to mutual recognition, technical barriers to trade, and trade facilitation. Global inequities in power relations, digital trade capabilities, trade infrastructure, access to circular finance, and industrial and innovation capabilities mean that developed countries are better positioned than developing to reap the benefits of circular trade. If an explicit goal to reduce inequality is not built into the global circular economy transition, then it is highly likely that these inequities will create a ‘circularity trade divide’, in which the gains accrued from circular trade are highly unevenly distributed between developed and least developed countries. International trade is a key enabler of a global and inclusive transition to a circular economy. However, current trade policy intended to promote coordination for more trade in circular goods, services and materials is being constrained by numerous barriers. An integrated and collaborative approach to overcoming these barriers is needed if the social, economic and environmental potential of circular trade is to be fully realized. This can only be achieved through commonly recognized outcomes and coordinated actions. The framework for inclusive circular trade presented in this paper is an attempt to bridge trade, circular economy, sustainability and development policy areas. It is designed to help guide trade and trade-related circular economy and development policies, practices and agreements to ensure these all work towards a shared goal of an inclusive circular economy (Barrie, et al, 2022).

The Figure 6 presents the framework for inclusive circular trade which aims at analyzing four target outcomes linked to sustainable development goals (SDGs) 8, 10, 12 and 17, and then it defines areas and principles for collective action.

Figure 6: Framework for inclusive circular trade



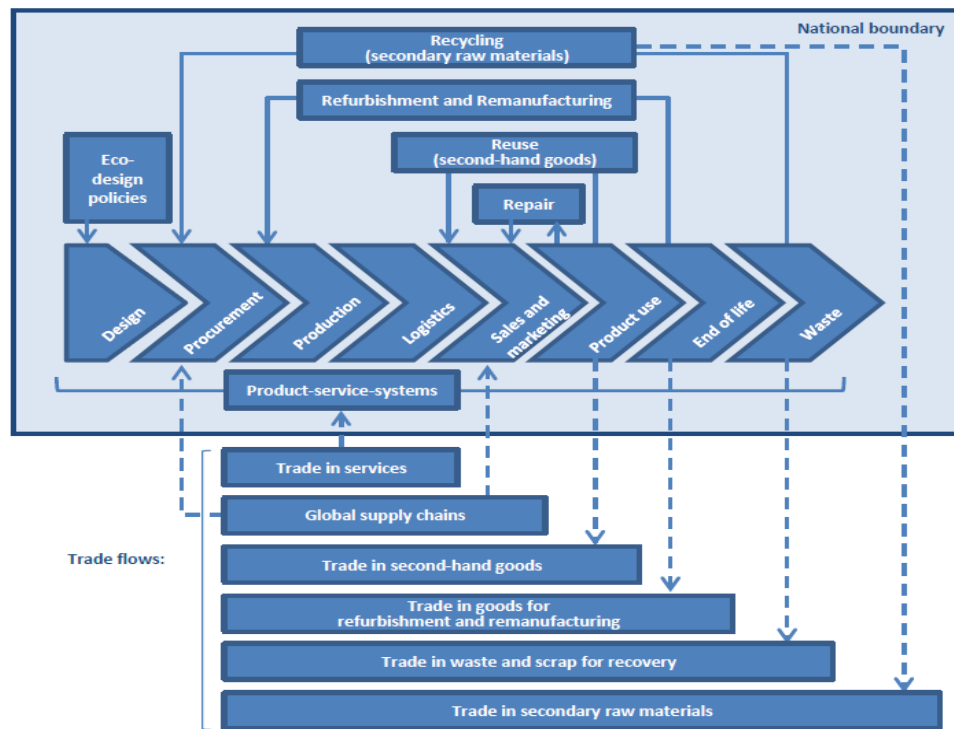
Source: Barrie et al. (2022b)

The group of authors (Barrie et al, 2022b) focuses on SDGs that are the most important for economic development, such as economic growth, reduction of inequalities, responsible production and consumption and finally partnership for achieving the goals.

4. Linkages between international trade and circular economy

International trade is a critical element to consider in implementing circular economy policies. While circular economy policies and initiatives largely take place domestically within national boundaries, there are important interlinkages with international trade. Indeed, this is because the world is interconnected through global value chains. Links between circular economy and trade can occur through various channels, from circular supply chains in raw materials, intermediate goods, and final products, to end-of-life value chains in waste and scrap, secondary raw materials and second-hand goods. This can also involve services trade as a circular economy transition generally entails a greater role for the services sector (Yamaguchi, 2021). Figure 7 presents how trade flows happen within national and international boundaries. The linkages are numerous and all parts of production and consumption processes may be interconnected, highly dependent and mutually beneficial, at national and international level. The benefits can be spread to individual consumers, businesses, national economies, regional integrations and advanced multilateral trade agreements.

Figure7: Linkages between international trade and circular economy



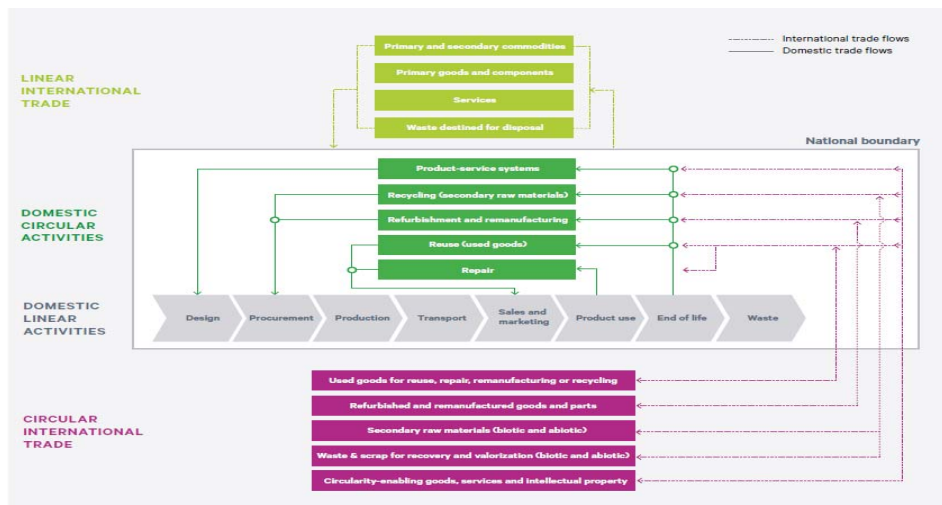
Source: Yamaguchi (2021)

The Circular Economy and International Trade – the Concept of Circular Trade

Circular trade offers many economic, environmental and social benefits. Trade in circular economy-enabling goods and services enables countries and companies to access the necessary knowledge, skills and equipment to implement new circular business models to conduct reuse, repair, remanufacturing and recycling activities. Trade in used goods for reuse, repair or remanufacturing enables affordable access to essential goods and services for those in secondary markets, and generates local demand for industry and employment.

In relation to goods, two distinct trade flows can influence the circularity of an economy, i.e. trade within supply chains and trade of end-of-life products. For example, upstream efforts on eco-design or managing material content would need to take account of supply chains that stretch across borders, as imports can occur through trade in raw materials and intermediate goods that feed into production processes as well as final products for end-user consumption. Concerning end-of-life value chains, products reaching their end-of-life can be collected (processed) and exported as trade in waste and scrap, trade in secondary raw materials, trade in goods for refurbishment and remanufacturing, and trade in second-hand goods. In addition to trade in goods, circular economy can also have implications on trade in services. A circular economy transition generally has a higher degree of service sector involvement such as maintenance, repair, and product service systems, and may bring about new opportunities for services trade (Yamaguchi, 2018).

Figure 8: Linear, domestic, circular and international circular trade flows



Source: Adapted from OECD (2018)

Experience at the WTO provides valuable insights into how WTO members can intensify trade cooperation efforts in support of a safe and efficient global circular economy. At the WTO, members have addressed issues related to the circular economy through policy dialogue, peer review, negotiations and more recently, Aid for Trade. This work paves the way for WTO members to expand the positive contribution of trade to a circular economy, not least by: (i) improving their collective understanding of how trade interacts with the circular economy; (ii) building trust and confidence to engage in mutually beneficial trade related to circular economy activities; (iii) opening and facilitating trade in key areas of the

circular economy; and (iv) supporting efforts in developing countries to seize the potential environmental, economic and trade benefits of a circular economy (Steinfatt, 2020).

5. Conclusion

As a contribution to the emerging field of research, this paper reviews the main findings of existing literature on circular economy and circular trade. It starts with a short description of the circular economy as a concept, before reviewing the role of international trade in facilitating a transition to a more circular economy and circular trade interaction. This paper sets out a framework for presentation of circular economy and trade, intended to enable a more inclusive understanding of the pathway for the circular economy transition. The link between trade and the circular economy is increasingly being recognized as an important issue for further discussion and action within national and international policy forums. International trade plays a key role in delivering an inclusive circular economy.

Therefore, this paper explores the interface between trade and a transition to a more circular economy. In today's highly integrated economy, international trade plays a critical role in facilitating this transition, by exploiting existing comparative advantages and allowing economies of scale. Goods and services already cross borders at virtually all stages of the circular value chain, from upstream design services to remanufactured goods and secondary raw materials. Yet trade policies are not always aligned with circularity objectives. Similarly, policies aimed at fostering a circular economy can have detrimental effects on trade even if unintended. As the role of trade and trade policy attracts more attention, understanding how it can effectively support a circular economy transition becomes critical for policy makers. The transition from linear towards circular economy, in a challenging and complex environment requires substantial interaction and collaboration between different stakeholders on various levels in order to witness its positive impact on local, regional and global prosperity.

The transition to a circular economy is also essential to address the triple threat of pollution, climate change and biodiversity loss. It is impossible for a single country to achieve a circular economy on its own, as interconnected global value chains and trade play a critical role in the concept. In addition, domestic circular economy actions can create ripple effects along entire value chains, with the potential to negatively impact other countries. Despite the importance of circularity, there remains limited awareness or consideration of the circular economy among global trade actors. Transitioning from a linear 'take-make-waste' economic model to a more circular 'reduce-reuse-recycle' approach is increasingly seen as a critical response to the triple crises of climate change, biodiversity loss and pollution. Rapid development of trade-related circular economy measures (TRCEMs) at all stages of life cycle to reduce and manage trade that undermines circular economy approaches, and to promote trade that supports circular economy goals. Any solution to overcome circular trade barriers will therefore require a collaborative and coordinated global response to ensure that all countries and territories benefit equally from the transition.

Finally, it is certain that new economic models including circular economy will influence future trade patterns. The application of primary goods is expected to decline, while secondary materials and sectors that do not rely on primary materials may see an increase, especially if overall economic activity is boosted by the transition. This will happen due to implementation of policies, which aim to improve resource efficiency and

The Circular Economy and International Trade – the Concept of Circular Trade

shift away from primary materials use. It is a very obvious that transition to a more resource efficient, circular economy will have significant effects on international trade patterns, and, indeed, vice versa.

References

- Barrie, J., Schröder, P. and Schneider-Petsinger, M. (2022a), *The role of international trade in realizing an inclusive circular economy*, Research Paper, London: Royal Institute of International Affairs, <https://doi.org/10.55317/9781784135393>.
- Barrie, J. et al. (2022b), *Trade for an inclusive circular economy: A framework for collective action*, Recommendations from a global expert working group, London: Royal Institute of International Affairs, <https://doi.org/10.55317/9781784135294>.
- Barrie, J., Anantharaman, M., Oyinlola, M. and Schröder, P. (2022c), ‘The circularity divide: What is it? And how do we avoid it?’, *Resources, Conservation and Recycling*, 180 (106208), <https://doi.org/10.1016/j.resconrec.2022.106208>.
- Bellmann, C. (2021) The circular economy and international trade, Options for WTO, International Chamber of Commerce
- Ellen MacArthur Foundation & McKinsey (2015), “Growth within: A circular economy vision for a competitive Europe”, https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf
- Ellen MacArthur Foundation (2019), *Completing the Picture: How the Circular Economy Tackles Climate Change*, <https://emf.thirdlight.com/link/w750u7vysuy1-5a5i6n/@/preview/1?o>.
- Ghisellini, P., Cialani, C., and Ulgiati, S. (2016). A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems. *J. Clean. Prod.* 114, 11–32. doi: 10.1016/j.jclepro.2015.09.007
- International Resource Panel (2019), *Global Resources Outlook 2019: Natural Resources for the Future We Want*, United Nations Environment Programme, <https://www.resourcepanel.org/reports/global-resources-outlook>.
- Korhonen, J., Nuur, C., Feldmann, A., and Birkie, S. E. (2018). Circular economy as an essentially contested concept. *J. Clean. Prod.* 175, 544–552. doi: 10.1016/j.jclepro.2017.12.111
- Lieder, M., and Rashid, A. (2016). Towards circular economy implementation: a comprehensive review in context of manufacturing industry. *J. Clean. Prod.* 115, 36–51. doi: 10.1016/j.jclepro.2015.12.042
- OECD (2018), *International Trade and the Transition to a Circular Economy, Policy Highlights*, RE-CIRCLE Project, <https://www.oecd.org/environment/waste/policy-highlights-international-trade-and-the-transition-to-a-circular-economy.pdf>.
- OECD (2019), *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264307452-en>.
- Petrović, V. (2023) The Bioeconomy and global challenges, *Zbornik radova, Cirkularna (Bio)ekonomija – Teorijski i praktični aspekti*, Ekonomski fakultet, Univerzitet u Beogradu
- Preston, F., Lehne, J. and Wellesley, L. (2019), *An Inclusive Circular Economy: Priorities for Developing Countries*, Research Paper, London: Royal Institute of International Affairs, <https://www.chathamhouse.org/2019/05/inclusive-circular-economy>.

- Stephenson, P.J.; Damerell, A. (2022), Bioeconomy and Circular Economy Approaches Need to Enhance the Focus on Biodiversity to Achieve Sustainability. *Sustainability* 2022, 14, 10643. <https://doi.org/10.3390/su141710643>
- Steinfatt, Karsten (2020) : Trade policies for a circular economy: What can we learn from WTO experience?, *WTO Staff Working Paper, No. ERSD-2020-10*, World Trade Organization (WTO), Geneva, <https://doi.org/10.30875/2ced559e-en>
- UN Environment Programme, 2019, www.unep.org
- World Trade Organization (2020), 'WTO Stats portal', <https://timeseries.wto.org>
- Yamaguchi, S. (2018), "International Trade and the Transition to a More Resource Efficient and Circular Economy: A Concept Paper", *OECD Trade and Environment Working Papers*, No. 2018/03, OECD Publishing, Paris, <https://dx.doi.org/10.1787/847feb24-en>.
- Yamaguchi, S. (2021) International trade and circular economy – Policy alignment, 2012/02, *OECD Trade and Environment Working paper*

CIRKULARNA EKONOMIJA I MEĐUNARODNA TRGOVINA – KONCEPT CIRKULARNE TRGOVINE

Rezime: Ovaj rad ima za cilj da doprinese razumijevanju veza između cirkularne ekonomije i međunarodne trgovine. Tema cirkularne ekonomije i njenih globalnih izazova je plodno tlo za interdisciplinarna i transdisciplinarna istraživanja i ovaj rad je doprinos ovoj agendi. Koncept cirkularne ekonomije je u poslednjoj deceniji istraživao sve veći broj autora, vlada, kompanija i međunarodnih instituta, zahvaljujući naglašavanju njegovog značaja za održivost i razvoj na nivou mikro preduzeća, makro države i sveta, uopšte. Očekuje se da će cirkularna ekonomija pokrenuti tranziciju ka održivoj ekonomiji rješavanjem nekih od glavnih globalnih izazova, uključujući klimatske promjene, nedostatak resursa i rastuće stanovništvo. Rad se u uvodnom delu bavi nastankom i konceptom cirkularne ekonomije, kao i drugim konceptima ekonomije životne sredine. Zatim sledeći odeljci kritički razmatraju međuzavisnost, interakciju i veze sa međunarodnom trgovinom. Cirkularna ekonomija ne može uspeti bez međunarodne trgovine, koja obezbeđuje efikasan i pouzdan pristup širokom spektru različitih materijala, dobara i usluga. Konačno, rad se fokusira na koncept cirkularne trgovine i okvir koji stoji iza ovog fenomena. U zaključku se tvrdi da tranzicija od linearne ka cirkularnoj ekonomiji, u izazovnom i složenom okruženju, zahtijeva suštinsku interakciju i saradnju između različitih zainteresovanih strana na različitim nivoima kako bi se svedočilo njenom pozitivnom uticaju na lokalni, regionalni i globalni prosperitet.

Ključne riječi: cirkularna ekonomija, međunarodna trgovina, cirkularna trgovina, održivost.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**SIROMAŠTVO I SOCIJALNA ISKLJUČENOST U RURALNIM
PODRUČJIMA – ISKUSTVO SRBIJE**

Dr Nataša Golubović *

Dr Marija Džunić•

***Rezime:** Život u ruralnim područjima povećava verovatnoću da pojedinac bude siromašan i socijalno isključen. Iako ruralno i urbano siromaštvo dele dosta zajedničkih karakteristika, siromašni u ruralnim sredinama suočavaju se specifičnim problemima, koji opredeljuju moguća rešenja tih problema. Istraživanje sličnosti i razlika između ruralnog i urbanog siromaštva neophodno je za kreiranje adekvatne strategije i politike smanjenja siromaštva. Razumevanje reprodukcije ruralnog siromaštva i depriviranosti zahteva širi pristup i fokusiranje na društvenu isključenost i njene procese. Ovo istraživanje ima za cilj da unapredi naše razumevanje ruralnog siromaštva u Srbiji analizom različitih dimenzija depriviranosti, sa ciljem identifikacije efikasnih strategija rešavanja problema siromaštva u ruralnom kontekstu.*

***Ključne reči:** siromaštvo, isključenost, ruralne sredine, deprivacija, Srbija*

1. Uvod

Pitanja siromaštva, uskraćenosti i socijalne isključenosti poslednjih nekoliko decenija izazivaju sve veću pažnju istraživača i kreatora politike. I pored toga, čini se da je srazmerno malo istraživanja posvećeno pitanjima specifičnosti siromaštva i socijalne isključenosti u ruralnim područjima. Tome doprinose i ograničene informacije i podaci o obrascima i procesima isključenosti ruralnog stanovništva. Život u ruralnim područjima povećava verovatnoću da pojedinac bude siromašan i socijalno isključen (Suttie, 2019; Kyzyma, 2018). U većini zemalja uslovi – u pogledu lične potrošnje i pristupa obrazovanju, zdravstvenoj zaštiti, pijaćoj vodi i kanalizaciji, stanovanju, transportu i komunikacijama – sa kojima se

* University of Niš, Faculty of Economics, Serbia; ORCID: 0000-0002-6789-5158,

✉ natasa.golubovic@ekonomski.rs

• University of Niš, Faculty of Economics, Serbia; ORCID: 54889018900;

✉ marija_dzunic@ni.ac.rs

UDK 364.662(497.11)

suočavaju siromašni na selu lošiji su od onih sa kojima se suočavaju siromašni u gradovima (Khan, 2001). Tome u prilog govori i činjenica da oko 79% siromašnih u svetu živi u ruralnim područjima. Na globalnom nivou, stopa siromaštva u ruralnim područjima iznosi 17,2% i tri puta veća od stope siromaštva u urbanim sredinama koja iznosi 5,3% (UN, 2019). Nedovoljno ulaganje u ruralnu infrastrukturu i pružanje usluga, spor ekonomski napredak ruralnih oblasti, doprinose opstajanju dispariteta između sela i gradova. Dodatno produbljivanje nejednakosti nastaje kada se različiti vidovi depriviranosti u ruralnim sredinama preklope sa drugim oblicima marginalizacije, npr. prema polu, uzrastu, etničkoj pripadnosti i sl (Suttie, 2019). Iz ekonomske perspektive, siromaštvo je posledica niske produktivnosti, nedostatka diverzifikacije u ruralnoj ekonomiji, ograničenog pristupa tržištu, obrazovanju, kvalitetnoj infrastrukturi, mogućnostima zapošljavanja, zdravlju i finansijskim proizvodima. Iz društvene perspektive, siromaštvu doprinose različiti oblici isključenosti pojedinih grupa u ruralnim zajednicama (poput žena i dece). U pogledu životne sredine, gubitak biodiverziteta i degradacija prirodnih resursa prvenstveno utiču na siromašne u ruralnim područjima, jer njihova egzistencija zavisi od prirodnih resursa. Nedovoljno učešće ruralnog stanovništva u kreiranju politika stvara jaz između ruralnih i urbanih područja i povećava rizik od siromaštva i uskraćenosti u ruralnim područjima.

Ovo istraživanje ima za cilj da unapredi naše razumevanje ruralnog siromaštva u Srbiji kroz analizu različitih demenzija depriviranosti, sa ciljem identifikacije efikasnih strategija rešavanja problema siromaštva u ruralnom kontekstu.

2. Siromaštvo, deprivacija i socijalna isključenost u ruralnim sredinama

Empirijski podaci pokazuju da život u ruralnim područjima povećava verovatnoću da pojedinac bude siromašan i socijalno isključen. Osnovna karakteristika ruralnog siromaštva je njegova slaba vidljivost – što je u velikoj meri posledica relativnog zanemarivanja u naučnim istraživanjima i politici (Nolan, Vhelan & Villiams, 1999, str. 71; Jackson & Haase, 1996). Ruralno siromaštvo i depriviranost su prostorno rasprostranjeni fenomeni koji su prisutni u svim delovima zemlje, ali su prikriiveni u agregatnim podacima za veće geografske celine. Osim nevidljivosti, ruralno siromaštvo ima još jednu prepoznatljivu karakteristiku. U ruralnim područjima dominira poljoprivredna proizvodnja, koja i dalje ima relativno najveći udeo u ruralnoj privredi mnogih zemalja. Razvoj i unapređenje poljoprivredne proizvodnje smanjuje potrebu za radnom snagom, što dovodi do migracije mladih ljudi u gradove i pogoršanja demografske strukture u selima, gde preovladavaju starije stanovništvo koje je u većem riziku od siromaštva (Commins, 2004). Studija iz 2019. koju je objavio Međunarodni centar za inkluzivni razvoj identifikuje nekoliko značajnih izazova sa kojima se suočavaju ruralna područja, a koja doprinose siromaštvu: položaj žena, dece i staraca; neadekvatan pristup zemljištu; neadekvatna socijalna zaštita ruralnog stanovništva; kršenje ljudskih prava i nepovoljan položaj migranata (IPC-IG, 2019).

Razumevanje uticaja siromaštva na pojedince i domaćinstva u ruralnim sredinama i razmatranje mera za smanjenje siromaštva, pretpostavlja istraživanje karakteristike ruralnog siromaštva. Analiza stvaranja i reprodukovanja siromaštva u ruralnim područjima podrazumeva sagledavanje imovine koju siromašni poseduju ili kojoj imaju pristup, kao i prinos od te imovine. Fizički kapital uključuje prirodni kapital (prava na zemljište, pašnjake, šume i vodu), mašine, alate, zalihe domaćih životinja i hrane i finansijski kapital (štednja i pristup kreditu). Ljudski kapital čine pojedinci sa svojim radnim sposobnostima, veštinama i

Siromaštvo i socijalna isključenost u ruralnim područjima – iskustvo Srbije

zdravljem. Infrastrukturni kapital u ruralnim sredinama obuhvata transport i komunikacije, pristup školama i domovima zdravlja, vodi za piće i kanalizaciji. Institucionalna imovina sastoji se od zakonom zaštićena prava i sloboda i stepen njihovog učešća u donošenju odluka koja se tiču njihovih lokalnih zajednica, ali i društva u celini (Khan, 2000b).

Siromašni u ruralnim područjima u velikoj meri zavise od poljoprivrede, ribarstva i šumarstva i srodnih delatnosti. Jedan deo ruralnog siromaštva u zemljama u razvoju čine domaćinstva koja se izdržavaju na osnovu relativno malih parcela zemljišta koje poseduju ili obrađuju. Zanatlije i mali farmeri u ruralnim sredinama imaju ograničene količine fizičkog kapitala (oni poseduju ili iznajmljuju fizički kapital, kao što su alati, mašine i sl.). Imaju ograničen pristup finansijskom kapitalu, a pozajmljeni kapital je često skup i koristi se za održavanje potrošnje u teškim vremenima ili za kupovinu zaliha i opreme potrebne za poljoprivredu. Mnogi od njih, budući da nisu u stanju da kroz poljoprivrednu proizvodnju obezbede dovoljno sredstva za život, prinuđeni su da potraže dodatne mogućnosti za zapošljavanje. Oni koji nisu ni vlasnici ni zakupci zemljišta su u najnepovoljnijem položaju. Ovi radnici zavise od sezone potražnje za radnom snagom u poljoprivredi i u neformalnim, malim industrijama i uslugama u ruralnim područjima. Pored toga, za razliku od svojih kolega u urbanim sredinama, oni su često isključeni iz sistema socijalnih davanja. Položaj žena na selu je znatno lošiji od položaja muškaraca, a njihov položaj i društveni status (zanemarljiva uloga u odlučivanju, često nisu vlasnici zemljišta) u velikom broju zemalja jedan je od najvažnijih razloga njihovog hroničnog siromaštva. U takvim uslovima, stanovnici u ruralnim sredinama su pod sve većim pritiskom da u potpunosti napuste poljoprivredni sektor. Neki od njih pokušavaju da nađu sezone poslove u urbanim sredinama ili se trajno nastanjuju u gradovima. Iako napuštanje sela može ruralnom stanovništvu da obezbedi raznovrsnije izvore prihoda i bolji kvalitet života, sve je manje migracija iz sela u grad koje vode do sigurnog zaposlenja. Brzi rast stanovništva u urbanim sredinama dodatno opterećuje ograničene resurse i infrastrukturu, posebno u oblastima sa niskim prosečnim dohotkom, što dovodi do povećanja siromaštva u gusto naseljenim urbanim područjima sa negativnim posledicama po urbanu deprivaciju i siromaštvo. Brza urbanizacija i migracija siromašnih iz ruralnih u urbana područja tokom poslednjih nekoliko decenija dovela je do globalnog fenomena nazvanog „urbanizacija siromaštva“. Migranti iz ruralnih u urbane sredine smanjuju teret siromaštva u ruralnim područjima, ali povećavaju siromaštvo u urbanim sredinama. U izvesnoj meri, urbano siromaštvo je prelivanje ruralnog siromaštva u gradske sredine. Migranti često ostaju siromašni u urbanom okruženju, a promena se ogleda samo u drugačijim pokazateljima siromaštva (Baker, 2008).

3. Apsolutno i relativno siromaštvo u ruralnim oblastima Srbije

Merenje apsolutnog i relativnog siromaštva zasniva se na liniji siromaštva koje se koristi za razgraničenje siromašnih od onih koji to nisu. Apsolutno siromašni su oni pojedinci i domaćinstva čiji prihod ne može da obezbedi minimalni nivo potrošnje dobara i usluga, definisan linijom siromaštva. Pojedinci ili domaćinstva čiji je nivo prihoda ispod ovog praga smatraju se siromašnima. Empirijski podaci na primeru Srbije pokazuju da je siromaštvo zastupljenije u ruralnim u odnosu na urbana područja. Kao što tabela 1 ilustruje, stope apsolutnog siromaštva u Srbiji su konstantno veće u ruralnim u odnosu na urbana područja u posmatranom periodu (2006-2020). Siromaštvo je izraženije u ruralnim područjima i koncentrisano u tradicionalno nerazvijenim područjima.

Tabela 1. Apsolutno siromaštvo u Srbiji prema stepenu urbanizacije, 2006-2020

	2006	2008	2010	2012	2014	2016	2018	2020
Ruralno stanovništvo	13,3	7,5	12,1	8,7	10,9	10,5	10,4	10,0
Urbano stanovništvo	5,3	5,0	4,1	4,3	5,3	5,1	4,8	4,8

Izvor: SIPRU (2020)

Između 2006. i 2020. prisutan je pad stope apsolutnog siromaštva i u ruralnim i u urbanim područjima, pri čemu je relativno smanjenje stope apsolutnog siromaštva bilo veće u ruralnim (25%) nego u urbanim područjima (9,5%). Ipak, stanovništvo u ruralnim oblastima je 2020. godine bilo dvostruko više pogođeno siromaštvom nego stanovništvo u urbanim oblastima, pri čemu 10,0% ruralnog stanovništva nije bilo u stanju da zadovolji osnovne potrebe (tabela 1).

Relativno siromaštvo doživljava se kao isključenost pojedinaca ili domaćinstava iz prosečnih životnih obrazaca, aktivnosti i učešća u društvenom životu zbog nedostatka resursa, npr. obrazovanje, prihodi, bogatstvo i politička moć. Stopa rizika od siromaštva (relativno siromaštvo), izračunava se kao udeo lica čiji je raspoloživi dohodak (nakon socijalnih transfera) ispod linije relativnog siromaštva, koja iznosi 60% medijane ekvivalentnog raspoloživog dohotka (nakon socijalnih transfera). Ovaj indikator ne meri nivo bogatstva ili siromaštva, već nivo prihoda u odnosu na ostale stanovnike u zemlji, što ne znači nužno nizak životni standard. Stopa rizika od siromaštva u ruralnim oblastima u Srbiji je u 2022. godini (27,3%) bila gotovo dvostruko veća nego u urbanim područjima (14,1). Međutim, relativni pad stope rizika od siromaštva u ruralnim područjima je znatno veći (sa 37,3% na 27,3%) nego u urbanim sredinama (sa 15% na 14,1%) između 2014. i 2022. godine. Stopa rizika od siromaštva ruralnog stanovništva u Srbiji je i znatno veća od stope rizika od siromaštva ruralnog stanovništva u EU-27 (17,5%), a ta razlika je još veća kada se uporedi sa razvijenim evropskim zemljama (tabela 2).

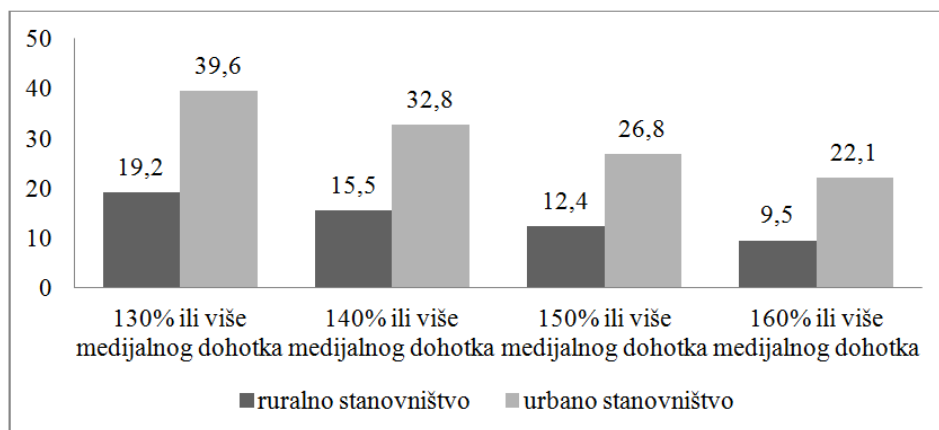
Tabela 2. Stopa rizika od siromaštva prema stepenu urbanizacije u Srbiji, 2014-2022

	2014	2015	2016	2017	2018	2019	2020	2021	2022
EU-27	15	16,1	19,1	18,1	16	15,2	14,6	14,1	14,1
Srbija	37,3	38,4	34,1	35,2	34,7	33,5	30,7	30,2	27,3

Izvor: Eurostat (2024)

Dodatni uvid u dohodno siromaštvo ruralne populacije može se dobiti preko udela stanovnika koji imaju dohodak jednak ili viši od specifičnog praga definisanog u odnosu na medijalni dohodak (slika 1).

Slika 1. Dohodak pojedinaca prema specifičnom pragu u odnosu na medijalni dohodak u Srbiji prema stepenu urbanizacije, 2022



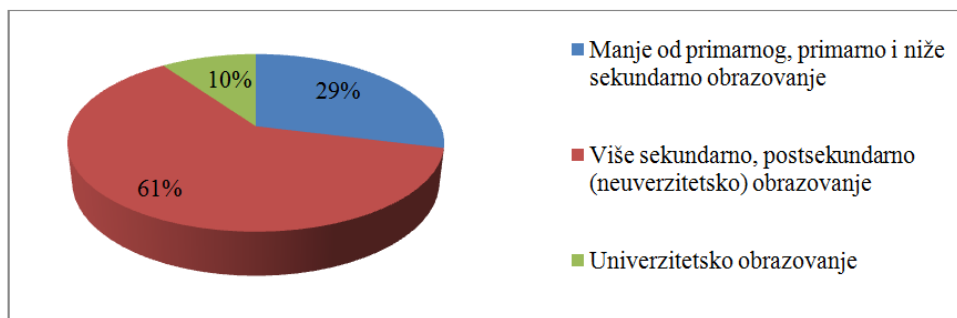
Izvor: Eurostat

U Srbiji je u 2022. godini svega 19,2% ruralnog stanovništva imalo dohodak koji je 30 ili više procenata iznad medijalnog dohotka. Sa povećanjem praga smanjuje procenat pojedinaca u ruralnim sredinama koji imaju dohodak iznad zadatog praga, tako da 60% ili više dohotka u odnosu na medijalni dohodak ima svega 9,5% stanovništva u ruralnim sredinama. Ovi procenti su daleko povoljniji za urbano stanovništvo.

4. Ostali indikatori ruralnog siromaštva i socijalne isključenosti u Srbiji

Zbog lošijih materijalnih uslova i ograničenog pristupa obrazovanju, stanovništvo u ruralnim sredinama ima slabija obrazovna postignuća u odnosu na urbano stanovništvo. Podaci o nivou obrazovanja ruralne i urbane populacije u 2023. godini pokazuju da skoro 1/3 populacije u ruralnim sredinama, starosti između 15 i 64 godine, ima manje od primarnog, primarno ili niže sekundarno obrazovanje, dok je svega 10% onih sa univerzitetskim obrazovanjem (slika 2). U urbanoj populaciji je 12% onih koji imaju manje od primarnog, primarno ili niže sekundarno obrazovanje, dok 38% ima univerzitetsko obrazovanje.

Slika 2. Ruralno stanovništvo prema nivou obrazovanja u Srbiji, 2023



Izvor: Eurostat

Samim tim, ruralno stanovništvo suočeno je sa većim rizikom da bude nezaposleno, odnosno da bude zaposleno na nesigurnim i slabo plaćenim poslovima. Stopa nezaposlenosti u ruralnim područjima u 2023. godini iznosila je 10,1%, dok je u urbanim sredinama iznosila 8,5%. Takođe, udeo mladih koji nisu zaposleni (starosti 15-34 godine), niti su u procesu školovanja ili obuke, bio je za 50% veći u ruralnim (18,8%) nego u urbanim sredinama (12,6%), što ukazuje na ograničene mogućnosti školovanja i zapošljavanja u ruralnim sredinama. U ruralnim sredinama žene su u nepovoljnijem položaju u odnosu na muškarce u pogledu nezaposlenosti. Naime, stopa nezaposlenosti žena u ruralnim sredinama iznosi 11,5%, a za muškarce 9,0%. Ta razlika je manja kod urbanog stanovništva, gde su stope nezaposlenosti muškaraca (8,4%) i žena (8,6%) približnije. Pored toga, procenat pojedinaca koji su u 2022. godini živeli u domaćinstvu u kome su radno sposobni članovi radili radno vreme jednako ili manje od 20% njihovog ukupnog potencijala iznosio je 16,6% u ruralnim, u poređenju sa 10,6% u urbanim sredinama.

Niža prosečna primanja, nesigurnost zaposlenja, veće stope nezaposlenosti, osetljivost na nepredviđene šokove, doprinose razvoju materijalne deprivacije u ruralnim oblastima. Stopa teške materijalne deprivacije prikazuje procenat pojedinaca koji žive u domaćinstvima koja ne mogu sebi da priušte najmanje četiri od devet stavki materijalne deprivacije, koje predstavljaju ono što većina ljudi smatra poželjnim ili nužnim za pristojan život: platiti račune na vreme, priuštiti adekvatno grejanje u najhladnijim mesecima, podmiriti neočekivane finansijske izdatke, priuštiti obrok koji sadrži meso, ribu ili vegetarijanski ekvivalent svaki drugi dan, priuštiti nedelju dana godišnjeg odmora van kuće za sve članove domaćinstva, televizor, mašinu za pranje rublja, automobil, telefon.

Tabela 3. Udeo stanovništva koje živi u teškoj materijalnoj deprivaciji u Srbiji prema stepenu urbanizacije, 2014-2022

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Ruralno stanovništvo	30,9	28,0	23,2	19,0	17,9	16,3	17,2	15,0	13,7
Urbano stanovništvo	21,6	20,0	16,3	15,0	12,9	12,4	9,4	9,7	10,0

Izvor: Eurostat

Najnoviji podaci Eurostata o materijalnoj deprivaciji iz 2022. godine pokazuju da je broj ljudi koji živi u teškoj materijalnoj deprivaciji u Srbiji u padu: stopa teške materijalne deprivacije iznosi 13,7%, dok je 2014. godine čak 30,9% ruralnog stanovništva Srbije živelo u uslovima teške materijalne deprivacije. U periodu 2014 – 2022 zabeleženo je kontinuirano opadanje ove stope, pri čemu se jaz između stopa teške materijalne deprivacije ruralnog i urbanog stanovništva znatno smanjila (tabela 3).

Iako se siromaštvo često doživljava kao rezultat dohodne depriviranosti, činjenica je da materijalni kao i nematerijalni aspekti doprinose njegovoj složenosti. Pokazatelji materijalne i socijalne deprivacije upućuju na uslove koji utiču na kvalitet života domaćinstava i pojedinaca. Podaci o materijalnoj i socijalnoj deprivaciji s obzirom na dimenziju ekonomske deprivacije i mogućnosti da domaćinstvo priušti neke aspekte životnog standarda prikazana je u tabeli 4.

Siromaštvo i socijalna isključenost u ruralnim područjima – iskustvo Srbije

Tabela 4. Stopa materijalne i socijalne deprivacije prema stepenu urbanizacije u Srbiji, 2014-2022

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Ruralno stanovništvo	52,3	46,4	/	41,6	35,2	28,5	28,4	26,4	25,6
Urbano stanovništvo	36,0	33,3	/	31,0	23,8	18,5	17,1	15,6	17,8

Izvor: Eurostat

Materijalna i socijalna deprivacija ukazuje na nemogućnost domaćinstva i njegovih članova da priušte sebi odgovarajuća dobra, usluge i aktivnosti koje većina ljudi smatra poželjnim ili čak nužnim za adekvatan život, a koja se metodologijom istraživanja smatraju kriterijima za merenje oskudevanja. *Stopa materijalne i socijalne deprivacije* pokazuje procenat ljudi koji žive u domaćinstvima koja iz finansijskih razloga ne mogu sebi da priušte najmanje pet od trinaest stavki (dobra, usluge ili društvene aktivnosti) materijalne i socijalne deprivacije: da podmire neočekivane troškove; obezbede jednonedeljni godišnji odmor van kuće; izmiraju obaveze na vreme (po hipotekama, zakupnini, računima za komunalije i/ili rate za kupovinu na kredit); priuštite obrok sa mesom, piletinom ili ribom ili vegetarijanski ekvivalent svakog drugog dana; održavaju svoj dom adekvatno toplim; automobil/kombi za ličnu upotrebu; zamene dotrajali nameštaj; zamene dotrajalu odeću nekom novom; imaju dva para obuće; potroše malu količinu novca svake nedelje na sebe; imaju redovne slobodne aktivnosti; odu sa prijateljima/porodicom na piće/obrok najmanje jednom mesečno; imaju internet vezu. Stopa materijalne i socijalne deprivacije ruralnog stanovništva je znatno veća u odnosu na urbano stanovništvo. Iako je u periodu 2014-2022 ova stopa opala i kod urbanog i kod ruralnog stanovništva, relativni jaz između njih je tek neznatno smanjen.

Indikator rizika od siromaštva ili socijalne isključenosti, skraćano AROPE, je glavni indikator za praćenje ostvarivanja cilja EU 2030 u vezi sa siromaštvom i socijalnom isključenošću, kao i glavni indikator za praćenje cilja strategije EU 2020 u vezi sa siromaštvom. Omogućava nam da utvrdimo udeo domaćinstava koja se suočavaju sa barem jednim od tri rizika od siromaštva i socijalne isključenosti: rizik od siromaštva, tešku materijalnu i socijalnu depriviranost i/ili život u domaćinstvu sa veoma niskim intenzitetom rada. AROPE odgovara zbiru osoba koje su ili u riziku od siromaštva, ili teško materijalno i socijalno deprivirane ili žive u domaćinstvu sa veoma niskim intenzitetom rada. Pojedinci su uključeni samo jednom, čak i ako se nalaze u više od jedne od gore navedenih situacija. AROPE stopa za ruralno stanovništvo je znatno iznad ove stope za urbano stanovništvo u posmatranom periodu (tabela 5).

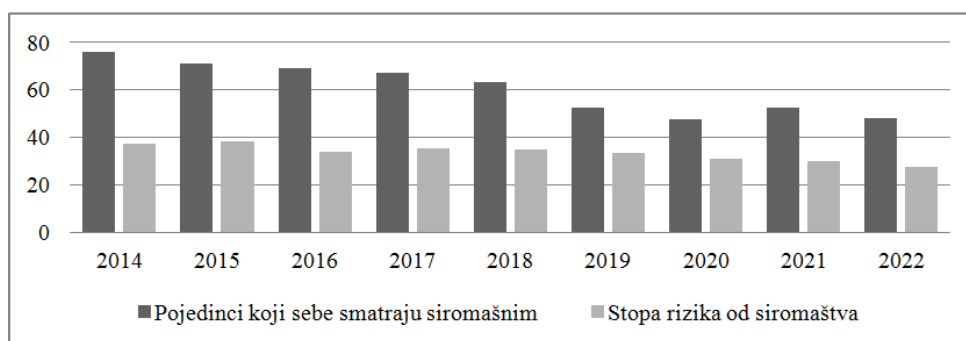
Tabela 5. Stopa rizika od siromaštva ili socijalne isključenosti (ARPE) u Srbiji prema stepenu urbanizacije (2014-2022)

	2014	2015	2016	2017	2018	2019	2020	2021	2022
ruralno stanovništvo	/	52,7	39,2	47,7	44,1	41,3	39,5	37,3	35,5
urbano stanovništvo	/	31,2	23,0	32,4	25,5	22,9	21,6	20,4	22,1

Izvor: Eurostat

Nasuprot objektivnim merilima siromaštva, istraživače i kreatora javnih politika često interesuje i subjektivni osećaj pojedinaca u vezi sa sopstvenim blagostanjem. Subjektivno siromaštvo je osećaj uskraćenosti koji ljudi imaju poredeći sebe sa drugima i poredeći svoje prihode s onim što smatraju minimumom za prihvatljiv nivo životnog standarda. Subjektivno siromaštvo ukazuje na percepciju pojedinaca o njihovom sopstvenom položaju i ne predstavlja objektivni pokazatelj materijalnog statusa, a odnos ovog indikatora sa relativnim siromaštvom ili drugim indikatorima može znatno da varira (subjektivni osećaj se može menjati).

Slika 3. Subjektivni osećaj siromaštva i stopa rizika od siromaštva ruralnog stanovništva u Srbiji, 2014-2022



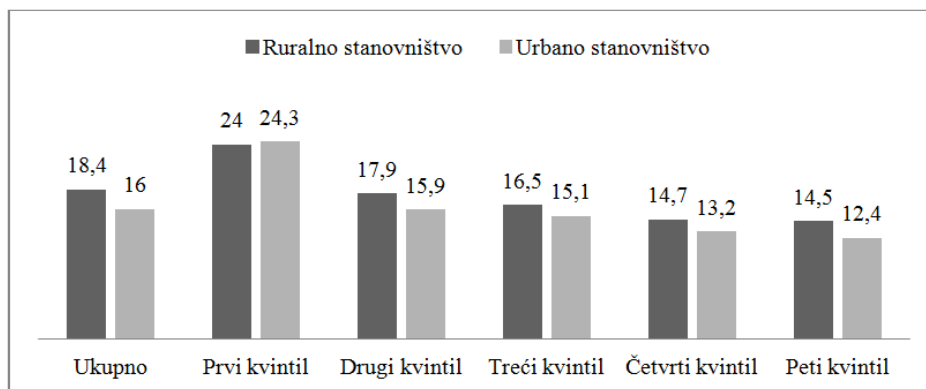
Izvor: Eurostat

Izračunava se na osnovu anketiranja domaćinstava koja su odgovorila „sa velikim poteškoćama“ ili „teško“ u pogledu mogućnosti da sastave kraj s krajem. Brojna istraživanja su pokazala da je u društvima zahvaćenim post-socijalističkom transformacijom ovaj subjektivni osećaj siromaštva izraženiji od objektivno izmerenog siromaštva. Tako je i u Srbiji u periodu 2014-2022 zabeleženo da je objektivno siromaštvo opadalo brže nego subjektivni osećaj siromaštva. Kada se uporede poslednji raspoloživi podaci o stopi rizika od siromaštva sa subjektivnom percepcijom siromaštva ruralnog stanovništva, vidimo da znatno više pojedinaca sebe doživljavalo siromašnima nego što to pokazuju podaci o relativnom siromaštvu (slika 3).

Siromašne segmente populacije karakteriše, po pravilu, osećaj izolovanosti od društva. Podaci pokazuju da je, osim u slučaju drugog kvintila, kod svih ostalih dohodnih kvintila osećaj društvene izolovanosti veći kod ruralnog stanovništva u odnosu na urbano (slika 4).

Pored navedenih dimenzija ruralnog siromaštva, treba uzeti u obzir i dodatne aspekte siromaštva u vezi sa pristupom društvenim i javnim resursima. Prema podacima V-dem-a, budući da žive u ruralnim područjima: 25 procenata (%) ili više stanovništva, čak i ako je kvalifikovano, nema pristup državnim poslovima; 25 procenata (%) ili više stanovništva, čak i ako je kvalifikovano, nemaju pristup državnim poslovnim mogućnostima; 25 procenata (%) ili više stanovništva nema pristup osnovnim javnim uslugama dobrog kvaliteta; oni koji žive u ruralnim područjima uživaju znatno manje građanskih sloboda nego stanovnici urbanih područja; stanovništvo u urbanim sredinama skoro da ima monopol na političku moć.

Slika 4. Osobe koje se osećaju izolovano od društva prema dohodnim kvintilima i stepenu urbanizacije u Srbiji, 2022 |



Izvor: Eurostat

5. Zaključak

Stanovništvo u ruralnim sredinama suočeno je sa većim rizikom od siromaštva i socijalne isključenosti jer nemaju dovoljno kapaciteta da apsorbuju šokove izazvane promenama u vremenskim prilikama, tržišnim kretanjima, investicijama i javnoj politici (Khan, 2001). Rezultirajuće fluktuacije u cenama i vrednosti njihove imovine i onoga što proizvode mogu ili produbiti njihovo siromaštvo ili im dati priliku da se iz njega izvuku. Pored toga, ekonomske krize i prirodne katastrofe mogu dovesti do naglog porasta ruralnog siromaštva i otežati siromašnima da ga izbegnu. Pored toga, politike koje su fokusirane na urbani razvoj, a zanemaruju razvoj socijalne, zdravstvene, obrazovne, sportske, kulturne i komunalne infrastrukture ruralnih područja mogu se smatrati važnim faktorom koji koči razvoj ruralnih područja i smanjenje ruralnog siromaštva (Khan 2000a).

Empirijski podaci na primeru Srbije pokazuju da je siromaštvo zastupljenije u ruralnim u odnosu na urbana područja. Stope apsolutnog i relativnog siromaštva, kao i ostali indikatori materijalne i socijalne deprivacije, konstantno su veći u ruralnim u odnosu na urbana područja u posmatranom periodu (2006-2020).

Imajući u vidu da je poljoprivreda okosnica ruralne privrede, jačanje kapaciteta poljoprivrede treba da bude osnova napora za smanjenje siromaštva. Pored ulaganja u poljoprivredu, razvoj malih industrija i turizma može doprineti poboljšanju kvaliteta života u ruralnim sredinama i smanjenju ruralnog siromaštva. Ostvarenje tog cilja treba da bude podržano adekvatnim javnim uslugama i infrastrukturom, kao i povoljnim kreditima za poljoprivrednu proizvodnju, razvoj malih industrija i zanata, obrazovanje i stručnu obuku. Neophodno je da ciljne grupe u ruralnim oblastima budu uključene u proces donošenja i implementacije odluka o društvenoj i fizičkoj infrastrukturi u ruralnim oblastima. Održiva strategija za smanjenje ruralnog siromaštva mora da obezbedi povoljan ambijent i resurse za stanovništvo u ruralnim oblastima (poljoprivredno zemljište ili drugi resursi, pristup kreditima i sl.). Jačanje ljudskog kapitala je neophodno za izlazak iz siromaštva, pri čemu su osnovna zdravstvena zaštita i obrazovanje, a posebno za žene i decu u ruralnim sredinama, suštinski gradivni blokovi strategije smanjenja ruralnog siromaštva.

Siromašni u ruralnim sredinama suočavaju se sa različitim problemima i nisu homogena grupa. Zato prikupljanje podataka o konkretnim problemima sa kojima se suočavaju treba da bude osnova za kreiranje decentralizovanih i ciljanih programa socijalnih davanja i podrške ruralnom stanovništvu.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Literatura

- Baker, J.L. (2008). Urban Poverty: A Global View. Urban Papers, UP 5, January 2008. Washington, D.C.: The World Bank.
- Commings, P. (2004). Poverty and Social Exclusion in Rural Areas: Characteristics, Processes and Research Issues. *Sociologia Ruralis*, 44(1), 60 – 75.
- Eurostat (2024). Luxembourg: European Commission. https://ec.europa.eu/eurostat/databrowser/explore/all/popul?lang=en&subtheme=liveon.ilc.ilc_pe.ilc_peps&display=list&sort=category&extractionId=ilc_peps13n
- Jackson, J.A. & Haase, T. (1996). Demography and the distribution of deprivation in rural Ireland. In: Curtin, C., Haase, T. & Tovey, H. (Eds.), *Poverty in rural Ireland: a political economy perspective* (pp. 59-85). Dublin: Oak Tree Press.
- IPC-IG (2019). Rural poverty reduction in the 21st century. *Policy in Focus*, 6 (1).
- Khan M. H. (2000a). *Rural Poverty in developing Countries Issues and Politics*. IMF Working Paper No 00/78, Washington: IMF.
- Khan M. H. (2000b). Rural Poverty in Developing Countries. Finance and Development. A quarterly magazine of the IMF, December 2000, Volume 37, Number 4.
- Khan, M. H. (2001). Rural Poverty in Developing Countries: Implications for Public Policy. IMF Economic Issues 2001/003, Washington: International Monetary Fund.
- Kyzyma, I. (2019). Rural-urban disparity in poverty persistence. *IRP Focus*; 34 (3), 13-19.
- Nolan, B., Whelan, C. & Williams, J. (1999). Spatial Aspects of Poverty and Deprivation, In: Pringle, D.G., Walsh, J. & Hennessy, M. (Eds.), *Poor People and Poor Places: A Geography of Poverty and Deprivation in Ireland* (37-74), Dublin: Oak Tree Press.
- Suttie, D. (2019). *Rural poverty in developing countries: Issues, policies and challenges*. IFAD – Investing in rural people. New York: United Nations.
- UN (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. Resolution Adopted by the General Assembly on 25 September 2015, 42809, 1-13.
- United Nations (2019). UN Sustainable Development Goals. End poverty in all its forms everywhere. UN: Department of Economic and Social Affairs. <https://unstats.un.org/sdgs/report/2019/Goal-01/>
- SIPRU (2020). *Apsolutno siromaštvo*. Tim za socijalno uključivanje i smanjenje siromaštva (2020). <https://socijalnoukljucivanje.gov.rs/sr/>

POVERTY AND SOCIAL EXCLUSION IN RURAL AREAS – INSIGHTS FROM SERBIA

Abstract: *Living in rural areas increases the likelihood of an individual being poor and socially excluded. Although rural and urban poverty share many common characteristics, the poor in rural areas face specific problems, which determine possible solutions to those problems. Researching the similarities and differences between rural and urban poverty is necessary for creating an adequate strategy and policy for poverty reduction. Understanding the reproduction of rural poverty and deprivation requires a broader approach and focus on social exclusion and its processes. The goal of this research is to improve our understanding of rural poverty in Serbia by analyzing different dimensions of deprivation, with the purpose of identifying effective strategies for solving the problem of poverty in the rural context.*

Key words: *poverty, exclusion, rural, deprivation, Serbia*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**THE LEVEL OF SOCIAL SUSTAINABILITY MEASURED BY
MULTIDIMENSIONAL POVERTY INDEX IN SERBIA, NORTH
MACEDONIA, AND MONTENEGRO**

Tabish Nawab*

Snežana Radukić¹*

Abstract: *This paper explores multidimensional poverty among Serbia, North Macedonia, Montenegro, and their Roma settlements, highlighting the limitations of traditional income-based measures and the advantages of the Multidimensional Poverty Index (MPI). By analyzing recent studies utilizing Multiple Indicator Cluster Survey (MICS) data, the paper examines critical aspects of poverty, including health, education, and living standards. Findings reveal significant disparities in child school attendance, years of schooling, nutrition, and cooking fuel among selected Western Balkan countries, particularly in Roma populations. The review identifies gaps in the current research, such as insufficient longitudinal data for all Western Balkan countries and a lack of comparative analysis and comprehensive policy evaluations. The paper stresses that more evidence should be presented for the theoretical propositions regarding the nature of these disparities and ways of eliminating them in a sequence that could enhance the quality of life. The main recommendation is that there is a need to examine the relationship between poverty dimensions and policy impact or success to contribute to improving poverty policy initiatives.*

Keywords: *Multidimensional Poverty Index (MPI), Health Disparities, Educational Access, Living Standards, Multiple Indicator Cluster Survey (MICS).*

* PhD Scholar, Ibn Haldun University, Department of Economics, Istanbul, Turkiye, ORCID: 0000-0002-4988-907X, ✉ tabish.nawab@ibnhaldun.edu.tr

• University of Niš, Faculty of Economics, Serbia; ORCID-ID: 0000-0001-5636-2893, ✉ snezana.radukic@eknfak.ni.ac.rs

This research is part of the 101136834 – CROSS-REIS – HORIZON-WIDERA-2023-ACCESS-03 project, funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency. Neither the European Union nor the European Research Executive Agency can be held responsible for them.

UDC 711.4(497.11+497.7+497.16)

1. Introduction

Economic development means raising citizens' quality of life, health, literacy levels, and well-being in general. However, there is a clear correlation between poverty, vulnerability, and economic development. Poverty was measured in terms of income which has been well-known but not very comprehensive. This approach only focuses on one basic need and may miss other basic needs such as education, health, and housing status. As a result, income growth does not guarantee enhanced performance in these indicators, confirming the necessity of a multidimensional approach to poverty. Sen's Capability approach to the extent of poverty expands the concept and goes beyond income and thinks of a living standard as the capability to achieve valuable functioning. According to Sen (1992) poverty needs to be understood in terms of minimal capabilities such as education and health that a person needs to have. It has influenced the WTO, IMF, and other international development agendas, such as the UN's Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs), which encourage the use of measures of welfare that conform to the multidimensional approach.

To overcome the shortcomings mentioned above of income-based poverty measures, The United Nations Development Program (UNDP) has developed the Human Development Index (HDI) and the Human Poverty Index (HPI). However, these indices suffered from numerous of drawbacks, including the lack of information concerning poverty distribution across various types of deprivation and within the populations. In reply, the Oxford Poverty and Human Development Initiative (OPHI) and the UNDP developed the Multidimensional Poverty Index (MPI) in 2010. The MPI offers a broader approach to determining poverty since it comprises different dimensions such as health, education, and living standards (Alkire & Santos, 2014).

Primarily, selected countries of the Western Balkans (Serbia, North Macedonia, and Montenegro) appear to have significant cause to employ the MPI because the regions involve complicated history, politics, and economy. Ignoring these factors, these countries are trying to develop and still face the problem of poverty, particularly in the Roma population. Traditional income-based poverty measures cannot sufficiently capture this type since other aspects, such as access to services, social exclusion, and economic endowment, are very important in these regions. Roma communities, which are located in the Western Balkans countries, are one of the most affected, in the sphere of education, health care, and living conditions, and experience very drastic problems. Research shows that such communities remain in significantly low socioeconomic status, and most of the Roma people inhabit the ghettos that poorly provide living conditions and employment prospects (Varadzhakova, 2023). What had been identified by the MPI is that there exist high levels of poverty within these communities and showed that the income-based poverty rate fails to capture the accurate picture. That is why combating poverty in these countries should be aimed at improving the quality of life of all those who suffer from various sorts of deprivations mentioned earlier and are characterized as vulnerable populations. Therefore, the information gathered from the MPI should inform policies intended to address education, health, and living standards among such groups. Policies also have to enhance equal access to fundamental rights and counter discrimination. In this regard, the wrath of policies should fall on the Roma population, the majority of whom remain marginalized in mainstream societies. In conclusion, it can be stated that the MPI provides a valuable angle to poverty in the Western Balkans, especially in the case of the Roma population. That is why the evidence

The Level of Social Sustainability Measured by Multidimensional Poverty Index in Serbia, North Macedonia, and Montenegro

from different dimensions of the MPI proves that developing and implementing localized policy interventions is necessary, as those people are in a very critical situation.

The MPI derived from the MICS dataset is the most pertinent poverty measurement framework that has been created to supplement the income-based poverty line. In MPI analysis, there are three dimensions including health, education, and living standards which further comprise ten indicators. This is especially true for the following MICS indicators that are closely connected to and critical for the attainment of the above-mentioned SDGs, namely, child mortality, child nutrition, drinking water, sanitation, multidimensional poverty –this is also known as MPI- and access to electricity targets. This analysis also assists in establishing the extent of deprivation of the Roma population in these dimensions and what policy interventions should be meet the SDGs and improve the quality of life of the Roma population in the Western Balkan countries.

2. Literature Review

This paper examines the issue of poverty among Western Balkan countries, i.e. Serbia, North Macedonia, and Montenegro and Roma settlements in these countries. It reveals that the problems remain unsolved despite being recognized since the early 2000s: first, it finds that utilizing the conventional, income-based poverty indicators presents some limitations in the case of the countries in question. The Multidimensional Poverty Index (MPI), which considers three dimensions: health, education and standard of living, is a better framework since it encompasses poverty in its real sense (Alkire & Foster, 2011). Several surveys, like the Multiple Indicator Cluster Survey (MICS), have been useful for data collection to study the multidimensional poverty in these areas. This paper aims to present the findings and possible gaps and drawbacks of the recent literature.

According to studies, cross-sectional MICS data have been employed to analyze health and education inequalities, as well as housing disparities in the Roma community in the Western Balkans. In Serbia, for Roma communities, housing disparities are also evident, with seven out of ten families living in informal settlements (Vasić et al., 2021). These indicators point out the significance of expanding poverty measures beyond income, which includes multidimensional indicators to reflect challenges in a better way faced by marginalized populations, such as the Roma. Applying the MPI which includes education, health, and living standards, is essential for framing effective policies for these settlements (Alkire & Foster, 2011).

In many Western Balkan countries, many household-level surveys, such as MICS, have been instrumental in understanding multidimensional poverty. For example, Kováčová (2024) found significant health disparities among Roma children in Serbia, including higher levels of malnutrition rates in comparison to non-Roma children. While the study efficiently diagnoses these disparities, this study lacks longitudinal data to track trends over time. Similarly, Varadzhakova (2023) explored alarming gaps in maternal care and child nutrition among Roma people in North Macedonia, but the research did not go deeply into the systemic causes of health issues. In Montenegro, Vuković-Ćalasan & Đoković (2023) identified geographical barriers, and an insufficient healthcare system as a significant challenge for Roma people. While the study discloses the structural issues, it didn't thoroughly examine the policy failures behind these inequalities.

Roma communities have also been under-researched for mental health. Kostić et al. (2021) identified socioeconomic issues as a cause of psychological distress among Roma in Serbia, but the small sample size limits the generalizability of the findings. Similarly, Arsenijević et al. (2020) found lower primary healthcare usage among Roma across the Western Balkans but did not examine how cultural factors impact healthcare access.

Education is crucial for poverty reduction, yet Roma communities in the Western Balkans have limited access to quality education. MICS data indicates that Roma children in Serbia face barriers such as economic hardship and discrimination, though the study primarily focuses on primary education (Georgieva et al., 2022). In North Macedonia, Georgieva et al. (2022) revealed that high dropout rates among Roma students are driven by both economic and cultural factors, yet the study does not fully explore policy solutions to these issues. In Serbia, Marković et al. (2021) noted that school segregation exacerbates educational disadvantages for Roma students but did not propose robust policy recommendations. In Montenegro, Petrova et al. (2022) highlighted the negative impact of poor living conditions and teacher bias on Roma children's education, yet the study lacks a detailed analysis of teacher training programs. Stanojević et al. (2021) emphasized the importance of early childhood education, noting that limited preschool availability in Serbia negatively impacts Roma children's learning. While valuable, this study overlooks the role of parental involvement in early education.

Housing, access to essential services, and environmental factors are key indicators of living standards. Several studies have used MICS to assess these conditions in Roma settlements. Vasić et al. (2021) documented overcrowding in Roma households in Serbia, while Petreski & Mojsoska-Blazevski (2021) found that Roma in North Macedonia often live in slums with inadequate facilities. However, the latter study could have explored the legal barriers Roma face in accessing services. Branković (2022) highlighted the environmental hazards Roma communities face, though social and economic factors were not fully explored. Jovanović et al. (2021) observed that Roma in Serbia are often denied access to clean water and sanitation, but the study fails to provide actionable policy recommendations.

In summary, existing literature on multidimensional poverty in the Western Balkans, particularly concerning Roma communities, reveals significant disparities in health, education, and living standards. MICS data has been invaluable in identifying these challenges, but there is a need for longitudinal studies to assess the long-term effects of these deprivations. Future research should also focus on evaluating the effectiveness of policies aimed at reducing poverty in marginalized communities. Addressing these gaps is crucial to formulating more effective strategies to combat multidimensional poverty in the region.

3. Theoretical Explanation of Indicators

Multidimensional poverty is the concept that is closer to realizing what it means to be poor or not by using other dimensions such as; education, health, and living standards than income only. Years of schooling and child attendance embody human capital accumulation and the concerned household's investment in the education of the next generations, which determines long-term knowledge and economic productivity. Child mortality rates are used to determine the health needs of the country, with a focus on inadequate health care and nutrition, availability of clean cooking fuel, and safe drinking water as crucial factors in combating respiratory and water-borne diseases. Housing factors such as floor type, light,

The Level of Social Sustainability Measured by Multidimensional Poverty Index in Serbia, North Macedonia, and Montenegro

and property possessions affect the general health, reduction of infections, interaction, and financial solidity respectively.

4. Data and Methodology

To construct the Multidimensional Poverty Index (MPI), we employed a rigorous approach involving well-defined datasets, units of analysis, and a standardized method for measuring poverty. The MPI is designed to assess the quality of life, education, and health standards simultaneously experienced by households. For this purpose, we adopted the Alkire and Foster (2011) framework for measuring multidimensional poverty. The level of analysis used in the study is Household level and the data used in the study is the Multiple Indicator Cluster Survey (MICS).

Table. 1 The dimensions, indicators, deprivation cut-offs, and weights of the Multidimensional Poverty Index

Dimensions of poverty	Indicator	Deprived of...	Weight
Education	Years of Schooling	No household member has completed five years of schooling.	1/6
	Child School Attendance	Any school-aged child is not attending school up to class 8.	1/6
Health	Child Mortality	Any child has died in the family.	1/6
	Nutrition	Any child for whom there is nutritional information is malnourished.	1/6
Living Standard (LS)	Electricity	The household has no electricity.	1/18
	Improved Sanitation	The household's sanitation facility is not improved (according to MDG guidelines) or improved but shared with other households.	1/18
	Improved Drinking Water	The household does not have access to improved drinking water (according to MDG guidelines), or safe drinking water is more than a 30-minute walk from home, roundtrip.	1/18
	Flooring	The household has a dirt, sand, or dung floor.	1/18
	Cooking Fuel	The household cooks with dung, wood, or charcoal.	1/18
	Assets ownership	The household does not own more than one telephone, mobile phone, radio, TV, bicycle, motorcycle/ scooter, car/ truck or animal driven cart or refrigerator, agriculture land, or livestock (no cattle, no horse, less than two goats, or less than ten chicken).	1/18

Source: Alkire & Foster, 2011.

4.1. Sample

This research focuses on three countries in the Western Balkans: Serbia, North Macedonia, and Montenegro. These are countries that one would expect to have a lot in common and to have gone through similar socioeconomic phases –thus, a reasonable basis for comparison.

4.2. Data

The MICS is a multicounty demographic and health household survey system created by the United Nations Children's Fund, UNICEF, and the United Nations Development Program, UNDP. Said data is collected on mortality, nutrition, maternal mortality, adult mortality, child mortality, water and sanitation, reproductive health, child development, literacy and education, well-being, and socioeconomic indicators. MICS was also developed to track advancement in the achievement of the MDGs, and well-known benchmark SDGs.

We employed six Multiple Indicator Cluster Surveys (MICS) in these three countries. As a cross-sectional survey instrument, MICS is cross-nationally comparable and intended for data collection at the household level.

The Serbia MICS (2019) sample was sourced from 8,101 households of 20,517 individuals with an 85% response rate. In Serbia, a survey was conducted only among the Roma settlements where 1,934 household members and 8329 individuals, including Roma people, participated in this survey with a 96.8% response rate. The North Macedonia MICS (2018-19) was conducted in 4,777 households and encompassed a population of 15,635 people, and the overall response rate was 89.7%. The survey of Roma settlements in the North Macedonia included 1,584 households and 6,249 people and the response rate was 94.2%. The Montenegro MICS (2018) sample consisted of 6,000 households and 13,391 individuals, with a response rate of 70.60%. Respondents in the Montenegrin Roma settlements comprised 1,165 households and 4,732 people. The survey covered an 80.9% response rate.

5. Results and Discussion

Table 2 compares MPI with its related indices – Poor Population and Intensity – for Serbia, North Macedonia, and Montenegro with rural and urban area.

Table 2. Multidimensional Poverty Index (MPI) and its Indices across Countries

Country	MPI			Poor Population (%)			Intensity (%)		
	Overall	Rural	Urban	Overall	Rural	Urban	Overall	Rural	Urban
Serbia	0.22	0.33	0.10	0.62	0.92	0.30	35.82	36.19	34.55
North Macedonia	0.45	0.31	0.57	1.11	0.78	1.40	40.14	39.28	40.55
Montenegro	0.24	0.34	0.15	0.71	1.00	0.45	34.02	34.37	33.33

Source: Authors calculations

**The Level of Social Sustainability Measured by Multidimensional Poverty Index
in Serbia, North Macedonia, and Montenegro**

In North Macedonia, MPI, and the percentage of the poor population stood highest 0.45, and 1.11% respectively. Interestingly, North Macedonia compared to Serbia, and Montenegro, and its rural settings have higher multidimensional deprivations. In addition, poverty intensity in rural areas is 39.28%, and almost a quarter of the poor population is deprived in total weighted indicators, such as education, health, and living standards. There is an unresolved issue with poverty in North Macedonia's urban areas and MPI for urban areas is slightly higher and it stands at 0.57 than in the rural area (UNDP Human Development Report, 2021). However, the collected data of the 2018-2019 MICS is consistent with these trends and has analogous patterns of urban-rural differences and, therefore, supports the necessity of interventions aimed at achieving the SDGs (UNDP Human Development Reports, 2021).

Table 3. Multidimensional Poverty Index (MPI) and its Indices across Countries for Roma Settlements

	MPI			Poor Population (%)			Intensity (%)		
	Overall	Rural	Urban	Overall	Rural	Urban	Overall	Rural	Urban
Serbia (Roma Settlements)	3.95	4.27	3.79	10.11	10.80	9.74	39.13	39.52	38.91
North Macedonia (Roma Settlements)	2.39	1.54	2.44	6.25	3.71	6.40	38.28	41.43	38.17
Montenegro (Roma Settlements)	6.26	1.79	7.12	13.51	5.36	15.07	46.34	33.33	47.22

Source: Authors calculations

MPI for Roma Settlements in Serbia, North Macedonia, and Montenegro in Table 3 found significant disparities not only overall but also across rural and urban areas. Montenegro has the highest value of MPI 6.26, whereas its urban areas deal with high MPI figure 7.12. In Serbia, the MPI stands at 3.95, with rural regions experiencing slightly worse conditions than urban settlements. North Macedonia stands out at the lowest MPI with 2.39, though urban areas still face higher deprivation compared to rural areas. Furthermore, the proportion of the population living in poverty is highest in Montenegro at 13.51%, where interestingly its urban population faces around three times more multidimensional poverty than its rural areas. In addition, the intensity of poverty which measures the depth of deprivation among all indicators reaches 46.34% in Montenegro, compared to 39.13% in Serbia and 38.28% in North Macedonia.

The present study's findings are compared with the data collected during the MICS survey in 2018-2019, which shows the following inequality between the Roma and non-Roma populations of these countries. The poverty and its related deprivations are more severe in the Roma settlements compared to the general population in the countries. It is important to note that the rural-urban divide exists across all three countries and yet, the intensity of poverty seems to be worse among Urban Roma, particularly those in Montenegro and North Macedonia. The latest data support that the need for interventions in the direction of poverty

reduction under SDG 1 is vital and most relevant to the inhabitants of the settlements with a predominant Roma population, which remain rather disadvantaged.

Table 4. Contribution of Dimensions and Indicators to MPI across Countries (in percentage)

	Serbia			North Macedonia			Montenegro		
MPI Indices	Overall	Rural	Urban	Overall	Rural	Urban	Overall	Rural	Urban
Education Dimension	52.21	53.33	48.24	46.92	21.37	58.59	48.99	48.49	50.00
<i>Child School Attendance</i>	9.06	11.61	0.00	12.00	0.00	17.48	0.00	0.00	0.00
<i>Years of Schooling</i>	43.16	41.72	48.24	34.92	21.37	41.11	48.99	48.49	50.00
Health Dimension	31.01	26.14	48.24	44.00	70.08	32.09	22.69	9.04	50.00
<i>Child Mortality</i>	2.46	3.15	0.00	28.12	52.61	16.93	0.00	0.00	0.00
<i>Nutrition</i>	28.55	22.99	48.24	15.88	17.47	15.16	22.69	9.04	50.00
Living Standard Dimension	16.78	20.53	3.51	9.08	8.55	9.32	28.32	42.46	0.00
<i>Electricity</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Improved Sanitation</i>	0.00	0.00	0.00	0.28	0.89	0.00	8.77	13.15	0.00
<i>Improved Drinking Water</i>	4.24	5.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Flooring</i>	2.16	2.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cooking Fuel</i>	9.26	10.89	3.51	6.40	7.66	5.83	10.78	16.16	0.00
<i>Assets Ownership</i>	1.13	1.44	0.00	2.40	0.00	3.49	8.77	13.15	0.00

Source: Authors calculations

Table 4 shows that Serbia has the highest contribution from the Education dimension at 52.21% and has significant rural deprivation. In addition, North Macedonia comes up next with 46.92%, but its urban settlements face more problems, particularly in child school attendance indicator, which adds 17.48%, the highest across all countries. On the other hand, Montenegro, shows the highest overall deficiency in the health dimension, especially in urban zones where health contributes 50% to multidimensional poverty, which highlights the critical healthcare problems. The living standards dimension also has notable differences, with Montenegro leading in this area at 28.32%, reflecting challenges in access to basic facilities such as clean cooking fuel and drinking water, particularly in rural regions.

In comparison with the recent SDGs data and the 2019 MICS reports, these inequalities align with ongoing issues in achieving particular targets in health and education. For example, North Macedonia continues to face significant nutrition-related challenges (North Macedonia MICS, 2018-19), which underscores the gaps in SDGs achievement, especially in Roma settlements (UNICEF, 2023; The United Nations in Serbia, 2023). Similarly, Serbia's differences in school attendance and health results need more serious interventions in rural and urban poverty reduction efforts.

**The Level of Social Sustainability Measured by Multidimensional Poverty Index
in Serbia, North Macedonia, and Montenegro**

**Table 5. Contribution of Dimensions and Indicators into MPI across Countries for
Roma Settlements (in percentage)**

	Serbia (Roma Settlements)			North Macedonia (Roma Settlements)			Montenegro (Roma Settlements)		
MPI Indices	Overall	Rural	Urban	Overall	Rural	Urban	Overall	Rural	Urban
Education Dimension	40.78	33.48	45.07	58.28	69.54	57.87	43.62	50.00	43.32
<i>Child School Attendance</i>	12.42	7.71	15.19	20.82	29.31	20.51	11.48	0.00	12.03
<i>Years of Schooling</i>	28.36	25.76	29.88	37.46	40.23	37.36	32.14	50.00	31.28
Health Dimension	39.65	39.60	39.68	28.43	0.00	29.48	34.44	0.00	36.10
<i>Child Mortality</i>	15.15	11.80	17.13	8.43	0.00	8.74	17.60	0.00	18.45
<i>Nutrition</i>	24.50	27.81	22.55	20.00	0.00	20.73	16.84	0.00	17.65
Living Standard Dimension	19.57	26.92	15.25	13.29	30.46	12.66	21.94	50.00	20.59
<i>Electricity</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Improved Sanitation</i>	3.31	5.18	2.20	2.69	13.41	2.29	5.36	16.67	4.81
<i>Improved Drinking Water</i>	0.86	2.32	0.00	0.57	0.00	0.59	0.00	0.00	0.00
<i>Flooring</i>	2.19	3.50	1.43	0.00	0.00	0.00	1.28	0.00	1.34
<i>Cooking Fuel</i>	10.77	12.96	9.48	8.21	13.41	8.02	7.65	16.67	7.22
<i>Assets Ownership</i>	2.44	2.96	2.14	1.81	3.64	1.75	7.65	16.67	7.22

Source: Authors calculations

Table 5 reveals unique inequalities in education, health, and living standards, contributing differently to poverty levels. Roma settlements in North Macedonia excel in education deprivation, especially in rural areas. In addition, education deprivation is highest not only among other dimensions and their indicators but also among other countries. The recent investigations stress education's critical role in reducing poverty (World Bank, 2022). Serbia's urban areas are identified with improved educational facilities, but rural regions still face significant challenges, according to the Roma Inclusion Index (2019).

Health disparities are higher in Serbia's Roma settlements and in both urban and rural regions, where a lack of healthcare services deepens poverty. These results are aligned with the European Union Agency for Fundamental Rights (FRA, 2020), which identifies the continuous health inequalities for Roma populations in Serbia. Furthermore, Montenegro tackles high child mortality rates as compared to its rural settlements in urban areas, signaling systemic health risks (UNDP, 2021).

In regards to disparities in living standards, rural Montenegro outperforms North Macedonia and Serbia, particularly in access to improved sanitation, likely facilitated by recent infrastructure investments (UNDP, 2022). Adding to this, the Roma population in North Macedonia lags, particularly in sanitation and cooking fuel, consistent with European Commission findings (2021).

6. Conclusion

The concluding remarks of this research focus on the critical rural-urban division in multidimensional poverty across Western Balkan countries: Serbia, North Macedonia, and Montenegro, with Roma settlements being disproportionately affected. Serbia has improved and progressed in urban areas but continues to fight with deprivations in education and healthcare dimensions in rural and Roma settlements. These results are aligned with SDG 1 (No Poverty) and SDG 4 (Quality Education), which particularly emphasize the need for equitable educational access and poverty reduction, are more focused on marginalized populations (World Bank, 2022; Roma Inclusion Index, 2019).

This study underscores the importance of targeted, culturally relevant interventions. The MICS dataset confirms that multifaceted, cross-sectoral policies are significantly important in multidimensional poverty reduction in Roma communities, predominantly in health, education, and living standards (World Bank, 2023).

The analysis of this study is limited because of the unavailability of the MICS datasets for the other Balkan countries. Thus this study prevents us from doing a comprehensive comparison across the region. Furthermore, the absence of comparable survey datasets for other EU countries hinders establishing a broader context for the measurements and findings. Future research should prioritize when it comes to collecting consistent data for all Western Balkan countries, allowing a more robust analysis and comparison with neighboring EU member states like Croatia, Romania, and Bulgaria.

Acknowledgment:

This research is funded by the Ministry of Science, Technological Development and Innovation, Republic of Serbia, Grants: No. 451-03-65/2024-03.

References

- Alkire, S. & Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics*, 95(7-8), 476–487. <https://doi.org/10.1016/j.jpubeco.2010.11.006>
- Alkire, S. & Santos, M. E. (2014). Measuring acute poverty in the developing world: Robustness and scope of the Multidimensional Poverty Index. *World Development*, 59, 251-274. <https://doi.org/10.1016/j.worlddev.2014.01.026>
- Arsenijević, J., Boehm, H., & Krstić, M. (2020). Access to health care for Roma in the Western Balkans: Comparing the impact of financial and non-financial barriers. *Health Policy*, 124(5), 511-518. <https://doi.org/10.1016/j.healthpol.2020.02.002>
- Branković, J. (2022). Environmental vulnerabilities in Roma settlements: Exploring the intersection of poverty and environmental risks. *Journal of Environmental Planning and Management*, 65(5), 853–872. <https://doi.org/10.1080/09640568.2022.2043155>
- European Commission. (2021). *Roma integration strategy: Living conditions and infrastructure*. Retrieved from: <https://www.ec.europa.eu> Accessed on 15 August 2024.
- European Union Agency for Fundamental Rights (FRA). (2020). *Health inequalities among Roma populations in Europe*. Retrieved from: <https://www.fra.europa.eu> Accessed on 15 August 2024.

**The Level of Social Sustainability Measured by Multidimensional Poverty Index
in Serbia, North Macedonia, and Montenegro**

- Georgieva, A., Petrova, V., & Marković, I. (2022). Roma children and education in the Western Balkans: Persistent barriers and dropout rates. *Journal of Ethnic and Cultural Studies*, 9(3), 67–84. <https://doi.org/10.29333/ejecs/1156>
- Jovanović, J., Lalić, A., & Janković, S. (2021). Access to water and sanitation in Roma settlements in Serbia. *Water International*, 46(6), 887–903. <https://doi.org/10.1080/02508060.2021.1952927>
- Kostić, M., Vuković, D., & Petrović, A. (2021). Mental health disparities in Roma communities: Socioeconomic stress and psychological distress. *International Journal of Social Psychiatry*, 67(2), 129–138. <https://doi.org/10.1177/0020764020949321>
- Kováčová, L. (2024). Exploring the socio-economic determinants of mental well-being of marginalized Roma communities in Slovakia. *Journal of Population Health*, 12(1), 55–71. <https://doi.org/10.1080/21665095.2024.1223415>
- Marković, I., Petrović, M., & Tomanović, S. (2021). School segregation and educational inequality: The case of Roma children in Serbia. *European Education*, 53(4), 281–299. <https://doi.org/10.1080/10564934.2021.1885979>
- Multiple Indicator Cluster Surveys (MICS). UNICEF MICS [Data set]. Retrieved from: <https://www.unicef.org/mics> Accessed on 20 August 2024.
- Petreski, M., & Mojsoska-Blazevski, N. (2021). Living standards of Roma in North Macedonia: An assessment using the Multidimensional Poverty Index. *Economics of Transition and Institutional Change*, 29(1), 111–130. <https://doi.org/10.1111/ecot.12302>
- Petrova, V., & Mojsoska-Blazevski, N. (2022). Barriers to education and housing conditions among Roma children in Montenegro. *Southeast European Journal of Education*, 5(2), 187–200. <https://doi.org/10.1080/2331186X.2022.2073478>
- Republic of Serbia Statistical Office. (2022). *At-risk-of-poverty rate and social transfers*. Belgrade, Serbia: Republic of Serbia Statistical Office.
- Sen, A. K. (1997). *On economic inequality* (Expanded edition with a substantial annexe by James E. Foster and Amartya Sen). Oxford: Clarendon Press.
- Stanojević, S., Kostić, J., & Petrović, N. (2021). Early childhood education among Roma in Serbia: Barriers, challenges, and policy implications. *Early Childhood Research Quarterly*, 57, 26–38. <https://doi.org/10.1016/j.ecresq.2021.04.008>
- Statistical Office of Montenegro (MONSTAT), & UNICEF. (2019). *2018 Montenegro multiple indicator cluster survey and 2018 Montenegro Roma settlements multiple indicator cluster survey, Survey findings report*. Podgorica, Montenegro: MONSTAT and UNICEF.
- Statistical Office of the Republic of Serbia, & UNICEF. (2020). *Serbia multiple indicator cluster survey and Serbia Roma settlements multiple indicator cluster survey, 2019: Survey findings report*. Belgrade, Serbia: Statistical Office of the Republic of Serbia and UNICEF.
- State Statistical Office & UNICEF. (2020). *2018-2019 North Macedonia multiple indicator cluster survey and 2018-2019 North Macedonia Roma settlements multiple indicator cluster survey, Survey findings report*. Skopje, North Macedonia: State Statistical Office and UNICEF.
- United Nations Development Programme (UNDP). (2021). *Child mortality and healthcare access in Roma settlements*. Retrieved from: <https://www.undp.org/reports> Accessed on 15 August 2024.

- United Nations Development Programme (UNDP). (2022). *Infrastructure improvements in rural Roma communities*. Retrieved from: <https://www.undp.org/reports> Accessed on 15 August 2024.
- UNICEF. (2023). *State of children in education and health in the Western Balkans*. Retrieved from: <https://www.unicef.org/balkans> Accessed on 20 August 2024.
- Varadzhakova, D. (2023). Spatial polarization and urban ghettoization of the Roma population in Bulgaria. *Journal of Health Disparities Research and Practice*, 16(2), 101–122. <https://doi.org/10.1128/jhd.22222>
- Vasić, M., Petrović, M., & Bošković, B. (2021). Housing conditions and informal settlements among Roma in Serbia: The policy challenge. *Social Indicators Research*, 155(4), 915–933. <https://doi.org/10.1007/s11205-021-02752-9>
- Vuković-Čalasan, D., & Đoković, R. (2023). Roma in the history of Montenegro: Displacement, marginalization and discrimination. *Southeast European and Black Sea Studies*, 23(4), 845–862.
- World Bank. (2022). *World development report: Education for the marginalized*. Washington, DC: World Bank.
- World Bank. (2023). *Poverty and equity briefs: Western Balkans*. Retrieved from: <https://www.worldbank.org/en/region/eca/brief/western-balkans> Accessed on 20 August 2024.

NIVO DRUŠTVENE ODRŽIVOSTI MEREN MULTIDIMENZIONALNIM INDEKSOM SIROMAŠTVA U SRBIJI, SEVERNOJ MAKEDONIJI I CRNOJ GORI

Rezime: Ovaj rad istražuje višedimenzionalno siromaštvo u Srbiji, Severnoj Makedoniji, Crnoj Gori i njihovim romskim naseljima, naglašavajući ograničenja tradicionalnih mera zasnovanih na prihodu i prednosti Multidimenzionalnog indeksa siromaštva (MPI). Analizom nedavnih studija koje koriste podatke Ankete višestrukih klaster indikatora (Multiple Indicator Cluster Survey - MICS), ovaj rad ispituje ključne aspekte siromaštva, uključujući zdravlje, obrazovanje i životni standard. Rezultati pokazuju značajne razlike prema pokazatelju da li deca idu u školu, godinama školovanja, ishrani i gorivu za kuvanje među odabranim zemljama Zapadnog Balkana, posebno u romskoj populaciji. U radu su identifikovani nedostaci u trenutnom istraživanju, kao što su nedovoljni longitudinalni podaci za sve zemlje Zapadnog Balkana i nedostatak komparativne analize i sveobuhvatne evaluacije politike. Takođe, u radu se naglašava da bi trebalo dati objašnjenje u vezi sa prirodom ovih dispariteta i načinima njihovog otklanjanja da bi se poboljšao nivo kvaliteta života. Glavna preporuka je da postoji potreba da se ispita odnos između dimenzija siromaštva i uticaja ili uspeha politike kako bi se doprinelo poboljšanju mera politike za smanjenje siromaštva.

Ključne reči: višedimenzionalni indeks siromaštva (MPI), zdravstveni dispariteti, pristup obrazovanju, životni standard, Anketa višestrukih klaster indikatora (Multiple Indicator Cluster Survey - MICS).



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**UTICAJ EKONOMSKIH SLOBODA NA NEJEDNAKOST U
RASPODELI DOHOTKA – PANEL ANALIZA BIVŠIH
SOCIJALISTIČKIH PRIVREDA**

Mladen Andelković*

Zoran Stefanović*

„Sigurno nijedno društvo ne može biti srećno i cvijetati, ako je kudikamo najveći deo njegovih članova siromašan i bijedan“. (Smith, 1952,73. str)

Rezime: Postsocijalističke zemlje prolaze kroz osobene privredno-sistemske procese, u nastojanju da zauzmu što povoljniji položaj u svetskoj podeli rada, i ovladaju institucionalnim rešenjima potrebnim za korišćenje novih, ekološki prihvatljivijih tehnoloških obrazaca proizvodnje. Uzor institucionalne izgradnje su aranžmani danas razvijenih Zapadnih privreda, čije su uporište ekonomske slobode. U radu se istražuju efekti institucionalnih promena, usmerenih na širenje granica ekonomskih sloboda, na dinamiku nejednakosti u postsocijalističkim privredama. U tom cilju izvršena je regresiona analiza uticaja ekonomskih sloboda na nejednakost u odabranoj grupi tranzicionih zemalja. Kao nezavisna varijabla koristi se prilagođen indeks ekonomskih sloboda Heritidž fondacije, uz učešće drugih prilagođenih kontrolnih varijabli. Uz ograde uslovljene kvalitetom uzorka, može se tvrditi da institucionalizacija ekonomskih sloboda, u neto efektu, može biti od određenog uticaja na ublažavanje problema nejednakosti, merene Džini koeficijentom.

Ključne reči: ekonomske slobode, postsocijalističke zemlje, nejednakost.

Uvod

Postsocijalističke zemlje prolaze kroz jedinstveni proces društveno-ekonomskog preobražaja. U njegovom središtu nalazi se institucionalna razgradnja socijalističkog sistema,

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ✉ mladen.andjelkovic@eknfak.ni.ac.rs

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID ID 0000-0003-4034-7239,

✉ zoran.stefanovic@eknfak.ni.ac.rs

UDK 330.564.6

čija su operativna rešenja u privredi oblikovana sa namerom da se omogući komandno ekonomsko upravljanje, utemeljeno u čvrstoj hijerarhiji relevantnih aktera. Svi ekonomski delatnici u takvom režimu ekonomske koordinacije morali su da podrede svoje ciljeve i akcije centralizovanom državnom plansko-proizvodnom aparatu. Nije neočekivan manjak slobode i privredne inicijative u takvom modelu ekonomskog upravljanja, što se neminovno moralo da odrazi i na učinke ovih privreda. Prelazak na efikasniji model privređivanja, kao svoj institucionalni uzor ima rešenja iz danas razvijenih Zapadnih ekonomija, usavršavana kroz privrednu istoriju. Premda nisu uniformna, njihovo principijelno uporište su individualizam i ekonomske slobode. Pored povećanja stepena ekonomskih sloboda, izgradnja efikasnih institucija treba da dovede do složenih i, u odnosu na domaće okolnosti, dobro izbalansiranih rešenja, kojima se izlazi u susret novim tehnološkim obrascima, usmerenim ka ekološki održivoj proizvodnji. Težnja tranzicionih ekonomija, da kroz institucionalne promene povećavaju stepen ekonomskih sloboda, i stimulišu privredni rast, ima određene reperkusije i na nejednakost u ovim društvima. U radu se istražuju efekti institucionalnih promena, shvaćenih kao proširenje obima ekonomskih sloboda na nejednakost u tranzicionim privredama.

U tom smislu, u prvom delu rada kratko su prikazana važnija shvatanja o odnosu ekonomskih sloboda i nejednakosti u ekonomskoj teoriji. Nakon napomena o metodologiji i podacima, prezentuju se rezultati istraživanja. Potom su data zaključna razmatranja.

1. Ekonomske slobode i nejednakost

Još od vremea Adama Smita javila se ideja da slobodna interakcija ekonomskih subjekata stvara najveće bogatstvo društva. Nažalost, značaj ekonomskih sloboda za društveno-ekonomski razvitak nije uvek i svuda bio prepoznat. Čitav 20. vek obeležila je ideološka podela sveta zasnovana na različitom odnosu prema svojini i ekonomskim slobodama pojedinca. Neprikosnovenosti privatne svojine i slobode u ekonomskim interakcijama u kapitalističkom svetu u socijalističkim zemljama bili su suprotstavljeni kolektivna svojina nad sredstvima za proizvodnju i opsežno potiskivanje ekonomskih i političkih sloboda pojedinaca, zarad proklamovane jednakosti. Ekstremni slučaj odnosa prema svojini bila je privreda SFR Jugoslavije, gde je na temelju prudonovske koncepcije „svojine kao krađe“ proizašla ustavna kategorija društvene svojine kao uopštene negacije svojine. Različiti oblici koordinacije ekonomske aktivnosti iznikli iz takvog ideološkog ambijenta, doživeli su kolektivni krah krajem 80-ih i 90-ih godina prošloga veka, a zemlje bivšeg istočnog bloka su krenule putem razvitka institucija tržišne privrede. U poslednjih četrdesetak godina leseferistička doktrina formalno dominira ekonomskom naukom, a uspešnost države u kreiranju optimalnog ambijenta za odvijanje ekonomske aktivnosti posmatra se kroz nivo ostvarenih ekonomskih sloboda i kvalitet institucionalne regulative koja služi kao garant tih sloboda.

Postoje različite definicije ekonomske slobode. Na sajtu World Heritage Foundation stoji da one predstavljaju osnovno pravo svakog čoveka da raspolaže sopstvenim radom i svojinom. Osnovu ekonomske slobode čine lični izbor, sloboda razmene dobara, slobodna konkurencija, zaštita ličnosti i imovine (Gwartney & Lawson, 2003). Državna intervencija u privredi deluje u pravcu ograničavanja autonomije ekonomskih subjekata i rezultira suboptimalnom alokacijom resursa. Ekonomske slobode ipak ne podrazumevaju potpuno ukidanje državnog sektora, odnosno intervencionizma, koji je u određenim oblastima nesmetanog funkcionisanja društva neophodan, već stvaranje i očuvanje zajedničkog osećaja slobode (Miller & Kim, 2016)

Uticaj ekonomskih sloboda na nejednakost u raspodeli dohotka – panel analiza bivših socijalističkih privreda

Privredno-istorijska iskustva danas razvijenog Zapadnog sveta pokazuju da ovako shvaćene ekonomske slobode ne samo što pozitivno deluju na privredni rast, već ujedno predstavljaju i neophodan preduslov održivosti i ekonomskog prosperiteta. Kada je reč o uticaju ekonomskih sloboda na jednakost, uprkos obimnoj literaturi i brojnim istraživanjima, ne postoji jedinstveno gledište. Benet i Nikolajev (2017) ističu da oprečni zaključci brojnih istraživanja proizilaze usled upotrebe različitih ekonometrijskih modela, različitih mera ekonomske nejednakosti, kao i da su rezultati osetljivi na izbor uzoraka.

U nekadašnjim socijalističkim zemljama, operacionalizacija ideje o jednakosti računala je sa kolektivnim upravljanjem i društvenim institucijama koje nisu utemeljene u individualističkim vrednosnim kategorijama. Takve sisteme karakterisao je nizak nivo ekonomskih sloboda, što je kao posledicu imalo niže stope privrednog rasta u odnosu na kapitalističke sisteme utemeljene na neprikosnovenosti privatne svojine u sferi potrošnje i proizvodnje. Odsustvo neposredne ekonomske motivacije u socijalističkim privredama, koja je prirodna posledica manjka svojinskih sloboda, jedan je od bitnih uzroka slabih performansi i njihovoj nesposobnosti da bitnije podignu životni standard stanovništva. Upravo u sferi vlasništva autori liberalne provenijencije pronalaze uzrok nejednakosti. Nejednakost je posledica činjenice da pravni i politički sistemi brojnih zemalja ograničavaju većini pristup formalnom sistemu svojine (DeSoto, 1989). DeSoto u gotovo hajkovskom maniru siromaštvo i nejednakost dovodi u vezu sa gušenjem ličnih sloboda, a pre svega pravom na svojinu. Ovakvo shvatanje ima poseban značaj za zemlje u razvoju sa visokim stepenom korupcije. Bogata elita korumpirajući političku vlast ograničava širokim slojevima osnovna građanska prava i participaciju u političkom procesu.

Ekonomske slobode utiču na jednakost na dva načina, kroz redistribuciju dohotka i kroz odnos stopa rasta dohotka bogatih i siromašnih (Berggren, 1999). Veličina državnog sektora utiče na sveukupnu efikasnost upotrebe resursa na nivou privrede. Posmatrano sa stanovišta udela javnih prihoda i rashoda u BDP-a, glomazan birokratski aparat u principu odvlači i preusmerava resurse sa produktivnih namena, i time sputava dalji rast privatnog sektora. Činjenica je da su produktivnost i zarade niže u javnom sektoru nego u privatnom, usled čega veći broj radnika ostaje sa manjim dohotkom. Nasuprot efektu veće produktivnosti u privatnom sektoru na tokove raspodele u društvu, stoji redistributivna uloga države sa potencijalno velikim socijalnim i transfernim davanjima. Jedna od osnovnih obaveza savremene države, jeste obezbeđenje društveno-prihvatljivog nivoa brige o socijalno ugroženim slojevima društva. Očekuje se da veliko učešće socijalnih davanja ublaži problem nejednakosti u društvu. Međutim postoje i istraživanja koja dovode u pitanje ne samo značaj socijalno uslovljene redistribucije dohotka, već čak i šireg doprinosa demokratije na smanjenje nejednakosti (Acemoglu et al., 2015). Bogatiji slojevi društva zahvaljujući nasleđenom bogatstvu iz prethodnog „nedemokratskog“ stanja društva korupcijom, lobiranjem i ostalim neformalnim kanalima održavaju de facto moć uprkos činjenici da je demokratizacija dovela do transfera de jure moći na siromašnije slojeve društva. Ipak ovde se ne radi o suštinskim demokratskim promenama, već isključivo o prividu demokratije, te se uticaj na jednakost ne može smatrati relevantnim.

Ne može se preskočiti činjenica da država sa velikom redistribucionom moći ne znači ujedno i postojanje države blagostanja (Bennet & Nikolaev, 2017). U nerazvijenim zemljama veliki udeo u ukupnim javnim rashodima čine investiciona ulaganja, gde država pokušava da nadomesti nizak nivo privatnih investicija, kao i pokriće dugova javnih preduzeća umesto socijalnih davanja. Takođe postoje čvrsti dokazi da je „velika država“ prema udelu javnih rashoda u BDP-u pozitivno korelisana sa neproduktivnim rent seeking aktivnostima i korupcijom (Scully, 1991; Goel & Nelson, 1998; H. Park et al., 2005). Autori se, takođe,

pozivaju na teorem o medijalnom glasaču, prema kojoj postoji verovatnoća da će srednja klasa preusmeriti socijalne transfere prema sebi, a zavisno od odnosa više i niže klase zavisice efekat na jednakost (Stigler, 1970). Dakle, postoje široke mogućnosti zloupotrebe socijalnih programa i čitavog birokratskog aparata, pri čemu su tome posebno izložene zemlje u razvoju sa nedovoljno razvijenim mehanizmom identifikacije i sankcionisanja takvih i sličnih neželjenih aktivnosti. Pored ispitivanja uticaja ekonomskih sloboda kao takvih, jedan od ciljeva rada je da se utvrdi koliki je doprinos veličine javnih rashoda na smanjenje nejednakosti.

Pedesetih godina 20. veka Sajmon Kuznjec (Kuznetz, 1955) je ukazao na postojanje nelinearnog odnosa između privrednog rasta i ekonomske nejednakosti. U prvim fazama privrednog razvoja zemlje procesi industrijalizacije i urbanizacije najpre dovode do rasta nejednakosti, ali u kasnijim fazama dovode do njenog smanjenja. Različiti institucionalni i politički faktori, praćeni akumulacijom ljudskog kapitala i kreiranjem novih poslovnih prilika imaju različite reperkusije na jednakost pri višim stupnjevima ekonomskog razvika društva. U skladu sa time prepoznata je činjenica da odnos između ekonomskih sloboda i jednakosti može imati nelinearni karakter. Najpre dolazi do smanjenja nejednakosti, međutim sa daljim rastom ekonomskih sloboda dolazi do koncentracije bogatstva (Carter, 2007). Nasuprot tome postoji shvatanje da ekonomske slobode najpre dovode do rasta nejednakosti, ali da sa uvećanjem ekonomskog bogatstva i pretnjom socijalnih nemira dolazi do promena na planu preraspodele dohotka, a samim time i do smanjenja nejednakosti (Acemoglu & Robinson, 2002; Bennet & Vedder, 2013; Apergis & Cooray, 2015).

Prelazak na tržišni sistem privređivanja kroz širenje ekonomskih sloboda otvara mogućnosti bavljenja brojnim zanimanjima, pre svega preduzetničkog karaktera koja kroz natprosečne zarade takođe mogu delovati u pravcu veće nejednakosti. Tržište u sebi ne sadrži socijalnu komponentu već nagrađuje samo najuspešnije. Na toj liniji rezonovanja moguće je očekivati da negovanje egoističkih interesa dovede samo do rastuće nejednakosti. Karter (2007) ističe da pri višim nivoima ekonomskih sloboda dolazi do koncentracije bogatstva.

Uprkos tome postoje istraživanja koja potvrđuju da pored pozitivnog efekta na privredni rast, ekonomske slobode dovode do smanjenja nejednakosti raspodele u društvu (Scully, 2002; Apergis & Cooray, 2015). Reforme privrednog sistema usmerene ka jačanju ekonomskih sloboda se mogu odvijati u različitim pravcima, i time imati različit uticaj na ispoljene nejednakosti. Dugoročne promene zasnovane na liberalizaciji trgovine i finansijskoj deregulaciji mogu rezultirati rastom dohotka siromašnijeg dela društva i time ostvariti pozitivan uticaj na jednakost (Berggreen, 1999). Ukoliko pozitivni efekti liberalizacije na rast dohotka kod siromašnijih slojeva nadmaši negativne efekte ukidanja socijalnih davanja i progresivnog poreskog sistema, krajnji efekat ekonomskih sloboda na jednakost će biti pozitivan. Ovo ukazuje da krajnje efekte nije moguće a priori definisati, već je neophodno sagledati ukupnost institucionalnih, političkih i ostalih širih društvenih okolnosti zemlje. U skladu sa time cilj ovog rada je da se utvrdi da li postoji i kakav je karakter uticaja ekonomskih sloboda na društvenu jednakost u postsocijalističim državama nakon okončanja procesa tranzicije.

2. Metodologija i podaci

Sve vrednosti posmatranih varijabli su preuzete iz dostupne baze Svetske banke (World bank), izuzev IEF indeksa, čije su vrednosti uzete sa sajta The Heritage Foundation. Korišćenjem podataka iz jedinstvenog izvora izbegnut je problem vezan sa uporedivošću podataka. U cilju dolaska do pouzdanih rezultata sve varijable u modelu su logaritmovane.

**Uticaj ekonomskih sloboda na nejednakost u raspodeli dohotka
– panel analiza bivših socijalističkih privreda**

Istraživanje je sprovedeno nad podacima za 20 bivših socijalističkih zemalja i odnosi se na period od 2012-2020. Izbor vremenskog perioda i zemalja je bio ograničen usled nepotpunosti podataka. Prikupljeni panel podaci su balansirani, a statistička obrada je izvršena programom STATA 13.

Za meru ekonomske nejednakosti uzet je GINI indeks (logGINI), koji predstavlja odnos površine između Lorencove krive i krive savršene jednakosti u raspodeli, i ukupne površine „trougla“. Vrednosti indeksa se kreću od 0 do 100, pri čemu 0 označava savršenu jednakost, a 100 savršenu nejednakost kada 1% populacije ostvaruje 100% ukupnog dohotka. Podaci se zasnivaju na anketama domaćinstava, prikupljenim od nacionalnih statističkih agencija i filijala Svetske Banke.

Veliko interesovanje i razvoj ekonometrijskih metoda omogućio je da nivo ekonomskih sloboda postignutih u zemlji postane cilj koji se može kvantitativno izmeriti i izraziti u vidu različitih indeksa.

Posmatrana nezavisna varijabla u istraživanju je IEF indeks (The index of economic freedom) koji od 1995. na godišnjem nivou publikuju The Heritage Foundation u saradnji sa Wall Street Journal. Istraživanja uticaja ekonomskih sloboda na nejednakost zasnivaju se najčešće na starijem EFW indeksu (Economic Freedom of the World), koji publikuje Fraser institut, međutim s obzirom na sličnu metodologiju primena IEF indeksa ne može da umani kvalitet istraživanja, a čak štaviše Hekelman (J. Heckelman, 2000) ističe prednosti IEF indeksa u odnosu na EFW indeks u vidu veće metodološke doslednosti i potencijalnog značaja za kreatora ekonomske politike. Pionirski rad zasnovan na upotrebi IEF indeksa publikovan je 2017. god (D. Bennet, B. Nikolaev, 2017). Indeks se zasniva na 12 različitih kvalitativnih i kvantitativnih indikatora svrstanih u 4 grupe:

1. Vladavina prava
2. Veličina vlade
3. Efikasnost regulative
4. Otvorenost tržišta

Tabela 1. Pregled determinanti IEF.

Vladavina prava	Veličina vlade	Efikasnost regulative	Otvorenost tržišta
Svojinska prava	Javna potrošnja	Poslovne slobode	Trgovinske slobode
Integritet vlade	Poresko opterećenje	Radne slobode	Sloboda investiranja
Efikasnost sudstva	Fiskalna stabilnost i održivost	Monetarne slobode	Finansijske slobode

Izvor: Autor na osnovu informacija sa sajta World Heritage.

Svaki od merenih 12 aspekata ekonomske slobode se kvantifikuje na skali od 0 do 100, pri čemu najveća vrednost odražava najviši stepen ekonomskih sloboda. Sveobuhvatni indeks zemlje se dobija kao njihova prosečna vrednost, gde svaki dobija podjednak ponder.

Poput EFW indeksa i IEF indeks ima multidimenzionalni karakter. Pojedini aspekti izmerene ekonomske slobode utiču na različite načine na ekonomsku jednakost. Determinante unutar segmenta veličina vlade, i to javna potrošnja i poresko opterećenje će imati neposredan uticaj na jednakost u društvu. Socijalni transferi su namenjeni socijalno ugroženim članovima društva i dopunjuju, a nekima predstavljaju i jedini dohodak, dok se u progresivnom poreskom sistemu najveće opterećenje prevlađuje na bogatije slojeve društva. Dakle, oni imaju eksplicitnu ulogu korekcije nejednakosti u društvu. Međutim ekonomske slobode podrazumevaju ograničene ingerencije i mešanje države u privredni život, što bi značilo da viši stepen slobode postoji u slučaju manjih socijalnih transfera/javne potrošnje i manjeg poreskog opterećenja. Zemlja sa većom vrednošću indeksa ima srazmerno manju javnu potrošnju i manje poresko opterećenje, za šta teorija navodi argumente u pravcu stvaranja veće ekonomske nejednakosti. Ipak visoka javna potrošnja ne mora uvek da znači pravedniju preraspodelu, jer ona obuhvata i pokriva gubitaka javnih preduzeća, finansiranje investicionih projekata kao i izdržavanje samog birokratskog aparata. Zavisno od političke orijentacije vlade biće određen je i uticaj na ekonomsku jednakost.

Ostali aspekti ekonomske slobode imaju posredan uticaj na jednakosti, upravo kroz kreiranje ekonomskog ambijenta pogodnog za sticanje dohotka. Pretpostavka je da jasno definisana i sprovedena svojinska prava sa efikasnim i nepristrasnim sudstvom kao njihovim garantom predstavljaju osnovu tržišnog sistema privređivanja. U tržišnoj utakmici usled postojanja poslovnih, trgovinskih i sloboda investiranja uspevaju najспособniji, a blagostanje društva kao celine je na maksimalnom nivou.

Pored ekonomskih sloboda u istraživanju su korišćeni i pokazatelji javne potrošnje, BDP-a po glavi stanovnika i stopa nezaposlenosti kao kontrolne varijable.

Za indikator javne potrošnje (loggov) uzeti su izdaci države za finalnu potrošnju izraženi u % BDP-a, koji uključuju kupovinu roba i usluga, kao i zarade zaposlenih u javnom sektoru.

Tabela 2. Pregled korišćenih varijabli.

Naziv varijable	Opis	Karakter	Izvor
logGINI	Gini indeks	Zavisna	World bank data
logunmp	Nezaposlenost	Nezavisna	World bank data
logIEF	Indeks ekonomskih sloboda	Nezavisna	World Heritage Foundation
loggov	Javna potrošnja	Nezavisna	World bank data
loggdppercapita	BDP po glavi stanovnika	Nezavisna	World bank data

Izvor: Kreirao autor

Tabela 3. Pregled prosečnih vrednosti GINI koeficijenta.

Table: List of Variables	
GINI	country
24.989	Slovenia
25.289	Slovak_Repu.
25.689	Czech_Rep.
25.722	Belarus
26.800	Moldova
30.789	Croatia
31.011	Poland

**Uticaj ekonomskih sloboda na nejednakost u raspodeli dohotka
– panel analiza bivših socijalističkih privreda**

31.078	Armenia
31.533	Hungary
31.644	Albania
32.078	Estonia
34.811	North_Mac.
35.022	Latvia
35.633	Romania
36.467	Lithuania
37.000	Georgia
37.767	Serbia
37.922	Montenegro
38.267	Russia
39.078	Bulgaria

Izvor: STATA13.

Tabela 4. Pregled prosečnih vrednosti IEF indeksa

Table: List of Variables	
IEF	country
53.556	Belarus
54.600	Russia
57.733	Moldova
60.800	Croatia
61.044	Serbia
62.833	Slovenia
62.956	Montenegro
65.678	Albania
66.456	Hungary
66.522	Slovak_Rep.
67.056	Bulgaria
67.178	Romania
67.644	Poland
68.533	Estonia
68.722	Armenia
69.167	North_Mace
70.133	Latvia
72.744	Czech_Rep
73.889	Georgia
74.278	Lithuania

Izvor: STATA13.

3. Statistika i diskusija rezultata

Prvi korak u analizi je ispitivanje postojanja zajedničkog korena posmatranih varijabli, tj. da li pripadaju istom redu kointegracije. Primenom Levin-Lin-Ču testa (Levin et al., 2002) utvrđena je stacionarnost svih varijabli izuzev javne potrošnje (loggov), zbog čega

je u daljim koracima korišćen prvi diferencijal ove varijable. U tabeli ispod prikazane su p-vrednosti posmatranih varijabli. Ukoliko je vrednost veća od 0.05 prihvatamo H_0 hipotezu testa da varijabla ima jedinični koren, tj. da nije stacionarna. Prvi diferencijal logaritmovane vrednosti predstavlja godišnju stopu rasta javne potrošnje. Iako više ne posmatramo relativnu veličinu javnog sektora u BDP-u suštinski i dalje možemo da steknemo zaključak kakav je uticaj javne potrošnje na nejednakost.

Tabela 5. Pregled vrednosti Levin-Lin-Ču testa.

Назив варијабле	р-вредност
logGINI	0.00
logIEF	0.00
loggdppercapita	0.00
loggov	0.96
difloggov	0.0091

Izvor: Kreirao autor na osnovu vrednosti iz programa STATA13.

U tabeli 9. prikazane su vrednosti panel analize. U prvoj koloni (1) nalaze se vrednosti dobije metodom fiksnih efekata, u drugoj (2) metodom slučajnim efektima, dok treća sadrži fiksne efekte sa robusnom standardnom greškom. Prilikom izbora između metoda slučajnih i fiksnih efekata koristimo Hausmanov test, koji polazi od pretpostavke da su oba modela konzistentna, ali da je jedan efikasniji. Statistika Hausmanovog testa ($p=0.023$) je manja od kritične vrednosti 0.05, što nas navodi da odbacimo H_0 hipotezu da su slučajni efekti efikasniji, i prihvatimo fiksne efekte.

Tabela 6. Hausmanov test.

Hausman (1978) specification test	
	Coef.
Chi-square test value	11.358
P-value	.023

Izvor: STATA 13.

Vrednost Vuldrizovog testa autokorelacije (0.0) je manja od kritične vrednosti 0.05, usled čega odbacujemo nultu hipotezu o nepostojanju autokorelacije između posmatranih nezavisnih varijabli.

Tabela 7. Vuldrizov test autokorelacije.

Wooldridge test for autocorrelation in panel data	
H0: no first-order autocorrelation	
F(1, 19) =	27.710
Prob > F =	0.0000

Izvor: STATA 13.

Jedna od osnovnih pretpostavki modela linearne regresije je da slučajne greške koje se javljaju u funkciji regresije imaju istu varijansu, tj. da su homoskedastične. Vrednosti modifikovanog Valdovog testa (xttest3) ukazuje na prisustvo heteroskedastičnosti podataka.

**Uticaj ekonomskih sloboda na nejednakost u raspodeli dohotka
– panel analiza bivših socijalističkih privreda**

Tabela 8. Modifikovani Valdov test heteroskedastičnosti.

Modified Wald test for groupwise heteroskedasticity in fixed effect regression model
H0: $\sigma(i)^2 = \sigma^2$ for all i
chi2 (20) = 462.18 Prob>chi2 = 0.0000

Izvor: STATA 13.

Tabela 9. Pregled dobijenih koeficijenata panel analize.

VARIABLES	(1) logGINI	(2) logGINI	(3) logGINI	(4) logGINI
logIEF	-0.248** (0.115)	-0.204* (0.110)	-0.248* (0.122)	-0.248* (0.121)
difloggov	-0.231*** (0.0780)	-0.230*** (0.0782)	-0.231* (0.112)	-0.231*** (0.0166)
loggdppercapita	-0.00702 (0.00615)	-0.00653 (0.00611)	-0.00702 (0.00462)	-0.00702** (0.00285)
logunmp	0.0275** (0.0112)	0.0323*** (0.0110)	0.0275 (0.0226)	0.0275** (0.00844)
Constant	4.480*** (0.487)	4.285*** (0.467)	4.480*** (0.535)	4.480*** (0.511)
Observations	160	160	160	160
R-squared	0.161		0.161	0.161
Number of countries	20	20	20	
Number of groups				20

Izvor: STATA 13.

Napomena: ***-nivo značajnosti 1%; **- nivo značajnosti 5%; *- nivo značajnosti 10%.

U cilju korekcije heteroskedastičnosti podataka i usled postojanja autokorelacije između varijabli može se koristiti model sa fiksnim efektima sa robusnom standardnom greškom. Međutim, primenom Pesaranovog (Pesaran, 2004) ($N > T$) testa utvrđeno je postojanje kros-sektorske korelacije. Osnovna (H_0) hipoteza testa polazi od toga da su reziduali kros sektorski nezavisni, međutim p-vrednost (0.00) je manja od kritične vrednosti pa odbacujemo H_0 hipotezu i zaključujemo da u testu postoji kros-sektorska zavisnost. Robusna standardna greška kontroliše problem heteroskedastičnosti i autokorelacije, međutim postojanje kros-sektorske korelacije dovodi u pitanje ispravnost dobijenih vrednosti.

Tabela 10. Pesaranov test kros sektorske kointegracije.

Pesaran's test of cross sectional independence =	4.298, Pr = 0.0000
Average absolute value of the off-diagonal elements =	0.421

Izvor: STATA 13.

U tu svrhu je kao konačan model izabrana četvrta kolona (4) u kojoj su date vrednosti sa obračunatom Driskol i Kraay (Driscoll & Kraay, 1998) standardnom greškom. Od strane korisnika je za STATA program razvijen modul xtsc, koji kontroliše heteroskedastičnost, autokorelaciju i kros-sektorsku zavisnost (Hoechle, 2006).

Bez obzira na izbor modela u svakome su se ekonomske slobode pokazale kao statistički značajan faktor jednakosti u društvu, dok BDP po glavi stanovnika tek u poslednjem i konačnom modelu postaje statistički značajan faktor. Prvi diferencijal logaritmovane vrednosti udela javne potrošnje u BDP-u je negativno korelisan sa ekonomskom nejednakošću, što potvrđuje da postoji značajan pozitivan efekat transfernih plaćanja. U delu vezanom za metodologiju je rečeno da IEF indeks obuhvata različite aspekte ekonomske slobode, uključujući i javnu potrošnju. Ekonomske slobode podrazumevaju povlačenje države iz ekonomske sfere društva, a samim time manja transferna plaćanja i manje poresko opterećenje. Uprkos tome može se nedvosmisleno reći da pozitivan efekat ostalih aspekata ekonomske slobode vezanih za sigurnost privatne svojine, efikasnost sudstva, trgovinske i investicione slobode prevazilazi negativan efekat povlačenja države iz neposredne alokacije resursa.

Stopa nezaposlenosti kao kontrolna varijabla se u svakom testu pokazala statistički značajna. Po pitanju vezu između nezaposlenosti i nejednakosti nisu potrebna dodatna objašnjenja. Što je veći broj nezaposlenih lica biće veća nejednakost u raspodeli dohotka.

Zaključak

Pre iznošenja zaključka treba ukazati na višestruka ograničenja koja prate istraživački deo rada. Istraživanjem je obuhvaćeno samo 20 postsocijalističkih zemalja, usled nedostupnosti podataka pojedine zemlje članice bivšeg Varšavskog pakta i i republike bivše Jugoslavije su ostale izuzete. Prikupljeni podaci se odnose na relativno kratak vremenski period. Međutim, to je vreme nakon formalnog okončanja procesa tranzicije u svim obuhvaćenim privredama. Upravo ta činjenica nam omogućava da sagledamo kakav je ex-post uticaj relativno novoformiranih institucija tržišne privrede na društvene nejednakosti u bivšim „egalitarističkim“ društvima. Naredno ograničenje se odnosi na izbor metoda. Najnoviji trendovi u analizi uticaja ekonomskih sloboda na društvenu jednakost se zasnivaju na primeni dinamičkih metoda panel analize poput GMM (General method of moments) i nelinearnih regresionih metoda. Međutim, relativno kratak vremenski horizont istraživanja u određenoj meri opravdava izbor statičke linearne regresije panel podataka. I poslednji problem je vezan za tumačenje rezultata. S obzirom na to da su varijable logaritmovane, nije moguće vršiti predviđanja kretanja zavisne varijable.

Uprkos navedenim ograničenjima može se zaključiti da ekonomske reforme usmerene ka jačanju institucija tržišne privrede i kreiranju veće ekonomske slobode pozitivno deluju na jednakost u društvu. Iako preduzetnički duh nije usađen u sve članove jednog društva, brojnije i veće prilike za bogaćenje pojedinaca generišu koristi svima, čak i siromašnijim

**Uticaj ekonomskih sloboda na nejednakost u raspodeli dohotka
– panel analiza bivših socijalističkih privreda**

slojevima. Značajna negativna korelacija javne potrošnje sa nejednakošću ukazuje na činjenicu da uprkos sprovedenim reformama i stečenim mogućnostima za bogaćenje pojedinaca država još uvek nosi bitnu socijalnu funkciju, ali da i dalje postoji potreba za državnom intervencijom u cilju poboljšanja životnog standarda. Pozitivan doprinos tržišta i širih ekonomskih sloboda još uvek nije rešio problem nejednakosti i siromaštva, premda jednakost u osnovi ne predstavlja cilj ovakvog sistema.

Ipak, u skladu sa prethodno navedenim ograničenjima iznete zaključke treba uzeti sa dozom rezerve, dok se kao predlog za buduća istraživanja nameće ispitivanje uticaja pojedinačnih komponenti IEF indeksa, kao i primena dinamičkog metoda regresije u cilju kontrole potencijalne endogenosti GINI koeficijenta.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Literatura

- Acemoglu, D. & Robinson, J. (2002). *The Political Economy of Kuznets Curve*, Review of Development Economy, Vol. 6, No.2, pp.183-202.
- Acemoglu, D. Naidu, S. Restrepo, P. & Robinson, J. (2015) *Democracy, Redistribution and Inequality*, Handbook of Income Distribution, Vol.2B, pp.1885-1966.
- Apergis, N. & Cooray, A. (2015). *Economic Freedom and Income Inequality: Evidence from a panel of global economies-a Linear and a Non Linear Long-run Analysis*, The Manchester School, Vol.85, No1. pp.88-105.
- Bennet, D. & Vedder, R. (2013). *A Dynamic Analysis of Economic Freedom and Income Inequality in the 50 U.S. States: Empirical Evidence of a Parabolic Relationship*, Journal of Regional Analysis & Policy, Vol.43, No.1, pp.42-55.
- Bennett, D. & Nikolaev, B. (2017). *On the Ambiguous economic freedom-inequality relationship*, Empirical Economics, Vol.53, No.1, pp.717-754.
- Berggren, N. (1999). *Economic Freedom and Equality: Friends or Foes?*, Public Choice, Vol.100, No. 3-4, pp. 203-223.
- Carter, J. (2007). *An Empirical Note on Economic Freedom and Income Inequality*, Public Choice, Vol. 130, No. ½. pp. 163-177.
- DeSoto, H. (2000). *The Mystery of Capital: why capitalism triumphs in the west and fails everywhere else*, Bantam Press
- Driscoll, J. & Kraay, A. (1998). *Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data*, The Review of Economics and Statistics, Vol. 80, No. 4, pp. 549-560.
- Goel, R. Nelson, M. (1998). *Corruption and Government Size: A Disaggregated Analysis*, Public Choice, Vol. 97, No. ½, pp.107-120
- Heckelman, J. (2000). *Economic Freedom and Economic Growth: A Short Run Causal Investigation*, Journal of Applied Economics, Vol.3, No.1

- Hoechle, H. (2006). *XTSCC: Stata module to calculate robust standard errors for panels with cross-sectional dependence*, The Stata Journal Promoting communications on statistics and Stata, Vol.7, No.3, pp.281-312.
<https://data.worldbank.org/indicator/SI.POV.GINI?skipRedirection=true&view=map>
приступљено 23. јула. 2024
<https://www.heritage.org/index/pages/about> приступљено 21. јула. 2024.
- Kuznetz, S. (1995). *Economic Growth and Income Inequality*, The American Economic Review, Vol. 45, No. 1, pp.1-28.
- Levin, A. Lin, C. & Chu, C. (2002). *Unit root tests in panel data: asymptotic and finite-sample properties*, Journal of Econometrics, Vol. 108, No.1, pp.1-24.
- Miller, T. Kim, A. (2016). *Defining Economic Freedom*, 2016 Index of Economic Freedom, The Heritage Foundation,
- Park, H. Philippopoulos, A. & Vassilatos, V. (2005). *Choosing the size of the public sector under rent seeking from state coffers*, European Journal of Political Economy, Vol. 21, No.1, pp.830-850.
- Pesaran, H. (2004). *General Diagnostic Test for Cross Section Dependence in Panels*, Discussion paper no.1240
- Scully, G. (1991). *Rent-Seeking in U.S. Government Budgets*, Public Choice, Vol. 70, No. 1, pp.96-106.
- Scully, G. (2002). *Economic freedom, government policy and the trade-off between equity and economic growth*, Public Choice, Vol 113, No ½. pp.77-96
- Smith, A. (1952). *Istraživanje prirode i uzroka bogatstva naroda*, Zagreb, Kultura.
- Stigler, G. (1970). *Director's Law of Public Income Redistribution*, Journal of Law and Economics, Vol. 13, No. 1, pp.1-10.

THE INFLUENCE OF ECONOMIC FREEDOMS ON INEQUALITY IN THE DISTRIBUTION OF INCOME - PANEL ANALYSIS OF FORMER SOCIALIST ECONOMIES

Abstract: *Post-socialist countries are going through special economic-systemic processes, in an effort to occupy the most favorable position in the world division of labor, and to master the institutional solutions necessary for the use of new, more ecologically acceptable technological patterns of production. The role model of post socialist institutional construction are the arrangements of today's developed Western economies, whose stronghold is economic freedom. The paper investigates the effects of institutional changes, aimed at expanding the boundaries of economic freedom, on the dynamics of inequality in post-socialist economies. To that end, a regression analysis of the impact of economic freedoms on inequality in a selected group of transition countries was performed. The Heritage Foundation's adjusted index of economic freedom is used as the independent variable, with the participation of other adjusted control variables. With fences conditional on the quality of the sample, it can be argued that the institutionalization of economic freedoms, in net effect, has a beneficial effect on inequality, measured by the GINI coefficient.*

Key words: *economic freedom, post-socialist countries, inequality.*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**OBNOVLJIVI IZVORI ENERGIJE ZEMALJA ZAPADNOG
BALKANA**

Dr Miloš Todorović*

Dr Ivan Marković*

M.A. Milan Kalinović*

Rezime: Dva osnovna cilja u energetskej politici zemalja Zapadnog Balkana su: osiguranje energetske nezavisnosti i prelazak na obnovljive izvore energije. Svih pet zemalja su uvoznici električne energije, s tim što povremeno Bosna i Hercegovina i Srbija imaju viškove za izvoz. Srbija trenutno dobija 38% električne energije iz obnovljivih izvora. U cilju unapređenja energetske održivosti, Srbija ima u planu i izgradnju novih hidroelektrana kao što su Bistrica i Đerdap 3. Nuklearna energija ostaje kontraverzna zbog dugog perioda i visokih troškova izgradnje, ali bi mogla biti deo budućih rešenja. Cilj rada jeste utvrditi postojeći i budući energetski miks zemalja Zapadnog Balkana.

Ključne reči: Energetski miks, obnovljivi izvori energije, zemlje Zapadnog Balkana

1. Uvod

Ekonomska nezavisnost svih zemalja sveta se pre svega zasniva na samodovoljnosti u proizvodnji hrane i energije. Kada je u pitanju energija, osim obezbeđenja dovoljnih količina, neophodno je zadovoljiti i diverzitet ponude u odnosu na potrebe privrede i stanovništva. Dodatni zahtev je ubrzano povećanje korišćenja, ekološki prihvatljivih, „zelenih“ ili obnovljivih izvora energije. To bi značilo smanjenje upotrebe uglja, nafte,

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID 0000-0002-3909-904X,

✉ milos.todorovic@eknfak.ni.ac.rs

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID 0000-0001-7907-7198,

✉ ivan.markovic@eknfak.ni.ac.rs

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID 0000-0001-8271-3677,

✉ milan.kalinovic@eknfak.ni.ac.rs

UDK 620.92(497-15)

mazuta u korist energije sunca, vetra, vode, biotermalnih izvora i biogasa. Uostalom, i Republika Srbija je preuzela obavezu da do 2040. godine potpuno prečisti gasove iz termoelektrana, a da se do 2050. godine izvrši potpuna dekarbonizacija proizvodnje električne energije. Takvim pristupom se samo po sebi nametnulo pitanje obezbeđenja tj. zamene baznih izvora energije koji neće zavisiti od atmosferskih prilika, prirode ili bilo kog nepredvidivog faktora koji može ugroziti energetska stabilnost.

Ekonomisti, inženjeri, ekolozi i političari imaju potpuno različita mišljenja kako odgovoriti na ove izazove. Ekonomisti se zalažu da se sa što manje ulaganja dođe do što jeftinijeg kilovatsata energije. Inženjeri kao svojevrsan profesionalni izazov prihvataju nove tehnologije, naročito one koje se tiču nuklearne energije, ističući njihove prednosti, pre svega bazičnost. Ekolozima su prihvatljivi isključivo obnovljivi izvori energije, makar ih i ne bilo dovoljno. A kada su u pitanju političari, oni dobri misle na buduće generacije i pri donošenju odluka konsultuju struku. Loše političare interesuju samo naredni izbori. No, čudnim okolnostima, na kraju po pravilu bude izabrana najskuplja varijanta.

2. Obnovljivi izvori energije u svetu

Samo sedam zemalja u svetu preko 99% električne energije dobija iz obnovljivih izvora energije. U Evropi su to Island i Albanija, u Aziji, Nepal i Butan, u Africi – Etiopija i Kongo i u Južnoj Americi Paragvaj (International Renewable Energy Agency, 2024). Jasno je da se ne radi o velikim i razvijenim ekonomijama. Zato se kao primer u korišćenju obnovljivih izvora energije najčešće navodi Norveška koja više od 98% električne energije dobija iz regenerativnih izvora. U više od 40 zemalja sveta, proizvodnja „zelenih“ kilovata premašuje 50% ukupno proizvedene električne energije (International Renewable Energy Agency, 2024)., ali to ni blizu nije dovoljno da se ublaži problem globalnog zagrevanja. Jer, rešavanje globalnih problema kao što je zagađenje atmosfere i preteći efekat staklene bašte zahteva angažovanje svih zemalja sveta. I umesto da se kapaciteti koji koriste neobnovljive izvore energije smanjuju, u 2023. godini svet je dosegao najviši nivo proizvodnje energije iz uglja. Ukupno je zatvoreno 105 termoelektrana, ali su otvorene 103 nove, najviše u Kini, Indiji i Indoneziji.

Kao jedini bazni izvor energije se u narednom periodu vide nuklearne elektrane. Međutim, dva su potpuno suprotna pristupa ovoj energiji prisutna u Francuskoj i Nemačkoj. Dok je Nemačka zatvorila i poslednju nuklearnu elektranu, Francuska preko 75% električne energije dobija iz nuklearki i planira otvaranje šest novih. Ukupno 31 zemlja sveta na svojoj teritoriji ima generatore na nuklearni pogon (World Nuclear Association, 2024).

U vezi nuklearnih elektrana je prisutan niz pozitivnih, ali i ništa manje negativnih stavova. Prvi i osnovni koji ide u korist njihove izgradnje je da se njihov aktivni rad procenjuje na oko 8.500 sati godišnje, tj. da one neprestano proizvode energiju osim desetak dana u proseku godišnje koji su namenjeni remontu. Zato one predstavljaju primarni ili bazni izvor energije, kao i termoelektrane. Ali, one 40 puta manje zagađuju atmosferu od elektrana na prirodni gas, a 70 puta manje od termoelektrana koje koriste ugalj. Kada su izgrađene, trošak proizvodnje kilovat sata je minimalan. No, izgradnja nuklearnih energetske kapaciteta je skuplja od bilo kog drugog izvora jer se mogu graditi samo po sistemu ključ u ruke. Njihovo projektovanje, obuka kadrova i izgradnja traju najmanje desetak godina. Flyvbjerg & Gardner (2023) su u knjizi „Kako se prave velike stvari“ analizirali cenu i rokove izgradnje 16.000 građevinskih objekata koje su svrstali u

Obnovljivi izvori energije zemalja Zapadnog Balkana

25 kategorija i došli do zaključka da nuklearne elektrane u konačnom koštaju 120% skuplje u odnosu na projektovanu cenu, a njihova izgradnja traje 65% duže od planirane. Lošije performanse imaju samo izgradnja olimpijskih objekata i objekata za skladištenje nuklearnog otpada. Osim što su skupe, one podrazumevaju i izgradnju kapaciteta za smeštaj nuklearnog otpada. Prosečna nuklearna kapaciteta 1.000 MW godišnje ima oko 50 kubnih metara otpada koji se mora na propisan način uskladištiti. Zaključivanje ugovora o izgradnji nuklearke u dobroj meri određuje i geopolitičku orijentaciju zemlje što dugoročno definiše, kako političke tako i ekonomske tokove. Specifičan stav Mađarske u Evropskoj uniji se jednim delom može objasniti i činjenicom da u tamošnjoj nuklearci PAKŠ, Rosatom ruskim kreditom dograđuje dva nova bloka.

Zbog svega navedenog se može reći da je izgradnja nuklearne elektrane strateško pitanje države. Međutim, ono što najviše izaziva podozrenje u vezi ove energije jesu mogući incidenti čije posledice prevazilaze razmere države na čijoj se teritoriji nalaze. Najpoznatije su havarija u ukrajinskoj nuklearci u Černobilu 1986. godine i u Fukušimi u Japanu 2011. godine. Iako su procentualno najbezbednije, havarije na nuklearnim elektranama u vezi radijacije imaju najdalekosežnije posledice i ostavljaju najjači utisak u javnosti.

U bivšoj Jugoslaviji je posle černobiljske katastrofe, Skupština SRJ 1995. godine donela Zakon o zabrani izgradnje nuklearnih elektrana u Saveznoj Republici Jugoslaviji. Taj Zakon će 2005. godine potvrditi Skupština Republike Srbije. U okruženju su nuklearni blokovi u funkciji u Mađarskoj, Bugarskoj i Rumuniji. U tom kontekstu i zemlje Zapadnog Balkana muče iste dileme i očekuje ozbiljan zaokret u energetskej politici, kao i jasno određenje u odnosu na nuklearnu tehnologiju.

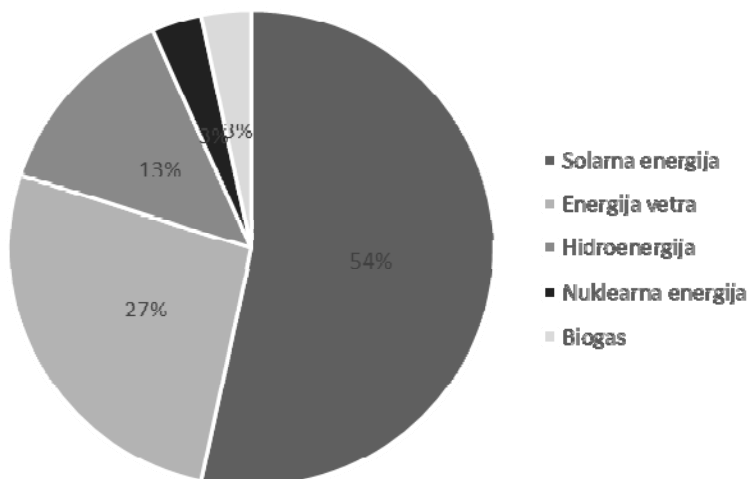
3. Obnovljivi izvori energije Republike Srbije

U Republici Srbiji obnovljivi izvori energije učestvuju u ukupnoj proizvodnji energije sa oko 25%, a u proizvodnji električne energije sa oko 38%. Daleko najveći izvor u proizvodnji električne energije (69%) predstavljaju termoelektrane koje koriste najmanje kalorični ugalj lignit. Termoelektrane „Nikola Tesla“ imaju instaliranu snagu od 3066 MW, a termoelektrana Kostolac 1007 MW (Elektroprivreda Srbije, 2024). Prema Integrisanom energetskej klimatskej planu Srbije (INEKPS), struktura proizvodnje električne energije bi trebalo do 2050. godine da se potpuno promeni u korist obnovljivih izvora energije uz potpunu dekarbonizaciju i zatvaranje termoelektrana (Ministarstvo rudarstva i energetike Republike Srbije, 2023).

Preko 50% energije bi u 2050. godini trebalo da Srbija dobija iz solarnih panela. U 2024. godini učešće ovog izvora je samo 0,04%, oko 20 MW, koji se dobijaju iz solarnih elektrana u Lebanu i Lapovu i oko 2.000 prozjumera. Procenjuje se da površina krovova u Srbiji iznosi oko 600 kvadratnih kilometara. Kada bi se samo na 10% te površine instalirali solarni paneli, Srbija bi imala struje za 6,5 miliona domaćinstava. Optimističke prognoze su bazirane na činjenici da bi se podsticajem privatnog sektora da instalira solarne panele mogla povećati proizvodnja, smanjiti tražnja za električnom energijom uz povećanje korišćenja obnovljivih izvora energije. Proizvodna cena solarnih panela je pala na 0,15 evra po jednom vatu instalirane snage, a u Srbiji već radi fabrika za njihovu proizvodnju u Velikoj Plani (kapaciteta 150 MW), dok je sa kineskim investitorom ugovorena izgradnja nove fabrike u Paraćinu kapaciteta 1.000 MW. Kada bi se ukupna proizvodnja plasirala na

domaćem tržištu, Srbija bi svoje kapacitete približno povećavala godišnje za snagu čerdpaskih hidroelektrana (1396 MW) (Elektroprivreda Srbije, 2024). Zbog toga bi subvencije namenjene proizjumerima i dobro pravno regulisanje ove oblasti značajno doprinelo energetskej stabilnosti uz minimalne budžetske izdatke.

Grafikon 1: Planirana proizvodnja električne energije u Srbiji za 2050. godina



Izvor: Integrirani nacionalni energetski i klimatski plan Republike Srbije za period do 2030. sa vizijom do 2050. godine

Problem sa solarnom energijom je što je u Srbiji sa oko 240 sunčanih dana stepen njihovog iskorišćenja oko 1200 sati godišnje. Ekonomisanje ovim izvorom energije pretpostavlja i mogućnost skladištenja energije u vidu izgradnje reverzibilnih hidroelektrana koje u letnjim mesecima višak proizvedene energije koriste za punjenje akumulacija koje će se trošiti tokom zime. Simbolično, solarne energije bi trebalo da budu građene na napuštenim površinskim ugljenokopima, devastiranim terenima koji bi se ovim pristupom i dalje koristili za proizvodnju energije.

Drugi projektovani regenerativni izvor jesu vetroparkovi. U Srbiji ih je trenutno devet. Prvi je otvoren u opštini Tutin na Peštarskoj visoravni, osam je sa leve strane Dunava, a poslednji u nizu je Krivača kod Golupca. Ovi vetroparkovi u proizvodnji struje u Srbiji učestvuju sa oko 1%, a planirano je da 2050. godine pokriju više od 25% ukupne proizvodnje. Biće upamćen 15. maj 2023. godine kada su vetroparkovi proizveli 15% električne energije, a iz obnovljivih izvora je dobijeno 51% proizvedene struje. Tehnologija vetroparkova se ubrzano razvijala pa je kilovat struje dobijen iz ovog izvora jeftiniji od onog iz termoelektrane.

Hidroenergija je još uvek najzastupljeniji izvor obnovljivih izvora energije. Međutim, svaka zemlja ima ograničene mogućnosti u korišćenju snage rečnog toka. Globalnim zagrevanjem se ti kapaciteti i smanjuju. U Republici Srbiji oko 18% proizvedene struje daju čerdpaske elektrane, oko 10% izgrađeni kapaciteti na Drini, i manje od 2% male elektrane na Vlasini i u Pirotu. Ekonomski najprihvatljivija je izgradnja

Obnovljivi izvori energije zemalja Zapadnog Balkana

reverzibilne hidroelektrane Bistrica na Uvcu za koju postoji prirodno akumulaciono jezero. Njen kapacitet bi bio oko 680 MW, a koštala bi oko jedne milijarde dolara. Praktično ona bi otvorila mogućnosti većeg iskorišćenja i solarnih panela i vetroparkova. Najveći kapacitet u pogledu hidro energije bi predstavljala takođe reverzibilna hidroelektrana Đerdap 3 i koja bi se gradila između Golupca i Donjeg Milanovca. Sa kapacitetom od 2400 MW, Srbija bi postala lider u proizvodnji električne energije u jugoistočnoj Evropi. Hidro potencijal bi u tom slučaju u ukupnoj proizvodnji struje učestvovao sa 37% uz potpunu dekarbonizaciju proizvodnje. Međutim, globalno zagrevanje smanjuje stepen iskorišćenja hidroelektrana pa se za 2050. godinu učešće ovog izvora procenjuje na manje od 15% (oko 4.000 MW).

Relativno izdašan izvor obnovljive energije u Srbiji je i biogas koji se dobija od nus produkata poljoprivredne proizvodnje, kako ratarstva, tako i stočarstva. Do sada izgrađene elektrane na biogas, većinom locirane u Vojvodini imaju instaliranu snagu oko 50 MW. Pretpostavlja se da se subvencijama koje bi mobilisale privatni sektor u investicijama ove vrste, lako moglo dostići kapacitet od oko 500 MW.

Najveće kontraverze u vezi energetskog miksa postoje u vezi izgradnje nuklearnih kapaciteta. Procenjuje se da bi taj proces, počev od ukidanja odluke iz 1989. godine o moratorijumu na izgradnju novih nuklearki, do puštanja u pogon najmanje trajao 10 do 15 godina. Sama obuka stručnjaka koji bi upravljali i održavali rad jednog takvog pogona ne bi bila kraća od 10 godina. Pretpostavke su da bi Srbiji bila potrebna jedna velika nuklearna elektrana od 1.000 do 1.200 MW. Dosadašnje procene kažu da bi ona koštala oko 7,5 milijardi dolara. Ali, ako bi se usvojili zaključci Flibjerga, njena cena bi u konačnom iznosila 16 milijardi dolara i umesto da bude završena 2039. godine, puštanje u rad bi usledilo tek 2049. godine.

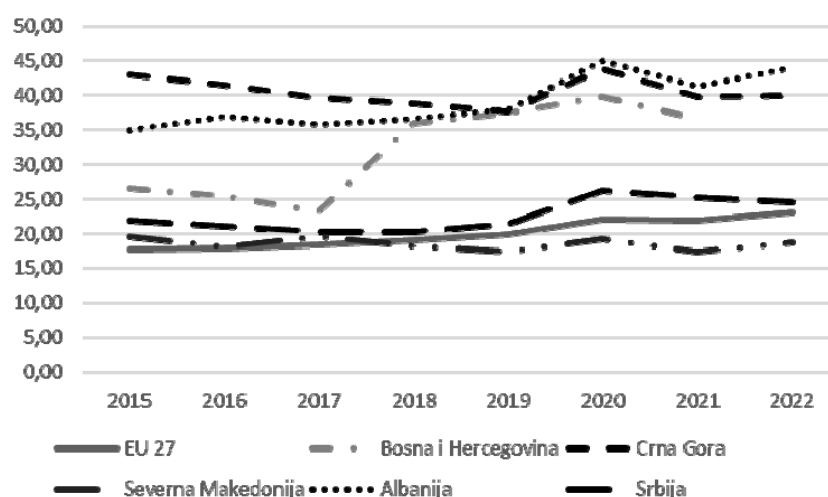
Političari kao alternativu nude male modularne nuklearne generatore, kapaciteta do 300 MW. Međutim, za sada u svetu rade samo dva takva generatora, u Rusiji i Kini. Radi se o novoj, neuhodanoj i skupljor tehnologiji od koje su odustale i SAD zbog drastičnog povećanja cena. Jedina moguća strategija u vezi nuklearki bi mogla da bude prati globalno, deluj lokalno, uz misli na dugi rok i deluj odmah ne bi li na pravi način odgovorio energetskim izazovima budućnosti.

4. Obnovljivi izvori energije zemalja Zapadnog Balkana

Zajednička karakteristika zemalja Zapadnog Balkana u proizvodnji energije jeste oslanjanje na dobijanje energije iz fosfornih goriva, prvenstveno iz uglja (Dunjic et al., 2016). Ovo čini region Zapadnog Balkana velikim proizvođačem ugljen-dioksida (Ignjatović et al., 2024). Kao potencijalne članice EU, zemlje Zapadnog Balkana nastoje da svoja nacionalna zakonodavstva usklade sa Direktivom 2009/28/EC Evropske unije o korišćenju energije iz obnovljivih izvora (Kontic et al., 2021), čime bi se smanjila i emisija CO₂. U skladu sa tim, jedan od ključnih ciljeva zemalja Zapadnog Balkana u oblasti energetike je povećanje udela obnovljivih izvora energije u ukupnoj i električnoj energiji. Prema trenutnom stanju, Albanija prednjači sa najvećim udelom obnovljivih izvora energije, dobivši 99% električne energije i 44% ukupne energije iz obnovljivih izvora. I Crna Gora ima visok udeo, sa oko 63% električne energije i 40% ukupne energije iz obnovljivih izvora. Srbija i Bosna i Hercegovina se takođe dobro kotiraju, sa udelom obnovljivih izvora energije u električnoj energiji sa 38% i 35%, dok je udeo u ukupnoj energiji 25% za obe zemlje. Severna Makedonija ima najmanji udeo, sa 25% u električnoj energiji i 20% u ukupnoj energiji. Na osnovu udela obnovljivih

izvora energije u ukupnoj energiji, zemlje Zapadnog Balkana, osim Severne Makedonije, nalaze se iznad proseka Evropske unije, koji iznosi 23% (Grafikon 2).

Grafikon 2: Učešće OIE u ukupnoj energiji zemalja Zapadnog Balkana, 2015-2022



Izvor: EUROSTAT (2024)

Pored proizvodnje energije, podjednako je značajno i pitanje distribucije električne energije. Zemlje Zapadnog Balkana, osim Albanije, nasledile su poprilično kvalitetnu distributivnu mrežu iz perioda SFRJ (Đurašković et al., 2021). Albanija najveći problem upravo ima sa starom distributivnom mrežom koja dovodi do ogromnog gubitka energije u procesu prenošenja do krajnjih potrošača (Sanfey et al, 2016). Procenjuje se da je godišnji gubitak električne energije Albanije oko 20%. Albanija je iskorak po ovom pitanju načinila tek februara 2023. godine, donošenjem Nacionalne strategije za evropski razvoj i integraciju do 2030. godine. Strategijom je predviđena modernizacija distributivne mreže koja bi dovela do povećanja efikasnosti i smanjenja gubitka električne energije za oko 20% (Smart Specialization Strategy Albania, 2024). Perspektive razvoja energetskeg sektora postoje u izgradnji solarnih elektrana pošto Albanija ima 220 sunčanih dana godišnje. Perspektive postoje i u izgradnji vetroparkova, međutim na ovom polju trenutno nema značajnijih investicija.

Crna Gora za cilj ima da do 2030. godine poveća učešće obnovljivih izvora energije u ukupnoj potrošnji sa 40% na 50%. Kao najznačajnije investicije u ovom domenu jesu ulaganja u izgradnju vetroparka i solarne elektrane. Crna Gora planira izgradnju vetroparka Gvozd kapaciteta 50 MW i solarne elektrane Briska Gora kapaciteta 250 MW (Elektroprivreda, 2019, str. 8).

Bosna i Hercegovina najveći procenat energije oko 90% dobija iz termo i hidroelektrana. Hidroenergija jeste najznačajniji obnovljivi izvor sa učešćem od oko 30% u ukupnoj energiji (Bosnia and Herzegovina – State Electricity Regulatory Commission, 2023). Napredak je ostvaren na polju proizvodnje solarne energije. U 2021. godini bilo je priključeno 453 prozjuma, dok je u 2023. godini ovaj broj porastao na 731. Ovaj sektor energetike je

Obnovljivi izvori energije zemalja Zapadnog Balkana

posebno interesantan investitorima pošto se procenjuje da je period povraćaja investicija do 6 godina. BiH ima potencijala i u dobijanju energije iz vetroparkova. Na području Tomislavgrada planirane su dve investicije u vetropark Jelovača (kapaciteta 36MW) i Ivovik (kapaciteta 84MW) (NOSBiH, 2024). Razvoj vetroparkova koči duga procedura dobijanja dozvola, studija i uverenja.

Energetski bilans ukupne energije Severne Makedonije za 2023. godinu podrazumeva da se 39,28% energije dobija iz termoelektrana, 27,34% iz hidroelektrana, 19,22% iz solarnih elektrana i 14,16% iz ostalih izvora (Energy, Water Services and Municipal Waste Management Services – Regulatory Commission of the Republic of North Macedonia, 2023). Fotonaponske elektrane u 2023. godini dostigle su kapacitet od 361,9 MW. Značajnim investicijama, kapacitet fotonaponskih elektrana povećao se za 251% u odnosu na 2022. godinu. Severna Makedonija ima za cilj da do 2023. godine poveća učešće obnovljivih izvora energije u ukupnoj energiji na 38%, sa sadašnjih 20%.

Tabela 1. Neto uvoz električne energije zemalja Zapadnog Balkana, 2020. godina

Država	Zavisnost od uvoza
Albanija	8,8%
Bosna i Hercegovina	-4,9%
Crna Gora	0,7%
Severna Makedonija	7,7%
Srbija	-0,3%

Izvor: EUROSTAT (2024)

Pored tranzicije ka obnovljivim izvorima energije, zemlje Zapadnog Balkana teže obezbeđenju i energetske samostalnosti. Među zemljama Zapadnog Balkana jedino su Srbija i BiH bile neto izvoznice električne energije u 2020. godini. Najmanji stepen energetske samostalnosti imaju Albanija i Severna Makedonija. Albanija ima najveću potrebu za uvozom električne energije od 8,8% ukupne električne energije. Deo ovog problema može se rešiti modernizacijom distributivnih mreža. Kao što je već rečeno, Albanija u prenosu gubi oko 20% proizvedene električne energije.

5. Zaključak

Usvajanjem zelene agende, države se obavezuju da povećaju učešće obnovljivih izvora energije u proizvodnji ukupne i električne energije. Do danas svega sedam zemalja je uspelo da izvrši potpuno „ozelenjavanje“ svog energetskog sektora, odnosno da preko 99% električne energije dobije iz obnovljivih izvora. Oslanjanje energetskog sektora na obnovljive izvore energije, kao što su vetar, sunce i voda, sa sobom nosi određeni rizik nepostojanosti u proizvodnji energije tokom godine. Kao odgovor na ovaj rizik, javlja se izgradnja nuklearnih elektrana. Međutim, previsoka cena, dug period izgradnje, ogromne negativne posledice u slučaju havarije i zalaženje u geopolitičke odnose između država glavni su ograničavajući faktori u značajnijem oslanjanju na nuklearnu energiju.

Zajednička karakteristika trenutnog energetskog miksa zemalja Zapadnog Balkana jeste oslanjanje na termo i/ili hidroelektrane. Prvenstveno oslanjanje na hidroenergiju

obebeđuje zemljama Zapadnog Balkana visoko učešće obnovljivih izvora energije u ukupnoj energiji, koje se nalazi iznad proseka zemalja Evropske unije. Jedino je Severna Makedonija ispod proseka EU. Međutim, ovi odnosi se ubrzano menjaju zbog velikih ulaganja u proizvodnju zelenih kilovata u EU članicama.

Druga karakteristika regiona Zapadnog Balkana jeste ogroman potencijal u solarnoj energiji i energiji vetra. Tako da se i očekuje da u budućem energetsom miksu dominira energija dobijena iz solarnih elektrana, vetroparkova i hidroelektrana. Na ovom polju postoje ili su u najavi brojne investicije. U BiH, značajne su investicije u vetroparkove poput Jelovača, Ivovik i Podveležje. U prethodnom periodu, BiH je zabeležila i napredak na polju solarnih kapaciteta čiji se broj skoro duplirao u 2023. godini u odnosu na 2021. Značajne investicije u ovom domenu ima i Crna Gora. Najznačajnije su investicije u vetropark Gvozd kod Nikšića i solarne elektrane Briska Gora kod Bjelog Polja. Severna Makedonija je u 2023. godini povećala kapacitete svojih fotonaponskih elektrana za 250% u odnosu na 2022. godinu.

Energetski miks Srbije za 2050. godinu podrazumeva da 54% električne energije dobije iz solarnih elektrana, 27% iz vetroparkova, 13% iz hidroelektrana, a ostalih 6% dobije pomoću nuklearne energije i biogasa. U „zelenom“ energetsom sektoru Srbije posebno su značajni projekti reverzibilnih hidroelektrana Bistrica i Đerdap 3. Reverzibilne elektrane omogućile bi efikasnije upravljanje energijom dobijene iz solarnih elektrana i vetroparkova. U cilju povećanja energetske efikasnosti, zemalja Zapadnog Balkana paralelno se moraju planirati i investicije u modernizaciju distributivnih mreža električne energije.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Literatura

- Bosnia and Herzegovina – State Electricity Regulatory Commission (2023). Annual Report 2023. Dostupno na: <https://www.derk.ba/en/godinj-izvjetaji-derk-a>. Pristupljeno: 07.10.2024.
- Dunjić, S., Pezzutto, S., & Zubaryeva, A. (2016). Renewable energy development trends in the Western Balkans. *Renewable and Sustainable Energy Reviews*, 65, pp. 1026-1032.
- Đurašković, J., Konatar, M., & Radović, M. (2021). Renewable energy in the Western Balkans: Policies, developments and perspectives. *Energy reports*, 7, 481-490. DOI: <https://doi.org/10.1016/j.egyr.2021.07.104>
- Elektroprivreda (2019). Obnovljivi izvori – naš najveći razvojni potencijal, List Elektroprivrede Crne Gore A.D. Nikšić, broj 388. ISSN 1805136
- Elektroprivreda Srbije (2024). Proizvodni kapaciteti. Dostupno na: <https://www.eps.rs/lat/Stranice/Kapaciteti-ElEn.aspx>. Pristupljeno: 06.10.2024.

Obnovljivi izvori energije zemalja Zapadnog Balkana

- Energy, Water Services and Municipal Waste Management Services – Regulatory Commission of the Republic of North Macedonia (2023). Annual Report 2023. Dostupno na: <https://www.erc.org.mk/odluki/ANNUAL%20REPORT%20for%202023%20-ERC.pdf>. Pristupljeno: 07.10.2024.
- EUROSTAT (2024). Eurostat database, Dostupno na: <https://ec.europa.eu/eurostat>, Pristupljeno: 09.09.2024.
- Flyvbjerg, B. & Gardner, D. (2023). *How Big Things Get Done: The Surprising Factors That Determine the Fate of Every Project, from Home Renovations to Space Exploration and Everything In Between*, United States, Cwown Currency. ISBN-13 978-05093239513
- Ignjatović, J., Filipović, S., & Radovanović, M. (2024). Challenges of the green transition for the recovery of the Western Balkans. *Energy, Sustainability and Society*, 14(1), 2. DOI: <https://doi.org/10.1186/s13705-023-00421-4>
- International Renewable Energy Agency (2024). Renewable energy statistics 2024. Dostupno na: chrome-extension://efaidnbmnnnibpcajpglclefindmkaj/https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2024/Jul/IRENA_Renewable_Energy_Statistics_2024.pdf. Pristupljeno: 06.10.2024.
- Kontic, L., Bogavac, M., & Zivanovic, N. (2021). Renewable energy potentials in Western Balkan countries: The case of Serbia. *Economic and Social Development: Book of Proceedings*, 133-141.
- Ministarstvo rudarstva i energetike Republike Srbije (2023). Integrisani nacionalni energetska i klimatski plan Republike Srbije za period do 2030. sa vizijom do 2050. godine. Dostupno na: <https://www.mre.gov.rs/tekst/sr/1115/-integrisani-nacionalni-energetski-i-klimatski-plan-republike-srbije-za-period-do-2030-sa-vizijom-do-2050-godine.php>. Pristupljeno: 08.09.2024.
- NOSBiH (2024). Indikativni plan razvoja proizvodnje 2025-2034. Dostupno na: <https://www.nosbih.ba/files/2024/06/20240611-lat-Indikativni-plan-razvoja-proizvodnje-2025-2034.pdf>. Pristupljeno: 07.10.2024.
- Sanfey, P., Milatovic, J., & Kresic, A. (2016). How the Western Balkans can catch up. *EBRD Working Paper*, No.185. DOI: <http://dx.doi.org/10.2139/ssrn.3119685>
- Smart Specialization Strategy Albania (2024). National Strategy for Development and European Integration 2023. Dostupno na: <https://s3albania.org/portfolio-item/national-strategy-for-development-and-european-integration-2030/>. Pristupljeno: 06.10.2024.
- World Nuclear Association (2024). Nuclear Power in the World Today. Dostupno na: <https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today>. Pristupljeno: 06.10.2024.
- Zakon o zabrani izgradnje nuklearnih elektrana u Saveznoj Republici Jugoslaviji („Službeni list SRJ“, broj 12 od 10. marta 1995, „Službeni glasnik RS“, broj 85 od 6. oktobra 2005-dr. zakon)

RENEWABLE ENERGY SOURCES OF THE WESTERN BALKAN COUNTRIES

Abstract: *The Western Balkan countries aim to achieve two main goals in energy production: ensuring energy independence and transitioning to renewable energy sources. All five countries are electricity importers, although Bosnia and Herzegovina and Serbia occasionally have surpluses for export. Serbia currently obtains 38% of its electricity from renewable sources. To improve energy sustainability, Serbia plans to build new hydroelectric power plants such as Bistrica and Đerdap 3. Nuclear energy remains controversial due to the long construction period and high costs, but it could be part of future solutions. The aim of this paper is to determine the existing and future energy mix of the Western Balkan countries.*

Keywords: *Energy mix, renewable energy sources, Western Balkan countries*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**ANALIZA UTICAJA EKONOMSKOG RASTA NA PRIRODNO
OKRUŽENJE KROZ OBRAČUN PRELOMNIH TAČAKA
KUZNETSOVE KRIVE**

Dorđe Kotarac*

Rezime: Postizanje većih stopa privrednog rasta i razvoja zemalja u okvirima očuvanja kvaliteta životne sredine postaje glavna odrednica razvojnih strategija zemalja sveta. Cilj rada je analiza odnosa godišnje promene bruto domaćeg proizvoda po glavi stanovnika, kao mere privrednog rasta zemalja i emisije ugljen dioksida per capita, kao indikatora zagađenja životne sredine. Predmet ovog rada se odnosi na analizu ekološke Kuznetsove krive kod deset zemalja Centralne Evrope. U okviru metodološkog dela rada se sprovodi obračun prelomnih tačaka i nagiba ekološke Kuznetsove krive, u periodu od 2000. do 2022. godine. Rezultati rada ukazuju da zemlje sa početno nižim nivoom dohotka po glavi stanovnika ostvaruju veće vrednosti prelomnih tačaka, što zahteva postizanje većih stopa ekonomskog rasta i duži vremenski period, kako bi se ostvario pozitivan efekat na kvalitet prirodnog okruženja. Takođe, privredni rast ostvaruje negativan efekat na kvalitet životne sredine u kratkom vremenskom periodu. Međutim, dugoročno posmatrano veće stope ekonomskog rasta i razvoja pozitivno utiču na kvalitet prirodnog okruženja zemalja Centralne Evrope.

Keywords: Ekonomski rast, Održivi razvoj, Kuznetsova kriva, Co2 emisija.

1. Uvod

U pravcu postizanja većih stopa ekonomskog rasta i razvoja privrednih sistema zemalja, neretko se zanemaruje kvalitet prirodnog okruženja tj. stepen zagađenja životne sredine (Apergis, Christou & Gupta, 2017). Kroz prekomernu upotrebu prirodnih resursa, povećanu emisiju štetnih gasova staklene bašte, kao i nepoštovanje ekoloških regulativa pri korišćenju savremenih tehnologija, razvija se opravdani strah od ugrožavanja kvaliteta prirodnog okruženja (De Bruyn, 2012). U proteklih nekoliko godina razvila se debata o

* University of Belgrade, Department of Economics, Faculty of Agriculture, Serbia, ORCID: 0009-0005-6794-3788, ✉ djordje.kotarac@agrif.bg.ac.rs / djordjekotarac777@gmail.com
UDK 330.35:502

moгуćnosti postizanja većeg ekonomskog razvoja, uz očuvanje trenutnog kvaliteta životne sredine (Skene & Murray, 2017). U okvirima savremene ekonomske teorije sprovodi se kontinuirana analiza uticaja privrednog rasta i razvoja zemalja na promenu uslova prirodnog okruženja. Prema rečima Karla Marksa (1818-1883), značajna kritika kapitalističkog sistema se odnosi na tezu da takav model nije održiv jer uništava životnu sredinu (Boggs, 2020). Kroz dalji razvoj polemike, uspostavljaju se dve škole mišljenja (Brock & Taylor, 2005). Prva škola se temelji na stavu da postizanje većih stopa ekonomskog rasta, koji se meri putem bruto domaćeg proizvoda po glavi stanovnika, dovodi do smanjenja kvaliteta prirodnog okruženja. Suprotno tome, druga škola se zasniva na mišljenju da će veći privredni razvoj zemalja dovesti do kvalitetnije alokacije prirodnih resursa, veće upotrebe čistijih tehnologija, razvoj ekološke svesti pojedinaca, što će u konačnici dovesti do smanjenja zagađenja životne sredine zemalja.

Za potrebe analize odnosa ekonomskog razvoja zemalja i kvaliteta prirodnog okruženja koristimo model Kuznetsove krive, koji uspostavlja nobelovac Kuznets, tokom 1955. godine. Ispitivanjem ekonomskog rasta i razvoja zemalja, merenog putem bruto domaćeg proizvoda po glavi stanovnika i nejednakosti u raspodeli dohotka stanovništva, identifikovanog putem gini koeficijenta, nobelovac Kuznets razvija krivu koja ima oblik inverznog slova U (Kuznets, 2019). Prema ovom teorijskom konceptu povećanje dohotka ili produktivnosti po glavi stanovnika uzrokuje povećanje nejednakosti stanovništva u početnom vremenskom periodu. Međutim, daljim rastom dohotka ili produktivnosti po glavi stanovnika dovede do smanjenja dohodne nejednakosti stanovništva posmatranih zemalja. Na osnovu ovog teorijskog koncepta, veći broj istraživača motivisano sprovodi empirijska ispitivanja i razvija ekološku Kuznetsovu krivu, u poslednjoj deceniji XX veka (Grossman & Krueger, 1995). Prema svojoj putanji ekološka Kuznetsova kriva poseduje početno rastući nagib i dugoročno opadajući nagib, što formira oblik inverznog latiničnog slova U. Takvo otkriće je predstavljalo okidač za sprovođenje niza empirijskih studija, koja su bile usmerene na testiranje uticaja stopa ekonomskog rasta i privrednog razvoja zemalja na promenu kvaliteta prirodnog okruženja (Lazăr, Minea & Purcel, 2019). Umesto merenje nejednakosti stanovništva pri raspodeli dohotka uključena je varijabla emisija ugljen dioksida tj. merenja štetnih gasova staklene bašte.

Uticaj ekonomskog rasta i privrednog razvoja zemalja na uvećanje emisije štetnih gasova staklene bašte i ugrožavanje kvaliteta životne sredine, postaje aktuelno pitanje u pravcu uspostavljanja održivog razvoja zemalja (Narayan, Saboori & Soleymani, 2016). Kao indikator kvaliteta prirodnog okruženja zemalja Centralne Evrope, koristiće se emisija ugljen dioksida per capita. Utvrđeno je da emisija ugljen dioksida per capita ostvaruje učešće od 75% od ukupnih štetnih gasova staklene bašte. Na osnovu toga, dolazimo do zaključka da je smanjenje emisije ugljen dioksida per capita ključno za očuvanje prirodnog okruženja (Atasoy, 2017). Strateške odrednice za postizanje nižih nivoa emisije ugljen dioksida po glavi stanovnika su istaknute u okviru Kjoto protkola u Japanu, u toku 1997. godine (Grubb, 2004). Planirana redukcija emisije štetnih gasova staklene bašte je izostala, što je posledica protivljenja kreatora ekonomskih politika, uz isticanje da će smanjenje nivoa ugljen dioksida dovesti do ograničenja stopa ekonomskog rasta zemalja. Iz istog razloga, nije se postiglo targetirano smanjenje emisije ugljen dioksida, koje je određeno Pariskim sporazumom o klimatskim promenama (Delbeke, Runge-Metzger, Slingenberg & Werksman, 2019). Prema izveštajima Evropske Komisije, u periodu od 2005. do 2030. godine, planirano smanjenje emisije ugljen dioksida će iznositi 19%, što je značajno ispod ciljanog smanjenja emisije ugljen dioksida od 30% (Runge-Metzger & Van Ierland, 2019).

2. Teorijski okvir rada

1. Pregled literature

Pionirska istraživanja iz sfere uticaja ekonomskog rasta i razvoja zemalja na kvalitet njihovog prirodnog okruženja sprovode se krajem 1980-tih godina. U toku 1991. godine nastaju prva naučna istraživanja i radovi na ovu temu od strane autora Grossman i Krueger. Uzimajući podatke o godišnjem kretanju bruto domaćeg proizvoda per capita pod uticajem različitih indikatora zagađenja prirodnog okruženja, izmerenih tokom 1977., 1982., i 1988. godine, autori dolaze do zaključka da ekonomski razvoj zemalja nije u svim vremenskim etapama praćen degradacijom životne sredine. Naime, u početnom vremenskom periodu privredni rast zemalja dovodi do povećanja zagađenja prirodnog okruženja, dok nakon dostizanja određenog nivoa dohotoka ili produktivnosti po glavi stanovnika, ostvaruje se smanjenje zagađenja životne sredine. Na taj način se potvrđuje ekološka Kuznetsova kriva, a kroz obračun prelomnih tačaka (4.500-15.000\$), vrši se identifikovanje promene nagiba Kuznetsove krive, koja razvija oblik inverznog slova U.

U istraživanju koje sprovodi Panayotou (1993), potvrđuje se statistički značajan uticaj privrednog rasta zemalja na kvaliteta životne sredine. Rezultati rada ukazuju na vrednosti pri kojoj nastaje promena nagiba ekološke Kuznetsove krive, koja prati inverzni oblika slova U. Na osnovu rezultata istaknutih istraživanja, potvrđuje se dugoročno pozitivna korelisanost ekonomskog rasta i razvoja zemalja i kvaliteta njihovog prirodnog okruženja, što je u skladu sa osnovnim postulatima održivog razvoja. Motivisani pionirskim radovima Seldon i Song (1994), analiziraju odnos ekonomskog rasta i kvaliteta životne sredine, u vremenskom periodu od 1951. do 1986., a na uzorku od 130 zemalja sveta. U analizu uključuju više indikatora zagađenja i njihovog uticaja na kvalitet životne sredine. Rezultati ovog istraživanja ukazuju na heterogenost u pogledu vrednosti prelomnih tačaka po zemljama, uz obračun prosečne vrednosti prelomnih tačaka, koja iznosi 35.428 dolara.

Prema navodima Tucker (1995), potvrđeno je postojanje ekološke Kuznetsove hipoteze, koja podrazumeva pojavu početnog povećanja zagađenja životne sredine usled privrednog rasta i razvoja zemalja. Dok se nakon postizanja vrednosti dohotka ili produktivnosti po glavi stanovnika koja je ekvivalentna vrednosti prelomne tačke, obezbeđuje smanjenje degradacije prirodnog okruženja posmatranih zemalja. Istraživanje je sprovedeno na osnovu 137 zemalja, a obuhvaćen je vremenski period od 1971. do 1991. godine. Rezultati navedenog istraživanja ukazuju da ekološka Kuznetsova kriva poseduje oblik inverznog slova V. Dodatno, obračunate vrednosti prelomnih tačaka datih zemalja nalaze se u intervalu od 8.884 dolara do 15.425 dolara.

U naučnoj studiji koju sprovode Song, Zheng i Tong (2008), potvrđuje se postojanje ekološke Kuznetsove krive, što je testirano u okviru 29 provincija Narodne Republike Kine, u periodu od 1985. do 2005. godine. Putem panel testova kointegracije utvrđena je dugoročna veza između ekonomskog razvoja različitih kineskih provincija i ukupne izmerene emisije tri različita indikatora zagađenja tj. štetnih gasova staklene bašte. Na osnovu toga, donet je zaključak o postojanju ekološke Kuznetsove krive i njenog izgleda u obliku inverznog latiničnog slova U. Prema rezultatima naučnog istraživanja Annichiarico (2009), sprovedeno je ispitivanje ekološke Kuznetsove hipoteze i obračun prelomnih tačaka pod kojima dolazi do promene nagiba date krive. Analizom kretanje stopa rasta italijanske privrede u periodu od

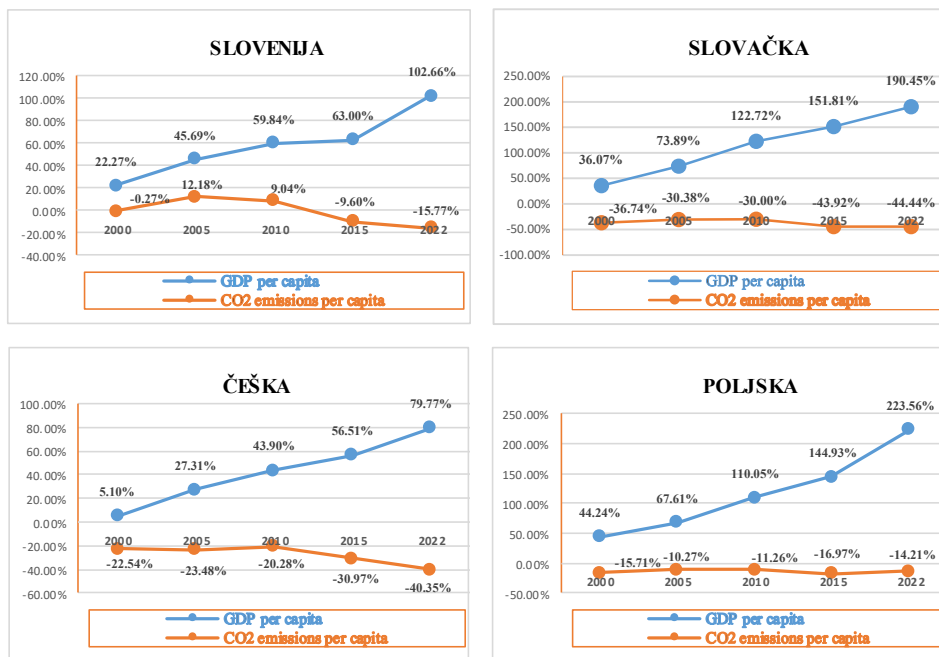
1861. do 2023. godine, dovelo je do zaključka da će dugoročno povećanje dohotka ili produktivnosti per capita uticati na smanjenje degradacije prirodnog okruženja. Pored toga, obračunata vrednost prelomne tačke se nalazi na nivou od 39.000 dolara.

Prema navodima Tatoğlu i Polat (2021), potvrđeno je postojanje ekološke Kuznetsove krive. Za potrebe istraživanja je formiran uzorak od 75 zemalja sveta. Istraživanje je obuhvatilo vremenski period od 2000. do 2018. godine. Kao ključni rezultat istraživanja se navodi potvrda dugoročnog uticaja dohotka ili produktivnosti po glavi stanovnika na promenu ukupnog zagađenja životne sredine posmatranih zemalja. Upotrebom formula za obračun prelomnih tačaka, dobijen je nagib Kuznetsove krive u kratkom u odnosu na duži vremenski period. U okviru ovog istraživanja su obračunate prelomne tačke za svaku zemlju pojedinačno, što omogućava formiranje intervala vrednosti prelomnih tačaka, koji se kreće od 10.000 dolara do 42.000 dolara.

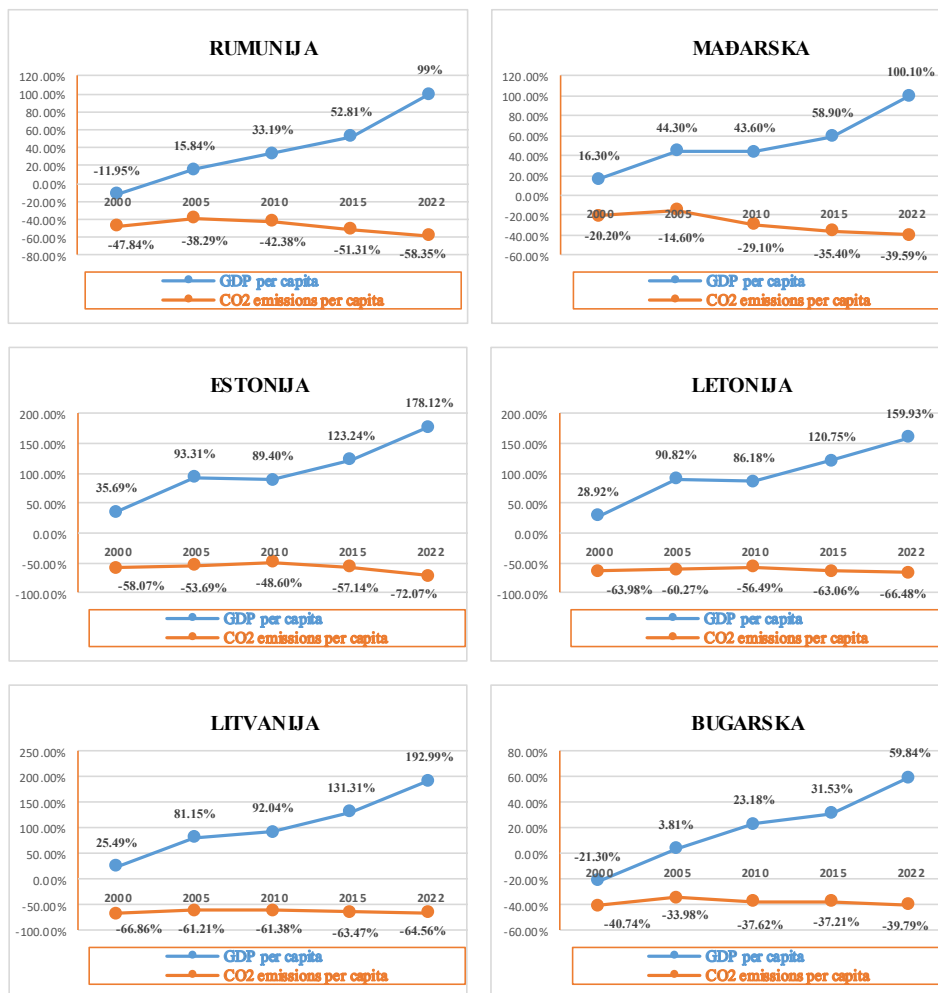
1.1. Analiza odnosa ekonomskog rasta i kvaliteta životne sredine zemalja

U nastavku rada prikazujemo odnos ekonomskog rasta i razvoja zemalja Centralne Evrope, praćen putem vrednosti bruto domaćeg proizvoda po glavi stanovnika i kvaliteta prirodnog okruženja, izmerenog putem emisije ugljen dioksida po glavi stanovnika.

Grafikon 1. Odnos GDP per capita i Co2 emisije per capita zemalja Centralne Evrope



Analiza uticaja ekonomskog rasta na prirodno okruženje kroz obračun prelomnih tačaka Kuznetsove krive



Izvor: World Bank (2023); Global Carbon Budget

Prema grafičkim prikazima, u okviru tabele 1., sprovodimo analizu odnosa ekonomskog rasta i razvoja zemalja Centralne Evrope i izmerenog kvaliteta životne sredine. U periodu do 2000. do 2022. godine prema godišnjoj promeni bruto domaćeg proizvoda per capita se izdvajaju zemlje poput Poljske, Slovačke, Litvanije i Estonije. U istom vremenskom periodu, u gotovo svim zemljama Centralne Evrope je izmereno značajno smanjenje emisije ugljen dioksida i ostalih štetnih gasova staklene bašte. Prema nivou godišnje promene zagađenja životne sredine, u periodu od 2000. do 2022. godine, istakle su se zemlje poput Litvanije, Letonije, Estonije i Rumunije.

Na osnovu tabele 1., sprovodimo analizu odnosa varijable bruto domaći proizvod per capita i promenljive nivo zagađenja životne sredine tj. emisije ugljen dioksida. Zemlje koje su ostvarile najveći procentualni godišnji rast bruto domaćeg proizvoda per capita su Poljska, Slovačka, Litvanija, Estonija i Letonija, koji je izmeren u toku 2022 godine. Sa

druge strane, zemlje koje postižu niži nivo godišnje promene bruto domaćeg proizvoda per capita su Slovenija, Mađarska, Rumunija i Češka. U toku 2022. godine, smanjenje emisije ugljen dioksida i njegovog uticaja na kretanje životne sredine u najvećoj meri je ostvaren u Estoniji (-72.07%), Letoniji (-66.48%) i Litvaniji (-64.56%). Najmanje smanjenje zagađenja životne sredine, izmereno je kod Poljske (-14.21%) i Slovenije (-15.77%).

1.2. Obračun prelomnih tačaka ekološke Kuznetsove krive na primeru zemalja Centralne Evrope

Analizu nagiba ekološke Kuznetsove krive sprovodimo putem obračuna prelomnih tačaka, za svaku od posmatranih zemalja Centralne Evrope. Kao vremenski okvir uzet je period od 2000. godine do 2022. godine. U toku posmatranog vremenskog intervala uočen je značajan rast bruto domaćeg proizvoda po glavi stanovnika kod sledećih zemalja Centralne Evrope: Slovenija, Slovačka, Češka, Poljska, Rumunija, Mađarska, Estonija, Letonija, Litvanija i Bugarska. U istom vremenskom periodu, izmeren uticaj štetnih gasova na kvalitet životne sredine opada, uz odsustvo tendencije rasta u budućem vremenskom periodu. Na osnovu toga, izvršili smo analizu odnosa između rasta privrednih sistema zemalja Centralne Evrope i promene uslova njihovog prirodnog okruženja putem ekološke Kuznetsove krive.

Za potrebe dobijanja ekološke Kuznetsove krive, koristimo vrednosti bruto domaćeg proizvoda per capita u posmatranom vremenskom intervalu, koji podrazumeva kako inicijalni, tako i dugoročni dohodak po glavi stanovnika. Putem obračuna prelomnih tačaka, dolazimo do vrednosti pri kojima će ekonomski rast i razvoj zemalja promeniti nagib Kuznetsove krive, uz ostvarivanje pozitivnog efekta na kvalitet životne sredine. Za obračuna prelomnih tačaka Kuznetsove krive koristimo sledeću formulu:

$$Pt = \exp(-\beta_1/2 * \beta_2) \quad (1)$$

* β_1 označava koeficijent koji objašnjava varijablu bruto domaći proizvod po glavi stanovnika u početnom vremenskom periodu, dok je koeficijent β_2 koeficijent koji objašnjava promenu dugoročni bruto domaći proizvod po glavi stanovnika.

Tabela 1. Obračun prelomnih tačaka zemalja Centralne Evrope

Broj	Naziv zemlje	Vrem. okvir	Obračun prelomnih tačaka	Rezultat
1	Slovenija	2000-2023	$\exp(-(-7.1322/2*0.4084))$	pt =38280.89253
2	Slovačka	2000-2023	$\exp(-(-9.6141/2*0.5059))$	pt =13386.16079
3	Češka	2000-2023	$\exp(-(-37.557/2*1.8933))$	pt =20304.70115
4	Poljska	2000-2023	$\exp(-(-3.3935/2*0.1944))$	pt =6174.617156
5	Rumunija	2000-2023	$\exp(-(-3.0248/2*0.1677))$	pt =8255.028572
6	Mađarska	2000-2023	$\exp(-(-6.9228/2*0.3889))$	pt =7386.134113
7	Estonija	2000-2023	$\exp(-(-1.5848/2*0.0857))$	pt =10365.18332
8	Letonija	2000-2023	$\exp(-(-4.1025/2*2.0214))$	pt =14486.75687
9	Litvanija	2000-2023	$\exp(-(-22.120/2*1.1865))$	pt =11178.51421
10	Bugarska	2000-2023	$\exp(-(-7.1321/2*0.4084))$	pt =6139.405074

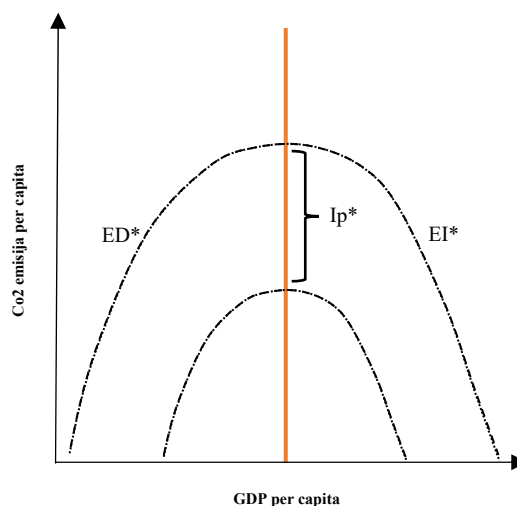
Izvor: Kalkulacija autora rada, na osnovu koeficijenata preuzetih: Jóźwik, B., Gavryshkiv, A. V., Kyophilavong, P., & Gruszecki, L. E. (2021). Revisiting the environmental Kuznets curve hypothesis: A case of Central Europe. *Energies*, 14(12), 3415.

Analiza uticaja ekonomskog rasta na prirodno okruženje kroz obračun prelomnih tačaka Kuznetsove krive

Na osnovu tabele 1., uočavamo da se vrednosti prelomnih tačaka ekološke Kuznetsove krive, kod zemalja Centralne Evrope, nalaze u intervalu od 6139.405074 dolara do 38280.89253 dolara. Rezultati pokazuju vrednosti prelomnih tačaka koje će dovesti do promene nagiba ekološke Kuznetsove krive kod zemalja Centralne Evrope. Nakon dostizanja vrednosti prelomnih tačaka Kuznetsove krive, započinje proces pozitivnog efekta ekonomskog rasta zemalja na uslove prirodnog okruženja. U nizu studija je dokazano da rast bruto domaćeg proizvoda po glavi stanovnika, kao instrument za merenje ekonomskog razvoja zemalja, negativno utiče na kvalitet prirodnog okruženja u početnom vremenskom periodu. Dugoročno posmatrano, ostvariće se pozitivan efekat daljeg rasta i privrednog razvoja zemalja na nivo zagađenja životne sredine. Naime, povećanje bruto domaćeg proizvoda po glavi stanovnika uticaće na smanjenje nivoa zagađenja životne sredine tj. očuvanje prirodnog okruženja u dužem vremenskom periodu.

U periodu pre dostizanja vrednosti prelomnih tačaka, Kuznetsova kriva poseduje rastući nagib, dok nakon postizanja vrednosti prelomnih tačaka, Kuznetsova kriva zadobija opadajući nagib. S toga, dolazimo do zaključka da kada određena zemlja dostigne vrednosti bruto domaćeg proizvoda po glavi stanovnika, koji je ekvivalentan vrednosti prelomne tačke ekološke Kuznetsove krive, započne proces smanjenja ukupnog zagađenja životne sredine. Kvalitet prirodnog okruženja biće izmeren putem godišnje emisije ugljen dioksida po glavi stanovnika. Nakon dostizanja vrednosti prelomnih tačaka, postiže se pozitivan efekat na kvalitet životne sredine, što se meri putem smanjenja svih štetnih gasova staklene bašte. U nastavku rada grafički prikazujemo ekološku Kuznetsovu krivu, kao i interval u kome se nalaze vrednosti prelomnih tačaka date krive.

Grafikon 2. Interval vrednosti prelomnih tačaka ekološke Kuznetsove krive



I_p^* označava interval u kome se nalaze vrednosti prelomni tačaka zemalja Centralne Evrope.

ED* označava povećanje nivoa zagađenja prirodnog okruženja usled rasta BDP per capita.

EI* označava smanjenje nivoa zagađenja prirodnog okruženja usled rasta BDP per capita.

Izvor: Nacrt autora rada, na osnovu obračunatih prelomnih tačaka ekološke Kuznetsove krive.

Na osnovu obračuna intervala u kome se nalaze vrednosti prelomnih tačaka (6.139\$ do 38.280\$), zaključujemo da dalji privredni rast zemalja Centralne Evrope uzrokuje unapređenje kvaliteta prirodnog okruženja. Dodatno, obračunata je prosečna vrednost prelomnih tačaka posmatrane grupe zemalja, koja iznosi 15.595 dolara. Najniže vrednosti prelomnih tačaka su utvrđene kod Bugarske (6.139\$) i Poljske (6.174\$). Dok su najveće vrednosti prelomnih tačaka dobijene kod zemalja poput Slovenije (38.280\$) i Češke (20.304\$). Izračunavanjem prelomnih tačaka dobijamo vrednosti pri kojima Kuznetsova kriva menja svoju putanju i ostvaruje opadajući nagib. Usled različitih vrednosti prelomnih tačaka ekološke Kuznetsove krive formirali smo 3 kluba zemalja. Prvi klub obuhvata zemlje sa najvećim vrednostima prelomnih tačaka, a koga sačinjavaju zemlje poput Slovenije (38.280\$), Češke (20.304\$) i Letonije (14.486\$). U drugom klubu sa manjim vrednostima prelomnih tačaka, nalaze se Slovačka (13306\$), Litvanije (11.178\$) i Estonije (10.365\$). Dok, u trećem klubu se nalaze zemlje poput Rumunije (8.255\$), Bugarske (6.139\$), Mađarske (7.386\$) i Poljske (6.174\$).

3. Zaključak

U ovom istraživanju je analiziran uticaj ekonomskog rasta i razvoja zemalja Centralne Evrope na izmereni nivo zagađenja prirodnog okruženja. Za praćenje ekonomskog rasta zemalja, upotrebljena je varijabla bruto domaći proizvod po glavi stanovnika. Dok je za merenje kvaliteta životne sredine korišćena godišnja emisija ugljen dioksida, kao jednog od vodećih gasova staklene bašte. U cilju otkrivanja vrednosti pri kojima dolazi do promene nagiba ekološke Kuznetsove krive tj. vrednosti pri kojima dalji ekonomski rast ostvaruje pozitivan efekat na kvalitet životne sredine, obračunali smo prelomne tačke za svaku zemlju pojedinačno. Istraživanje se odnosi na analizu odnosa ekonomskog rasta i indikatora za merenje kvaliteta životne sredine zemalja Centralne Evrope, u periodu od 2000. do 2022. godine. Doprinos ovog rada podrazumeva obračun prelomnih tačaka za svaku zemlju pojedinačno, utvrđivanje intervala u kojima se nalaze vrednosti prelomnih tačaka ekološke Kuznetsove krive, kao i klasifikaciju zemalja u različite klubove prema prethodno izračunatim vrednostima njihovih prelomnih tačaka.

Na osnovu dobijenih rezultata zaključujemo da zemlje sa početno nižim nivoom privredne razvijenosti odnosno dohotka ili produktivnosti po glavi stanovnika ostvaruju niže vrednosti prelomnih tačaka ekološke Kuznetsove krive. Sa druge strane, zemlje koje poseduju početno viši nivo dohotka ili produktivnosti po glavi stanovnika, ostvaruju više vrednosti prelomnih tačaka ekološke Kuznetsove krive. U nizu studija se pokazalo da veći životni standard prati razvijenost svesti stanovništva o značaju životne sredine, kao i kvalitetnije mere ekološke politike i zakonskih regulativa u pogledu zaštite prirodnog okruženja. Samim tim, prostor za unapređenje kvaliteta životne sredine je značajno manji kod razvijenijih zemalja sveta u odnosu na zemlje u razvoju. S toga, zemlje u razvoju će u kraćem vremenskom periodu dostići vrednost prelomne tačke u odnosu na razvijene zemlje, što će uzrokovati bržu promenu nagiba ekološke Kuznetsove krive. Na taj način, ostvariće se pozitivan uticaj daljeg privrednog rasta na kvalitet njihovog prirodnog okruženja. Na kreatorima ekoloških politika je da pravilnim odredbama doprinesu zaštiti prirodnog okruženja, uz podsticanje daljeg ekonomskog rasta i razvoja zemalja. Pogrešno je bilo utemeljenje da će se kroz ograničenje razvoja privrednih sistema zemalja, obezbediti unapređenje uslova prirodnog okruženja i smanjiti nivo štetnih gasova staklene bašte. Kao osnovni postulat ekološke Kuznetsove hipoteze, navodi se postojanje negativnog uticaja

Analiza uticaja ekonomskog rasta na prirodno okruženje kroz obračun prelomnih tačaka Kuznetsove krive

ekonomskog rasta na kvalitet životne sredine, ali isključivo u kratkom vremenskom periodu. Međutim, posmatrajući dugoročno potvrđen je pozitivan efekat ekonomskog rasta i privrednog razvoja zemalja na kvalitet njihovog prirodnog okruženja.

Reference

- Ansari, M. A., Haider, S., & Khan, N. A. (2020). Environmental Kuznets curve revisited: an analysis using ecological and material footprint. *Ecological Indicators*, 115, 106416.
- Annicchiarico, B., Bennato, A. R., & Costa, A. (2009). Economic growth and carbon dioxide emissions in Italy, 1861-2003.
- Atasoy, B. S. (2017). Testing the environmental Kuznets curve hypothesis across the US: Evidence from panel mean group estimators. *Renewable and Sustainable Energy Reviews*, 77, 731-747.
- Apergis, N., Christou, C., & Gupta, R. (2017). Are there environmental Kuznets curves for US state-level CO₂ emissions?. *Renewable and Sustainable Energy Reviews*, 69, 551-558.
- Boggs, C. (2020). Was Karl Marx an Ecosocialist?. *Fast Capitalism*, 17(2), 67-94.
- Brock, W. A., & Taylor, M. S. (2005). Economic growth and the environment: a review of theory and empirics. *Handbook of economic growth*, 1, 1749-1821.
- De Bruyn, S. M. (2012). *Economic growth and the environment: An empirical analysis* (Vol. 18). Springer Science & Business Media.
- Destek, M. A., Ulucak, R., & Dogan, E. (2018). Analyzing the environmental Kuznets curve for the EU countries: the role of ecological footprint. *Environmental Science and Pollution Research*, 25(29), 29387-29396.
- Delbeke, J., Runge-Metzger, A., Slingenberg, Y., & Werksman, J. (2019). The paris agreement. In *Towards a climate-neutral Europe* (pp. 24-45). Routledge.
- Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. *The quarterly journal of economics*, 110(2), 353-377.
- Grubb, M. (2004). The economics of the Kyoto Protocol. In *The Economics of Climate Change* (pp. 92-134). Routledge.
- Junyi, S. H. E. N. (2006). A simultaneous estimation of environmental Kuznets curve: evidence from China. *China Economic Review*, 17(4), 383-394.
- Jóźwik, B., Gavryshkiv, A. V., Kyophilavong, P., & Gruszecki, L. E. (2021). Revisiting the environmental Kuznets curve hypothesis: A case of Central Europe. *Energies*, 14(12), 3415.
- Kuznets, S. (2019). Economic growth and income inequality. In *The gap between rich and poor* (pp. 25-37). Routledge.
- Lazăr, D., Minea, A., & Purcel, A. A. (2019). Pollution and economic growth: Evidence from Central and Eastern European countries. *Energy Economics*, 81, 1121-1131.
- Mazur, A., Phutkaradze, Z., & Phutkaradze, J. (2015). Economic growth and environmental quality in the European Union countries—is there evidence for the environmental Kuznets curve?. *International Journal of Management and Economics*, 45(1), 108-126.
- Narayan, P. K., Saboori, B., & Soleymani, A. (2016). Economic growth and carbon emissions. *Economic Modelling*, 53, 388-397.
- Runge-Metzger, A., & Van Ierland, T. (2019). The effort sharing regulation. In *Towards a Climate-Neutral Europe* (pp. 95-116). Routledge.

- Skene, K., & Murray, A. (2017). *Sustainable economics: Context, challenges and opportunities for the 21st-century practitioner*. Routledge.
- Simionescu, M. (2021). Revised environmental Kuznets Curve in CEE countries. Evidence from panel threshold models for economic sectors. *Environmental Science and Pollution Research*, 28(43), 60881-60899.
- Selden, T. M., & Song, D. (1994). Environmental quality and development: is there a Kuznets curve for air pollution emissions?. *Journal of Environmental Economics and management*, 27(2), 147-162.
- Shuai, C., Chen, X., Shen, L., Jiao, L., Wu, Y., & Tan, Y. (2017). The turning points of carbon Kuznets curve: evidences from panel and time-series data of 164 countries. *Journal of cleaner production*, 162, 1031-1047.
- Tatoğlu, F. Y., & Polat, B. (2021). Occurrence of turnig points on environmental kuznets curve: Sharp breaks or smooth shifts?. *Journal of Cleaner Production*, 317, 128333.
- Tao, S., Zheng, T., & Lianjun, T. O. N. G. (2008). An empirical test of the environmental Kuznets curve in China: a panel cointegration approach. *China Economic Review*, 19(3), 381-392.
- Tucker, M. (1995). Carbon dioxide emissions and global GDP. *Ecological Economics*, 15(3), 215-223.

ANALYSIS OF THE IMPACT OF ECONOMIC GROWTH ON THE NATURAL ENVIRONMENT THROUGH THE CALCULATION OF THE TURNING POINTS OF THE KUZNETS CURVE

Abstract: Achieving higher rates of economic growth and development of countries within the framework of preserving the quality of the environment is becoming the main determinant of the development strategies of the countries of the world. The aim of this paper is to analyze the ration of annual changes in gross domestic product per capita, as a measure of economic growth of countries, and carbon dioxide emissions per capita, as an indicator of enviromental pollution. The subject of the paper involves the analysis of the ecological Kuznets curve in the countries of Central Europe. In the methodological part of the research paper, the calculation of turning points and slopes of the ecological Kuznets curve was carried out, in the period from 2000. to 2022. The results indicate that the countries with an initially lower level of income per capita reach higher values of turning points, which requires a higher rate of economic growth and a longer period of time to achieve a positive effect on the environment. The results suggest that economic growth has a negative effect on the environment in a short period of time. However, in the long term, higher rates of economic growth and development have a positive effect on the environment of Central European countries.

Keywords: Economic growth, Sustainable development, Kuznets curve, Co2 emission per capita.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**UTICAJ CEFTA2006 SPORAZUMA NA IZVOZ BOSNE I
HERCEGOVINE U ZEMLJE ČLANICE CEFTA2006**

Luka Marković*

Dr Irma Dedić•

Dr Marko Đogo°

Rezime: Postoji podjela među ekonomistima u vezi pitanja da li liberalizacija trgovine vodi ekonomskom prosperitetu jedne zemlje. Najrazvijenije zemlje svijeta su svoje bogatstvo stekle primjenjujući trgovinski protekcionizam, dok su kasnije ostatku svijeta preporučivale liberalizaciju međunarodne razmjene, a danas je primjetan trend ponovnog uvođenja protekcionizma. Ispitivanje uticaja CEFTA2006 sporazuma na izvoz Bosne i Hercegovine u zemlje članice navedene organizacije je problematika koja je istražena u ovom radu. U nastojanju objašnjenja obrazaca međusobne trgovine korišten je gravitacioni model, a on je ocjenjen uz pomoć PPML metode (Poisson Pseudo Maximum Likelihood). Analizirani period obuhvata razdoblje od 20 godina (2003 – 2022. godine), a ključni nalazi do kojih smo došli ukazuju da sporazum CEFTA2006 nije imao značajan uticaj na rast izvoza Bosne i Hercegovine u zemlje posmatrane organizacije. Do rasta izvoza je prvenstveno došlo zbog bilateralnih sporazuma sklopljenih sa dominantnom zemljom u okviru date organizacije (Hrvatska i sada Srbija), sa kojom se obavlja najveći dio razmjene, a koji su značajno olakšali i uvećali međusobnu razmjenu.

Ključne riječi: Liberalizacija trgovine, trgovinski protekcionizam, PPML, CEFTA2006

* Univerzitet Istočno Sarajevo, Ekonomski fakultet Pale, UNO Međunarodna ekonomija, BIH; ✉ luka.markovic@ekofis.us.rs.ba

• Univerzitet „Džemal Bijedić“, Ekonomski fakultet Mostar, UNO Menadžment, BIH; ✉ irma.dedic@unmo.ba

° Univerzitet Istočno Sarajevo, Ekonomski fakultet Pale, UNO Međunarodna ekonomija, BIH; ✉ marko.djogo@ekofis.ues.rs.ba

UDK 339.564(497.6)
339.54:061.1(4:497.6)

Uvod

Kroz istoriju, trgovinski protekcionizam je bio najznačajniji instrument pomoću kog su velike zemlje stekle najveći dio svog bogatstva (Čang, H., Dž., 2019, kao i Čang, H., Dž., 2016). Tokom 17. i 18. vijeka, u eri merkantilizma, bio je zastupljeno gledište da se bogatstvo jedne države izražava u novcu, do kog se dolazi isključivo putem spoljne trgovine (izvoza), ukoliko zemlja ne raspolaže sa značajnim rudnicima plemenitih metala. Sa druge strane, uvoz vodi smanjenju bogatstva, te ga je potrebno, putem različitih mjera državnog intervencionizma ograničiti. Primjetna je analogija između politika sprovedenih tokom pomenute ere i strateške trgovinske politike, koja je podsticana za vrijeme Ronalda Regana (1981 – 1989. godine), a čiji su se ciljevi odnosili na zaštitu domaće proizvodnje, podsticanje izvoza i rast domaćeg blagostanja (Douglas, A., I., 1991). U periodu merkantilizma, državne monopolske kompanije su obavljale trgovinu između Evrope i ostalih regiona svijeta, a karakterisala ju je nesavršena konkurencija (primjer Istočnoindijske kompanije). Pojava monopolskog profita je navela monarhe da usvajaju intervencionističke politike, kako bi ovaj profit prisvojili za sebe. Argument da strateška trgovinska politika, koja se zasniva na Vladinoj intervenciji pružanja strateške prednosti domaćim firmama u konkurenciji sa inostranim, ima potencijal da poveća nacionalno blagostanje, pronalazimo i kod Helpman, E. & Krugman, P.R. (1989).

Po okončanju Drugog svjetskog rata, pristupilo se postepenom uklanjanju trgovinskih barijera. Liberalizacija trgovine započeta je donošenjem Opšteg sporazuma o carinama i trgovini (GATT) 1948. godine. Vođeno je 8 rundi pregovora na kojima je postignuto smanjenje carina za 73% (Bičić, S., 2013). GATT je bio na snazi sve do 1994. godine, kada ga zamjenjuje WTO (Svjetska trgovinska organizacija), čiji je zadatak dalja liberalizacija trgovine među zemljama članicama. Staiger, R., W. & Bagwell, K. (1996) ističu da je merkantilistička orijentacija ukorjenjena u GATT, gdje se odluka Vlade da smanji ograničenja na uvoz, posmatra kao ustupak koji je vrijedan samo zbog izvoznih beneficija koje bi recipročna koncesija od strane trgovinskog partnera generisala. Prema liberalnim ekonomistima, svako ukidanje barijera slobodnom odvijanju trgovine vodi prosperitetu privrede, a Krugman, P., Obstfeld, M., Melitz, M. (2012) ističu da su glavni argumenti u korist slobodne trgovine sljedeći: a) Politički argument; b) Uklanjanje gubitaka učinkovitosti u proizvodnji i potrošnji; c) dodatne koristi od liberalizacije trgovine u vidu pozitivnih efekata ekonomije obima, mogućnosti učenja, inovacija i jačanja konkurentnosti.

Međutim, u posljednje vrijeme svjedoci smo toga da trgovinski protekcionizam ponovo dobija na značaju, posebno u zemljama koje se ponose svojim slobodno – tržišnim tendencijama. Prema pisanju međunarodne medijske organizacije *Project Syndicate* (2024), industrijska politika ponovo postaje popularna u SAD, gdje se od 2021. godine uvode politike podrške ključnim privrednim sektorima, sa ciljem ubrzanja inovacija i jačanja ekonomije kao cjeline. Više pažnje bi trebalo posvetiti politici širenja znanja, te pružati podršku isključivo onim privrednim granama koje imaju održiv put ka profitabilnosti. Iste politike se preporučuju i zemljama EU, kako bi iskoristile potencijale svojih regiona. Takođe, na snazi je novi trgovinski rat na relaciji SAD – Kina, koji je započet uvođenjem uvozne carine od 100% na kineske električne automobile, od strane SAD, a čiji je cilj bio zaštita američke industrije i radnih mjesta, od nelojalne konkurencije iz Kine (Velike priče, 2024).

Što se tiče BiH, ona je potpisnica 3 regionalna sporazuma o slobodnoj trgovini: 1) Sporazum o stabilizaciji i pridruživanju – potpisan 16.06.2008. godine, a na snagu je stupio 01.06.2015. godine; 2) CEFTA2006 – potpisan 19.12.2006. godine, a na snagu stupa 22.11.2006. godine; 3) EFTA – potpisan 24.06.2013. godine, a na snagu je stupio 01.01.2015. godine.

Uticaj CEFTA2006 sporazuma na izvoz Bosne i Hercegovine u zemlje članice CEFTA2006

Akcenat u ovom radu je stavljen na razmjenu BiH sa zemljama članicama CEFTA2006 (Albanija, Hrvatska (ulaskom u EU 2013. godine, istupa iz CEFTA), Sjeverna Makedonija, Moldavija, Crna Gora i Srbija), kako bismo ispitali kakve je efekte na BiH izvoz imala liberalizacija trgovine sa zemljama članicama pomenute organizacije. Na bazi prethodnog bismo donijeli zaključke da li je za BiH bilo bolje da umjesto liberalizacije pribjegne nekom vidu trgovinskog protekcionizma, koji bi zaštitio i razvio domaću privredu, što bi u konačnici rezultiralo i u rastu izvoza. Prema tome, istraživanje u radu kreće sa sljedećim hipotezama:

H0: Sporazum CEFTA2006 ima značajan uticaj na izvozne tokove BiH u članice date organizacije

H1: Sporazum CEFTA2006 nema značajan uticaj na izvozne tokove BiH u članice date organizacije.

Spoljnotrgovinska razmjena sa CEFTA2006 grupacijom

CEFTA2006 grupacija se ubraja u drugog po važnosti spoljnotrgovinskog partnera BiH. Naime, prema podacima Agencije za statistiku BiH, o spoljnotrgovinskoj razmjeni, uvidamo da su 3 najznačajnija regiona za BiH izvoz u 2022. godini: EU (73,59%), CEFTA2006 (18,38%) i EFTA (1,74%). Ista struktura je i u pogledu uvoznih tržišta, gdje najveće učešće ima EU (59,91%), CEFTA (12,28%) i EFTA (0,67%). U EU, tokom 2022. godine, BiH je izvezla robe u vrijednosti od 13,26 milijardi KM, dok je istovremeno uvoz iznosio 16,29 milijardi KM, i ostvarila spoljnotrgovinski deficit od 3,07 milijardi KM. Tokom iste godine, u zemlje CEFTA2006 grupacije, izvezeno je od strane BiH robe u vrijednosti od 3,30 milijardi KM, a uvezeno je 3,51 milijardi KM robe, što predstavlja deficit u međusobnoj razmjeni od 213 miliona KM. U razmjeni sa zemljama EFTA grupacije, ostvaren je spoljnotrgovinski suficit od 119 miliona KM. U date zemlje, BiH je izvezla robe u vrijednosti od 312 miliona KM, a uvezla 192 miliona KM vrijednosti robe.

U narednoj tabeli, možemo vidjeti kako je izgledala struktura međusobne razmjene sa pojedinačnim zemljama članicama CEFTA2006 u 2022. godini.

Tabela br. 1: Spoljnotrgovinska razmjena BiH sa pojedinačnim zemljama članicama CEFTA2006 u 2022. godini

Zemlja	Izvoz	Uvoz	Saldo
Albanija	44.342.336	66.013.041	-21.670.705
Crna Gora	576.469.280	163.753.912	412.715.368
S. Makedonija	182.248.063	196.982.286	-14.734.223
Srbija	2.363.435.438	3.057.569.930	-694.134.492
Moldavija	11.528.493	6.081.014	5.447.479

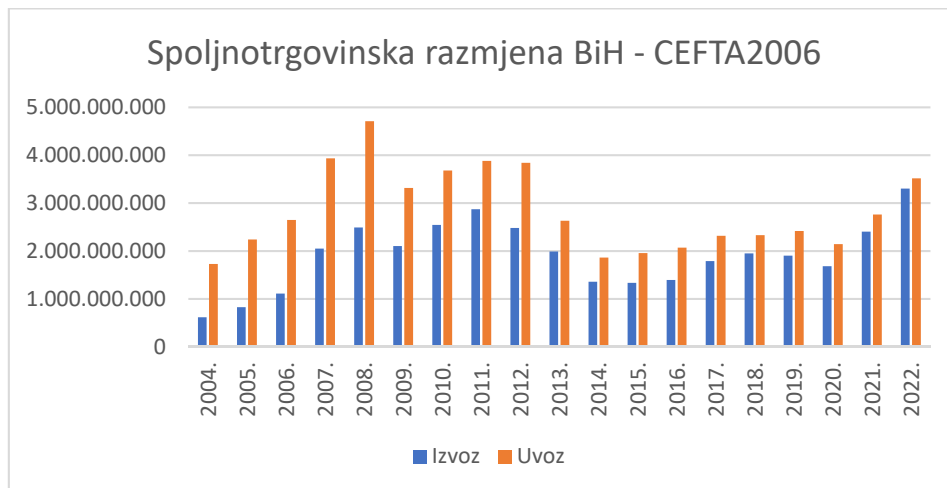
Izvor: Agencija za statistiku BiH

Najveće učešće u ukupnom izvozu BiH u pomenutu organizaciju ima Srbija 71,54%, zatim slijedi Crna Gora 17,45% i Sjeverna Makedonija 5,52%. Slična struktura je i u pogledu uvoza, gdje najveće učešće ponovo ima Srbija od 86,94%, Sjeverna Makedonija 5,60% i Crna Gora sa učešćem od 4,66%. U odnosu na 2021. godinu, izvoz u CEFTA2006 je porastao za 37,30% (za 897,49 miliona KM), dok je uvoz porastao za 754,13 miliona KM (rast za 27,30%).

Spoljnotrgovinski deficit je smanjen u odnosu na prethodni period za 40,18%, dok je ukupna pokrivenost uvoza izvozom porasla za 6,84% i za 2022. godinu je iznosila visokih 93,93%.

Na narednom grafiku, prikazano je kretanje ukupnog izvoza i uvoza BiH u razmjeni sa zemljama CEFTA2006 grupacije, tokom perioda 2004 – 2022. godine.

Grafik br. 1: Spoljnotrgovinska razmjena BiH – CEFTA2006 tokom 2004 – 2022. godine



Izvor: Kalkulacija autora na bazi podataka preuzetih sa Statističkog Web portala CBBiH (datum pristupa 01.08.2024.)

Tokom posmatranog perioda dolazilo je do fluktuacija u vrijednosti izvoza i uvoza, kako zbog uticaja različitih kriza, tako i zbog istupanja Hrvatske iz ove organizacije i njenog priključenja zemljama EU u 2013. godini. Vrijednost BiH izvoza u CEFTA2006 je doživjela nagli pad u 2013. godini u odnosu na prethodni period, upravo zbog činjenice, da je njen najznačajniji spoljnotrgovinski partner – Hrvatska, postala članica EU. Udio Hrvatske u BiH izvozu u CEFTA2006 je rastao od 2008. do 2013. godine, sa 46,43% na 60,08% (rast od 29,39%). Rast je zabilježen i u pogledu udjela uvoza, gdje je zabilježeno povećanje sa 59% na 74,30% (rast od 25,93%). U istom periodu, udio CEFTA2006 u ukupnom izvozu BiH je u prosjeku iznosio 33,56%, dok je uvoz participirao u iznosu od 25,06%. Nakon istupanja Hrvatske iz ove grupacije, došlo je do smanjenja udjela CEFTA2006 u ukupnom izvozu i uvozu BiH. Tokom perioda 2013 – 2022. godine, udio CEFTA2006 u ukupnom izvozu je iznosio 16,19% (smanjenje za 51,75% u odnosu na period 2008 – 2013. godine), dok se udio u ukupnom uvozu smanjio za 50,47% (tokom perioda 2013 – 2022. godine iznosio je 12,41%). Istovremeno, ukoliko pogledamo podatke za EU, zabilježen je rast udjela, kako izvoza tako i uvoza, tokom posmatrana dva potperioda. Tokom 2013 – 2022. godine udio izvoza BiH u zemlje EU je porastao na 72,39% u prosjeku, u odnosu na prethodni period 2008 – 2013. godine kada je iznosio 57,26% (rast od 26,42%), dok je udio uvoza porastao sa 48,18% na 60,19% (rast od 24,92%), u prosjeku. Detaljniji podaci o kretanjima izvoza i uvoza na relaciji BiH – CEFTA2006 i EU, kao i njihovim udjelima u ukupnoj spoljnotrgovinskoj razmjeni BiH su dati u Apendixu.

Uticaj CEFTA2006 sporazuma na izvoz Bosne i Hercegovine u zemlje članice CEFTA2006

Dakle, primjetno je smanjenje relativnog značaja CEFTA2006 za spoljnu trgovinu BiH nakon napuštanja integracije od strane Hrvatske, dok je istovremeno primjetan rast značaja EU tržišta. Slične zaključke, iznijeli su Brkić, S. & Sušić, R. (2019) kao i Šarganović, H. (2016), ističući značaj Hrvatske kao spoljnotrgovinskog partnera BiH.

Vrijednost izvoza, ali i uvoza BiH iz CEFTA2006 je tek na kraju 2021. godine premašila vrijednosti iz 2013. godine. Do povećanja razmjene, ali i značaja CEFTA2006 za BiH, je najvećim dijelom došlo zbog veće razmjene sa Srbijom tokom 2021. i 2022. godine. Naime, 2022. u odnosu na 2021. godinu, izvoz u Srbiju se povećao za 37,21%, dok je uvoz porastao za 25,96%. U 2021. prema 2020. godini, ta povećanja su u relativnom smislu iznosila: 49,51% za izvoz, te 28,04% kada je u pitanju uvoz iz Srbije. Takođe, izvoz u Srbiju je na kraju 2022. godine, prvi put premašio 2 milijarde KM (2.363.435.438 KM), a uvoz je bio veći od 3 milijarde KM (3.057.569.930 KM), prema podacima CBBiH. Navedene brojke pokazuju da Srbija preuzima mjesto koje je ranije zauzimala Hrvatska, po značaju u okviru ove organizacije, kako za BiH, tako i za ostale zemlje članice.

Ono što je pozitivna činjenica, jeste da je došlo do smanjenja spoljnotrgovinskog deficita BiH u razmjeni sa zemljama CEFTA2006 grupacije, tokom posmatranog perioda. Dato smanjenje je najvećim dijelom posljedica istupanja Hrvatske iz ove organizacije (razmjena sa njom se sada knjiži kao razmjena sa zemljom članicom EU), ali i posljedica rasta konkurentnosti BiH u okviru ove organizacije (istupanje Hrvatske je ostavilo prostor ostalim zemljama članicama da povećaju svoj značaj u datoj organizaciji). Kretanje spoljnotrgovinskog deficita BiH u razmjeni sa CEFTA2006 dato je na grafiku u nastavku.

Grafik br. 2: Kretanje spoljnotrgovinskog deficita BiH u razmjeni sa CEFTA2006 tokom 2004 – 2022. godine



Izvor: Kalkulacija autora na bazi podataka preuzetih sa Statističkog web portala CBBiH (datum pristupa 01.08.2024.)

Ukoliko pogledamo podatke Spoljnotrgovinske komore BiH za 2022. godinu o robnoj strukturi BiH izvoza i uvoza iz CEFTA2006, zapažamo da postoji značajna sličnost, te da BiH istovremeno izvozi ali i uvozi proizvode nižeg stepena obrade i sirovine. Što se tiče izvoza, dominantno je zastupljena električna energija (620,16 miliona KM); koks, polukoks od kamenog uglja, mrkog uglja (432,48 miliona KM); toplo valjana žica od željeza ili nelegiranog čelika (219,90 miliona KM); drvo obrađeno po dužini, debljine veće od 6mm (143,48 miliona KM), te mrki ugalj (138,79 miliona KM). Sa druge strane, u uvozu su najzastupljeniji: naftna ulja i ulja dobijena od bitumenskih minerala, osim sirovih (440,69 miliona KM); električna

energija (225,21 miliona KM); toplo valjani pljosnati proizvodi od željeza ili nelegiranog čelika širine 600mm ili više (126,60 miliona KM); kukuruz (109,16 miliona KM), te hljeb, peciva, kolači, keks i ostali pekarski proizvodi (90,66 miliona KM). Primjetno je da postoji potencijal za izvozom proizvoda većeg stepena obrade u navedene zemlje, međutim, zbog činjenice da sve zemlje date organizacije većinski takve proizvode uvoze iz zemalja EU, neophodno je poraditi na konkurentnosti BiH proizvoda. To se može postići ulaganjem u tehnološka unapređenja, inovacije, istraživanje i razvoj, te generalno u unapređenje ljudskog kapitala s ciljem rasta produktivnosti radnika (putem unapređenja obrazovanja, kroz praćenje savremenih trendova) (Marković, L., 2024). Pored toga, BiH može primijeniti i neki vid protekcionizma, poput strateške trgovinske i industrijske politike, kako bi privremeno zaštitila domaća preduzeća dok ne postanu konkurentna na međunarodnom tržištu. Posljednjoj tvrdnji u prilog ide rast značaja navedenih mjera u SAD, gdje univerzitetski profesori preporučuju sprovođenje datih mjera i u zemljama EU (Project Syndicate, 2024).

Pregled dosadašnjih istraživanja

Kikerkova, I. (2009) zaključuje da sve bivše jugoslovenske zemlje uočavaju region Jugoistočne Evrope kao vrlo značajno tržište za svoje proizvode, a naročito za izvoz svojih agrarnih proizvoda. Implementacija multilateralnih sporazuma u proteklom periodu je uvećala trgovinsku razmjenu između zemalja članica. Takođe, svaka od zemalja članica zavisi od trgovinske razmjene samo sa 1 ili 2 velika trgovinska partnera iz regiona, dok je saradnja sa ostalim državama članicama na dosta niskom nivou. Autor ističe značaj saradnje i integracija zemalja regiona, posebno zbog disolucije regiona 90-ih godina prošlog vijeka, što se negativno odrazilo na stanje njihovih ekonomija.

Kako bi se iskoristio puni kapacitet CEFTA2006 sporazuma, zemlje članice se moraju izboriti sa brojnim političkim problemima, koji predstavljaju kočnicu intenzivnijoj ekonomskoj saradnji i intraregionalnoj trgovini (Simić, J., Đurić, D., Mihajlović, M., 2011.). Između ostalog potrebno je smanjiti nivo korupcije, jer zemlje članice ove integracije, i nakon potpisivanja sporazuma o slobodnoj trgovini, karakteriše visok indeks percepcije korupcije. Autori preporučuju i određene konkretne mjere kako bi se ovi problemi prevazišli i kako bi u konačnici došlo do rasta izvoza i GDP zemalja članica. Te mjere se uglavnom odnose na nastavak evrointegracija; povećanje ekonomske saradnje u regionu CEFTA2006; razvijanje infrastrukture; uklanjanje barijera prilivu SDI; borba protiv korupcije i slično.

Petreski, M. (2013) je izvršio analizu uticaja CEFTA2006 na trgovinu zemalja članica, te uporedio dobijene rezultate sa prvobitnom CEFTA (osnovanom 1992. godine) i trgovinskom liberalizacijom u okviru EU integracionih procesa. Kao argumente ulaska zemalja Jugoistočne Evrope (JIE) u ovu integraciju navodi ekonomsku sličnost, geografsku blizinu, te nastojanje ovih zemalja da se što prije priključe EU i na taj način spriječe eventualne buduće sukobe na Balkanu. Nalazi do kojih je došao sugerišu da je Sporazum CEFTA2006 imao pozitivan efekat u vidu uvećanja trgovine za sedam do osam puta više, u odnosu na period 1990-ih godina, kada su trgovinski tokovi zemalja JIE (Jugoistočne evrope) bili poremećeni zbog ratova, embarga, hiperinflacije i socijalnih nemira.

Sprovođenje Sporazuma CEFTA je unapredilo promet roba, usluga i investicija, te umanjilo tehničke i necarinske barijere, ali iste u određenoj mjeri još uvijek postoje, pogotovu od strane velikih ka manjim zemljama (Škrbić, V. & Marjanović, S., 2013.). Sporazum CEFTA2006 predstavlja jedan od glavnih instrumenata za privrednu stabilizaciju regiona i

Uticaj CEFTA2006 sporazuma na izvoz Bosne i Hercegovine u zemlje članice CEFTA2006

podsticaj za regionalnu saradnju. Primjena ovog sporazuma dovela je do više pozitivnih efekata, a kao najbitniji se smatra uspješna ekonomska i trgovinska saradnja, tj. ubrzan protok roba, oslobođen raznih dažbina, tehničkih i necarinskih barijera.

Čejvanović, F., Ivanković, M., Lasić, M., Vaško, Ž., (2014) ističe značaj ulaska BiH u CEFTA2006, posebno zbog pozitivnog efekta na izvoz njenih poljoprivrednih proizvoda u zemlje članice ove zone slobodne trgovine, tokom analiziranog perioda 2005.-2011. godine. U savremenom svijetu, kog karakteriše rastući značaj spoljnotrgovinske razmjene, odnosi između zemalja imaju značajnu ulogu za njihov ekonomski rast i razvoj. Uklanjanje barijera slobodnom protoku roba, usluga, ljudi i kapitala su smanjili nezaposlenost i generisali ekonomski rast. Saradnja sa inostranstvom će proizvesti pozitivne efekte po ekonomije zemalja, samo u slučaju usklađenosti sa planovima i programima ekonomskog razvoja datih zemalja.

Sporazum CEFTA2006 u značajnoj mjeri doprinosi razvoju izvoznih aktivnosti u BiH i prilagođavanju privrednih subjekata uslovima poslovanja na tržištu EU (Jakupović, S., Aleksić, M., Novaković, V., 2016). Osnovni doprinos sporazuma se ogleda kroz povećanje trgovinske razmjene između zemalja članica, te njihovu pripremu za punopravno članstvo u EU. Postavljena hipoteza u ovom radu, da je vrijednost izvoza iz zemalja CEFTA2006 u zemlje EU povećana nakon primjene CEFTA2006 sporazuma, je potvrđena, što je vidljivo na primjeru BiH. Dakle, stupanjem u CEFTA2006, došlo je do rasta izvoza, ne samo u zemlje članice, nego i u zemlje EU.

Mahmutović, H., Merdić, A., Omerika, H., (2017) navode da liberalizacija trgovine ne mora nužno dovesti do pozitivnih efekata. Pozitivne efekte će imati samo one zemlje koje su konkurentski pripremljene za liberalizaciju. BiH kontinuirano povećava stepen liberalizacije trgovine (kroz CEFTA2006, EFTA i SSP) kako bi se adekvatno pripremila za članstvo u EU. Rezultati analize koja je izvršena u ovom radu ukazuju na kontinuirano povećanje obima spoljnotrgovinske razmjene BiH, kao i povećanje pokrivenosti uvoza izvozom. BiH liberalizacijom trgovine nastoji povećati izvoz, te otvoriti prostor za plasman proizvoda na inostrana tržišta.

Grahovac, D. & Baraković, B. (2017) analiziraju uticaj primjene CEFTA2006 sporazuma na BDP i stopu nezaposlenosti zemalja članica. Na osnovu regresione korelacione analize izvršene u programu SPSS, za period 2007.-2014. godine, došlo se do rezultata da je postojao značajan uticaj međunarodne trgovine BiH sa CEFTA2006 na nivo njenog BDP, te da je 42,8% varijacija BDP objašnjeno varijacijama obima trgovine sa CEFTA2006.

Koristeći gravitacioni model, Klimczak, Ł., & Trivić, J. (2018), analizirali su uticaj tri faktora na obim trgovine: uticaj bilateralnih sporazuma o liberalizaciji trgovine koji su prethodili CEFTA-i, uticaj same CEFTA-e i uticaj efikasnosti institucija u zemljama CEFTA-e. Došli su do zaključka da su bilateralni sporazumi imali značajniji pozitivan efekat na rast obima trgovine nego CEFTA. Takođe, način na koji funkcionišu državne institucije, može igrati važnu ulogu u povećanju obima međusobne trgovinske razmjene, u smislu da smanjenje administrativnih barijera vodi rastu izvoza.

Istraživanje koje su sproveli Brkić, S. & Sušić, R. (2019), ukazuje na smanjenje relativnog značaja CEFTA2006 za spoljnu trgovinu BiH nakon napuštanja integracije od strane Hrvatske (2013. godine), iako obim trgovine sa regionom nastavlja rasti u apsolutnom iznosu. CEFTA2006 je i dalje drugi najznačajniji spoljnotrgovinski partner BiH, nakon EU. Unapređenje performansi BiH se ogleda u povećanju izvoza BiH i poboljšanju trgovinskog bilansa u trgovini sa pojedinim članicama CEFTA2006. Međutim, stagnantna izvozna

struktura, kao i stagnantan obrazac komparativnih prednosti sa naglaskom na proizvodima niže dodate vrijednosti, upućuju na zaključak da trgovinska pozicija BiH u integraciji tokom perioda 2007.-2018. godine, nije unapređena u skladu sa očekivanjima, te da zahtjeva dalje poboljšanje.

Metodologija

Analizu smo bazirali na primjeni gravitacionog modela međunarodne trgovine, čije je temelje postavio Tinbergen, J. (1962), koristeći analogiju sa Njutnovim zakonom gravitacije, kako bi opisao obrasce trgovine između 2 zemlje. Obim razmjene je proporcionalan GDP-u tih zemalja i obrnuto proporcionalan razdaljini između njihovih glavnih trgovinskih centara. Prema njemu gravitacioni model ima sljedeći oblik:

$$T_{ij} = \frac{GDP_i^\alpha * GDP_j^\beta}{D_{ij}^\theta}$$

Prethodni pristup je ubrzo generalizovan, te je postavljena specifikacija koja se smatra osnovnim oblikom gravitacione jednačine (Đorđević, A., Z. 2021):

$$PX_{ij} = \beta_0(Y_i)^{\beta_1}(Y_j)^{\beta_2}(D_{ij})^{\beta_3}(A_{ij})^{\beta_4}u_{ij}$$

gdje Y_i i Y_j predstavljaju BDP izvoznika i uvoznika; D_{ij} se odnosi na udaljenost između zemalja, dok su varijablom A_{ij} obuhvaćeni svi ostali faktori koji mogu imati uticaj na međusobnu trgovinsku razmjenu (npr. efekti zajedničke granice, efekti trgovinskih sporazuma, zone slobodne trgovine, kulturne i ostale sličnosti među njima).

Vremenom, gravitaciona jednačina je evoluirala, gdje su različiti teoretičari u polazni model dodavali nove varijable koje imaju uticaj na izvoz jedne zemlje. Linnemann, H. (1966) je uključio broj stanovnika u polaznu jednačinu, a prema njemu ona ima sljedeći oblik:

$$X_{ij} = \beta_0(Y_i)^{\beta_1}(N_i)^{\beta_2}(Y_j)^{\beta_3}(N_j)^{\beta_4}(D_{ij})^{\beta_5}(P_{ij})^{\beta_6}u_{ij}$$

gdje, N_i i N_j predstavljaju broj stanovnika u posmatranim zemljama, a varijabla P_{ij} jeste Preferential trade factor (zapravo, svi faktori koji mogu uticati na međusobnu razmjenu).

Uzimajući u obzir prethodnu teorijsku specifikaciju, za potrebe naše analize definisali smo regresijsku jednačinu gravitacionog modela u njenom nelinearnom obliku:

$$X_{ij} = \beta_0(GDP_i)^{\beta_1}(GDP_j)^{\beta_2}(D_{ij})^{\beta_3}(L_i)^{\beta_4}(L_j)^{\beta_5}(ZG)^{\beta_6}(Language)^{\beta_7}(FT)^{\beta_8}u_{ij}$$

gdje su:

X_{ij} – izvoz iz BiH u konkretnu zemlju članicu CEFTA2006 (u dolarima). Izvor: *Direction of Trade Statistics (DOTS) IMF*

GDP_i – GDP BiH (u dolarima). Izvor: *IMF World Economic Outlook Database*

GDP_j – GDP ostalih članica CEFTA2006 (u dolarima). Izvor: *IMF World Economic Outlook Database*

L_i – broj stanovnika u BiH. Izvor: *IMF World Economic Outlook Database*

L_j – Broj stanovnika ostalih članica CEFTA2006. Izvor: *IMF World Economic Outlook Database*

Uticaj CEFTA2006 sporazuma na izvoz Bosne i Hercegovine u zemlje članice CEFTA2006

Dij – Rastojanje između BiH i pojedinačnih zemalja (u kilometrima). Izvor: Aplikacija *HERE WeGo*

ZG – dummy varijabla (zajednička granica) koja ima vrijednost 1 za one zemlje sa kojima BiH graniči i vrijednost 0 za sve ostale zemlje

Language – dummy varijabla koja ima vrijednost 1 za one zemlje koje koriste sličan jezik kao u BiH (Srbija, Crna Gora, Makedonija i Hrvatska) i vrijednost 0 za ostale zemlje (Moldavija i Albanija)

FT – dummy varijabla koja ima vrijednost 1 za period nakon pristupanja BiH u CEFTA2006 grupaciju (2007 – 2022. godine) i vrijednost 0 za period prije priključivanja (2003 – 2007. godine). U slučaju Hrvatske, uzima vrijednost 1 za period 2007 – 2013. godine, a za ostale godine vrijednost nula.

U_{ij} – greška modela.

Istražujući literaturu, odlučili smo modifikovati naš polazni model, izbacivanjem varijabli koje obuhvataju broj stanovnika, kako u BiH, tako i u ostalim zemljama članicama CEFTA2006. Naime, prema Kalirajan, K., & Sigh, K. (2008), stanovništvo je indirektno obuhvaćeno kroz veličinu GDP jedne ekonomije, tako da se ono izbacuje iz polazne gravitacione jednačine zbog rizika od pojave problema multikolinearnosti. Takođe, uzimajući u obzir činjenicu da korišteni panel ima nedostajuće podatke o izvozu u Srbiju i Crnu Goru, u periodu prije 2006. godine, kada su ove dvije zemlje bile jedna država, te ukoliko bismo logaritmovali polazni model radi njegovog prevođenja u linearnu formu, došlo bi do izostavljanja važnih informacija i dobila bi se iskrivljena slika o spoljnotrgovinskoj razmjeni (logaritam od nule nije definisan).

U tom smislu, prema Silva, J. S., & Tenreyro, S. (2006) i prema Silva, J. S., & Tenreyro, S. (2011), predlaže se upotreba *Poisson pseudo-maximum likelihood modela* (PPML), koji rješava problem nedostajućih podataka kod zavisne varijable. Larson, J., Baker, J., Latta, G., Ohrel, S., Wade, C. (2018) i Westerlund, J. & Wilhelmsson, F. (2011) ukazuju na nedostatke uobičajenog pristupa logaritmovanja polazne gravitacione jednačine s ciljem prevođenja iz nelinearnog u linearni oblik, kako bi se mogla analizirati primjenom OLS pristupa na model sa fiksnim efektima. Umjesto toga, oni predlažu ocjenu gravitacionog modela uz upotrebu PPML metoda (Poisson Pseudo Maximum Likelihood), koji podrazumjeva kombinaciju linearnih i logaritmovanih varijabli (lin – log model). Prema njima, prednosti ovog metoda su te što uvažava nulte vrijednosti u podacima, te pokazuje dobre performanse kod malih uzoraka. Uzimajući u obzir sve prethodno obrazloženo, polaznu jednačinu u sprovedenoj analizi smo modifikovali, tako da ona ima sljedeći oblik u svom linearnom obliku:

$$X_{ij} = \beta_0 + \beta_1 \ln GDP_i + \beta_2 \ln GDP_j + \beta_3 \ln D_{ij} + \beta_4 ZG + \beta_5 Language + \beta_6 FT + u_{ij}$$

Prije same analize, potrebno je razmotriti i očekivane znakove koeficijenata uz korištene varijable. Rast GDP vodi rastu bogatstva stanovništva jedne zemlje, što rezultira u rastu njihove tražnje, kako za domaćim, tako i za inostranim proizvodima, tako da znak koji očekujemo ispred varijabli GDP_i i GDP_j , treba da bude pozitivan. Veće rastojanje između glavnih trgovinskih centara se negativno oslikava na obim međusobne razmjene dvije zemlje, zbog postojanja transportnih troškova, te iz tog razloga, očekivani znak ispred varijable *Dij* treba da bude negativan. Zemlje koje dijele zajedničku granicu, imaju tendenciju da više međusobno trguju, tako da bi znak ispred varijable *ZG* trebao biti pozitivan. Jezičke barijere mogu

predstavljati značajno ograničenje spoljnotrgovinskoj razmjeni između dvije zemlje, ali u posljednje vrijeme, trend je da se engleski jezik koristi u poslovnoj komunikaciji, tako da se uticaj ove vrste ograničenja polako smanjuje. Međutim, očekivani znak ispred ove varijable bi trebao biti pozitivan, jer što su niže barijere na međusobnu razmjenu između zemalja, obim trgovine će biti veći. Očekivani znak ispred varijable FT može biti pozitivan ili negativan, u zavisnosti od toga da li je liberalizacija trgovine, usljed pristupanja BiH CEFTA2006 grupaciji, imala pozitivne ili negativne posljedice.

Analizirani period je 20 godina i obuhvata razdoblje od 2003. do 2022. godine, a analiza je izvršena pomoću programa *Stata17*. U obzir su uzete sljedeće zemlje: Albanija, BiH, Crna Gora, Sjeverna Makedonija, Srbija, Hrvatska i Moldavija, dok je iz analize isključeno tzv. Kosovo, jer nije međunarodno priznata država.

Empirijski rezultati i diskusija

Tabela br. 2: Ocjena paramtara PPML

Zavisna varijabla X_{ij}		
Nezavisne varijable	Koeficijenti	Standardna devijacija
$\ln GDP_i$	1,0344 ***	0,1324
$\ln GDP_j$	0,6302 ***	0,0291
$\ln Dij$	-0,4731 **	0,1902
ZG	1,2423 ***	0,1194
Language	1,5153 ***	0,1382
FT	-0,1113	0,0603
Pseudo R^2	0,9672	
Number of obs	113	
*** = $P < 0,01$		
** = $P < 0,05$		
* = $P < 0,1$		

Izvor: Kalkulacija autora u *Stata17*

Iz prethodne tabele primjećujemo da sve korištene nezavisne varijable imaju očekivani znak i da je njihov uticaj na zavisnu varijablu statistički značajan. GDP, ima pozitivne implikacije na domaći izvoz, s tim što je uticaj GDP BiH veći od uticaja GDP zemalja njenih spoljnotrgovinskih partnera u okviru CEFTA2006. Ukoliko se GDP BiH poveća za 1%, obim njenog izvoza će se povećati za 1,03%, dok sa druge strane, ukoliko se GDP posmatranih zemalja uvoznica poveća za 1%, izvoz BiH će porasti za 0,63%. Dobijeni rezultati o uticaju veličine ekonomije na obim izvoza, su u skladu sa istraživanjima sprovedenih od strane Klimczak, Ł., & Trivić, J. (2018), kao i Toshevska-Trpchevska, K., Disoska, E. M., Kikerkova, I., & Tonovska, J. (2022), koji takođe ističu da je postojao statistički značajan i istovremeno veći i pozitivan uticaj GDP zemlje izvoznice u odnosu na GDP zemalja uvoznica, na obim izvoza posmatranih zemalja u okviru CEFTA2006 grupacije. Udaljenost između glavnih trgovinskih centara je, zbog prisustva transportnih troškova, imala negativan uticaj na vrijednost BiH izvoza. Naime, veća udaljenost utiče na smanjenje izvoza BiH u posmatrane zemlje za 0,47%. Feruni, N., & Hysa, E. (2020), u istraživanju koje su sprovodili za Albaniju, su dobili slične rezultate, kako o uticaju veličina ekonomija, tako i o uticaju transportnih troškova (preko razdaljine između

Uticaj CEFTA2006 sporazuma na izvoz Bosne i Hercegovine u zemlje članice CEFTA2006

spoljnotrgovinskih partnera), na obim izvoza. Izvodimo zaključak da isti faktori na sličan način utiču na nivo izvoza i u slučaju ostalih zemalja članica CEFTA2006 grupacije. Kada je riječ o vještačkim varijablama, njihov uticaj se tumači na nešto drugačiji način, odnosno na bazi obrasca: $(e^{\beta} - 1) * 100 = XX\%$. Prema tome, zajednička granica je uticala na uvećanje obima izvoza BiH za 246,35%. Sa druge strane, zajednički jezik je vodio uvećanju izvoza za 355,07%. Slične rezultate su dobili Toshevska-Trpchevska, K., et al. (2022), u čijem istraživanju, varijable jezik i zajednička granica, imaju statistički značajan i pozitivan uticaj na izvoz zemalja u okviru CEFTA2006 grupacije. Klimczak, Ł., & Trivić, J. (2018) su došli do drugačijih rezultata, i ističu da je uticaj zajedničke granice na obim izvoza skoro zanemariv (blizu nule). Uticaj varijable FT nije statistički značajan, što upućuje na zaključak da ulazak BiH u CEFTA2006 grupaciju nije značajnije uticao na kretanje njenog izvoza. Feruni, N., & Hysa, E. (2020) ističu isti zaključak u vezi Albanije, utvrdivši da CEFTA2006 sporazum nije imao značajan pozitivan uticaj na obim izvoza u slučaju navedene zemlje. Iste rezultate su dobile i po pitanju albanskog uvoza, na bazi čega su izvele zaključak da je uzrok ovakvog stanja to što se njeni ključni spoljnotrgovinski partneri nalaze u zemljama EU. Do drugačijeg rezultata su došli Klimczak, Ł., & Trivić, J. (2018), ističući značaj CEFTA sporazuma na obim spoljnotrgovinske razmjene, ali da je on znatno manji u odnosu na značaj bilateralnih sporazuma sklopljenih prije njega.

Zaključak

Rezultati do kojih se došlo, govore da se postavljena nulta hipoteza može odbaciti, tj. da CEFTA2006 sporazum nije imao značajan uticaj na povećanje BiH izvoza u zemlje članice ove organizacije. Kao najznačajniji razlog takvog stanja, možemo navesti bilateralne trgovinske sporazume, koje je BiH zaključila sa ključnim partnerima u okviru ove grupacije, a koji su olakšali i uvećali međusobnu razmjenu. Posebno je značajna saradnja sa Hrvatskom, koja je do 2013. godine bila najznačajniji spoljnotrgovinski partner BiH u okviru navedene organizacije. Istupanjem Hrvatske iz CEFTA2006, primjećuje se smanjenje značaja ove organizacije u spoljnotrgovinskoj razmjeni BiH, ali se istovremeno bilježi i značajno povećanje razmjene sa Evropskom unijom, jer se sada razmjena sa ovom zemljom knjiži kao razmjena sa članicom Evropske unije. Do rasta značaja CEFTA2006 za BiH, ponovo je došlo 2021. godine, kada je razmjena sa datom organizacijom ponovo dostigla vrijednosti iz 2013. godine. Ovo je rezultat povećanja razmjene sa Srbijom, koja je preuzela poziciju koju je ranije imala Hrvatska u okviru date organizacije. Zaključujemo da će razmjena BiH sa CEFTA2006 biti značajna, sve dok u okviru date organizacije postoji jedna dominantna zemlja sa kojom će se obavljati najveći dio razmjene. Takođe, taj značaj će opadati kako se navedene zemlje budu priključivale Evropskoj uniji.

Što se tiče ostalih analiziranih varijabli, gravitacioni model je pokazao da GDP ima značajan pozitivan uticaj na izvoz BiH, s tim što rast domaćeg ima veći uticaj od rasta GDP zemalja spoljnotrgovinskih partnera. Rast GDP BiH od 1% rezultira u rastu obima njenog izvoza za 1,03%, dok rast GDP zemalja uvoznica od 1%, dovodi do uvećanja izvoza BiH za 0,63%. Veće rastovanje između glavnih trgovinskih centara, negativno utiče na obim izvoza, zbog prisustva transportnih troškova, a za BiH to smanjenje konkretno iznosi 0,47%. Zajednička granica i jezik su imali pozitivne implikacije na obim izvoza BiH, gdje zajednička granica vodi rastu izvoza za 246,35%, dok zajednički jezik uvećava obim izvoza za 355,07%.

Uočen je takođe i potencijal za unapređenjem robne strukture BiH izvoza prema zemljama članicama CEFTA2006. Međutim, kako bi BiH počela izvoziti proizvode većeg stepena obrade,

bilo bi potrebno izvršiti ulaganja u tehnološka unapređenja, inovacije istraživanje i razvoj, te generalno u razvoj ljudskog kapitala, kako bi se unaprijedila produktivnost radne snage. Pored ovoga, bilo bi potrebno sprovesti i određene privremene protekcionističke mjere u vidu strateške trgovinske i industrijske politike, kako bi se domaći proizvođači konkurentski pripremili, a što bi u konačnici rezultiralo rastom izvoza. Ove mjere je potrebno sprovesti kako bi zemlje CEFTA2006, uvoz navedenih proizvoda iz Evropske unije, zamjenile uvozom iz Bosne i Hercegovine.

Literatura

- Bičić, S. (2013). *Multilateralna liberalizacija spoljne trgovine*. Završni rad thesis, Sveučilište Jurja Dobrile u Puli
- Brkić, S. & Sušić, R. (2019). *Karakteristike trgovine Bosne i Hercegovine u okviru CEFTA: Rezultati prve decenije*. Ekonomske ideje i praksa br. 35. str. 43-60
- Čang, H., Dž. (2019). *Ekonomija: uputstvo za upotrebu*. Beograd: Mali vrt
- Čang, H., Dž., (2016). *Loši samarićani*. Beograd: Mali vrt
- Čejvanović, F., Ivanković, M., Lasić, M., Vaško, Ž. (2014). *The impact of foreign trade in agricultural products of Bosnia and Herzegovina within the framework of CEFTA2006*. Economics of Agriculture 4., str. 975-987.
- Douglas, A.I. (1991). *Mercantilism as Strategic trade policy: The Anglo-Dutch rivalry for the East India trade*. Journal of Political Economy. The University of Chicago press. str. 1296-1314
- Dorđević, A.Z., (2021). *Uticaj deviznih kurseva na izvoz zemalja Centralne, Istočne i Jugoistočne Evrope: Analiza na nivou sektora*. Doktorska disertacija. Univerzitet u Beogradu, Ekonomski fakultet. str 148.
- Feruni, N., & Hysa, E. (2020). *Free trade and gravity model: Albania as part of central European free trade agreement (CEFTA)*. In Theoretical and applied mathematics in international business (pp. 60-90). IGI Global.
- Grahovac, D. & Branković, B. (2017). *Uticaj CEFTA2006 sporazuma na privredu zemalja Zapadnog Balkana*. Časopis za poslovnu teoriju i praksu „Poslovne studije“, godina 9. broj 17-18. str. 137-149.
- Helpman, E. & Krugman, P.R. (1989). *Trade policy and market structure*. Cambridge, MIT press
- Jakupović, S., Aleksić, M., Novaković, V. (2016). *Doprinos „CEFTA“ sporazuma razvoju ekonomija država članica*. Časopis za ekonomiju i tržišne komunikacije br. 2. str. 306-315
- Kalirajan, K., & Singh, K. (2008). *A Comparative Analysis of China's and India's Recent Export Performances*. Asian Economic Papers, 7(1), 1-28. <https://doi.org/10.1162/asep.2008.7.1.1>
- Kikerkova, I. (2009). *CEFTA2006 as a basis for economic reintegration of Western Balkan countries*. Proceedings from the Third International Conference: Regional Cooperation and Economic integration, challenges and opportunities. Skopje, Republic of Macedonia. str. 157-169.
- Klimczak, Ł., & Trivić, J. (2018). *Institutions and intra-regional trade in CEFTA 2006: A gravity approach*. Proceedings of the Faculty of Economics in East Sarajevo, Issue 17, pp. 11-25
- Krugman, P., Obstfeld, M., Melitz, M. (2012). *International economics theory policy*. Ninth edition. Pearson Education, Boston
- Larson, J., Baker, J., Latta, G., Ohrel, S., Wade, C. (2018). *Modeling International Trade of Forest Products: Application of PPML to a Gravity Model of trade*. Forest Product Journal 68(3). str. 303-316

Uticaj CEFTA2006 sporazuma na izvoz Bosne i Hercegovine u zemlje članice CEFTA2006

- Linnemann, H. (1966). *An Econometric Study of International Trade Flows*. Amsterdam: North – Holland Publishing Company
- Mahmutović, H., Merdić, A., Omerika, H. (2017). *Utjecaj ekonomskih integracija na vanjskotrgovinsku razmjenu: Slučaj zona slobodne trgovine BiH & EFTA*. Časopis za ekonomiju i politiku tranzicije br. 40.
- Marković, L. (2024). *Istraživanje potencijala za porast izvoza Bosne i Hercegovine na tržišta zemalja Evropske unije*. Master rad. Univerzitet u Istočnom Sarajevu, Ekonomski fakultet Pale
- Petreski, M. (2013). *South – Estern European trade analysis: A role for endogenous CEFTA2006?*. Emerging markets finance & trade JSTOR
- Silva, J. S., & Tenreyro, S. (2006). *The log of gravity*. The Review of Economics and statistics, 88(4), 641-658.
- Silva, J. S., & Tenreyro, S. (2011). *Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator*. Economics Letters, 112(2), 220-222.
- Simić, J., Đurić, D., Mihajlović, M. (2011). *CEFTA i izvozna orijentacija zemalja Zapadnog Balkana*. Škola biznisa br.3. str. 52-59
- Staiger, R.W. & Bagwell, K. (1996). *Reciprocal trade Liberalization*. NBER working paper series. working paper 5488
- Šarganović, H. (2016). *Analiza uticaja ulaska Hrvatske u EU na ekonomiju Bosne i Hercegovine*. Društvena i tehnička istraživanja, (2), 1-14.
- Škrbić, V. & Marjanović, S. (2013). *Spoljnotrgovinski promet Bosne i Hercegovine sa državama CEFTA*. PRIMUS- informatika, pravo, ekonomija, bankarstvo. str. 39-43
- Tinbergen, J. (1962). *Shaping the World Economy; Suggestions for an International Economic Policy*. The Twentieth Century Fund, New York.
- Toshevska-Trpchevska, K., Disoska, E. M., Kikerkova, I., & Tonovska, J. (2022). *The Impact of Trade Facilitation Indicators on Trade between CEFTA-2006 Members*. In Proceedings of 13 th SCF International Conference on “Contemporary Economic Policy and European Union Accession Process” (p. 177).
- Westerlund, J & Wilhelmsson, F. (2011). *Estimating the gravity model without gravity using panel data*. Applied Economics. str. 641-649

Internet izvori

- Agencija za statistiku Bosne i Hercegovine. Dostupno na: <https://bhas.gov.ba/>
- Aplikacija Here WeGo. Dostupno na: Play trgovina
- Centralna banka Bosne i Hercegovine. *Statistički Web portal CBBiH*. Dostupno na: http://statistics.cbbh.ba/Panorama/novaview/SimpleLogin_cr_html.aspx
- Direction of Trade Statistics – IMF Data. Dostupno na: <https://data.imf.org/?sk=9d6028d4f14a464ca2f259b2cd424b85>
- International Monetary Fund. *World Economic Outlook Databases, April 2024*. Dostupno na: <https://www.imf.org/en/Publications/WEO/weo-database/2024/April>
- Project Syndicate. (2024). *Industrial Policy is back. Now what?*. Dostupno na: https://www.project-syndicate.org/onpoint/industrial-policy-is-back-now-what?utm_source=facebook&utm_medium=organic-social&utm_campaign=page-posts-july24&utm_term=subscriber-exclusive&utm_content=image&fbclid=IwZXh0bgNhZW0CMTEAAR3Ii_3XoksdAcEgB

6VAOrlg_13umL6dTE44QqK2y9RT2vkvKR_8d5xdPKA_aem_quoApnfDMxI7y6lBDam
mOA . (pristupljeno 13.07.2024.)

Spoljnotrgovinska komora Bosne i Hercegovine. Dostupno na: <https://komorabih.ba/>
Velike priče. (2024). *U utorak, 14. maja 2024. počeo je trgovinski rat*. Dostupno na:
<https://velikeprice.com/biznis/poceo-je-trgovinski-rat/> (pristupljeno 10.07.2024.)

Appendix

Tabela br. 1: Udio Hrvatske u izvozu BiH u CEFTA2006 grupaciju tokom perioda 2008 – 2013. godine

Godina	Izvoz u Hrvatsku	Ukupan izvoz u CEFTA2006	Udio%
2008.	1.156.835.899	2.491.475.437	46,43
2009.	944.143.955	2.104.498.202	44,86
2010.	1.070.625.251	2.546.584.900	42,04
2011.	1.204.439.829	2.873.868.828	41,91
2012.	1.165.019.049	2.483.108.716	46,92
2013.	1.194.637.104	1.988.560.034	60,08

Izvor: Kalkulacija autora na bazi podataka preuzetih sa Agencije za statistiku BiH (pristupljeno 01.08.2024.)

Tabela br. 2: Udio Hrvatske u uvozu BiH iz CEFTA2006 grupacije tokom perioda 2008 – 2013. godine

Godina	Uvoz iz Hrvatsku	Ukupan uvoz iz CEFTA2006	Udio%
2008.	2.779.926.965	4.712.136.245	59,00
2009.	1.855.136.118	3.316.113.396	55,94
2010.	2.058.946.377	3.683.358.786	55,90
2011.	2.226.507.276	3.881.624.674	57,36
2012.	2.202.545.387	3.841.486.131	57,34
2013.	1.956.353.105	2.633.108.364	74,30

Izvor: Kalkulacija autora na bazi podataka preuzetih sa Agencije za statistiku BiH (pristupljeno 01.08.2024.)

Tabela br. 3: Udio CEFTA2006 u ukupnom izvozu BiH u periodu 2008 – 2022. godine

Godina	Izvoz u CEFTA2006	Ukupan izvoz	Udio izvoza u CEFTA2006 u ukupnom izvozu (u %)	Prosjeak u 2 perioda (u %)
2008.	2.491.475.437	6.711.690.000	37,12	
2009.	2.104.498.202	5.531.199.000	38,05	
2010.	2.546.584.900	7.095.505.000	35,89	
2011.	2.873.868.828	8.222.112.000	34,95	
2012.	2.483.108.716	7.857.962.000	31,60	
2013.	1.988.560.034	8.380.275.000	23,73	33,56
2014.	1.358.237.620	8.681.742.000	15,64	
2015.	1.334.264.753	8.987.194.000	14,85	
2016.	1.393.660.425	9.418.109.000	14,80	
2017.	1.790.463.207	11.055.383.000	16,20	
2018.	1.948.645.137	11.900.251.000	16,37	
2019.	1.903.629.886	11.492.564.000	16,56	
2020.	1.684.092.133	10.521.159.000	16,01	
2021.	2.406.118.498	14.273.529.000	16,86	
2022.	3.303.612.830	17.973.740.000	18,38	16,19

Izvor: Kalkulacija autora na bazi podataka preuzetih sa Agencije za statistiku BiH (pristupljeno 01.08.2024.)

**Uticaj CEFTA2006 sporazuma na izvoz Bosne i Hercegovine
u zemlje članice CEFTA2006**

Tabela br. 4: Udio CEFTA2006 u ukupnom uvozu BiH u periodu 2008 – 2022. godine

Godina	Uvoz iz CEFTA2006	Ukupan uvoz	Udio uvoza iz CEFTA2006 u ukupnom uvozu (u %)	Prosjek za 2 perioda (u %)
2008.	4.712.136.245	16.292.516.000	28,92	
2009.	3.316.113.396	12.355.179.000	26,84	
2010.	3.683.358.786	13.616.238.000	27,05	
2011.	3.881.624.674	15.525.428.000	25,00	
2012.	3.841.486.131	15.252.942.000	25,19	
2013.	2.633.108.364	15.169.793.000	17,36	25,06
2014.	1.863.081.008	16.199.278.000	11,50	
2015.	1.957.093.016	15.851.692.000	12,35	
2016.	2.068.993.185	16.161.014.000	12,80	
2017.	2.319.229.365	18.185.642.000	12,75	
2018.	2.329.514.339	19.273.968.000	12,09	
2019.	2.419.509.825	19.498.584.000	12,41	
2020.	2.145.491.321	16.886.285.000	12,71	
2021.	2.762.877.095	21.596.900.000	12,79	
2022.	3.517.009.857	28.636.447.000	12,28	12,41

Izvor: Kalkulacija autora na bazi podataka preuzetih sa Agencije za statistiku BiH (pristupljeno 01.08.2024.)

Tabela br. 5: Udio EU u ukupnom izvozu BiH u periodu 2008 – 2022. godine

Godina	Izvoz u EU	Ukupan izvoz	Udio izvoza u EU u ukupnom izvozu (u %)	Prosjek u 2 perioda (u %)
2008.	3.703.299.575	6.711.690.000	55,18	
2009.	3.000.687.923	5.531.199.000	54,25	
2010.	3.869.909.930	7.095.505.000	54,54	
2011.	4.586.688.492	8.222.112.000	55,78	
2012.	4.552.560.123	7.857.962.000	57,94	
2013.	5.519.200.420	8.380.275.000	65,86	57,26
2014.	6.266.552.858	8.681.742.000	72,18	
2015.	6.452.621.786	8.987.194.000	71,80	
2016.	6.735.908.918	9.418.109.000	71,52	
2017.	7.867.867.055	11.055.383.000	71,17	
2018.	8.681.456.881	11.900.251.000	72,95	
2019.	8.388.169.792	11.492.564.000	72,99	
2020.	7.625.959.151	10.521.159.000	72,48	
2021.	10.394.620.184	14.273.529.000	72,82	
2022.	13.226.063.463	17.973.740.000	73,59	72,39

Izvor: Kalkulacija autora na bazi podataka preuzetih sa Agencije za statistiku BiH (pristupljeno 01.08.2024.)

Tabela br. 6: Udio EU u ukupnom uvozu BiH u periodu 2008 – 2022. godine

Godina	Uvoz iz EU	Ukupan uvoz	Udio uvoza iz EU u ukupnom uvozu (u %)	Prosjek u 2 perioda (u %)
2008.	7.820.047.133	16.292.516.000	48,00	
2009.	6.064.406.939	12.355.179.000	49,08	
2010.	6.251.455.142	13.616.238.000	45,91	
2011.	7.045.735.262	15.525.428.000	45,38	
2012.	7.158.142.115	15.252.942.000	46,93	
2013.	8.156.023.759	15.169.793.000	53,76	48,18
2014.	9.543.934.318	16.199.278.000	58,92	
2015.	9.644.834.317	15.851.692.000	60,84	
2016.	10.007.081.954	16.161.014.000	61,92	
2017.	11.075.968.218	18.185.642.000	60,91	
2018.	11.659.423.615	19.273.968.000	60,49	
2019.	12.079.905.825	19.498.584.000	61,95	
2020.	10.275.806.950	16.886.285.000	60,85	
2021.	12.730.902.112	21.596.900.000	58,95	
2022.	16.297.392.082	28.636.447.000	56,91	60,19

Izvor: Kalkulacija autora na bazi podataka preuzetih sa Agencije za statistiku BiH (pristupljeno 01.08.2024.)

**THE IMPACT OF THE CEFTA2006 AGREEMENT ON BOSNIA
AND HERZEGOVINA'S EXPORT TO MEMBER COUNTRIES OF
THE CEFTA2006**

***Abstract:** There is a division among economists regarding whether trade liberalization leads to economic prosperity for a country. The world's most developed countries accumulated their wealth through trade protectionism, while they later recommended trade liberalization to the rest of the world, and today there is a noticeable trend of reintroducing protectionism. This paper investigates the impact of the CEFTA2006 agreement on Bosnia and Herzegovina's exports to the member countries of the organization. The gravity model was used to explain the patterns of bilateral trade, and it was evaluated using the PPML method (Poisson Pseudo Maximum Likelihood). The analyzed period covers 20 years (2003–2022), and the key findings indicate that the CEFTA2006 agreement did not have a significant impact on the growth of Bosnia and Herzegovina's exports to the member countries of the organization. Export growth primarily occurred due to bilateral agreements made with the dominant country within the organization (Croatia and now Serbia), with which the majority of the trade is conducted, and which significantly facilitated and increased mutual trade.*

***Keywords:** Trade Liberalization, Trade Protectionism, PPML, CEFTA2006*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**CHALLENGES AND OPPORTUNITIES TO INCREASE GDP VIA
USING AI - A COMBINATION OF MICRO AND MACRO
ECONOMIC PRACTICAL APPROACH IN LINE WITH THE
ECONOMIC REALITIES OF THE REPUBLIC OF SERBIA AND
THE REPUBLIC OF BULGARIA**

Hristo Medarov*

***Abstract:** AI undoubtedly provides an opportunity for expansion in a number of sectors, which would collectively lead to an increase in GDP. At the state vision level, Serbia and Bulgaria have developed strategic documents. However, the transition from macro-level strategy to implementation in a specific sector and company is often not so easy. This text is an attempt to create a basic approach how to combine efforts at both - micro and macro levels – as to get the best economic effective result.*

***Keywords:** AI, GDP, Forecasts*

1. Introduction

The Balkan countries are not often at the forefront of technological and scientific discoveries, and there are many even historical reasons for this. However, every new technology that gains popularity is another opportunity for catch-up and even pre-emptive development for the countries that quickly adapt it. It must be said that investing in new technologies always entails risks that can hardly be accurately assessed in the early phases of development. For example, graphene, which was touted as a super material of the future and received serious support for research within the EU, has a very limited role today. The new promising technologies are related to AI, which logically steps into Big Data and also robotics. In the present work, an attempt is made to create a practical approach at the micro and macro level, applicable as an example to RSerbia and RBulgaria, which could lead to the wider use of AI leading to an increase in GDP.

*PhD Student, UNWE, Sofia, Bulgaria, ORCID 0009-0000-7259-6817;
✉ hmedarov@gmail.com
UDC 004.8:330.56(497.11+497.2)

2. AI as a GDP growth accelerator

AI is the new hype. Social media, "traditional" media, scientific publications, and even everyday conversations are all about AI and how it will transform the world. More and more business leaders understand that even the mere mention of AI in relation to their products creates charisma and sales, and also has a serious effect on the stock prices of the companies. But despite this certain overexposure of the topic, the importance of AI for the future development of business and society is still undeniable. And although the definition of AI is still in the stage of development, even by official institutions and government bodies, as well as in a scientific plan, it is obvious that the technology in its variations stands on two fundamental and mandatory bases - algorithms, including self-learning and secondly a significant amount of data, which in most cases meets the definition of Big Data.

A number of scientific studies, government institutions and business leaders are making serious predictions about how AI will change the rules of the game altogether. Among all these predictions, a few that show signs of scientific validity and relative impartiality deserve to be singled out. Such a study was conducted by PwC and covers a forecast period up to 2030. Based on different analyzes for different parts of the world, the authors make a prediction that the total contribution of AI to the increase in global GDP will be around of 15.7 trillion US dollars (p. 3), which is currently the sum of the GDP of India and China combined. This amount will naturally not be evenly distributed among individual regions and countries, and the more economically and technologically developed ones will have a larger share of it. In this sense, North America (mostly the US) and China together will "take the lion's share" of almost 2/3 of this amount or \$10.7 trillion in growth or in % - 26.1% growth for China and 14, 5% for USA. For Europe, the study makes predictions regarding the North and the South of the continent separately, with the effect for the latter in % being an increase of up to 11.5%, which would be equal to 0.7 trillion US dollars and would be in absolute value more of twice less than that for the other part. Even as a continent, Europe seriously lags behind the leaders, but it is still ahead of other regions. This forecast is not surprising if the GDP trends in the last 5 to 10 years are analyzed, but rather it is a guide that in the technological aspect Europe is generally lagging behind, and this is no exception also with regard to AI-related technologies.

Other forecasts are much more conservative and even predict that the real effect on GDP will not be so strong, as the discrepancies are tens of times larger. Daron Acemoglu (2024) in his article quite convincingly predicts that the real effect of AI on GDP would be between 0.9%–1.1% in 10 years with a weak increase in investments in technology and with an investment boom these percentages would increase in range up to 1.6%–1.8%.

The difference between the two predictions is obvious, and looking for some sort of averaging between them would hardly be a workable approach. In any case, even in the more pessimistic of them the role of AI in increasing GDP is recognized. In this regard, it would definitely be good for business to have some readiness to adopt AI.

2.1. A macro approach to driving the use of AI in the economy

And since AI will have a cumulative effect at the macro level, a number of governments are also getting involved in creating policies to mitigate possible undesirable consequences of its use, while at the same time trying to multiply its positive effects. An

Challenges and Opportunities to Increase GDP Via Using AI - A Combination of Micro and Macro Economic Practical Approach in Line with the Economic Realities of the Republic of Serbia and the Republic of Bulgaria

example of similar countries with an established policy in the field of AI are RSerbia and RBulgaria. The two are neighboring countries in the Balkans and have very similar characteristics in terms of a number of indicators – both countries have roughly the same population of around 6.5 million people, according to the website <https://countryeconomy.com/> their indicators in economic terms, such as GDP in absolute value and per capita also do not differ that much. But there are also natural differences between them, the most significant of which can be highlighted in relation to the membership of the two countries in various international economic (and political) organizations and unions. In this regard, the commitment of the management of both countries to the use of AI is understandable and should be evaluated positively. The "Strategy for the Development of Artificial Intelligence in the Republic of Serbia for the period 2020-2025" has been adopted and is currently in effect in the Republic of Serbia. Similarly, in the Republic of Bulgaria, the Ministry of Transport and Communications adopted a CONCEPT FOR THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE IN BULGARIA UNTIL 2030. Without doing a comparative analysis of the two documents, even just from their content, it can be seen that the approach followed is too similar, although the time horizons are different.

If we assume that there is a consensus that AI will lead to an increase in GDP in the next few years, then it is logical to ask the question - How exactly should AI be used so that the maximum beneficial effect of the business can be achieved?

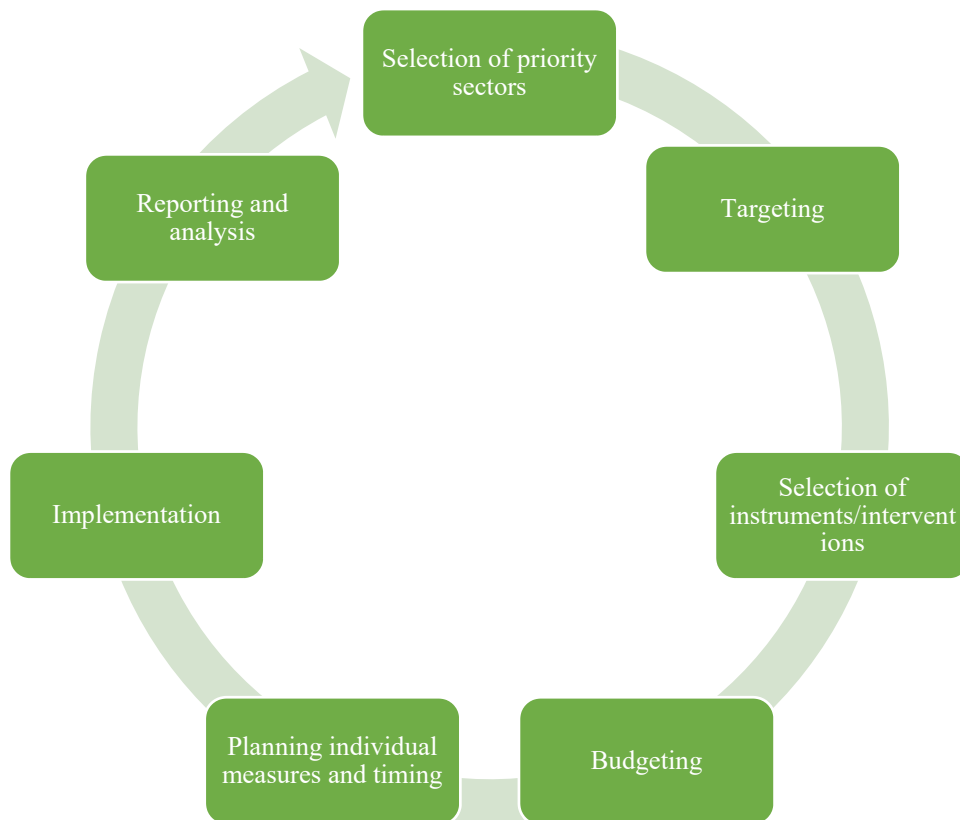
Although both neighboring countries have developed their strategic documents regarding AI - this is more of a skeleton on which to superimpose a regulatory framework and/or specific policies if necessary. By themselves, these strategic documents answer a number of questions, but precisely because they are at a strategic level, they do not provide practical answers that would be useful for an individual branch/sector and, above all, a company. The process of realizing any strategy goes through its "decomposition" into specific plans and programs and into sequences of actions. This is precisely where such a strategic approach is weak, since for individual companies from a given sector, such strategies are simply a wishful document and do not provide (and they should not!) practical instructions on how and what to do in practice. If any positive impact at the macro level is to be expected, it will not happen without action at the micro level, and individual companies in certain sectors do not start using AI in their operations, adding value.

In this regard, the author believes that there is still a lot to be done in the direction of the use of AI in business, which will lead to the maximum possible potential increase in GDP, and there are still many steps to be taken.

This document aims to partially fill this gap by providing general guidelines that could be followed by different companies in certain sectors of the economy or even implemented by industry associations and organizations, as guidelines on how to evaluate and where possible, the potential of AI is used in a given sector or at the company level.

Above all, the approach to using AI with a view to increasing GDP can be two-way - demand-driven or demand-driven or top-down vs. bottom-up. For clarity, both approaches will be considered, starting with the macro-level approach.

When it comes to macro-level intervention, some expert judgment is always needed on what direction to target it, what measures to use and in what quantity and in what time frame. The strategic documents created and already cited are a good starting point, but although they specify the individual priority sectors, the measures related to them are not described nor quantified, and even less valued and located in time. In general, the process should, at a macro level, follow the steps described here in Diagram 1 – Steps at Macro Level for support of AI adoption:



This sequence is relatively general and not specific in relation to driving the use of AI. To the extent that the first two steps of the macro-level process have been largely implemented through the adopted strategic documents, the next ones described in the diagram should also be implemented.

The approach that is recommended at the national level is to prioritize sectors in which, according to expert assessment, there is the greatest potential for AI-based expansion. In these sectors, self-assessment of potential needs to be encouraged and models developed that can be easily replicated and used by companies in them. If there is a possibility of government intervention in these sectors in the direction of stimulating their development through the use of public resources or other methods, then a selection of interventions should

Challenges and Opportunities to Increase GDP Via Using AI - A Combination of Micro and Macro Economic Practical Approach in Line with the Economic Realities of the Republic of Serbia and the Republic of Bulgaria

be carefully made with a view to maximizing the overall economic effect in the medium term. In other words, the first step on the basis of the already adopted strategic documents should be for the competent state organizations to decide what tools and to which sectors they will use to stimulate their development and in what proportion.

Each state has the opportunity to intervene in a targeted manner in selected sectors by providing various forms of financial incentives to speed up the widespread use of AI in them. But besides direct tax and/or direct incentives in the form of grants, the state policy should direct efforts in the direction of creating a suitable environment and a complete ecosystem for these sectors, while also ensuring the staffing process. Here, serious management decisions should be made, based on expert assessments, about which sector to approach, with what incentives and measures, and how to financially secure them. In this sense, the role of branch and sector associations and organizations is also particularly important when such a preliminary discussion is to be held. As a rule, even the best and fast-reacting state administration, due to the very specifics of state interventions and the related coordination and budget procedures, generate a serious reaction time lag. In this sense, the whole process, which runs top-down and which aims to stimulate the demand for AI (through the cited incentives), has a longer-term time perspective, but due to the power of the state, it can involve more and different parties (science-business- education). With a view to maximizing the effect, it is appropriate to seek active feedback through the methods of the national statistics of each country on the extent to which the planned and implemented measures had a direct effect on the selected sectors and possibly a spin-off effect on the lateral, other related supply chain sectors.

At the Budgeting stage, a budget should be determined for each of the selected instruments and in general for the entire intervention. Logically, at the next stage, individual measures and their timing are planned for the selected instruments in order to maximize their effect. For example - when and which grant scheme should be used and which type of companies should it be aimed at? After the implementation of the specific measures, an analysis of their impact should be made at the level of selected instruments and also at the level of the industry. After this analysis, the process can be repeated, taking into account the feedback from the information gathered so far.

2.2. A sectoral approach to drive the use of AI in the economy

Even if the state slows down or fails to intervene by stimulating the sectors with the highest potential for development based on the use of AI, their industry and sector organizations could initiate certain actions that support the companies. What is meant? At the sector level, it is possible to develop a common methodology for how AI should be used in the processes typical of companies in the sector and to promote it. In this way, a general guideline will be given on how each company could use AI, where it is applicable to its specifics, so as to achieve the maximum effect for the whole sector and to develop it ahead of time. The question is - how easy is it to develop such a common methodology? If we talk specifically about the two Balkan countries, we can easily conclude that in most economic sectors they are not world leaders in terms of technological development and investments in technological development as well as in scientific research are at best average for the

relevant sector worldwide order. In other words, in most sectors where AI can be applied to support development, there are competitors in Europe or other parts of the world that are ahead of the regional firms. In this sense, the policy at the sector level and when developing a methodology for the use of AI in the sector should be aligned with the leading ones in the field, and their approach should be followed or copied. This implies an active collection of information at the sector level, how the leading competitors in the use of AI globally use the technology and in which processes they apply it. Their approach should be evaluated on its applicability to the specific sector and the lessons learned creatively applied in creating the common methodology for using AI in the given sector. This can be considered a kind of first step in the process of adopting AI in a given sector. It should be said here that this step is important as the sectoral approach and the possibility of developing a common methodology based on it, would lead to an economy of resources for the companies in the sector, which would otherwise be forced to separately collect and process the information and to develop the necessary steps. But even due to a lack of well-functioning sector and branch organizations, if this step is not performed correctly, this does not threaten the overall implementation of the idea of using AI in a given sector, but only makes the process slower and more resource-intensive. Each company alone could do this analysis of the leading competitors in the sector and how they use AI and in which processes. This analysis can also be supported by external consulting and scientific expertise, as the resources of the companies are often directed towards solving other typical tasks. The sectoral approach can also be encouraged at the macro level by government institutions in the scheme described above, with the level of incentives being sectoral and/or such as to stimulate the creation of clusters of firms that use common resources to solve similar problems and specifically related to the introduction of AI in the given sector.

2.3 The microeconomic approach to drive the use of AI in the economy

Regardless of the success or failure, and even the presence or absence of macroeconomic or sectoral efforts to introduce AI into business processes, the ultimate change that must occur is at the company level. There can be no change on a macro level, including an increase in GDP when using AI, if individual companies do not recognize the importance of this tool and do not adopt it. The real work of transforming a company is done by its managers and employees. Above all, in a market economy, economic entities are driven by market incentives and accordingly firms seek to preserve and maximize their profit and profitability. This is a slightly simplified model of market relations, but the main point is that on a micro level, companies are trying to protect and expand their market share, and in this sense, AI should be considered and adopted by them, as an opportunity for this. On the other hand, AI is not only an opportunity for a company to optimize its profit, but also a threat that if it does not adopt it, as a technology in its processes, its competitors who use it would gain a competitive advantage. This combination of economic incentives and threats should be recognized by managers and owners.

Logically, the first step or phase related to the idea of using AI in a company's business processes is the one in which it is realized that there is a problem or an opportunity that would be missed. This step, which can be called "Problem recognition", is related to having information about the environment and what is happening in similar companies in the region or around the world. This step can also be initiated by the action of external factors, such as incentives that a given, government policy provides for the development

Challenges and Opportunities to Increase GDP Via Using AI - A Combination of Micro and Macro Economic Practical Approach in Line with the Economic Realities of the Republic of Serbia and the Republic of Bulgaria

and use of AI in a given sector. Off-topic, but with a high degree of analogy, is for example the introduction of energy storage systems for self-consumption from RES, which was stimulated and attracted interest within the framework of financing with money from EU funds. In general, the management of companies must realize that either they will miss an opportunity to improve their competitiveness by using AI or that competitors are already using it and this challenge should be met.

After recognizing the need or the possibility of using AI in the company's business processes, concrete steps should be taken towards this. Here, the company should describe and analyze the business processes that are typical and lead to value creation. This step can be called "Process Self-Description". At this stage, the company has two possible approaches, depending on whether a quality management system (ISO or similar) has been implemented and, if so, to what extent all business processes are described in it. In the event that such a system is in place, it follows from its registers to review all business processes and confirm that they are up-to-date - i.e. this can also be done with a dedicated audit of the system itself. In the event that such a system is not available for the company or it is not up-to-date, the company must follow a well-described process for reengineering algorithm (For example, see - TB Gigova and NS Geshanova). At the end of this step, the company's management should have a file created in which each business process is described, such as start, end, sequence, sub-processes and responsible for its execution and control. For most companies with a well-developed quality management system and computer-based process control and management systems (ERP, CRM and similar), this step would be particularly easy to implement. This step can also be successfully supported by sector-level analyzes and recommendations to highlight leading processes and opportunities for their optimization.

The next step is "Analysis and Financial Evaluation" - in this step it should be analyzed which of the business processes can be optimized by using AI and which are not suitable. In the analysis process, it is appropriate to involve external AI specialists to propose solutions for the use of AI in the processes, and a board chosen by the company's management to accept or reject these proposals. At the end of this process, a financial evaluation of the possible solutions should be made and whether the investment in AI would be viable. In case that there are one or more processes that can be improved or performed economically better by using AI, they are evaluated on the basis of ROI. In the event that none of the company's processes at this stage can be optimized by using AI in an economically profitable way, then the evaluation process is terminated and can be repeated after a certain period of time, when any changes have occurred or in the processes of value creation in the firm or in the cost and capabilities of the AI technology that can be used. Here again, sector-level recommendations for the use of AI for the optimization of given typical business processes would be particularly useful, even more if bound and with specific recommendations as to what solutions to use and of what value they would be.

The final step to be performed if the analysis from the previous one has shown that there is at least one process that can be optimized through AI in a cost-effective way is "Implementation and Testing". Within this step, already selected processes are optimized using AI, implementation is best done using external expertise and a testing period is allowed in which the performance of the AI systems is monitored and/or duplicated by the work of company personnel. In many cases, self-learning systems need to accumulate a

critical mass of data on which they can operate adequately, and human supervision is mandatory in the beginning.

It should be said that this step is specific to each individual company and can be implemented incrementally by deciding what the schedule is for introducing AI in the various processes of the company and the adoption itself is consistent, starting from those processes which are most cost-effective to optimize.



Diagram 2 – Steps in Micro level for adoption of AI

This algorithm does not represent any innovation, but rather is common to any new technology that can be used in a company's business processes. Of interest is the possibility of interaction between government policy, business, science and technology integrators. In fact, here is the most serious challenge to the entire system that can be determined and what the concrete impact of AI will be on overall GDP growth. In this sense, the result of all this is an increase in the use of AI with the aim of increasing GDP, as an intersection of government policies, sectorial approach and microeconomic incentives. The scientific community and technology companies integrating AI technologies are also included in this system, although in many cases they could be external to a given national economy, but this would definitely logically result in less than the potential growth of the respective GDP compared to using local technology.

3. Conclusion

In conclusion of the reasoning made so far, it should be said that the potential for increasing GDP based on the use of AI exists, although it can hardly be precisely predicted for a given economy. Both RSerbia and Bulgaria have created their own strategies for using AI in their economies, but at the national level there is still a lack of implementation of specific policies to accelerate the process. At the same time, at the micro-level and at the sectoral level, independent efforts can also be made to result in improved competitiveness of economic entities when using AI. The described general algorithm for analysis and assessment of opportunities can serve as a guide for the sequence of steps, and it should be specified for a given sector and business entity. Regardless of what has been said here, the most powerful and at the same time the most underestimated step to take is related to companies and sector organizations maintaining a good company intelligence system that allows them to have timely information about what happening in their sector not only in the region, but globally. The early awareness of the problems and opportunities hidden by the use of AI by competitors in the global market is precisely the key incentive for the companies in the region to act.

**Challenges and Opportunities to Increase GDP Via Using AI - A Combination of
Micro and Macro Economic Practical Approach in Line with the Economic Realities
of the Republic of Serbia and the Republic of Bulgaria**

References

- Acemoglu Daron, The Simple Macroeconomics of AI, Massachusetts Institute of Technology April 5, 2024
- CONCEPT FOR THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE IN BULGARIA UNTIL 2030, <https://www.mtc.government.bg/sites/default/files/conceptforthedevelopmentofaiinbulgariauntil2030.pdf>
- Gigova, T., Geshanova, N, Algorithm for business process reengineering in industrial enterprises, 2020 IOP Conf. Ser.: Mater. Sci. Eng. 878 012077, DOI 10.1088/1757-899X/878/1/012077
- <https://countryeconomy.com/countries/compare/bulgaria/serbia>
- Sizing the prize . What's the real value of AI for your business and how can you capitalize?, <https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf>, 170905-115740-GK-OS ; www.pwc.com/AI
- Strategy for the Development of Artificial Intelligence in the Republic of Serbia for the period 2020-2025, <https://www.srbija.gov.rs/tekst/en/149169/strategy-for-the-development-of-artificial-intelligence-in-the-republic-of-serbia-for-the-period-2020-2025.php>

**IZAZOVI I MOGUĆNOSTI ZA POVEĆANJE BDP-a PREKO
KORIŠĆENJA VI – KOMBINACIJA MIKRO I MAKRO
EKONOMSKOG PRAKTIČNOG PRISTUPA U SKLADU SA
EKONOMSKIM STVARNOSTIMA REPUBLIKE SRBIJE I
REPUBLIKE BUGARSKE**

Rezime: VI nesumnjivo pruža mogućnost za razvoj u nizu sektora, što bi kolektivno dovelo do povećanja BDP-a. Na nivou državne vizije RS Srbija i Bugarska izradile su strateške dokumente. Međutim, prelazak sa strategije na makro nivou na implementaciju u određenom sektoru i kompaniji često nije tako lak. Ovaj tekst je pokušaj da se stvori osnovni pristup kako kombinovati napore i na mikro i na makro nivou – kako bi se dobio najbolji ekonomski efektivni rezultat.

Ključne reči: VI, BDP, prognoza



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**VEŠTAČKA INTELIGENCIJA I PAMETNI GRADOVI:
KARAKTERISTIKE I PERSPEKTIVE RAZVOJA**

Dr Gorica Bošković *

Dr Ivana Kostadinović •

MSc Aleksandar Manasijević ♦

Rezime: Ovaj rad istražuje ulogu veštačke inteligencije u razvoju pametnih gradova, sa fokusom na tehnološke karakteristike, primenu i perspective razvoja. Pametni gradovi predstavljaju koncept koji obuhvata inovativna urbana rešenja koja koriste tehnologije poput interneta stvari (IoT) i analitike velikih podataka kako bi poboljšali efikasnost upravljanja javnim resursima, unapredili bezbednost i povećali kvalitet života građana. U prvom delu rada razmatraju se ključne oblasti primene veštačke inteligencije, uključujući upravljanje saobraćajem, energetska efikasnost i bezbednosne sisteme. Zatim se analiziraju tehnički izazovi i etička pitanja, posebno u pogledu privatnosti i sigurnosti podataka. Na kraju, rad prikazuje buduće trendove u razvoju pametnih gradova i moguće društvene i ekonomske koristi. Rezultati ukazuju na to da veštačka inteligencija ima potencijal da značajno unapredi urbani razvoj, ali zahteva balans između tehnološkog napretka i etičkih standarda. Ova analiza može doprineti boljem razumevanju uloge veštačke inteligencije u održivom razvoju urbanih sredina kao i kreiranju smernica za dalja istraživanja u ovoj oblasti.

Ključne reči: Veštačka inteligencija, pametni gradovi, održivi razvoj, urbani razvoj.

1. Uvod

Razvoj veštačke inteligencije poslednjih godina doneo je revolucionarne promene u mnogim sektorima, posebno u urbanim sredinama, gde je omogućio razvoj takozvanih pametnih gradova. Pametni gradovi predstavljaju složene sisteme u kojima su integrisani

* Redovni profesor, Ekonomski fakultet u Nišu, Srbija, gorica.boskovic@eknfak.ni.ac.rs

• Vanredni profesor, Ekonomski fakultet u Nišu, Srbija, ivana.kostadinovic@eknfak.ni.ac.rs

♦ Doktorand, Ekonomski fakultet u Nišu, Srbija, aleksandar.manasijevic@eknfak.ni.ac.rs

različiti tehnološki resursi i informacioni sistemi s ciljem optimizacije javnih usluga, poboljšanja kvaliteta života građana i efikasnijeg korišćenja resursa. Koncept pametnog grada zasnovan je na upotrebi naprednih tehnologija kao što su internet stvari, analitika velikih podataka i veštačka inteligencija, koje omogućavaju prikupljanje, obradu i analizu ogromnih količina podataka u realnom vremenu. Ove tehnologije, kombinovane sa pametnim infrastrukturnim rešenjima, omogućavaju donošenje odluka zasnovanih na podacima, što je ključno za unapređenje urbanog okruženja (World Economic Forum, 2021).

Imajući u vidu da stanovništvo urbanih područja i dalje raste, potreba za efikasnijim i održivijim gradovima postaje sve izraženija. Prema predviđanjima Ujedinjenih nacija, više od 68% svetske populacije živeće u urbanim sredinama do 2050. godine. Ovaj trend zahteva inovativne pristupe u upravljanju gradovima, uključujući pametnu infrastrukturu, efikasnije upravljanje resursima i poboljšanje ekološke održivosti. Primena veštačke inteligencije u ovim oblastima predstavlja ključan korak ka rešavanju urbanih izazova kao što su saobraćajne gužve, energetska efikasnost, bezbednost i upravljanje otpadom. Na primer, pametni saobraćajni sistemi omogućavaju prilagođavanje semafora u realnom vremenu kako bi se smanjile gužve i emisije gasova, dok analitika podataka pomaže u optimizaciji potrošnje energije.

Uz sve prednosti koje veštačka inteligencija donosi, postoje i brojni izazovi koji se odnose na privatnost, sigurnost i etičke dileme. Kako se sve više podataka o ponašanju i aktivnostima građana prikuplja i analizira, raste zabrinutost o mogućem narušavanju privatnosti i sigurnosti podataka. Postavlja se pitanje kako pronaći balans između tehnološkog napretka i zaštite privatnosti, posebno kada su u pitanju osetljivi podaci građana. Na primer, algoritmi koji se koriste za nadzor i predikciju ponašanja mogu doneti korisne uvide, ali istovremeno i izazvati etičke dileme i zabrinutost zbog mogućih zloupotreba.

Cilj ovog rada je istražiti karakteristike i perspektive razvoja pametnih gradova kroz prizmu veštačke inteligencije. Prvo ćemo se osvrnuti na glavne oblasti primene veštačke inteligencije u pametnim gradovima, zatim ćemo analizirati ključne tehnološke karakteristike i izazove koji se javljaju u procesu njihove implementacije. Na kraju, razmatraćemo perspektive razvoja i buduće trendove u ovoj oblasti, sa posebnim osvrtom na društvene, ekonomske i ekološke aspekte.

2. Primena veštačke inteligencije u pametnim gradovima

Primena veštačke inteligencije u pametnim gradovima postala je ključni element unapređenja urbanih sredina, sa širokim spektrom aplikacija koje doprinose efikasnosti, održivosti i bezbednosti. Jedna od najvažnijih oblasti primene veštačke inteligencije je upravljanje saobraćajem, gde se napredni algoritmi koriste za analizu i predikciju saobraćajnih tokova, smanjenje gužvi i optimizaciju rada semafora. Na primer, u Singapuru se koriste prediktivni modeli i senzori koji omogućavaju prilagođavanje saobraćajnih signala u realnom vremenu, čime se smanjuju zagušenja i zagađenje vazduha. Slični pristupi su prisutni u Barseloni, gde se podaci sa senzora integrišu kroz pametne sisteme upravljanja za efikasniji protok saobraćaja i smanjenje emisije ugljen-dioksida (World Economic Forum, 2021). Ovi primeri pokazuju kako veštačka inteligencija može transformisati saobraćajnu infrastrukturu, čineći je reaktivnijom i prilagodljivijom potrebama grada.

Energetska efikasnost je druga ključna oblast u kojoj veštačka inteligencija igra značajnu ulogu. Integrisani sistemi pametnih mreža omogućavaju bolje praćenje i upravljanje

Veštačka inteligencija i pametni gradovi: karakteristike i perspektive razvoja

potrošnjom energije, kao i optimizaciju korišćenja obnovljivih izvora. Veštačka inteligencija se koristi za analizu potrošnje energije i optimizaciju korišćenja resursa na osnovu predikcija potražnje, čime se povećava efikasnost i smanjuje nepotrebna potrošnja. Studije pokazuju da primena veštačke inteligencije u energetsom sektoru doprinosi smanjenju operativnih troškova i emisije štetnih gasova kroz upotrebu pametnih mreža koje optimizuju distribuciju energije u skladu sa stvarnim potrebama korisnika (IEEE Xplore, 2022). Ovi sistemi ne samo da omogućavaju održivije korišćenje energije, već smanjuju zavisnost od fosilnih goriva i podržavaju tranziciju ka čistijim energetskekim rešenjima.

Kada govorimo o sektoru bezbednosti, veštačka inteligencija pruža napredne alate za prepoznavanje i analizu potencijalnih pretnji u urbanim sredinama. Kroz analizu video-nadzornih podataka i primenu tehnologija za prepoznavanje obrazaca, bezbednosne službe mogu pravovremeno prepoznati neobične aktivnosti i reagovati na vreme. Ovi sistemi koriste algoritme mašinskog učenja za detekciju anomalija u ponašanju i omogućavaju brže reagovanje na incidente, što povećava sigurnost građana. Gradovi poput Barselone koriste ove tehnologije kako bi povećali bezbednost u javnim prostorima, dok istovremeno zadržavaju visok nivo privatnosti građana zahvaljujući šifrovanju i anonimnim podacima.

Međutim, i pored svih koristi, postoje i značajni tehnički izazovi i ograničenja u primeni veštačke inteligencije u pametnim gradovima. Jedan od glavnih izazova je prikupljanje i obrada velikih količina podataka koji dolaze iz različitih izvora, kao što su senzori, kamere i pametni uređaji. Upravljanje ovim podacima zahteva složene algoritme za analizu u realnom vremenu, što često dovodi do problema skalabilnosti i potrebe za naprednom infrastrukturuom (Cugurullo, 2020). Osim toga, integracija veštačke inteligencije sa postojećim sistemima može biti izazovna zbog neskladnosti između novih tehnologija i zastarelih infrastrukturnih rešenja u mnogim gradovima.

Pri tome, etička pitanja, poput zaštite privatnosti i bezbednosti podataka, postaju sve relevantnija kako se obim prikupljanja podataka povećava. Razvoj propisa i standarda za upotrebu veštačke inteligencije u urbanim sredinama ključno je za balansiranje između koristi koje pruža veštačka inteligencija i prava građana na privatnost i zaštitu ličnih podataka. Ovi tehnički izazovi i etička ograničenja zahtevaju kontinuirano istraživanje i unapređenje kako bi se obezbedila odgovorna primena veštačke inteligencije u pametnim gradovima i podržao njihov održivi razvoj.

U oblastima kao što je upravljanje saobraćajem, podaci pokazuju da implementacija veštačke inteligencije može smanjiti prosečno vreme zastoja do 20% u velikim gradovima, što direktno utiče na smanjenje emisije ugljen-dioksida (Kassens-Noor & Hintze, 2020). Na primer, London je uveo napredni sistem zasnovan na mašinskom učenju koji koristi podatke sa saobraćajnih kamera i senzora za prilagođavanje rada semafora. Rezultati pokazuju da su gužve smanjene, dok se vreme putovanja značajno skratilo, što doprinosi i manjoj emisiji gasova sa efektom staklene bašte.

U oblasti energetske efikasnosti, veštačka inteligencija omogućava bolju optimizaciju resursa kroz predikciju potrošnje na osnovu istorijskih podataka i vremenskih uslova. Amsterdam koristi sistem koji kombinuje podatke o vremenskim prilikama i analizu potreba za energijom kako bi smanjio potrošnju tokom špiceva, što je smanjilo energetske trošak grada za približno 15% godišnje (Akhtar & Moridpour, 2021). Ovi sistemi, takođe, olakšavaju integraciju obnovljivih izvora energije u mrežu, čime smanjuju zavisnost od fosilnih goriva i podržavaju ekološku održivost urbanih sredina.

Kada je reč o bezbednosti, veštačka inteligencija pomaže u analizi i obradi ogromne količine podataka sa kamera i senzora. Na primer, u Tokiju, tehnologija prepoznavanja lica koristi se za identifikaciju potencijalnih pretnji u realnom vremenu, posebno u zonama visoke frekvencije, poput metro stanica i komercijalnih centara. Ovaj sistem se pokazao kao izuzetno efikasan, što je rezultiralo smanjenjem incidenata za oko 30% u odnosu na prethodne godine (Ullah, et al., 2020).

Tehnički izazovi i dalje ostaju značajan faktor. S obzirom na brzu ekspanziju i rast podataka u pametnim gradovima, postojeći sistemi često imaju ograničene kapacitete za obradu i skladištenje ogromnih količina podataka. Istraživanja pokazuju da je za optimalno funkcionisanje veštačke inteligencije u ovakvim uslovima neophodna infrastruktura koja podržava visoku skalabilnost, što predstavlja veliki finansijski izazov za mnoge gradove (Stecula, et al. 2024).

3. Tehnološke karakteristike i izazovi primene veštačke inteligencije

Tehnološke karakteristike i izazovi primene veštačke inteligencije u pametnim gradovima temelje se na nekoliko ključnih tehnologija koje omogućavaju razvoj i funkcionalnost ovih urbanih ekosistema. Internet stvari, veliki podaci, *cloud computing* i mreže senzora predstavljaju osnovne tehnološke komponente koje omogućavaju implementaciju veštačke inteligencije u urbanim sredinama. Internet stvari omogućava prikupljanje podataka u realnom vremenu, dok veliki podaci (*big data*) omogućavaju analizu i prepoznavanje obrazaca koji se koriste za unapređenje efikasnosti gradskih usluga, od saobraćaja do energije. *Cloud computing* omogućava skladištenje i obradu velikih količina podataka, čineći ih dostupnim u realnom vremenu za analizu i donošenje odluka (Masood & Ahmad, 2021). Mreže senzora su ključne za praćenje i upravljanje vodom, energijom i saobraćajem, omogućavajući gradovima da postanu dinamični i responzivni.

Međutim, implemetnacija ovih tehnologija u urbanim sredinama može dovesti do značajnih bezbednosnih rizika, naročito u pogledu privatnosti podataka. Prikupljanjem velikih količina podataka sa senzora i drugih izvora, stvara se rizik od njihovog neovlašćenog korišćenja ili zloupotrebe. Na primer, tehnologije prepoznavanja lica, koje se koriste za unapređenje bezbednosti u javnim prostorima, mogu ugroziti privatnost građana. Pored toga, rizik od takozvanih *cyber* napada na infrastrukturne sisteme gradova je sve prisutniji, jer su sistemi bazirani na veštačkoj inteligenciji i internetu stvari ranjivi na hakerske napade (Batty, 2018). U tom smislu, potrebno je razviti robustne sisteme zaštite podataka, kao i uvesti zakonske regulative koje bi obezbedile sigurnost i privatnost korisnika.

Etika i društveni izazovi uvođenja veštačke inteligencije u javne sisteme takođe predstavljaju značajnu prepreku. Iako savremena tehnologija nudi brojne prednosti u smislu efikasnosti i optimizacije svih društveno-ekonomskih procesa, mora se voditi računa o njenim socijalnim i etičkim implikacijama. Na primer, ugradnja automatizovanih sistema za nadzor može dovesti do prekomernog nadzora, što može uticati na slobode građana. Takođe, veštačka inteligencija može stvoriti i nove oblike socijalne isključenosti, jer određeni delovi stanovništva možda neće imati pristup ili znanje za korišćenje novih tehnologija (Dounis, 2010).

Osim tehnoloških i društvenih izazova, primena veštačke inteligencije u pametnim gradovima ima značajan uticaj na lokalni ekonomski razvoj. Uvođenje takozvanih pametnih tehnologija omogućava stvaranje novih radnih mesta u sektoru tehnologije i inovacija, kao i poboljšanje poslovnog okruženja.

Veštačka inteligencija i pametni gradovi: karakteristike i perspektive razvoja

Gradovi koji implementiraju napredne tehnologije mogu postati atraktivniji za strane investitore, čime se pozitivno utiče na ostvarivanje ciljeva ravnomernog regionalnog razvoja. Na primer, gradovi kao što su Singapur i Barselona su postali centri za tehnološke inovacije i privlače investicije u sektorima kao što su informaciono-komunikacione tehnologije, zelene tehnologije i pametna infrastruktura, što direktno doprinosi njihovom ekonomskom rastu (Golubchikov & Thornbush, 2020). Primena ovakve tehnologije omogućava i efikasnije korišćenje resursa, smanjenje troškova i viši nivo konkurentnosti na globalnom tržištu.

Primena veštačke inteligencije u pametnim gradovima donosi brojne prednosti, ali i izazove. Ključ za uspešnu implementaciju leži u ravnoteži između tehnološke inovacije i zaštite interesa građana, kao i u razvijanju adekvatnih politika koje će omogućiti bezbedno i etičko korišćenje ovih tehnologija.

Ekonomski efekti primene veštačke inteligencije u lokalnim sredinama mogu biti značajni, posebno u pogledu smanjenja troškova i poboljšanja efikasnosti javnih usluga. Na primer, implementacija pametnih sistema za upravljanje saobraćajem može smanjiti gužve, što dovodi do smanjenja vremena putovanja i potrošnje goriva. Takođe, optimizacija potrošnje energije kroz pametne mreže može smanjiti operativne troškove gradskih vlasti i poboljšati energetske efikasnost, čime se doprinosi smanjenju emisije ugljen-dioksida i ostvarivanju ciljeva održivog razvoja.

U takvom okruženju, lokalna privreda može profitirati kroz poboljšanje kvaliteta života građana, smanjenje troškova života i kroz viši nivo regionalne, nacionalne i međunarodne konkurentnosti. Pored toga, pametni gradovi mogu privući investitore i stimulisati lokalnu industriju, stvarajući tako nove ekonomske prilike i otvarajući nova radna mesta u sektoru tehnologije i inovacija.

Primena veštačke inteligencije u urbanim sredinama može doprineti ravnomernijem regionalnom razvoju kroz poboljšanje upravljanja javnim resursima i kroz inteziviranje lokalnog ekonomskog razvoja. Na primer, implementacija tehnologija za analizu podataka može pomoći u identifikovanju ekonomskih izazova i pružanju preciznih informacija za donošenje odluka na lokalnom nivou. Kroz efikasnije korišćenje resursa, gradovi mogu smanjiti javne dugove i povećati kvalitet usluga, što direktno utiče na poboljšanje životnog standarda i ekonomsku stabilnost.

4. Perspektive razvoja veštačke iteligenције i pametnih gradova

Razvoj pametnih gradova postavlja visoke zahteve u pogledu integracije savremenih tehnologija, pri čemu je veštačka inteligencija ključni faktor u procesu transformacije urbanih sredina. Veštačka inteligencija, kao što smo i pomenuli, omogućava implementaciju naprednih sistema koji olakšavaju upravljanje infrastrukturom, resursima i uslugama. Prednosti korišćenja veštačke inteligencije u pametnim gradovima uključuju poboljšanje efikasnosti saobraćaja, smanjenje emisije štetnih gasova, optimizaciju energetske potrošnje i unapređenje bezbednosti, dok istovremeno omogućavaju bolju povezanost između različitih gradskih sistema. Pametni gradovi koriste veštačku inteligenciju za prikupljanje i analizu podataka u realnom vremenu, što omogućava brže donošenje odluka i efikasnije upravljanje urbanom infrastrukturom, a čime se smanjuju troškovi i poboljšava kvaliteta života.

Jedan od najistaknutijih aspekata primene veštačke inteligencije u pametnim gradovima jesu autonomna vozila. Gradovi kao što su Singapur i San Francisco već

implementiraju testove autonomnih vozila koja imaju potencijal da transformišu urbanu mobilnost. Ova vozila ne samo da smanjuju potrebu za parkirnim mestima i saobraćajnim gužvama, već omogućavaju i efikasnije korišćenje energetske resursa i smanjenje emisije CO₂. Na primer, Singapur planira da do 2030. godine uvede autonomni taksi servis na većem delu svoje urbane mreže. Očekuje se da će uvođenje autonomnih vozila doprineti smanjenju saobraćajnih nesreća, jer je poznato da ljudska greška predstavlja najveći faktor u nastanku saobraćajnih incidenata. Takođe, ove tehnologije omogućavaju bolju koordinaciju sa ostalim urbanim sistemima, kao što su upravljanje saobraćajem, javni prevoz i upravljanje energijom. Prema izveštaju Svetskog ekonomskog foruma, autonomna vozila mogu smanjiti emisiju CO₂ za čak 30% do 40% na globalnom nivou (Tahiliani & Dizalwar, 2018).

Održiva urbana infrastruktura, takođe, predstavlja ključni pravac u razvoju pametnih gradova. Veštačka inteligencija omogućava uvođenje pametnih mreža koje prate potrošnju energije u realnom vremenu i optimizuju distribuciju resursa. Gradovi poput Barselone već koriste pametne sisteme za upravljanje energijom i vodom, što omogućava efikasnije korišćenje obnovljivih izvora energije i smanjenje gubitaka u distribuciji. Ovaj pristup može značajno smanjiti emisiju ugljen-dioksida, doprinosti smanjenju troškova i činiti gradove energetski efikasnijim. Slično tome, pametni gradovi koriste sisteme za upravljanje otpadom koji omogućavaju precizno praćenje količine i vrste otpada u realnom vremenu, što omogućava efikasnu reciklažu i smanjenje ukupne količine otpada. Gradovi kao što je Amsterdam implementirali su pametne sisteme za reciklažu i otpad, a sve u cilju smanjenja emisija i postizanja ciljeva održivosti (Yigitcanlar & Cugurullo, 2020).

Uloga države u daljem razvoju pametnih gradova je ključna, jer je potrebno obezbediti odgovarajući regulatorni okvir koji omogućava implementaciju novih tehnologija. Takođe, inicijative donosioca odluka, kao ključnih aktera mogu podstaknuti privatni sektor da investira u razvoj novih tehnologija i infrastruktura koje podržavaju pametne gradove. Na primer, države mogu ponuditi subvencije i poreske olakšice za preduzeća koja se bave razvojem autonomnih vozila, pametnih mreža ili tehnologija za upravljanje saobraćajem. S druge strane, privatni sektor igra ključnu ulogu u kreiranju i implementaciji inovacija i komercijalizaciji novih tehnologija. Startapovi i tehnološke kompanije razvijaju i implementiraju napredne sisteme za pametne gradove, dok velike kompanije kao što su *Google* i *Tesla* investiraju u razvoj autonomnih vozila i novih rešenja za urbanu mobilnost.

Potencijalne društveno-ekonomske koristi od razvoja pametnih gradova su ogromne. Pametni gradovi mogu doneti značajne uštede u oblasti energije i resursa, kao i poboljšanje kvaliteta života građana. Na primer, optimizacijom saobraćaja i smanjenjem zagađenja može se značajno poboljšati zdravlje stanovništva, dok efikasnije korišćenje resursa omogućava dugoročnu održivost gradova. Takođe, razvoj pametnih gradova može podstaći ekonomski rast kroz nove industrije, radna mesta i tehnologije. Iako postoje brojni izazovi u vezi sa implementacijom ovih tehnologija, kao što su visoki troškovi ulaganja, sigurnost podataka i etička pitanja, prednosti koje pametni gradovi donose svakako opravdavaju ulaganja u njihov razvoj. U narednim godinama, očekuje se da će pametni gradovi postati model za takozvanu urbanu budućnost, čime će doprineti i globalnom napretku ka ostvarivanju ključnih ciljeva održivog razvoja.

5. Zaključak

Razvoj pametnih gradova uz pomoć veštačke inteligencije predstavlja ključnu promenu u načinu na koji upravljamo urbanim sredinama i resursima. Integracija naprednih tehnologija kao što su autonomna vozila, pametne energetske mreže, sistemi za upravljanje saobraćajem i održivi urbanizam nije samo tehničko-tehnološka inovacija, već i društveni i ekonomski korak ka budućnosti. Pametni gradovi omogućavaju optimizaciju resursa, smanjenje emisija ugljen-dioksida, efikasnije korišćenje energije, kao i značajna poboljšanja u životnoj sredini i kvalitetu života građana.

Međutim, razvoj pametnih gradova nosi i izazove, među kojima se ističu tehnički problemi vezani za infrastrukturu, sigurnost podataka, etička pitanja i visoki troškovi implementacije novih tehnologija. Ove prepreke zahtevaju angažovanje vlade i privatnog sektora, koji moraju obezbediti odgovarajući regulatorni okvir, stimulatívne politike i investicije u istraživanje i razvoj. Privatni sektor, sa svojom sposobnošću za inovacije i primenu novih rešenja, igra ključnu ulogu u ubrzanju tranzicije prema pametnim gradovima.

Društveno-ekonomske koristi od razvoja pametnih gradova su značajne i dalekosežne. Osim što mogu doneti direktne koristi u pogledu uštede resursa i smanjenja troškova, pametni gradovi mogu postati i generatori novih industrija, radnih mesta i ekonomskog rasta. Ulaganja u tehnologiju, obrazovanje i obuku radne snage osiguravaju konkurentnost i razvoj gradova na globalnom nivou. Takođe, transformacija urbanih sredina u pametne gradove doprinosi globalnim naporima ka održivom razvoju, smanjujući ekološki otisak i unapređujući kvalitet života, čineći ga održivijim za buduće generacije.

U narednim godinama, očekuje se da će pametni gradovi postati temelj buduće urbane transformacije i zelene tranzicije, pružajući bolju povezanost, sigurnost, održivost i kvalitet života u gradovima širom sveta. Kroz intenzivniju primenu veštačke inteligencije i komplemetarnih savremenih tehnologija, koncept pametnih gradova će igrati ključnu ulogu u oblikovanju savremenog društva, omogućavajući da gradovi postanu efikasniji, otporniji i prilagodljiviji potrebama svojih stanovnika.

Razvoj pametnih gradova uz primenu veštačke inteligencije, iako izazovan, predstavlja priliku za stvaranje novih društvenih normi i ekonomskih modela koji mogu unaprediti sve sfere urbanog života. Postizanje ravnoteže između tehnološkog napretka i očuvanja privatnosti građana, kao i smanjenje potencijalnih negativnih efekata tehnologije, biće ključno za dugoročni uspeh ovih tehnologija i koncepata. Transparentnost u procesu implementacije, odgovorno korišćenje podataka i etički principi moraju biti u fokusu kako bi se obezbedila sigurnost, poverenje i adekvatna primena tehnologije. Ove promene će zahtevati saradnju između svih sektora društva, od javnog do privatnog, što će stvoriti mogućnosti za nove oblike saradnje, inovacije i zajedničko rešavanje svih pomenutih problema i izazova. Kroz kontinuirani dijalog i odgovoran pristup, koncept pametnih gradova može postati održivo rešenje koje, ne samo da zadovoljava trenutne potrebe, već pruža i fleksibilnost i otpornost za izazove budućnosti, kojih će svakako biti.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Reference

- Akhtar, M., & Moridpour, S. (2021). "A Review of Traffic Congestion Prediction Using Artificial Intelligence." *Journal of Advanced Transportation*, 2021.
- Batty, M. (2018). "Artificial Intelligence and Smart Cities." *Environment and Planning B: Urban Analytics and City Science*, 45(1), 3-6.
- Cugurullo, F. (2020). "Urban Artificial Intelligence: From Automation to Autonomy in the Smart City." *Frontiers in Sustainable Cities*, 2, 38.
- Dounis, A.I. (2010). "Artificial Intelligence for Energy Conservation in Buildings." *Advanced Building Energy Research*, 4, 267-299.
- Golubchikov, O., & Thornbush, M. (2020). "Artificial Intelligence and Robotics in Smart City Strategies." *Smart Cities*, 3, 1133-1144.
- IEEE Xplore. (2022). "Artificial Intelligence and Smart Cities: A DEMATEL Approach to Adaptation Challenges and Initiatives." *IEEE Journals & Magazine*.
- Kassens-Noor, E., & Hintze, A. (2020). "Cities of the Future? The Potential Impact of Artificial Intelligence." *AI*, 1, 192-197.
- Masood, A., & Ahmad, K. (2021). "A Review on Emerging Artificial Intelligence Techniques for Air Pollution Forecasting." *Journal of Cleaner Production*, 322, 129072.
- Stecula, K. (2024). "Artificial Intelligence in Smart Cities: Applications, Barriers, and Future Directions." *Smart Cities*, 7(3), 1346-1389.
- Tahiliani, V., & Dizalwar, M. (2018). "Green IoT Systems: An Energy Efficient Perspective." In *Proceedings of the Eleventh International Conference on Contemporary Computing*.
- Ullah, Z., Fadi, T., Mostarda, L, Gagliardi, R. (2020). "Applications of Artificial Intelligence and Machine Learning in Smart Cities." *Computer Communications*, 154, 313-323.
- World Economic Forum. (2021). "How AI is Transforming Decarbonising and Cleaning Up the Grid."
- Yigitcanlar, T., & Cugurullo, F. (2020). "The Sustainability of Artificial Intelligence: An Urbanistic Viewpoint from the Lens of Smart and Sustainable Cities." *Sustainability*, 12(8548).

ARTIFICIAL INTELLIGENCE AND SMART CITIES: CHARACTERISTICS AND DEVELOPMENT PERSPECTIVES

Abstract: *This paper examines the role of artificial intelligence in the development of smart cities, focusing on technological characteristics, applications, and future perspectives. Smart cities represent innovative urban solutions that leverage technologies such as the Internet of Things and big data analytics to enhance resource management efficiency, improve safety, and increase citizens' quality of life. The first part of the paper discusses key areas of AI application, including traffic management, energy efficiency, and security systems. Next, technical challenges and ethical issues are analyzed, particularly regarding data privacy and security. Finally, the paper presents future trends in smart city development and potential social and economic benefits. The findings indicate that AI has significant potential to advance urban development but requires a balance between technological progress and ethical standards. This analysis may contribute to a better understanding of AI's role in sustainable urban development and offer guidelines for further research in this field.*

Keywords: *Artificial Intelligence, Smart Cities, Sustainable Development, Urban Development.*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**PRIMENA KONCEPTA ODRŽIVOG RAZVOJA U PROIZVODNJI
KOZMETIČKIH PROIZVODA**

Dr Tatjana Stevanović*

Dr Marija Petrović-Randelović •

Rezime: Klimatske promene i jačanje svesti o potrebi smanja uticaja ljudskih aktivnosti na životnu sredinu radi očuvanja planete Zemlje, doveli su do značaja pitanja efikasnog korišćenja prirodnih resursa i održivosti industrijskog razvoja. Sve veći broj potrošača usmerava svoje ponašanje na društveno i ekološki odgovorniju potrošnju koja štedi energiju i koja je ekološki prihvatljiva. Rastuća osetljivost kod potrošača je pokrenula zelenu tranziciju i u proizvodnji kozmetičkih proizvoda. S tim u vezi, mnoge kompanije iz oblasti proizvodnje kozmetičkih proizvoda danas posvećuju veliku pažnju održivim inovacijama u ovoj oblasti. Upravo iz tog razloga, primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda predstavlja predmet istraživanja koji je obuhvaćen ovim radom. Osnovni cilj rada je da kroz sveobuhvatnu analizu uticaja proizvodnje kozmetičkih proizvoda na ekološku komponentu održivog razvoja, ukaže na značaj primene koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda.

Ključne reči: održivi razvoj, kozmetički proizvodi, strategija

1. Uvod

Trend rasta proizvodnje kozmetičkih proizvoda primetan je u proteklih dvadesetak godina, usled sve veće tražnje, kako u razvijenim, tako i u zemljama u razvoju. Međutim, u izveštaju „Kreiraj budućnost“, koji je pripremio Quantis, vodeća konsultantska kuća za ekološku održivost, naglašava se da procesi ekstrakcije i prerade sirovina, koji učestvuju sa 10% u ukupnim emisijama u proizvodnji kozmetičkih proizvoda, prekomerna upotreba

* Univerzitet u Nišu, Ekonomski fakultet; Srbija; ORCID 0000-0003-1270-7129,

✉ tatjana.stevanovic@ekonomski.rs

• Univerzitet u Nišu, Ekonomski fakultet; Srbija; ORCID 0000-0003-2905-1023,

✉ marija.petrovic@eknfak.ni.ac.rs

UDK 502.131.1:665.5

plastike za pakovanje (20%), transport (10%) i faza upotrebe proizvoda (40%), predstavljaju glavne faktore uticaja proizvodnje kozmetičkih proizvoda na ekološku ravnotežu. Osim toga, proizvodnja kozmetičkih proizvoda generiše do 120 milijardi jedinica plastične ambalaže godišnje i doprinosi gubitku 18 miliona hektara šume.

Kozmetičke proizvode svakodnevno koristi veliki broj ljudi, bez obzira na pol i starosnu dob. Kako briga o sebi i dobrobit postaju važniji za potrošače širom sveta, proizvodnja kozmetičkih proizvoda postaje sve vrednija, a trendovi pokazuju da će i u narednim godinama ona nastaviti svoju ekspanziju. Svetsko tržište kozmetike zabeležilo je u 2022. godini rast od preko 15% u odnosu na prethodnu godinu, ali je primećeno da je pandemija virusa COVID-19 doprinela opadanju tražnje za nekim kategorijama kozmetičkih proizvoda, sa promenom uobičajenih navika potrošača. Osim toga, pandemija je dovela i do digitalizacije tržišta kozmetičkih proizvoda, što potvrđuje podatak da je trgovina kozmetičkim proizvodima učestvovala sa 22% u e-trgovini u 2020. godini u poređenju sa samo 14% u 2019. godini. Pandemija virusa COVID-19 ostaviće dalekosežne posledice, posebno na zdravstveno stanje stanovništva, što u izvesnoj meri opravdava i sve veću zabrinutost potrošača za održivu proizvodnju kozmetičkih proizvoda.

U uslovima kada održivost više ne predstavlja trend, već vrednost kojoj treba težiti po svaku cenu, promena ponašanja svih aktera prema raspoloživim, ali ograničenim prirodnim resursima, kako bi se umanjio ekološki otisak i negativne posledice na životnu sredinu, preduslov je održivog razvoja sektora industrije. Imajući u vidu da je sa aspekta održivog razvoja najprihvatljiviji onaj proizvod koji ispunjava traženu funkciju i minimizira ukupan uticaj na sva tri stuba održivog razvoja tokom celog životnog ciklusa, primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda preduslov je smanjivanja ekološkog uticaja proizvodnje i ostvarivanja koristi od upotrebe održivih proizvoda. U cilju podmirivanja zahteva potrošača u pogledu ekoloških karakteristika kozmetičkih proizvoda, kompanije iz oblasti proizvodnje kozmetičkih proizvoda preduzimaju aktivnosti istraživanja i razvoja u pravcu pronalaženja ekološki prihvatljivih rešenja, koja će doprineti povećanju održivosti proizvodnje kozmetičkih proizvoda.

Prvi deo rada biće posvećen formulisanju i implementaciji strategije održivosti, dok se drugi deo rada odnosi na primenu strategije održivosti u kozmetičkoj industriji. Primeri dobre prakse u primeni koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda biće predstavljeni u trećem delu rada.

2. Formulisanje i implementacija strategije održivosti

Održivi razvoj je počeo da se široko prihvata kao globalni politički koncept krajem 80-ih godina XX veka nakon njegovog popularisanja u Brundtlandskom izveštaju *"Naša zajednička budućnost"* ("Our Common Future"). Svetska komisija za životnu sredinu i razvoj (World Commission on Environment and Development - WCED) pri Ujedinjenim nacijama je 1987. godine u Brundtlandskom izveštaju iznela najčešće citiranu definiciju održivog razvoja: *"Čovečanstvo poseduje sposobnost da razvoj učini održivim – da obezbedi da on podmiruje potrebe sadašnje, bez ugrožavanja mogućnosti budućih generacija da podmiruju sopstvene potrebe"*. U osnovi ove definicije mogu se prepoznati dva osnovna koncepta (WCED, 1987): koncept potreba koji zagovara postizanje ili očuvanje prihvatljivog životnog standarda za sve, i koncept ograničenja kapaciteta životne sredine, uslovljenog dostignutim nivoima u tehnološkom razvoju i društvenoj organizaciji.

Primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda

Održivost u velikoj meri utiče na razvoj strategije unutar kompanija. Dok su se kompanije ranije fokusirale na kratkoročnu maksimizaciju profita, porastom težnje ka ekološkoj i društvenoj dugoročnoj održivosti, održivost postaje suštinski faktor ukupnog uspeha kompanija na duži rok (Galpin et al, 2015). Studije pokazuju da kompanije „visoke održivosti“ nadmašuju svoje konkurente, pa otuda i veza između performansi održivosti kompanije i njenog ukupnog rasta (Baumgartner, 2014).

Postizanje održivosti, međutim, zahteva njeno definisanje i analizu unutar korporativne strategije i involviranje u procese strateškog donošenja odluka (Galpin et al, 2015). Prema Epstein i Roi (2001), strategija održivosti ima za cilj „uravnotežavanje društvenih, ekoloških i ekonomskih potreba i kompanije i društva“. Autori navode da se uspešne strategije održivosti moraju posmatrati u dugom periodu, kako bi se proučavali indikatori efikasnosti i izvršila pažljiva identifikacija ključnih pokretača performansi. Održivost mora biti ugrađena u organizacionu strategiju, proširujući mogućnosti koje stvaraju vrednost za kompaniju (Ljoret, 2016).

Održivi razvoj kompanije uključuje napore da se zadovolje potrebe kompanije bez ugrožavanja aspekata očuvanja prirodnih i ljudskih resursa. Razrada održivosti kompanije unutar strategije zahteva od donosilaca odluka da istraže pitanja održivosti i njihov uticaj na organizaciju, definišu interne i eksterne pokretače i sagledaju faktore podrške i ograničenja. Identifikovanje interesa stejkholdera, prevođenje ciljeva u kriterijume održivosti, određivanje ključnih faktora i odnosa između faktora značajnih za postizanje ciljeva održivosti, postaju faze unutar modela dostizanja održivog razvoja. Iz modela se mogu sagledati ulazni elementi, ograničenja i povratne informacije za proces kreiranja strategija, što pokreće donosiocje odluka da istraže inovativne strateške alternative (Amrina et al, 2021).

Održivost postaje strateški imperativ 21. veka. Mnoge kompanije su objavile svoju stratešku posvećenost održivosti, ali uspešnost ove strategije zahteva stvaranje infrastrukture za odražavanje i jačanje ove inicijative. Stoga su faze formulisanja i implementacije strategije održivosti ključne (Galpin et al, 2015).

S obzirom na to da ne postoji standardizovana strategija održivosti koju bi primenjivale sve kompanije prilikom dostizanja željenih ciljeva i rezultata, izbor strategije održivosti i njeno pažljivo prilagođavanje konkretnim okolnostima preduzeća jedan od značajnih izazova sa kojima se kompanije danas suočavaju (Engert & Baumgartner, 2016). Formulisanje „redovne“ strategije poslovanja savremenog preduzeća podrazumeva sistematski, interaktivni i iterativni proces koji polazi od razumevanja izazova iz okruženja i stanja internih mogućnosti preduzeća (Lynch, 2003). Međutim, formulisanje strategije održivosti uglavnom je određeno eksternim zainteresovanim stranama, a ne trenutnim zahtevima kupaca, što ovaj proces čini složenijim. U fazi formulisanja strategije, kompanija mora da sagleda svaku komponentu strategije kroz sočivo održivosti. Kompanije moraju imati jasnu definiciju održivosti u fazi formulisanja strategije održivosti, kao i viziju koja integriše održivost u kulturu kompanije (Engert & Baumgartner, 2016).

Dostizanje superiornih performansi i konkurentske prednosti preduzeća moguće je ostvariti efikasnom primenom dobro formulisane i razvijene poslovne strategije. Najbolja strategija postaće profitabilna isključivo ukoliko se uspešno implementira. Zato je implementacija strategije u praksi jedan veoma težak, izazovan i kontinuirani zadatak kome menadžeri preduzeća moraju biti veoma posvećeni imajući u vidu promenljivo i konfrontaciono okruženje. Implementacija strategije je komplikovan proces pretvaranja dobro

razrađenih planova u akcije, koji igra ključnu ulogu u ukupnom uspehu poslovne strategije. Menadžeri se suočavaju sa poteškoćama tokom procesa implementacije zbog nedostatka prakse u prevazilaženju raznih prepreka ili nedostatka znanja iz praktične perspektive.

Razumevanje koncepta održivosti ne znači da kompanije mogu lako da ga implementiraju u jezgro poslovnih aktivnosti. Implementiranje održivosti zahteva razvijanje plana izvršenja strategije, kojim bi se teorija prevela u praksu. Sprovođenje strategije postalo je izazovan deo kreiranja celokupne strategije održivosti (Engert, Baumgartner, 2016). Uprkos preprekama sa kojima se kompanija može suočiti tokom sprovođenja strategije, još uvek ih je moguće prevazići razvijanjem smernica, procenom troškova ispunjavanja postavljenih zahteva i njihovim stavljanjem u odnos sa profitabilnošću poslovanja. Zaključujemo da, iako organizacije treba da budu odgovorne za uticaj koji njihovi proizvodi ili usluge prouzrokuju na životnu sredinu, ne treba zanemarivati važnost daljeg sticanja profita (Epstein & Roi, 2001).

Iako se priroda same strategije održivosti razlikuje od preduzeća do preduzeća, značaj i pozitivan efekat integracije održivosti u strategiju i implementacija ovog koncepta kao svakodnevnih poslovnih aktivnosti treba da postanu imperativ svake organizacije.

3. Održivi razvoj u kozmetičkoj industriji

Kozmetika se generalno definiše kao svaka supstanca ili smeša namenjena za dodir sa spoljašnjim delovima ljudskog tela ili sa zubima i sluzokožom usne duplje, isključivo ili uglavnom sa namenom za njihovo čišćenje, parfimisanje, menjanje izgleda, zaštitu, održavanje u dobrom stanju ili neutralisanje telesnih mirisa (Evropska komisija, 2015). Smatra se da kozmetika ima suštinsku ulogu u savremenom društvu, omogućavajući poboljšanje kvaliteta života potrošača kroz svoje funkcionalne i emocionalne prednosti.

Važnost kozmetike se često umanjuje, ali mnogi elementi, kao što su sapuni i paste za zube su deo osnovnih higijenskih proizvoda, a losioni za sunčanje i balzami za usne igraju značajnu ulogu u zaštiti i dobrobiti kože. Kada je u pitanju održivost u kozmetici, fokus je uglavnom na izvorima sirovina, zelenim formulacijama i pakovanju. Kompanije su počele da prate iskorišćenost vode, energije i resursa, istovremeno se fokusirajući na efikasnost poslovanja.

Do 2020. godine, svetska kozmetička industrija je konstantno rasla i vredela je oko 500.000 miliona dolara (u 2019). Slično mnogim drugim sektorima, kozmetička industrija je doživela pad zbog poremećaja uzrokovanih pandemijom Covid-19, pošto su prodavnice bile prinuđene da se zatvore, lanci snabdevanja prekinuti, a potrošnja opala. Međutim, očekuje se da će tržište ostvariti snažan oporavak sa kombinovanom godišnjom stopom rasta od 6%, koja se očekuje do 2026.

Tokom protekle decenije, kozmetička industrija je pokazala razuman rast i jedna je od najvećih industrija u svetu. Potražnja potrošača za kozmetičkim proizvodima je porasla, kako u razvijenim zemljama tako i u zemljama u razvoju. Međutim, kozmetička industrija je poznata po velikoj upotrebi plastike, toksičnih hemikalija i stvaranju otpada. Proizvodni ciklus kozmetičke industrije povezan je sa visokom emisijom CO₂ i značajnom potrošnjom energije i vode (Fortunati et al, 2020).

Primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda

Zbog velikog uticaja na životnu sredinu, povećava se pritisak na kompanije iz oblasti proizvodnje kozmetičkih proizvoda da primenjuju održivi pristup u poslovanju, kako u pogledu ekoloških, tako i u pogledu socijalnih pitanja. Održivost utiče na ceo lanac snabdevanja kozmetikom (Bom et al, 2020). Kozmetička industrija kreće se putem održivog razvoja, shodno potrebi za efikasnošću resursa i potražnji za održivim dobrima. Stoga je 21. vek postao prekretnica koja kozmetičku industriju usmerava ka poslovanju povezanom sa održivošću.

Održive inovacije u proizvodnji kozmetičkih proizvoda danas predstavljaju predmet interesovanja različitih stakeholdera. Kompanije tragaju za ekološki prihvatljivim rešenjima u pronalaženju obnovljivih i biorazgradivih sastojaka, koji neće štetiti društvu ili životnoj sredini. Sve ovo zahteva uvođenje novih linija proizvoda i redizajniranje strategija u održivom smislu, jer se jedino na taj način može osigurati uspešna budućnost u kozmetičkoj industriji.

Održivost u kozmetici počinje u fazi projektovanja, što utiče na sve naredne faze. Tokom izbora i nabavke sirovina, održivost se može povećati zamenom konvencionalnih sastojaka održivim, sintezom sastojaka korišćenjem zelene hemije, prevođenjem nusproizvoda agro-prehrambene industrije u sastojke dodatne vrednosti i razvojem proizvoda za smanjenje vodenog otiska. Održivost tokom proizvodnje uključuje implementaciju inovativnih fabrika koje ponovo koriste vodu i energiju, na primer. Kompanije, takođe, edukuju potrošače o tome kako da na održiv način koriste kozmetiku. U postpodajnoj fazi, reciklaža, ponovna upotreba ili ponovno punjenje korišćene ambalaže je poželjnije od odlaganja na deponijama. Konačno, kompanije moraju da se pozabave karbonskim otiskom koji proizilazi iz nekoliko faza distribucije.

Nedavna studija od strane Cosmetics Europe on the Product Environmental Footprint of Shampoo pokazala je da se samo 5% do 20% uticaja ukupnog životnog ciklusa šampona može pripisati sirovinama, proizvodnji, distribuciji i pakovanju šampona. To znači da je u najvećoj meri uticaj na životnu sredinu povezan sa upotrebom i odlaganjem šampona (Cosmetics Europe, 2020).

Prepoznajući važnost održive nabavke sastojaka, neke kozmetičke kompanije su počele da se udružuju sa svojim dobavljačima kako bi poboljšale transparentnost i održivost svog lanca snabdevanja. Platforma EcoVadis omogućava kompanijama da procene ekološke i društvene performanse svojih globalnih dobavljača, a nekoliko članova Cosmetics Europe koristi ovu alatku za poboljšanje ukupnih performansi održivosti duž svog lanca snabdevanja.

Faza dizajniranja kozmetičkih proizvoda ima veliki uticaj na održivost finalnog proizvoda, a izbor sastojaka za formulaciju kozmetike smatra se jednim od najvažnijih koraka koji određuje održivost gotovih proizvoda. Međutim, učinak sastojaka je takođe važan, a prirodni ili održivi sastojci možda neće biti tako efikasni kao njihove sintetičke ili neodržive alternative. Na primer, plastične mikroperle su bile preferirane u odnosu na prirodne abrazive kao što su mlevene koštice voća, jer njihova glatkoća manje oštećuje kožu i poboljšavaju vizuelnu privlačnost proizvoda (Chang, 2015).

Potrošnja energije i emisije gasova staklene bašte su usko povezane. Promenom izvora energije kompanija može značajno da smanji emisije. Poslednjih godina, mnogi proizvođači kozmetike povećali su udeo svojih energetskeg zaliha koji potiču iz obnovljivih izvora, a neke fabrike sada koriste isključivo obnovljivu energiju, bilo proizvedenu na licu mesta ili nabavljenu od drugih preduzeća. Kozmetičke kompanije ulažu u solarnu

fotonaponsku energiju, energiju vetra, biometanizaciju, biomasu i hidroenergiju, kao i ponovno korišćenje pare iz otpadnih voda proizvedenih tokom proizvodnje. Neki takođe pokušavaju da smanje svoje emisije kroz energetske efikasnost i korišćenjem čistije energije sa niskim sadržajem ugljenika, na primer prirodnog gasa, za razliku od uglja.

Da bi smanjili svoj ugljenični otisak, proizvođači kozmetike su implementirali stroge sisteme upravljanja životnom sredinom, učinili proizvodne procese efikasnijim i izvršili prilagođavanja samih proizvodnih pogona. Neke proizvodne lokacije su postigle odlične performanse energetske efikasnosti inovativnim rešenjima, na primer, instaliranjem visoko efikasnih ventilacionih sistema, ventilisanih spoljašnjih zidnih obloga, korišćenjem LED osvetljenja i prirodnog dnevnog svetla postavljanjem solarnih cevi. Neki proizvodni pogoni su takođe kombinovani prirodni sistemi za kontrolu klime sa povratom toplote.

Proizvodni otpad izaziva značajnu zabrinutost u kozmetičkoj industriji, ne samo iz perspektive održivosti, već i zbog toga što može biti skup za odlaganje. Da bi se smanjio otpad, neke fabrike koriste kutije koje se mogu višekratno koristiti za transport sastojaka, a neke su implementirale proizvodne procese koji su dizajnirani da svedu gubitke i otpad proizvoda na minimum. Takođe, kako bi se sprečilo slanje otpada na deponiju, proizvođači kozmetike vrše reciklažu, biotretman ili spaljivanje otpada. Kozmetička industrija stalno poboljšava stope reciklaže i neke fabrike već recikliraju 100% svog otpada.

Sveža, čista voda je kritičan resurs koji omogućava održavanje života na Zemlji. Takođe je vitalni resurs za kozmetičku industriju i koristi se u formulaciji i proizvodnji gotovo svake vrste kozmetičkih proizvoda. Prepoznajući važnost efikasnog upravljanja ovim dragocenim, ali ograničenim resursom, mnoge kozmetičke kompanije su počele da mapiraju količinu vode koja se koristi duž lanca vrednosti kozmetike. Ovo im je omogućilo da daju prioritet akcijama za smanjenje upotrebe vode. Sakupljanje kišnice i ponovna upotreba otpadnih voda su dva pristupa koja su korišćena za smanjenje potrošnje vode u kozmetičkoj industriji. Zagađenje vode takođe izaziva zabrinutost među kozmetičkim kompanijama i preduzimaju se koraci za prečišćavanje otpadnih voda pre nego što ponovo uđu u životnu sredinu.

Kozmetička industrija prilagođava svoju praksu distribucije kako bi smanjila emisije povezane sa transportom kozmetike. Kompanije preusmeravaju transport sa drumskog na železnički saobraćaj i sa vazdušnog na morski ili uvide hibridna ili električna vozila. Na primer, nekoliko kompanija je konsolidovalo svoje distributivne mreže kako bi smanjilo rastojanje između distributivnih centara i prodavaca, a neke su počele da koriste mega-skladišta, tj. velike distributivne centre u kojima se proizvodi skladište do potrebne količine za isporuku, kako bi se smanjila nepotrebna prevoženja. Korišćenje većih kontejnerskih kamiona i uvođenje novih „kompaktnih“ proizvoda pomoglo je da se smanji ukupan broj potrebnih prevoza. Kompaktni proizvodi su manji po veličini i zapremini od konvencionalnih. Ne samo da generalno zahtevaju manja pakovanja, nego se veći broj jedinica može transportovati istovremeno, što smanjuje emisiju gasova staklene bašte povezane sa njihovom distribucijom.

Kozmetičke proizvode direktno koriste potrošači ili ih primenjuju profesionalci (na primer frizeri i kozmetičari). Sve je više dokaza da se veliki deo ekološkog otiska kozmetičkih proizvoda za ispiranje (proizvodi za tuširanje i kupanje, šamponi i balzami, itd.) javlja tokom faze upotrebe. Za ove proizvode, količina vode i energija neophodna za njeno zagrevanje mogu imati značajan uticaj na životnu sredinu. Procenjeno je, na primer,

Primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda

da oko 90% ukupnih emisija CO₂ tokom životnog ciklusa šampona potiče od zagrevanja i upotrebe vode iz slavine. Kozmetička industrija se suočava sa ovim problemom inoviranjem proizvoda i edukacijom potrošača. Razvijaju se inovativni proizvodi koji zahtevaju manje vode tokom upotrebe. Na primer, neke kompanije su razvile koncentrovane formule šampona koje zahtevaju samo jednu penu, dok su druge razvile „dva u jednom proizvoda“, koji uklanjaju potrebu za korišćenjem posebnog regeneratora.

Postoje i inicijative kozmetičkih kompanija koje imaju za cilj da edukuju potrošače o očuvanju vode. Veb lokacije mnogih kompanija pružaju sugestije i savete za potrošače o načinima smanjenja upotrebe vode u domaćinstvu, na primer postavljanjem vodoefikasnih tuševa, zatvaranjem slavine tokom pranja zuba, kraćim tuširanjem itd. Fokus nije samo na odraslima koji kupuju kozmetičke proizvode, već i na deci. Na primer, u školama se daju lekcije kako bi se deca obrazovala o tome kako da štede vodu. Direktna komunikacija na prodajnom mestu je još jedna inicijativa koja ima za cilj da edukuje potrošače o njihovom uticaju na životnu sredinu.

Kozmetički proizvodi nakon što su isprani ili oprani, odlaze u postrojenja za prečišćavanje otpadnih voda. Ambalažni otpad podleže različitim tehnikama upravljanja otpadom, koje zavise od infrastrukture i navika potrošača, ulaganja u moderno sakupljanje, separaciju i sisteme obrade, vrste pakovanja i materijala itd. U kozmetičkoj industriji je široko priznato da upotreba reciklirane i/ili reciklabilne ambalaže može pomoći da se smanji količina potrošačkog otpada koji se šalje na deponiju. Kozmetičke kompanije sve više koriste reciklirani papir i karton za pakovanje. Nekoliko kompanija je uvelo podsticaje za potrošače (na primer besplatni proizvodi ili vaučeri) za vraćanje ambalaže koja se može dopuniti i/ili ponovo koristiti. Korišćenjem ambalaže za višekratnu upotrebu štedi se na sirovinama, što je ekološki povoljno, ali se povezane uštede mogu preneti i na potrošača. Brojne kompanije su uvele dopunjivu ambalažu u oblasti nege kose, losiona, hidratantnih krema i sapuna. Drugi način na koji su kozmetičke kompanije pomogle u borbi protiv potrošačkog otpada je upotreba kompostirajuće ambalaže (na primer zamena petrohemijskih ambalaža biljnim vlaknima). Karton se istorijski koristio kao sistem za pakovanje, ali neke kompanije koriste i druge materijale, kao što su bambus, slama ili određena bioplastika. Otprilike jedna petina potrošača kupila bi proizvode za tuširanje, u ekološki prihvatljivom pakovanju, a oko polovina bi želela da kupi proizvode koji dolaze u ambalaži koja se može reciklirati. U nekim slučajevima, kompanije su uspele da uklone pakovanje u potpunosti.

Većina kozmetičkih proizvoda je dizajnirana tako da se može isprati odmah ili nakon kratkog perioda upotrebe. Ovo, u kombinaciji sa sveprisutnom upotrebom kozmetike širom sveta, znači da se kozmetički otpad kontinuirano unosi u sisteme otpadnih voda i životnu sredinu (Bilal et al, 2020). Bioakumulacija aktivnih i potencijalno toksičnih aditiva ima potencijal da negativno utiče i na vodene ekosisteme i na zdravlje ljudi. Na primer, antimikrobni agens Triklosan (TCS) se često koristi kao konzervans u nizu kozmetičkih proizvoda, uključujući šampone, paste za zube i sapun za ruke. TCS ima tendenciju da opstane u životnoj sredini zbog neefikasne eliminacije u postrojenjima za prečišćavanje otpadnih voda, a zagađivač se nalazi svuda u jezerima, rekama i priobalnim vodama širom sveta. U ovim sredinama, TCS može ometati funkcionalnost ekosistema zbog svoje toksičnosti za mikroorganizme, ribe i druge vodene vrste. Ostali sastojci kao što su parabeni, silikoni i organski filteri za ultraljubičasto svetlo takođe imaju potencijal da uđu u vodeno okruženje, gde mogu da štete vodenoj bioti i dovedu do poremećaja ekosistema (Bilal et al, 2020).

Pored hemijskog otpada, ambalaža je takođe važan izvor otpada povezanog sa kozmetičkim proizvodima, jer se procenjuje da se 70% ambalaže kozmetike spaljuje ili odlaže na deponiju (Vang et al, 2022). Iako se ambalaža sve više prepoznaje kao značajan izvor otpada u industriji, može biti teško implementirati principe, kao što su reciklaža ili ponovna upotreba, zbog prirode samih kozmetičkih proizvoda. Ambalaža kozmetike se uglavnom ne koristi ponovo, a to je delimično zbog poteškoća povezanih sa čišćenjem ambalaže koja sadrži kremaste ili proizvode bazirane na ulju. Slično tome, hemijska i mehanička reciklaža pakovanja kozmetike često je neizvodljiva zbog kontaminacije ostacima proizvoda. Iako biorazgradiva ambalaža može da pruži obećavajuću alternativu konvencionalnoj plastici, rezidualni proizvod takođe može da ometa proces kompostiranja jer surfaktanti ili konzervansi koji se koriste u formulaciji mogu negativno uticati na aktivnost bakterija i drugih mikroorganizama (Cinelli et al., 2019).

Kozmetika je, takođe, značajan izvor primarnog mikroplastičnog otpada u obliku mikrozrna, šljokica i plastičnih vlakana (primarna mikroplastika se namerno proizvodi u malim veličinama, za razliku od sekundarne mikroplastike koja fragmentira veće plastične predmete). Mikroperle su male plastične (obično polietilenske) perle koje su dizajnirane tako da mogu da obezbede efekat pilinga, u proizvodima kao što su piling za lice i sredstva za pranje ruku. Nakon što su ovi proizvodi upotrebljeni i isprani, plastične mikroperle ulaze u sistem otpadnih voda, što zauzvrat dovodi do njihovog oslobađanja u vodene ekosisteme. Iako samo mali procenat mikrozrna može direktno da izbegne tipične procese prečišćavanja otpadnih voda, većina i dalje može da uđe u vodene ekosisteme indirektno tako što se taloži u mulj koji se potom širi po poljima. Mikrozrnca u okeanu preuzimaju mnogi morski organizmi uključujući zooplankton, korale, ribe i mekušce. Dugoročne posledice ove plastične akumulacije na vodene ekosisteme su još uvek nepoznate.

Organska, prirodna, zelena kozmetika se povezuje sa poreklom i vrstom poljoprivredne prakse koja se koristi za dobijanje sastojaka proizvoda i ne znači nužno održiva. Zelena kozmetika je ona koja uglavnom sadrži prirodne ili organske sastojke i koja izbegava upotrebu sintetike. Održivi sastojci su, međutim, oni koji sadrže sve dimenzije održivosti (ekološke, etičke/društvene i ekonomske). Komponenta održivosti u ovom slučaju prisutna je u svim fazama životnog ciklusa proizvoda (Bom et al., 2020). Organska kozmetika ima stroge smernice i treba da ponudi maksimalnu ekološku efikasnost, sigurnost i stabilnost. Zelena, organska kozmetika se u osnovi može koristiti bez štete po životnu sredinu i uglavnom je napravljena od biljnih i voćnih ekstrakata i koncentrata. Iako je glavni razlog kupovine prirodnih i organskih proizvoda zabrinutost za zdravlje i bezbednost, faktor održivosti je takođe doprineo uspehu. Održive alternative se sa razlogom poboljšavaju, uključujući činjenicu da su kupci spremni da potroše više novca na održive brendove.

Ulaganjem u zelene komponente, širenje asortimana zelenih sirovina postaje sve dostupnije za proizvođače. Ovaj razvoj je rezultirao daljim inovacijama i proširenjem tržišta prirodne i organske kozmetike. S tim u vezi, kvalitet i performanse proizvoda takođe postaju bolje jer je sve više zelenih osnovnih materijala dostupno za proizvodnju i upotrebu. U današnje vreme skoro sve velike hemijske kompanije imaju prirodne/organske komponente u svom portfoliju. Godine 2010. Johnson & Johnson je predstavio Johnson's Natural, prirodni losion za telo za bebe i decu (Amberg & Magda, 2018).

U prilog održivosti kozmetičke industrije govori činjenica da su velike kozmetičke kompanije na zelenoj listi globalnih kompanija. Na listi World's Most Ethical (WME) Etisfere Instituta za 2014. postoji sedam kozmetičkih firmi: L'Oreal, Shiseido, Colgate-Palmolive, Henkel, Natura Brasil, Kao korporacije i Kimberli-Klark.

Primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda

Prema Metodologiji Corporate Knights, koja obuhvata ocenjivanje performansi preduzeća sa aspekta ekoloških, društvenih i menadžerskih sposobnosti, neke kompanije, kao Avon i Grupo Boticario su osnovale fondacije sa ciljem promocije društvenog dobra. Za sada nekoliko kompanija preferira fer odnose klijent-dobavljač i različite oblike društvenih investicija.

Ekološka svest, zdravstvena svest i prirodan izgled postali su centralna pitanja lanca snabdevanja. U pogledu nabavke sirovina i osnovnog materijala, uvećan je značaj ekoloških i društvenih kriterijuma povećanjem brige o komponentama i pakovanju proizvoda. Osnovni ciljevi uključuju minimiziranje krčenja šuma, biodiverziteta i osiguravanje raznovrsnosti različitih vrsta. Palmino ulje i ulje lavande dobijaju sve veći značaj kao sirovine, dok plastična ambalaža polako nestaje. Biomasa, plastika na organskoj osnovi i polietilen organskih izvora postaju sve značajniji. Preduzete su i mere zaštite pčela. Nekoliko kozmetičkih proizvoda sadrži sirovine koje potiču od pčela poput jedinjenja meda i voska (Amberg & Magda, 2018). Plantaže palmi su pod sve većom kontrolom zbog svog uticaja na životnu sredinu, uključujući degradaciju zemljišta, gubitak šuma koje sekustiraju ugljenik i kritično stanište za ugrožene vrste. Prepoznajući potrebu uzgoja palminog ulja i njegovih derivata na održiv način, bez štete po životnu sredinu ili zajednicu, mnogi pojedinačni članovi Cosmetics Europe su se obavezali da će svoje palmino ulje nabavljati od sertifikovanih dobavljača koji su ispunili stroge kriterijume društvene i ekološke održivosti (Cosmetics Europe, 2020).

4. Primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda - primeri

Trenutno postoje stotine kozmetičkih kompanija koje integrišu održivost u jednu ili nekoliko faza životnog ciklusa svojih proizvoda. Na primer, Garnier i L'Oreal uvode održivost tokom celog životnog ciklusa proizvoda. Zbog svog programa „L'Oreal za budućnost – Obaveze održivosti za 2030.“, L'Oreal grupa je prepoznata kao vodeća u oblasti održivosti. Program zagovara sledeće premise: (i) transformacija i evolucija industrije treba da poštuju granice planeta; (ii) treba promovisati izgradnju kapaciteta poslovnog ekosistema kako bi se pomoglo prelasku na održiviji svet; (iii) treba dati doprinosa za rešavanje izazova sa kojima se svet suočava, podržavajući hitne ekološke i društvene potrebe. U skladu sa postavljenim premisama, L'Oreal je definisao jasne ciljeve u vezi sa korišćenjem prirodnih resursa: za rešavanje klimatskih promena, kompanija je napravila kompromis da smanji 50% gasova staklene bašte po finalnom proizvodu do 2030. godine, doprinoseći održavanju globalne temperature, koja ne prelazi 1,5 °C iznad predindustrijskog nivoa; što se tiče potrošnje vode, postoje naponi da se održi upravljanje njenom potrošnjom, uz implementaciju fabrika vodene petlje koje će zameniti sva konvencionalna postrojenja do 2030. godine; poštovanje biodiverziteta, eliminacijom svih praksi koje dovode do krčenja šuma do 2030. godine; očuvanje prirodnih resursa, implementacijom rešenja koja omogućavaju reciklažu i promovišu razvoj cirkularne ekonomije. Što se tiče druge premise, L'Oreal nastoji da uključi potrošače, dobavljače i zajednice u procese transformacije, pomažući im da pređu na održiviji svet definisanjem merljivih ciljeva. Konačno, oko premise (iii), L'Oreal je uložio 150 miliona evra u ovaj projekat, kako bi se odgovorilo na neke od hitnijih trenutnih ekoloških i društvenih potreba, promovisujući programe za podršku izuzetno ranjivim ženama, i kako bi se doprinelo regeneraciji prirode i promovisala cirkularna ekonomija.

Garnier, kompanija koja pripada L'Oreal grupi, stvorila je Garnier Green Beauty Initiative, kako bi se pozabavila čitavim lancem vrednosti brenda, smanjujući ili eliminišući uticaj svojih proizvoda na životnu sredinu. Kompanija je postavila nekoliko ciljeva, koje treba da postigne do 2025. godine: (i) održiva nabavka sirovina i poštena trgovina (Garnier već koristi sastojke prirodnog porekla, kao što su južnoafrički pčelinji vosak, mađarski bagremov med, ulje nevena iz Francuske i Aloe vera iz Meksika, i namerava da podrži 800 zajednica širom sveta); (ii) smanjenje potrošnje vode stvaranjem čvrstih proizvoda (na primer 94% prirodnog porekla i 97% biorazgradivih ekoloških čvrstih šampona koji traju duže od tečnih šampona); (iii) zamena kompletne ambalaže koja se ne može reciklirati plastikom koja se može reciklirati, biorazgradivom i/ili za višekratnu upotrebu, čime se smanjuje proizvodnja plastike za 37 hiljada tona godišnje; (iv) korišćenje samo obnovljivih izvora energije i 100% CO₂ neutralna postrojenja do 2025. (emisije CO₂ su se već smanjile za 72%); (v) smanjenje zagađenja plastikom udruživanjem sa NGO (na primer Zaštita okeana, Plastika za promene) (Martins & Marto, 2020).

Pored gigantskih kozmetičkih kompanija, održivošću svojih proizvoda bave se i manje kompanije u oblasti kozmetičke industrije. Mnogi proizvođači kozmetike koriste procene životnog ciklusa kako bi analizirali pun uticaj svojih proizvoda na životnu sredinu, i identifikovali kako njihova održivost može biti poboljšana. Ovo uključuje procenu uticaja ekstrakcije sirovina, prerade materijala, transportnih emisija i metoda odlaganja, a zatim sprovođenje promena kako bi se minimizirali uticaji ovih procesa. Na primer, grupa Lush nastoji da primeni principe eko-dizajna tokom faza dizajniranja i "izvora" u proizvodnji kozmetike, radeći sa malim lokalnim proizvođačima i odabirom sastojaka biljnog porekla u cilju očuvanja biodiverziteta (Fortunati, Martiniello & Morea, 2020).

Smeštena u Valorisu, blizu Nice u južnoj Francuskoj, fabrika Le Parfum Citoien (A Sparknews report, 2020) je parfemski atelje, čiji ceo proces proizvodnje je u potpunosti lokalni, od stvaranja različitih mirisa do sklapanja finalnog proizvoda. Iako je ovaj mladi start-up pokrenut pre samo godinu i po dana, njen lokalni pristup poslovanju već je imao dokazan uticaj na zanatlije u regionu, na finansije kompanije i na životnu sredinu. Pored toga, brend ima 100% kolektivnu pozadinu — Le Parfum Citoien, što bukvalno znači „građanski parfem“, a nastao je zahvaljujući uspešnoj kampanji za prikupljanje sredstava od više od 100 francuskih građana. Osnivač Adrien Gautier je radio kao menadžer ljudskih resursa u Monaku u vreme terorističkih napada u Parizu koji su šokirali ceo svet. Duboko uznemiren tragedijom, tada 28-godišnjak je počeo da preispituje svoj posao i svrhu u životu. Ubrzo je shvatio da mora da započne sopstveni etički posao, da se posveti nečemu što je zaista strastveno i od društvenog značaja. Budući da je unuk proizvođača parfema iz Grasa, francuskog regiona poznatog po svojoj zanatskoj industriji parfema i istoriji, bilo je sasvim prirodno da se mladi preduzetnik okrene porodičnom nasleđu: luksuznim etičkim mirisima lokalno napravljenim. Deda Adriana Gautiera bio je deo generacije parfimera koji su bili nezavisni, ali suviše mali da bi izdržali promene savremenog sveta. Parfimerije u regionu su jednostavno bile prisiljene da se zatvore nakon dolaska masovnog marketinga i velikih kozmetičkih korporacija i maloprodajnih lanaca. Mladi Francuz je imao veoma precizan koncept: brend parfema koji kombinuje tradiciju i modernizam. Zabavni deo koncepta bila je mogućnost koja se potrošačima nudila da biraju između 10 mirisa ili „mirisnih portreta“, pet za muškarce i pet za žene, u zavisnosti od njihove ličnosti od „geek chic“ do „buntovne princeze“. Sve je proizvedeno od organskih sirovina iz Grassa i oslanjajući se na 100% mrežu dobavljača iz južne Francuske za primarno i sekundarno pakovanje, koji su takođe sertifikovani ekološki odgovorni od strane Saveta za upravljanje šumama i Programa za odobrenje sertifikacije

Primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda

šuma. A proizvodnja na lokalnom nivou minimizira uticaj karbonskog otiska, pošto nije potreban skoro nikakav transport. Mirisi, bočice, haube, kutije, etikete, sve je proizvedeno u francuskim porodičnim preduzećima, fokusirajući se pre svega na najkraće cikluse. Osim uticaja na životnu sredinu, rad sa nezavisnim parfimerima je omogućio Le Parfum Citoien da do sada otvori otprilike 60 novih radnih mesta u regionu. Danas je ambicija Adriana Gautiera da postane ključni etički referentni igrač usred tržišta „Made in France“ i industrije lepote, deleći francusko znanje i iskustvo sa ostatkom sveta. Sada se njegovi mirisi prodaju onlajn, u koncept prodavnicama u Evropi i u više od 150 nezavisnih parfimerija francuske zadruga Passion Beauti. Brend je takođe prisutan na tržištu Sjedinjenih Država uz nadu se da će biti u bliskoj budućnosti i na japanskom tržištu.

Organsko je dobro, ali biotehnologija matičnih ćelija je bolja i ekološki prihvatljivija. Na ovoj jednostavnoj pretpostavci, letonski brend za negu kože i kose Madara Cosmetics (A Sparknews report, 2020) ima za cilj da preoblikuje budućnost industrije lepote, stvarajući aktivne sastojke svog proizvoda koristeći biljne matične ćelije koje su razvijene u njihovoj laboratoriji, bez berbe stvarnih biljaka, kako bi sačuvali zemljište, vodene resurse i biodiverzitet. Stvorena 2006. godine, Madara je rođena kao mali start-up iz frustracije svog osnivača i izvršnog direktora Lotte Tisenkopfa-Iltnera, koji nije mogao da pronađe nijedan prirodni proizvod u svojoj zemlji. Danas kompanija ima 130 saradnika u Letoniji i isporučuje više od 20 organskih proizvoda u preko 120 zemalja širom sveta. Ključ njihovog rasta je u efikasnim ekosertifikovanim sastojcima u kombinaciji sa održivom proizvodnjom i istraživanjem. Čim je stigla na tržište za negu kože, Madara je počela da analizira hemijski sastav biljnih ekstrakata koje su koristili i da sprovodi ispitivanja sa aktivnim sastojcima in vitro. Ali tek pre pet godina, njihovi istraživački i razvojni naponi su počeli da se fokusiraju na ponovno stvaranje ćelija ugroženih biljnih vrsta u njihovoj laboratoriji - biljaka koje obično rastu u teškim nordijskim vremenskim uslovima i stoga razvijaju izvanredne aktivne sastojke za preživljavanje. Biotehnologija matičnih ćelija je bila odgovor.

Za razliku od redovne ekstrakcije biljnih aktivnih sastojaka, Madarina tehnologija omogućava brendu da razvije samo biljne ćelije koje imaju najveću koncentraciju hranljivih materija u bioreaktorima, umesto da uzgaja celu biljku. Takođe im omogućava da koriste ugrožene biljne vrste, koje su retke i zabranjene za dodirivanje u prirodnim staništima, kao što je nordijska zmajeva glava — glavni sastojak prvog proizvoda matičnih ćelija, linije za zaštitu od sunca, lansirane u proleće 2018. Upotreba biotehnologije zahtevala je godine ispitivanja, prvo da se pronađu precizni uslovi temperature, svetlosti i hranljivih materija kako bi ćelije rasle, a zatim da se in vitro testovi povećaju na masovnu proizvodnju, a na kraju je ceo lanac vrednosti kompanije postao deo avangardnog i eko-održivog projekta. Lansiranje kreme za sunčanje za lice sa matičnim ćelijama SPF30 bilo je Madarino „najbolje ikad“, prema kompaniji, što je izazvalo ogromnu buku među kupcima i medijima. Od tada, SPF30 postao je jedan od najvažnijih proizvoda u njihovom portfoliju, sa značajnim rastom prodaje u 2018. godini, posebno u e-trgovini.

Prema Madari, proces je čak i čistiji od jednostavnog korišćenja organskih biljnih sirovina, jer nema nikakvog uticaja na životnu sredinu, nema uključenih mašina za žetvu, niti vode niti zemlje potrebne za razvoj ovih ćelija, što znači da su prirodni resursi očuvani. Čak i u pogledu potrošnje energije, matične ćelije bi trebalo da budu zelenije od zelenih: potrebno im je samo malo svetla i neke hranjive materije da bi „rasle“, dok redovno vađenje aktivnih sastojaka iz biljaka zahteva mnogo više energije. Uz to, kompanija je prešla na 100% zelenu energiju proizvedenu u Letoniji 2017.

Za sada su samo dva proizvoda kompanije zasnovana na matičnim ćelijama, ali Madara Cosmetics nastavlja da traži inovativne načine za stvaranje aktivnih sastojaka. Usred njihovih ambicija za 2019, formula za akne zasnovana na matičnim ćelijama je u toku. Neki od Madarinih budućih otkrića verovatno će uključivati nordijske pečurke, za koje kompanija istražuje njihovu moguću primenu u kozmetici, medicini, energetici i ambalaži. Međutim, oni će ih ubrati na tradicionalan način, a ne u laboratoriji. Za razliku od biljnih ugroženih vrsta, pečurke se bez napora pojavljuju svuda u Letoniji.

5. Zaključak

Kozmetička industrija snažno se fokusira na poboljšanje ekološke održivosti svojih aktivnosti i proizvoda i aktivno podržava širok spektar dobrovoljnih i samoregulatornih inicijativa u cilju ispunjavanja svoje misije. Obaveze i aktivnosti kozmetičke industrije omogućavaju potrošačima da imaju koristi od proizvoda sa boljim profilima održivosti i usvoje navike održivije potrošnje.

Svi potrošački proizvodi utiču na životnu sredinu tokom svog životnog ciklusa. Prepoznajući potrebu za dizajniranjem proizvoda i procesa koji minimiziraju njihov uticaj na životnu sredinu, kompanije u kozmetičkoj industriji su implementirale širok spektar strategija koje istovremeno doprinose poboljšanju i održivosti sektora. Programi ekološke održivosti će se dalje razvijati u budućnosti. Na primer, upotreba biorazgradivog, reciklažnog i višekratnog pakovanja nastavlja da raste, a pakovanje se sve više dizajnira na osnovu razmišljanja o životnom ciklusu. Podstiču se eko-dizajn formule i ambalaže, koje prati edukacija i podela najboljih praksi. Ekološki i društveni kriterijumi se sve više uzimaju u obzir pri nabavci sastojaka i materijala za pakovanje. Krčenje šuma se minimizira i preduzimaju se koraci kako bi se osiguralo očuvanje biodiverziteta. Efikasni procesi i tehnologije se progresivno koriste tokom proizvodnje kako bi se smanjila potrošnja energije i vode i smanjile emisije, zagađenje i otpad. Gde je to moguće, energija se dobija iz obnovljivih izvora. Da bi smanjile emisije iz transporta, kozmetičke kompanije prilagođavaju i svoju distribuciju. S obzirom na to da veliki deo ekološkog otiska mnogih kozmetičkih proizvoda nastaje tokom upotrebe i naknadnog odlaganja, kozmetička industrija sve više traži načine da angažuje potrošače, takođe putem digitalnih medija.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Literatura

- A Sparknews report in collaboration with Cosmoprof Worldwide Bologna (2020) Impact for beauty, Sustainability in the Cosmetic Industry 2019. Available at: <https://mail.google.com/mail/u/1/#inbox/FMfcgzQVzNzwMldJWJDNKLrJJWksXBjq?projector=1&messagePartId=0.2>.
- Amberg, N. & Magda, R. (2018). Environmental Pollution and Sustainability or the Impact of the Environmentally Conscious Measures of International Cosmetic Companies on

Primena koncepta održivog razvoja u proizvodnji kozmetičkih proizvoda

- Purchasing Organic Cosmetics. *Visegrad Journal on Bioeconomy and Sustainable Development*, 7, (1), 23–30. Available at: <https://mail.google.com/mail/u/1/#inbox/FMfcgzQVzNzwMldJWJDnKLrJJWksXBjq?projector=1&messagePartId=0.1>
- Amrina, U., Hidayatno, A. & Zagloel, M. (2021). A Model-Based Strategy for Developing Sustainable Cosmetics Small and Medium Industries with System Dynamics. *Journal of Open Innovation: Technology, Market and Complexity*, 7, 225. Available at: <https://mail.google.com/mail/u/1/#inbox/FMfcgzQVzNzwMldJWJDnKLrJJWksXBjq?projector=1&messagePartId=0.7>
- Baumgartner, R. (2014). Managing Corporate Sustainability and CSR: A Conceptual Framework Combining Values, Strategies and Instruments Contributing to Sustainable Development: Managing Corporate Sustainability and CSR. *Corporate Social-Responsibility and Environmental Management*, 21(5), 258–271.
- Bilal, M., Mehmood, S. & Iqbal, H. (2020). The beast of beauty: environmental and health concerns of toxic components in cosmetics. *Cosmetics*, 7(1), 13.
- Bom, S., Ribeiro, H. & Marto, J. (2020). Sustainability Calculator: A Tool to Assess Sustainability in Cosmetic Products. *Sustainability (Basel, Switzerland)*, 12(4).
- Cinelli, P., Coltelli, M. B., Signori, F., Morganti, P., & Lazzeri, A. (2019). Cosmetic packaging to save the environment: Future perspectives. *Cosmetics*, 6(2), 26. Available at: <https://mail.google.com/mail/u/1/#inbox/FMfcgzQVzNzwMkVnczBJTrDQJwzbzTTm?projector=1&messagePartId=0.3>
- Cosmetics Europe - The Personal Care Association (2020). Environmental Sustainability: the European Cosmetics Industry's Contribution 2017-2019. Available at: <https://mail.google.com/mail/u/1/#inbox/FMfcgzQVzNzwMldJWJDnKLrJJWksXBjq?projector=1&messagePartId=0.8>
- Engert, S. & Baumgartner, R. (2016). Corporate sustainability strategy – bridging the gap between formulation and implementation. *Journal of Cleaner Production*, 113, 822–834.
- Epstein, M. & Roy, M. (2001). Sustainability in Action: Identifying and Measuring the Key Performance Drivers. *Long Range Planning*, 34(5), 585–604.
- European Commission. (2015). *Closing the loop - an EU action plan for the circular economy*. Available at: <https://www.eea.europa.eu/policy-documents/com-2015-0614-final>.
- Fortunati, S., Martiniello, L. & Morea, D. (2020). The Strategic Role of the Corporate Social Responsibility and Circular Economy in the Cosmetic Industry. *Sustainability (Basel, Switzerland)*, 12(12), 5120.
- Galpin, T., Whittington, J. & Bell, G. (2015). Is your sustainability strategy sustainable? Creating a culture of sustainability. *Corporate Governance (Bradford)*, 15(1), 1–17.
- Ljoret, A. (2016). Modeling corporate sustainability strategy. *Journal of Business Research*, 69(2), 418–425.
- Lynch, R. (2003). *Corporate Strategy*. England: Prentice Hall financial times.
- Martins, A. & Marto, J. (2020). A sustainable life cycle for cosmetics: From design and development to post-use phase. *Sustainable Chemistry and Pharmacy* 35 (2023) 101178. Available at: <https://mail.google.com/mail/u/1/#inbox/FMfcgzQVzNzwMkVnczBJTrDQJwzbzTTm?projector=1&messagePartId=0.4>
- Wang, J., Tang, M. & Wang, H. (2022). Research on the Design of Intelligent Recycling System for Cosmetics Based on Extenics. *Procedia Computer Science*, 199, 937–945.
- WCED (1987). Our Common Future: Report of the World Commission on Environment and Development. Chapter 2: Towards Sustainable Development. Available at: <http://www.un-documents.net/ocf-02.htm> [Approached August, 2024.].

APPLICATION OF THE CONCEPT OF SUSTAINABLE DEVELOPMENT IN THE PRODUCTION OF COSMETIC PRODUCTS

Abstract: Climate change and the strengthening of awareness of the need to reduce the impact of human activities on the environment in order to preserve the planet Earth, have led to the importance of the issue of efficient use of natural resources and the sustainability of industrial development. An increasing number of consumers are directing their behavior towards more socially and environmentally responsible consumption that saves energy and is environmentally acceptable. The growing sensitivity of consumers has initiated a green transition in the production of cosmetic products as well. In this regard, many companies in the field of the production of cosmetic products today pay a lot of attention to sustainable innovations in this area. Precisely for this reason, the application of the concept of sustainable development in the production of cosmetic products is the subject of research that is included in this paper. The main goal of the work is to point out the importance of applying the concept of sustainable development in the production of cosmetic products through a comprehensive analysis of the impact of the production of cosmetic products on the ecological component of sustainable development.

Keywords: sustainable development, cosmetic products, strategy



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**CIRCULAR WATER MANAGEMENT IN URBAN
ENVIRONMENTS: CO-CREATING STRATEGIES AND
ACTION PLANS WITH STAKEHOLDERS**

Simona Muratori*

Jelena J. Stanković •

Marina Stanojević •

Žarko Popović •

Abstract: Urban water management is increasingly challenged by climate change, urbanization, and resource scarcity. Circular water management, rooted in circular economy principles, offers a transformative approach to addressing these challenges by emphasizing the reuse, recycling, and recovery of water and associated resources. This paper explores the development and application of circular water management strategies in urban environments, focusing on stakeholder co-creation as a vital component. Drawing from the experiences of the "City Water Circles" (CWC) project, the study examines methods for engaging diverse stakeholders in developing long-term visions, actionable strategies, and policy recommendations. Through case studies, including possibility of applications in Serbian cities, the research highlights the potential and challenges of implementing circular water management practices. The findings contribute to the growing knowledge on sustainable urban water systems, offering practical insights for policymakers, planners, and water managers striving to enhance urban resilience and sustainability.

Keywords: circular economy, water management, stakeholders.

-
- * POLIEDRA, Politecnico di Milano, Italy, ✉ simona.muratori@polimi.it
 - Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0000-0002-9875-9861, ✉ jelena.stankovic@eknfak.ni.ac.rs
 - Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0000-0002-5784-1607, ✉ marina.stanojevic@eknfak.ni.ac.rs
 - Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0000-0002-4347-6960, ✉ zarko.popovic@eknfak.ni.ac.rs
- UDC 628.1/3

1. Introduction

The escalating hydrological risks triggered by climate change are heightening the susceptibility of European cities (and not only) to urban floods, while simultaneously exacerbating water scarcity issues. This, combined with the increasing anthropic pressure and the subsequent increase in water consumption and wastewater volumes requiring treatment, poses a significant threat to the security of future water supplies. The adoption of a circular economy approach, which presents numerous economic and environmental advantages, can assist municipalities in overhauling antiquated urban water infrastructure systems and implementing circular water management within their territories, thus guaranteeing resilience. Recognizing this emerging potential, municipalities and public (waste)water companies from 5 urban contexts (Functional Urban Areas of Budapest, Turin, Maribor, Bydgoszcz, Split) and thematic expert organisations decided to join their efforts in the Interreg Central Europe project City Water Circles (CWC, <https://www.interreg-central.eu/Content.Node/CWC.html>) in order to enable cities to make this circular change. Goals can be achieved by promoting water saving culture, including use of non-conventional water resources, and by adopting urban rainwater harvesting and utilization, as well as greywater recovery measures on city-level. In the CWC project, we tested in the 5 involved urban contexts the creation and application of circular water use measures and smart governance by realizing a pilot case and co-designing with stakeholders action lines and strategies. At the moment, the possibility to transfer this experience to an extra-EU country, Serbia, is under study through the Horizon Widera European project URDATA (<https://urdataport.com/>).

The increasing complexity of urban water challenges, driven by climate change, rapid urbanization, and anthropogenic pressures, necessitates a paradigm shift in how cities manage their water resources. Conventional water management approaches, often linear in nature, are proving inadequate in addressing issues such as water scarcity, flooding, and pollution. As cities face growing demands on finite water resources, there is an urgent need for innovative and sustainable strategies that promote resilience, resource efficiency, and environmental stewardship. Circular water management, rooted in the principles of the circular economy, offers a transformative framework for rethinking urban water systems. By emphasizing the reuse, recycling, and recovery of water and associated resources, this approach seeks to close the loop in water use, minimize waste, and maximize the value of water at every stage of its cycle. In urban contexts, circular water management integrates technical solutions such as rainwater harvesting, greywater recycling, and wastewater treatment with resource recovery, alongside collaborative governance and participatory planning processes.

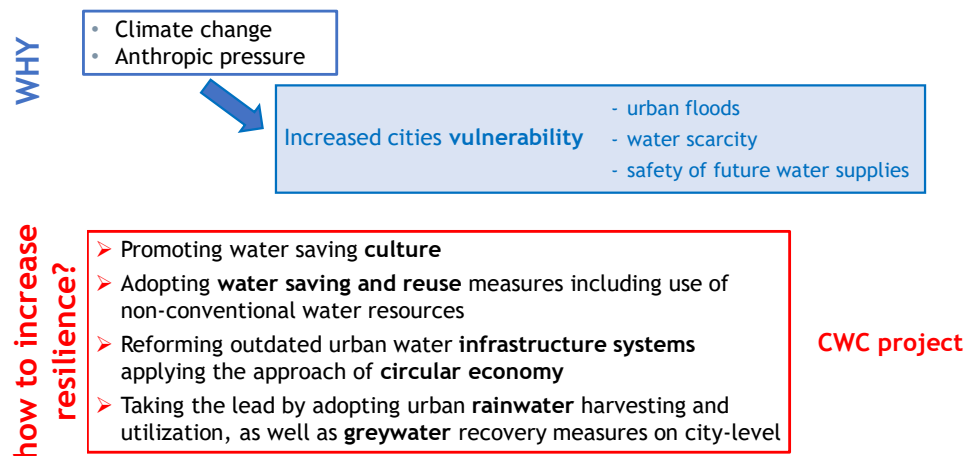
Stakeholder engagement is a cornerstone of successful circular water management. The complexity and interconnectivity of urban water systems demand a co-creation process that brings together diverse actors, including public authorities, private enterprises, community organizations, and individual citizens. This collaborative approach not only ensures that strategies and action plans are tailored to local needs and conditions but also fosters innovation and builds the social acceptance necessary for effective implementation. The findings presented in this paper contribute to the growing body of knowledge on circular economy applications in urban water systems. They offer practical insights for policymakers, urban planners, and water managers seeking to transition toward more sustainable water management practices. Furthermore, the study underscores the importance of stakeholder collaboration as a driver of innovative, inclusive, and impactful solutions in the face of escalating urban water challenges.

**Circular water management in urban environments:
co-creating strategies and action plans with stakeholders**

2. Circular use of water to increase cities resilience

The concept of the circular economy offers a paradigm shift in how urban water systems are managed, addressing challenges like resource scarcity, climate change, and population growth. CE emphasizes the recovery, reuse, and recycling of water and wastewater, fostering sustainability and resilience. The CE model aims to minimize waste and extend resource use through closed-loop systems. Kirchherr et al. (2017) define circular economy as a framework for sustainable development, emphasizing material cycles and resource efficiency. In urban water systems, circularity principles align with integrated water resource management, focusing on resource recovery and system optimization (Geissdoerfer et al., 2017). Reclaimed water has been widely explored as a viable alternative to reduce dependence on freshwater sources. Studies by Opher and Friedler (2016) highlight advancements in wastewater treatment technologies that allow for potable and non-potable reuse, demonstrating environmental and economic benefits. Similarly, Molina et al. (2021) evaluate greywater recycling as a practical approach for residential and industrial applications, reducing water demand and waste discharge.

Figure 1: Circular water management concept

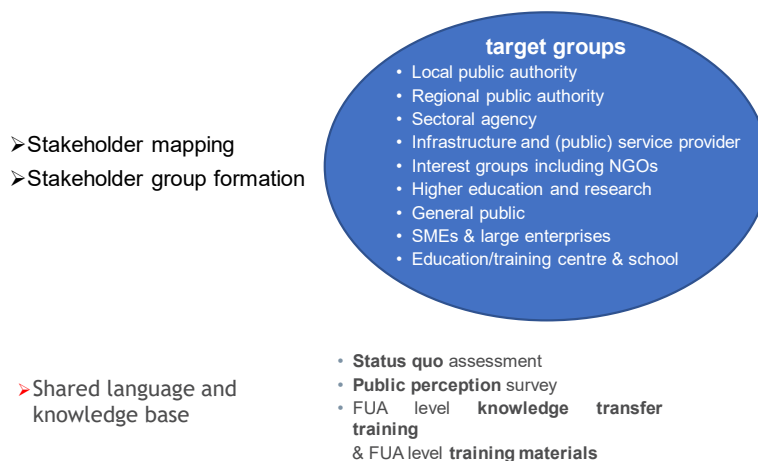


Decentralized water management systems, such as rainwater harvesting and green infrastructure, are integral to CE. Fletcher et al. (2015) demonstrate how green infrastructure supports stormwater management and mitigates urban flooding. Decentralized approaches also allow for localized resource recovery. Stakeholder participation is critical for the success of CE initiatives. Reed et al. (2009) emphasize the importance of inclusive processes in developing water strategies, ensuring solutions are tailored to local needs. In the context of Functional Urban Areas (FUAs), collaboration across jurisdictions is essential, as FUAs often lack unified governance structures, complicating decision-making (Ellen MacArthur Foundation, 2019).

The application of CE in urban water systems represents a transformative approach to sustainability. By leveraging resource recovery, green infrastructure, and stakeholder

engagement, cities can enhance resilience to climate change and urbanization challenges. Future research should address the scalability of circular economy practices and develop robust frameworks to overcome barriers.

Figure 2: Stakeholders approach in circular water management



Green-blue infrastructure (<https://greenblue.com/gb/about-us/why-green-and-blue/>) integrates natural and semi-natural systems into urban landscapes to address environmental, social, and economic challenges. It combines green elements (such as parks, green roofs, and urban forests) with blue elements (such as rivers, lakes, wetlands, and sustainable urban drainage systems) to create multifunctional spaces that contribute to sustainability. In the context of the circular economy, GBI embodies principles of resource efficiency, reuse, and system resilience by closing resource loops and optimizing ecosystem services. Green-blue infrastructure is a cornerstone of the circular economy's application in urban water management. By combining ecological functionality with resource efficiency, it not only enhances urban sustainability but also contributes to creating resilient, adaptive, and inclusive urban environments. As cities continue to face challenges from climate change and rapid urbanization, green-blue infrastructure represents a viable pathway to integrating nature-based solutions into the fabric of urban living.

3. Current State of Circular Water Management in Serbia

Having in mind that circular water management, as a key component of the broader circular economy framework, emphasizes the sustainable use, reuse, and recycling of water resources, it is necessary to raise awareness on its importance in underdeveloped countries, too. In Serbia, the adoption of circular water management practices is gaining attention as the country seeks to align with European Union environmental standards and address domestic challenges related to water scarcity, pollution, and aging infrastructure.

Serbia has initiated several strategic frameworks to promote the circular economy, which encompass aspects of water management. The "Roadmap for Circular Economy in Serbia," developed by the Ministry of Environmental Protection, serves as a guiding document to facilitate the transition towards circular practices across various sectors,

Circular water management in urban environments: co-creating strategies and action plans with stakeholders

including water management. Despite these strategic initiatives, the practical implementation of circular water management faces significant challenges. The country's water infrastructure is outdated, with only a limited number of municipalities equipped with adequate wastewater treatment facilities. This inadequacy leads to untreated industrial and municipal wastewater being discharged into natural water bodies, contributing to pollution and environmental degradation. To advance circular water management, Serbia has embarked on several projects and collaborations aimed at enhancing research and technical capacities in order to shift from traditional linear models to circular approaches in the water sector. Additionally, the EU continues to support systemic reforms in Serbia's water sector to enhance efficiency and environmental standards, aligning with best practices of EU member states. The "Circular Economy Development Programme in the Republic of Serbia 2022-2024" further outlines measures to create a stimulating environment for circular economy development, emphasizing the importance of water management among other sectors.

Despite these positive developments, challenges persist. The lack of a comprehensive national water protection strategy hampers strategic investment planning in the water sector. Moreover, the absence of implementing legislation required by the Water Law indicates a need for further regulatory development to fully harmonize with the EU Water Framework Directive. While Serbia has made commendable strides towards embracing circular water management through strategic planning and international collaborations, significant efforts are required to overcome infrastructural, regulatory, and practical challenges. A concerted approach involving policy reforms, infrastructure investments, and stakeholder engagement is essential to realize the full potential of circular water management in Serbia.

Furthermore, the level of recycling or reuse of waste, including water, remains low, indicating a need for substantial improvements in waste management practices to support circular economy principles. Circular water management, a key component of the broader circular economy framework, emphasizes the sustainable use, reuse, and recycling of water resources. In Serbia, the adoption of circular water management practices is gaining attention as the country seeks to align with European Union environmental standards and address domestic challenges related to water scarcity, pollution, and aging infrastructure.

3.1. Transferability of the City Water Circles (CWC) experience to Serbia

The transferability of the City Water Circles (CWC) project experience to Serbia presents a significant opportunity to modernize urban water management and address pressing challenges related to water infrastructure, governance, and sustainability. The CWC project, implemented under the Interreg Central Europe program, demonstrates how circular water management principles can be effectively applied to increase urban resilience through innovative practices such as water reuse, rainwater harvesting, and stakeholder collaboration. For Serbia, adopting these approaches could help align with European Union environmental standards and address critical issues in the water sector. One of the key reasons the CWC experience is highly relevant to Serbia is its alignment with EU policies, such as the Water Framework Directive, which emphasizes sustainable and integrated water management. As Serbia progresses toward EU membership, applying circular water management principles provides a pathway to achieving compliance with these standards while also tackling domestic issues like outdated water infrastructure and inadequate wastewater treatment systems. This

transition would not only benefit the environment but also enhance the quality of life in urban areas. Serbia's cities, much like the Functional Urban Areas (FUAs) addressed by the CWC project, face challenges related to fragmented governance in water management. The project's FUA-based framework, which promotes collaboration across municipal boundaries, could significantly improve coordination and decision-making in Serbian cities. Moreover, the stakeholder engagement processes employed in the CWC project offer a model for ensuring local solutions are inclusive, context-specific, and widely supported by communities and organizations.

However, transferring these practices to Serbia is not without challenges. Institutional and regulatory barriers, such as outdated policies and fragmented responsibilities, need to be addressed to create an enabling environment for circular water management. Financial constraints also pose a significant hurdle, as modernizing infrastructure and implementing advanced water reuse technologies require substantial investments. Securing EU funding and fostering international partnerships will be essential in overcoming these obstacles.

Public awareness and acceptance represent another critical factor in the success of circular water management initiatives. In Serbia, cultural perceptions and limited awareness about the benefits of water reuse and recycling may initially hinder adoption. Educational campaigns and participatory planning efforts can help build trust and understanding among citizens, ensuring that new practices are embraced and sustained over the long term.

Despite these challenges, Serbia has the opportunity to make significant progress by initiating pilot projects in urban areas, such as Belgrade, Niš or Novi Sad, to test and adapt the methodologies developed through the CWC project. These pilots can serve as proof-of-concept models, demonstrating the feasibility and benefits of circular water management practices in the Serbian context. By adopting the lessons learned from the CWC project, Serbia can pave the way for a more sustainable and resilient water management system. This approach not only supports environmental protection and urban resilience but also aligns with the country's broader goals of economic development and EU integration. With a strategic focus on policy reform, capacity building, and community engagement, Serbia can effectively transition toward circular water management, creating a lasting impact for future generations.

3.2. Implications for the stakeholders

Strategic Steps for Serbia could be recognized as follows:

- *Policy and Regulatory Alignment:* Develop national and municipal-level policies aligned with circular water principles and the CWC framework.
- *Capacity Building:* Train water managers, engineers, and policymakers on implementing circular practices.
- *Pilot Projects:* Initiate pilot projects in cities such as Belgrade or Novi Sad to test and adapt CWC methodologies.
- *EU Funding Utilization:* Leverage EU programs like Interreg and Horizon Europe to finance circular water initiatives.
- *Community Engagement:* Launch awareness campaigns and participatory planning processes to ensure public support and stakeholder collaboration.

4. Conclusion

The application of circular economy principles in urban water systems holds immense potential for transforming how cities manage their water resources. By promoting the reuse and recycling of water, as well as the recovery of valuable resources, circular economy addresses key challenges such as water scarcity, urban resilience, and environmental sustainability. While the benefits are clear—reduced resource dependence, cost savings, and environmental protection—the path to implementation is not without obstacles. Aging infrastructure, fragmented governance, limited funding, and public skepticism are significant challenges that require targeted strategies.

Despite these barriers, circular economy practices can align urban water systems with broader sustainability goals, such as those outlined in the United Nations Sustainable Development Goals (SDGs). Specifically, CE supports the achievement of clean water and sanitation (Goal 6) and sustainable cities and communities (Goal 11). The key to success lies in fostering collaboration, building trust among stakeholders, and creating an enabling environment for innovation and investment.

To make this transition a reality, policymakers must take several steps. First, the development of comprehensive national strategies is essential. These strategies should establish clear objectives, promote innovation in water reuse and resource recovery, and provide guidelines for safe and effective practices. Alongside this, investments in modernizing water infrastructure are critical. Cities need systems capable of supporting resource recovery and decentralized solutions like rainwater harvesting and greywater recycling, especially in underserved areas.

Building local capacity and expertise is equally important. Policymakers should support training programs and create platforms for knowledge sharing, enabling urban planners, engineers, and water managers to effectively implement circularity principles. Public awareness campaigns can also play a transformative role. Educating communities about the safety and benefits of reclaimed water, while involving them in decision-making processes, can help overcome resistance and build trust.

International collaboration and funding opportunities must not be overlooked. Many Balkan and Serbian cities can benefit from EU programs that provide financial and technical support for sustainability initiatives. Additionally, regional cooperation among cities can accelerate the exchange of successful practices and innovative solutions.

Acknowledgement:

The activities described in this paper received funding from the European Union's Horizon Europe Framework Programme (HORIZON) under Grant Agreement No. 101059994 (UR-DATA).

References

Brussels regional public service (2017) *Water Sector in Serbia Wastewaters-overview*. <https://www.awex-export.be/files/library/Infos-sectorielles/PECO/2017/SERBIE/Water-sector-Serbia.pdf>

- City Water Circles <https://programme2014-20.interreg-central.eu/Content.Node/CWC.html>
- Ellen MacArthur Foundation (2019). Circular economy and cities: A research agenda.
- European Circular Economy Stakeholder Platform, Roadmap for circular economy in Serbia <https://circulareconomy.europa.eu/platform/en/strategies/roadmap-circular-economy-serbia>
- Fletcher, T. D., et al. (2015). Stormwater management using green infrastructure: A review. *Water Science and Technology*, 72(4), 387–403.
- GreenBlueUrban <https://greenblue.com/gb/about-us/why-green-and-blue/>
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221–232.
- Molina, C., et al. (2021). Greywater reuse in the circular economy: Advances and challenges. *Journal of Cleaner Production*, 281, 124874.
- Opher, T., & Friedler, E. (2016). Comparative LCA of decentralized wastewater treatment alternatives for non-potable urban reuse. *Water Research*, 81, 115–125.
- Pincetl, S., et al. (2016). An urban metabolism approach to study energy use in cities and resource conservation. *Journal of Industrial Ecology*, 20(5), 1175–1185.
- Reed, M. S., et al. (2009). Who's in and why? Stakeholder analysis as a prerequisite for sustainable natural resource management. *Journal of Environmental Management*, 90(5), 1933–1949.
- Smith, A., et al. (2018). Public perceptions of water reuse: Survey results and policy implications. *Environmental Research Letters*, 13(4), 044002.
- Tortajada, C. (2006). Water management in Singapore. *Water Resources Development*, 22(2), 227–240.
- United Nations, Sustainable development goals. <https://sdgs.un.org/goals>.

CIRKULARNO UPRAVLJANJE VODOM U URBANIM SREDINAMA: ZAJEDNIČKO KREIRANJE STRATEGIJA I AKCIONIH PLANOVA SA STEJKHOLDERIMA

Apstrakt: Upravljanje vodama u urbanim sredinama je sve više izazvano klimatskim promjenama, urbanizacijom i nedostatkom resursa. Cirkularno upravljanje vodama, ukorenjeno u principima cirkularne ekonomije, nudi transformativni pristup rešavanju ovih izazova naglašavajući ponovnu upotrebu, reciklažu i revitalizaciju vode i povezanih resursa. Ovaj rad istražuje razvoj i primenu strategija kružnog upravljanja vodama u urbanim sredinama, fokusirajući se na ko-kreaciju zainteresovanih stejkholdera kao vitalnu komponentu. Oslanjajući se na iskustva projekta "City Water Circles" (CVC), studija ispituje metode za uključivanje različitih zainteresovanih strana u razvoj dugoročnih vizija, strategija koje se mogu primeniti i preporuka za kreatora politika. Kroz studije slučaja, uključujući mogućnosti primene u gradovima Srbije, istraživanje naglašava potencijal i izazove primene praksi kružnog upravljanja vodama. Nalazi doprinose rastućem znanju o održivim urbanim sistemima vode, nudeći praktične uvide kreatorima politike, planerima i menadžerima voda koji nastoje da poboljšaju otpornost i održivost gradova.

Ključne reči: cirkularna ekonomija, vodoprivreda, stejkholderi.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**PREDVIĐANJE KRETANJA INDEKSA CIRKULARNE
EKONOMIJE U REGIONU EVROPSKE UNIJE PRIMENOM
ARIMA MODELA**

Dr Sunčica Stanković*

Dr Ivana Kostadinović*

Dr Dejan Đorđević*

Rezime: Cirkularna ekonomija je način razmišljanja o otpadu kao o vrednom resursu, koji lokalne ekonomije mogu da koriste za stvaranje vrednosti. Cilj rada je, predviđanje kretanja vrednosti indeksa cirkularne ekonomije u regionu Evropske unije, za period 2022.-2026., na osnovu vrednosti ovog indeksa u periodu 2004.-2021. godine. Rezultati izabranog ARIMA modela ukazuju na trend rasta ovog indeksa u narednom periodu. Osim što novokreirana kompozitna mera može biti od koristi kreatorima politike, kao i istraživačima, za ocenu stepena razvoja cirkularne ekonomije, primenjeni model se može koristiti za praćenje trenda budućeg razvoja cirkularne ekonomije u regionu Evropske unije.

Ključne reči: Reciklaža, oporavak, smanjenje otpada.

1. Uvod

Cirkularna ekonomija (CE) je rezultat zabrinutosti za životnu sredinu, koja je podstakla organizacije širom sveta da preispitaju svoje strateške prioritete kako bi podržale inicijative za održivost, nefinansijske performanse i cirkularne strategije (Behl et al., 2023). Osnovni principi CE su oporavak, reciklaža, ponovna upotreba i smanjenje otpada (Chauhan

* Faculty of Business Economics and Entrepreneurship, Serbia, ORCID: 0000-0001-8824-1973, ✉ suncica.stankovic@vspep.edu.rs

• University of Niš, Faculty of Economics, Serbia, ORCID: 0000-0002-7676-3472,
✉ ivana.kostadinovic@eknfak.ni.ac.rs,

• University of Niš, Faculty of Economics, Serbia, ORCID: 0000-0003-4568-7523,
✉ dejan.djordjevic@eknfak.ni.ac.rs

UDK 338.1:502.131.1(4-672EU)

et al., 2022). Ideju „kraja života“ zamenjuju principi CE, koji je čine legitimnom alternativom pristupu linearne ekonomije (Behl et al., 2023; Truant et al., 2024).

Za razliku od zelene ekonomije, koja je, pre svega, usmerena na primenu zelenih tehnoloških i društvenih inovacija, cirkularna ekonomija je više fokusirana na minimiziranje i eliminisanje otpada. U tom smislu, cirkularna ekonomija, u širem kontekstu održivog razvoja, predstavlja jedan od najvažnijih alata održivosti, koji kroz automatizaciju proizvodnih procesa i redizajniranje ekonomije smanjuje ili potpuno eliminiše otpad. Kao nova paradigma, dakle, cirkularna ekonomija ima za cilj da smanji probleme zaštite životne sredine u proizvodnim procesima (Salibi et al., 2022). Prelaz sa tradicionalne linearne na cirkularnu ekonomiju, zahteva promene u mnogim oblastima. Primarna prepreka, kako sugeriše Velenturf sa saradnicima (2018), za postizanje cirkularnosti je nedostatak integracije i koordinacije strategija, politika i odluka koje donose kreatori politike, što, prema Velenturf et al. (2019), može dovesti do propuštenih prilika za unapređenje cirkularnosti zbog nemogućnosti praćenja napretka privrede i reagovanja na pravi način i u pravom trenutku.

Uz uvažavanje dosadašnjih metrika, primenjenih za ocenu dostignutog stepena razvoja cirkularne ekonomije, cilj ovog rada je kreiranje nove kompozitne mere i, na osnovu novokreiranog indeksa predviđanje budućeg kretanja cirkularne ekonomije u regionu Evropske unije. Nakon uvodnog izlaganja, prikazana je metodologija, a zatim rezultati istraživanja. Na kraju rada izvedeni su ključni zaključci istraživanja.

2. Metodologija istraživanja

2.1. Konfiguracija indeksa cirkularne ekonomije

Prateći metodologiju, koju su u svojim istraživanjima primenili Stanković et al. (2021), kao i Marković et al. (2023), za potrebe istraživanja su korišćeni godišnji podaci za 8 pokazatelja: 1) Generisani otpad (C1); 2) Tretman otpada (C2), 3) Odlaganje - sagorevanje i oporavak - energetski oporavak (C3), 4) Odlaganje – deponija i drugo (C4), 5) Reciklaža (C5), 6) Stopa ponovne upotrebe materijala (C6), 7) Trgovina sirovinama koje se mogu reciklirati – izvoz (C7), i 8) Trgovina sirovinama koje se mogu reciklirati – uvoz (C8). Podaci su preuzeti iz Eurostat baze, sa ciljem kreiranja indeksa razvoja cirkularne ekonomije na nivou Evropske unije (EU-27). Zbog dostupnosti podataka, istraživanjem je obuhvaćen period od 2004. – do 2021. godine. Na osnovu tabelarnog prikaza (tabela 1), može se primetiti da je najveća disperzija rezultata zabeležena kod pokazatelja Trgovina sirovinama koje se mogu reciklirati – izvoz, a najmanja kod pokazatelja Stopa ponovne upotrebe materijala. Jarque-Bera testom je testirana nulta hipoteza da su podaci normalno raspoređeni, nasuprot alternativnoj da nemaju normalan raspored. Vrednost Jarque-Bera statistike dostiže statističku značajnost veću od 0.05, što znači da se nulta hipoteza ne treba odbaciti, odnosno da podaci imaju normalan raspored. Detaljnije informacije su prikazane u tabeli 1.

Budući da su vrednosti pokazatelja izražene u različitim mernim jedinicama, najpre je izvršena standardizacija tih vrednosti, primenom Z - skor pristupa. Nakon toga, vrednost kompozitnog indeksa cirkularne ekonomije je izračunata kao aritmetička sredina predloženih pokazatelja. Ovaj način obračuna kompozitnog indeksa se vrlo često primenjuje u naučnim istraživanjima (Rybalkin et al., 2021; Chaaben et al., 2024;

Predviđanje kretanja indeksa cirkularne ekonomije u regionu Evropske unije primenom ARIMA modela

Stanković et al., 2024). Svrha kreiranja nove kompozitne mere je formulisanje instrumenta, koji može biti od koristi kreatorima politike, kao i budućim istraživačima, za ocenu stepena razvoja cirkularne ekonomije u regionu Evropske unije.

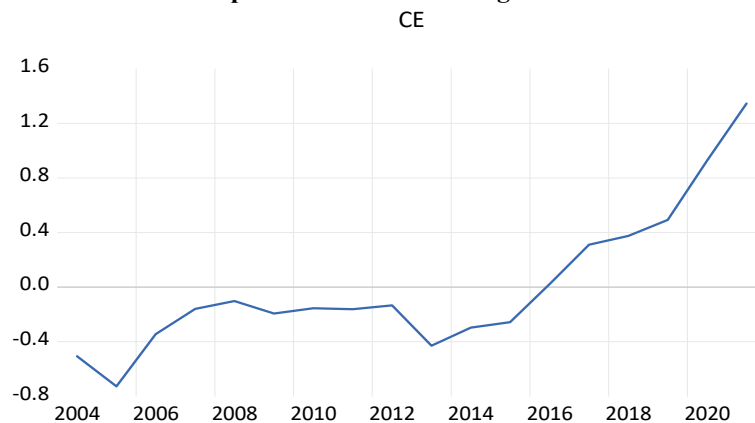
Tabela 1. Deskriptivna statistika pokazatelja cirkularne ekonomije

	C1	C2	C3	C4	C5	C6	C7	C8
Mean	502.1111	486.0000	124.1111	157.5556	205.8333	10.47778	32794849	42806962
Median	501.5000	487.5000	126.5000	147.5000	199.0000	11.05000	34407032	42947940
Maximum	532.0000	524.0000	138.0000	215.0000	264.0000	11.60000	40568862	46838227
Minimum	478.0000	466.0000	103.0000	117.0000	159.0000	8.200000	22577977	38533916
Std. Dev.	14.88738	15.21222	9.373862	34.40455	29.87474	1.148685	5914427.	2138669.
Skewness	-0.002531	0.734438	-0.568635	0.315889	0.302993	-0.780038	-0.641297	-0.344785
Kurtosis	2.433852	3.388270	2.735693	1.487094	2.212098	2.056425	1.981340	2.625777
Jarque-Bera	0.240412	1.731261	1.022429	2.016021	0.741006	2.493127	2.012035	0.461662
Probability	0.886738	0.420786	0.599767	0.364944	0.690387	0.287491	0.365672	0.793874

Izvor: Autori

Na slici 1 je prikazana vremenska serija indeksa cirkularne ekonomije na nivou EU-27, za period 2004.-2021. godine. Sa grafikona se može uočiti da indeks cirkularne ekonomije, nakon opadanja u 2005.-oj, beleži blagi rast do 2008. godine, a zatim, od 2009.-2012. godine sledi period stagnacije, U periodu 2012.-2013. godine je primetan trend opadanja vrednosti posmatranog indeksa, nakon čega sledi, uglavnom uzlazni trend do kraja posmatranog perioda. Najmanja vrednost indeksa cirkularne ekonomije je zabeležena 2005. (-0.73), a najveća 2021. godine (1.34).

**Slika 1. Indeks cirkularne ekonomije u regionu Evropske unije,
u periodu od 2004.-2021. godine**



Izvor: Autorski prikaz

2.2. Model istraživanja

Za predviđanje kretanja indeksa cirkularne ekonomije je primenjen ARIMA model, koji je veoma često korišćen model vremenske serije i model kratkoročnog predviđanja sa

visokom preciznošću. Osnovna ideja modela je da su neke vremenske serije skup slučajnih promjenljivih, koje zavise od vremena, pri čemu promene cele vremenske serije imaju određena pravila, koja se mogu aproksimirati odgovarajućim matematičkim modelom, čijom analizom se mogu fundamentalnije razumeti struktura i karakteristike vremenskih serija, i postići optimalno predviđanje u smislu minimalne varijanse.

ARIMA model, kao metod predviđanja vremenskih serija, su predložili Box i Jenkins 1970.-ih godina. Model se sastoji od AR, I i MA. AR predstavlja, autoregresivni model, I – red integrisanosti, a MA – model pokretnog proseka. Uopšteno, stacionarni niz može uspostaviti model predviđenja, za čiju se procenu koristi test jediničnog korena. Ukoliko se radi o nestacionarnom nizu, on se konvertuje u stacionarni niz diferenciranjem. Najčešći broj potrebnih diferenciranja je 0, 1 ili 2. ARIMA (p, d, q) model je, u suštini, kombinacija diferencnih procesa i ARMA (p, q) modela (Ma et al., 2018).

Serija, koja se može modelovati kao stacionarni ARMA (p, q) proces, nakon što se diferencira d puta se označava kao ARIMA (p, d, q). ARIMA model je, dakle, stohastički proces, definisan sa tri parametra: p, d, q , gde p označava autoregresivni AR(p) proces, d je integracija (potrebna za transformaciju u stacionarni stohastički proces), a q je pokretni prosek MA(q) procesa (Al-Chalabi et al., 2018). Forma ARIMA (p, d, q) modela se može specificirati kao:

$$\Delta^d y_t = c + \Phi_1 \Delta^d y_{t-1} + \dots + \Phi_p \Delta^d y_{t-p} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_q \varepsilon_{t-q} \quad (1)$$

Gde je: $\Delta^d y_t$ - d – diferencirana vremenska serija; $\Phi_1, \dots, \Phi_p$ - regresioni parametri; θ - konstantni prinos ili pad; ε_t - beli šum.

Očekuje se da će rezultati pokazati trend rasta indeksa cirkularne ekonomije u regionu Evropske unije.

3. Rezultati istraživanja

U tabeli 2 su prikazani rezultati testiranja jediničnog korena, dobijeni primenom metode običnih najmanjih kvadrata, za varijablu indeks cirkularne ekonomije u regionu EU-27. Nulta hipoteza glasi: Postoji jedinični koren (serija je nestacionarna). Ukoliko je značajnost $\leq 5\%$, nulta hipoteza se odbacuje. Prema rezultatima ADF i PP testa, vremenska serija je nestacionarna na nivou ($p > 0.05$). Međutim, nakon testiranja prvog diferencijala, na osnovu rezultata oba testa ($p < 0.05$), može se odbaciti nulta hipoteza, prema kojoj vremenska serija ima jedinični koren, i zaključiti da je vremenska serija stacionarna.

Tabela 2. Rezultati ADF i PP testova jediničnog korena za vremensku seriju indeks cirkularne ekonomije na nivou EU-27, u periodu 2004.-2021. godine

Varijabla	ADF - Fisher chi-square		PP - Fisher chi-square	
	Nivo	Prvi diferencijal	Nivo	Prvi diferencijal
Indeks cirkularne ekonomije	1.465851	-3.132077*	1.488645	-3.206869*

Napomena: * - značajnost na nivou od 5%

Izvor: Proračun autora

Predviđanje kretanja indeksa cirkularne ekonomije u regionu Evropske unije primenom ARIMA modela

Nakon eliminisanja jediničnog korena, za dalju analizu se koristi diferencirana varijabla Indeks cirkularne ekonomije u regionu EU-27. U tabeli 3 su prikazani kriterijumi za izbor najadekvatnijeg ARIMA modela predviđanja, pri čemu se, kao najbolji, bira model sa najmanjom vrednošću SigmaSQ, Aikike (AIC) i Švarc-Bajesovog (BIC) koeficijenta i najvećom vrednošću koeficijenta verodostojnosti (LogL).

Tabela 3. Kriterijumi za izbor ARIMA modela za predviđanje kretanja indeksa cirkularne ekonomije u regionu Evropske unije

Model	SigmaSQ	LogL	AIC	BIC
(1,1,0)	0.039284	3.371992	-0.043764	0.103274
(0,1,1)	0.039375	3.355162	-0.044784	0.105254
(0,1,2)	0.040549	3.385223	0.072327	0.268377
(1,1,1)	0.039242	3.375041	0.073525	0.269575
(2,1,0)	0.040497	3.372279	0.073849	0.269900

Izvor: Proračun autora

Poređenjem više modela, utvrđeno je da ARIMA (1,1,0) model, sa zavisnom varijablom indeks cirkularne ekonomije, na osnovu zadatih kriterijuma ima najbolja svojstva. Rezultati za izabrani model su prikazani u tabeli 4.

Tabela 4. Vrednosti parametra modela ARIMA (1,1,0) ocenjen metodom najmanjih kvadrata

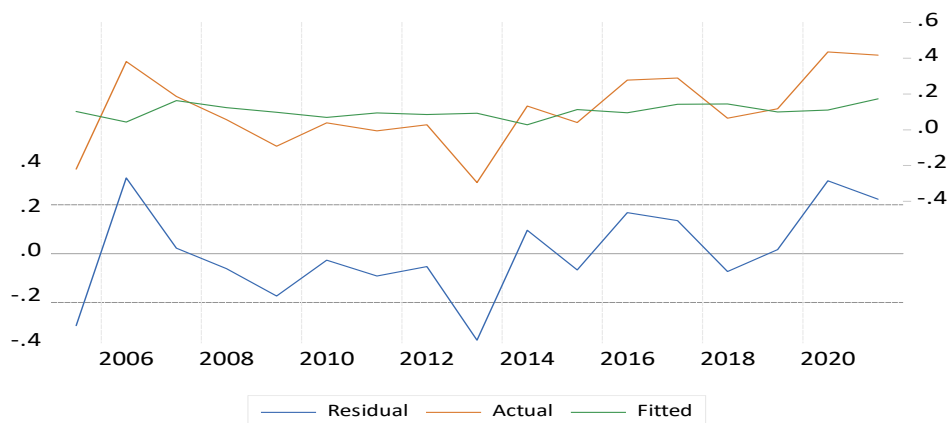
Varijabla	Coefficient	Std. Error	t-Statistic	Prob.
C	0.108629	0.060899	1.783736	0.0961
AR(1)	0.198476	0.273096	0.726763	0.4793
SIGMASQ	0.039284	0.015853	2.478074	0.0266
R-squared	0.032461	Mean dependent var		0.108932
Adjusted R-squared	-0.105759	S.D. dependent var		0.207700
S.E. of regression	0.218407	Akaike info criterion		-0.043764
Sum squared resid	0.667823	Schwarz criterion		0.103274
Log likelihood	3.371992	Hannan-Quinn criter.		-0.029148
F-statistic	0.234852	Durbin-Watson stat		1.802324
Prob(F-statistic)	0.793741			
Inverted AR Roots	.20			

Izvor: Proračun autora

Na osnovu grafičkog prikaza (slika 2) primetno je da postoji slaganje između originalne i modelom predviđene serije podataka, sa opadanjem vrednosti indeksa cirkularne ekonomije ispod linije dve standardne greške od modelski udaljene dinamike za jednu opservaciju (za 2013. godinu).

Adekvatnost modela je porverena testiranjem odsustva autokorelacije u rezidualima, primenom Box-Ljungove Q statistike. Na osnovu p-vrednosti reziduala Box-Ljungove statistike (slika 3), može se primetiti da rezultat na svim docnjama nije signifikantan, odnosno da je na svim docnjama p-vrednost veća od 0.05, zbog čega se zaključuje da u ocenjenom modelu ne postoji autokorelacija reziduala.

Slika 2. Originalni i modelom predviđene vrednosti indeksa cirkularne ekonomije u regionu Evropske unije



Izvor: Autorski prikaz

Slika 3. Korelogram obične i parcijalne funkcije vremenske serije indeksa cirkularne ekonomije, u regionu Evropske unije, za model ARIMA(1,1,0)

Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob
		1 -0.024	-0.024	0.0119	
		2 0.039	0.039	0.0448	0.832
		3 -0.054	-0.052	0.1111	0.946
		4 0.225	0.222	1.3653	0.714
		5 0.016	0.029	1.3726	0.849
		6 0.009	-0.008	1.3750	0.927
		7 -0.355	-0.353	5.4453	0.488
		8 0.011	-0.059	5.4494	0.605
		9 -0.147	-0.161	6.3189	0.612
		10 0.082	0.080	6.6319	0.675
		11 -0.125	0.048	7.4776	0.680
		12 -0.216	-0.223	10.490	0.487

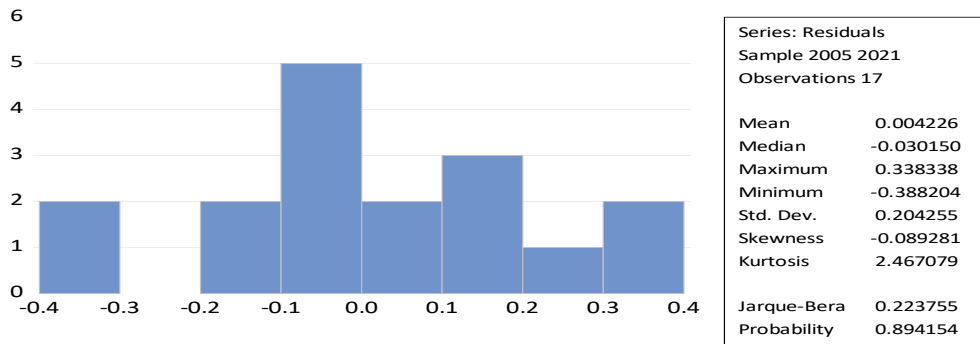
Izvor: Autorski prikaz

Prema rezultatima Jarque-Bera testa (slika 4), može se zaključiti da ne postoji značajno odstupanje reziduala od normalnog rasporeda ($JB = 0.2237$; $p = 0.894$).

Prema ocenjenom ARIMA (1,1,0) modelu, za period 2004.-2021. godine, izvršena je prognoza vrednosti indeksa cirkularne ekonomije u regionu Evropske unije za 5 perioda unapred (2022.-2026. godine). Modelom prognozirane vrednosti su prikazane na slici 5.

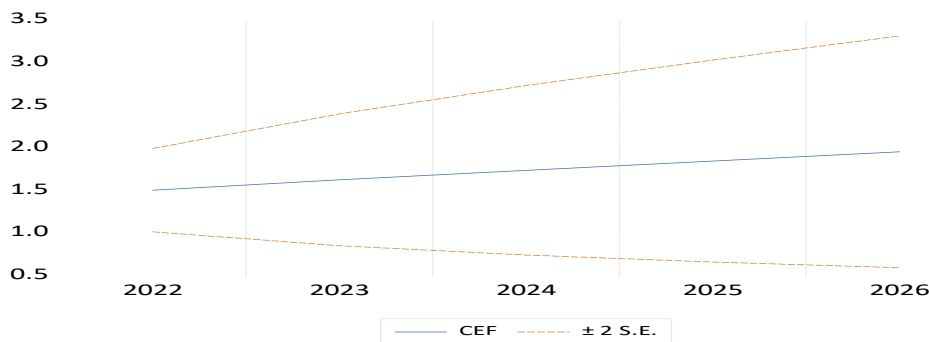
**Predviđanje kretanja indeksa cirkularne ekonomije u regionu Evropske unije
primenom ARIMA modela**

Slika 4. Test normalnosti rasporeda reziduala za model ARIMA(1,1,0)



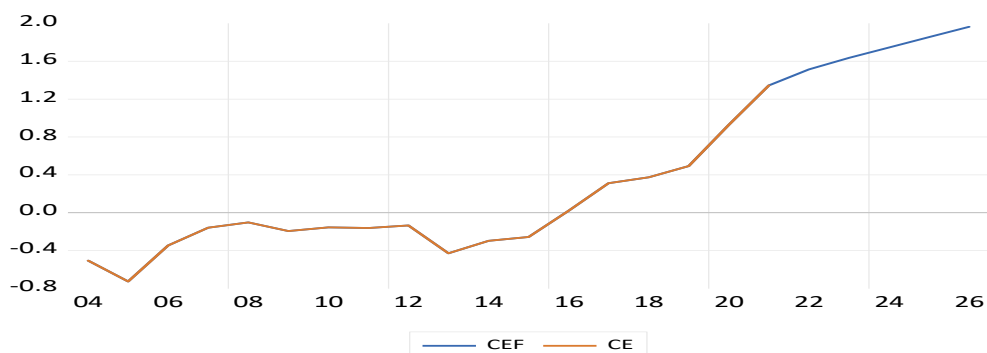
Izvor: Autorski prikaz

**Slika 5. Modelom prognozirane vrednosti indeksa cirkularne ekonomije, u regionu
Evropske unije, za period 2022.-2026. godine**



Izvor: Autorski prikaz

**Slika 6. Prikaz stvarnih i prognoziranih vrednosti indeksa cirkularne ekonomije u
regionu Evropske unije, u periodu 2004.-2026. godine, na osnovu ARIMA (1,1,0) modela**



Izvor: Autorski prikaz

Izborom najadekvatnijeg modela ARIMA (1,1,0) za prikazivanje vremenske serije indeksa cirkularne ekonomije u regionu Evropske unije, dobijena su sledeća predviđanja: vrednost indeksa CE 2022 = 1.51, vrednost indeksa CE 2023 = 1.64, vrednost indeksa CE 2024 = 1.75, vrednost indeksa CE 2025 = 1.86, i vrednost indeksa CE 2026 = 1.96.

Prema rezultatima analize, za naredne predviđene godine (2022., 2023., 2024., 2025., i 2026.), sledi kontinuirani rast vrednosti indeksa cirkularne ekonomije u regionu Evropske unije. Kretanje indeksa cirkularne ekonomije, za period 2004.-2026. godine je prikazano na slici 6.

4. Zaključak

Cilj sprovedenog istraživanja je bio predviđanje kretanja vrednosti indeksa cirkularne ekonomije u regionu Evropske unije, za period 2022.-2026., na osnovu vrednosti ovog indeksa u periodu 2004.-2021. godine. Indeks cirkularne ekonomije je kreiran na osnovu 8 pokazatelja, povezanih sa cirkularnom ekonomijom. Rezultati izabranog ARIMA (1,1,0) modela su pokazali trend rasta ovog indeksa u prognoziranom periodu.

Praktičan doprinos ovog rada se ogleda, pre svega, u tome što novokreirana kompozitna mera može biti od koristi kreatorima politike, kao i budućim istraživačima, za ocenu stepena razvoja cirkularne ekonomije. Osim toga, primenjeni model se može koristiti za praćenje trenda budućeg razvoja cirkularne ekonomije u regionu Evropske unije.

Ovo istraživanje ima i određena ograničenja. Naime, osim što se najnoviji dostupni podaci odnose na 2021. godinu, u radu su korišćeni samo podaci o pokazateljima cirkularne ekonomije na regionalnom nivou, dok bi druga istraživanja mogla biti proširena na svaku od zemalja EU pojedinačno.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Reference

- Al-Chalabi, H., Al-Douri, Y.K., & Lundberg, J. (2018). Time Series Forecasting using ARIMA Model. A Case Study of Mining Face Drilling Rig. *ADVCOMP 2018 : The Twelfth International Conference on Advanced Engineering Computing and Applications in Sciences*, (pp. 1-3). Athens, Greece.
- Behl, A., Singh, R., Pereira, V., & Laker, B. (2023). Analysis of Industry 4.0 and circular economy enablers: A step towards resilient sustainable operations management. *Technological Forecasting and Social Change*, 189, 122363.
- Chaaben, N., Elleuch, Z., Hamdi, B., & Kahouli, B. (2024). Green economy performance and sustainable development achievement: empirical evidence from Saudi Arabia. *Environment, Development and Sustainability*, 26(1), 549-564.

Predviđanje kretanja indeksa cirkularne ekonomije u regionu Evropske unije primenom ARIMA modela

- Chauhan, C., Parida, V., & Dhir, A. (2022). Linking circular economy and digitalisation technologies: A systematic literature review of past achievements and future promises. *Technological Forecasting and Social Change*, 177, 121508.
- Ma, L., Hu, C., Lin, R., & Han, Y. (2018). ARIMA model forecast based on EViews software. *IOP Conf. Series: Earth and Environmental Science*, 208, 012017.
- Marković, M., Popović, Z., & Marjanović, I. (2023). Towards a circular economy: evaluation of waste management performance in European Union countries. *Serbian Journal of Management*, 18(1), 45-57.
- Rybalkin, O., Lavrinenko, O., Ignatjeva, S., & Danileviča, A. (2021). Introduction of EEPSE green economy index for the analysis of regional trends. *Entrepreneurship and Sustainability Issues*, 9(1), 415-435.
- Salibi, J.G.D.O.R., Rodrigues, A.L.D.S.M., Lima, P.A.B., & de Souza, F.B. (2022). Lean and the circular economy: A systematic literature review. *Journal of Lean Systems*, 7(4), 23-46.
- Stanković, J.J., Janković-Milić, V., Marjanović, I., & Janjić, J. (2021). An integrated approach of PCA and PROMETHEE in spatial assessment of circular economy indicators. *Waste Management*, 128, 154-166.
- Stanković, S., Ilić, B., & Rabrenović, M. (2024). Using the Composite EEPSE Green Economy Index to Assess the Progress of Emerging Economies in Achieving the Sustainable Development Goals. *Problemy Ekorozwoju*, 19(1), 78-88.
- Truant, E., Giordino, D., Borlatto, E., & Bhatia, M. (2024). Drivers and barriers of smart technologies for circular economy: Leveraging smart circular economy implementation to nurture companies' performance. *Technological Forecasting and Social Change*, 198, 122954.
- Velenturf, A.P., Archer, S.A., Gomes, H.I., Christgen, B., Lag-Brotons, A.J., & Purnell, P. (2019). Circular economy and the matter of integrated resources. *Science of the Total Environment*, 689, 963-969.
- Velenturf, A.P., Purnell, P., Tregent, M., Ferguson, J., & Holmes, A. (2018). Co-producing a vision and approach for the transition towards a circular economy: Perspectives from government partners. *Sustainability*, 10(5), 1401.

FORECASTING MOVEMENTS OF THE CIRCULAR ECONOMY INDEX IN THE EUROPEAN UNION REGION USING THE ARIMA MODEL

Abstract: The circular economy is a way of thinking about waste as a valuable resource that local economies can use to create value. The aim of the paper is to predict the movement of the value of the circular economy index in the region of the European Union, for the period 2022–2026, based on the this index value in the period 2004–2021. The results of the selected ARIMA model indicate the growth trend of this index in the coming period. In addition to the fact that the newly created composite measure can be useful to policymakers as well as researchers to assess the degree of development of the circular economy, the applied model can be used to monitor the trend of the future development of the circular economy in the European Union region.

Keywords: Recycling, recovery, waste reduction.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**ULAGANJE U OBRAZOVANJE I EKONOMSKI RAST:
ANALIZA PANEL PODATAKA**

Dr Vinko Lepojević *

Dr Vesna Janković-Milić*

Rezime: Ovaj rad istražuje uticaj ulaganja u obrazovanje na ekonomski rast u zemljama Evropske unije korišćenjem analize panel podataka. Analiza se bazira na podacima za 27 zemalja Evropske unije koje su posmatrane u periodu 1996-2022., a prema 6 različitih indikatora. U radu se posmatra rast GDP u funkciji izdvajanja za obrazovanje, pri čemu ostale nezavisne promenljive – GDP per capita, inflacija, javna potrošnja i otvorenost privrede, imaju ulogu kontrolnih promenljivih. Rezultati pokazuju da u Evropskoj uniji postoji pozitivan uticaj obrazovanja na privredni rast, sa korakom zaostajanja od najmanje 5 godina.

Keywords: Obrazovanje, ekonomski rast, panel analiza, EU

1. Uvod

Jedan od esencijalnih uslova koje je potrebno ispuniti za ostvarivanje dugoročno stabilnog i održivog privrednog razvoja, jeste razvijen i kvalitetan sistem obrazovanja. Obrazovani pojedinci su, pre svega, pojedinci osposobljeni da stvaraju novu vrednost. Oni članovi društva koji poseduju viši stepen obrazovanja, produktivniji su prilikom obavljanja delatnosti od onih sa nižim stepenom obrazovanja. Obrazovani, a naročito visokoobrazovani pojedinci, predstavljaju segment društva koji ga usmerava ka pozitivnim promenama, te su izvor prosperiteta privrede i povećanja životnog standarda. Stoga je potpuno opravdano dati obrazovanju jedno od centralnih mesta u procesu generisanja privrednog rasta i razvoja.

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID 0000-0002-8364-1078;

✉ vinko.lepojevic@eknfak.ni.ac.rs

• Univerzitet u Nišu, Ekonomski fakultet, Srbija, ORCID 0000-0002-9645-8598;

✉ vesna.jankovic@eknfak.ni.ac.rs

UDK 371+330.35

Obrazovanje je temelj ekonomskog razvoja i dokazana pokretačka snaga ekonomskog rasta. Ono omogućava radnoj snazi sticanje neophodnih vještina i znanja za povećanje produktivnosti i kreiranje inovacija (Aghion et al., 2009). Pozitivan odnos između obrazovanja i ekonomskog rasta je uobičajena pretpostavka u ekonomiji. Obrazovanje koje predstavlja jedan od ključnih pokretača ljudskog kapitala, povećava produktivnost rada, podiže efikasnost, i povećava učinak privrede. Ideja da ulaganje u obrazovanje rezultira ekonomskim prosperitetom i rastom nije nova. Otuda je evidentan snažan fokus na obrazovnu politiku, pa je i mnogo javnih debata na tu temu. Razumevanje odnosa između ulaganja u obrazovanje i ekonomskog rasta je od suštinske važnosti za formulisanje efikasnih ekonomskih politika (Lucas, 1988).

S jedne strane, ulaganja u obrazovanje treba da povećaju produktivnost privrede unapređenjem njenih radnih kapaciteta, tj. kroz uvećanje ljudskog kapitala. S druge strane, povećanje potrošnje na obrazovanje predstavlja dodatnu investiciju u privredu, jer se na taj način kreiraju nova radna mesta i povećava potražnja za daljim obrazovanjem. Svaka promena koja bi unapredila kvalitete obrazovanja dobro bi došla, ali je za njenu implementaciju potrebno puno vremena.

2. Pregled literature

Ključne uloge koju imaju kompetencije i znanje, uveliko su prepoznate u podsticanju ekonomskog rasta i bile su važna tema istraživanja ekonomista, posebno zbog činjenice da postoji dosta studija koje ukazuju i dokazuju pozitivnu vezu između ekonomskog rasta i ljudskog kapitala. Rezultati modela koje su razvili Mankiv, Romer i Veil (1992) pokazali su značajan i siguran pozitivan uticaj ulaganja u obrazovanje na proces ekonomskog rasta.

S druge strane, postoje istraživanja koja su otkrila dvosmernu vezu između dve varijable (model Islama, 1995), a rezultati ovih modela su sasvim suprotni od prethodnih modela, koji su bili u korist ulaganja u obrazovanje kako bi se ostvario ekonomski rast. Otuda je postalo prilično teško navesti apsolutnu korelaciju između BDP-a po glavi stanovnika i različitih nivoa ljudskog kapitala (sa stanovišta obrazovanja). Naime, polazna pretpostavka je da povećanje potrošnje na obrazovanje vodi ka kvalitetnijem obrazovanju. Da li je to uvek tako? Podaci Svetske banke pružaju dokaze da to nije uvek slučaj (Hanushek & Voßmann, 2007). Naime, nedostatak kvalitetnog obrazovanja se navodi kao glavnih faktor zašto povećanje potrošnje na obrazovanje ne rezultira kvalitetnijim ljudskim kapitalom, a takođe je utvrđena mala razlika u nivou uspeha studenata zemalja sa višim ili nižim troškovima obrazovanja. Ovi dokazi su u suprotnosti sa uvreženim stavom da veća potrošnja u obrazovanju nužno predstavlja pozitivan impuls za privredni razvoj, te da je rast ulaganja u obrazovanje u direktnoj vezi sa kvalitetom obrazovanja (Levine & Renelt, 1992).

Štaviše, potrošnja za obrazovanje mogla bi uticati na ekonomski rast drugim kanalima, na mikro i makro nivou. Obrazovanje povećava individualne zarade, što proističe iz pretpostavke da obrazovanje rezultira sticanjem znanja koje dalje vodi ka rastu produktivnosti (Barro, 2000). Imajući u vidu da je kriva tražnje za radom zapravo kriva vrednosti graničnog proizvoda rada, odnosno da svaki poslodavac upošljava onoliko radnika koliko je potrebno da izjednači nadnicu sa vrednošću marginalnog proizvoda rada, dolazimo do zaključka da su edukovaniji radnici istovremeno i plaćeniji (Vukotić i dr., 2013). Obrazovanje je dugo bilo povezano sa unapređenjem drugih aspekata društva, pri čemu zdravlje predstavlja jedan od najvažnijih. Obrazovanje utiče na zdravlje kroz brojne

Ulaganje u obrazovanje i ekonomski rast: analiza panel podataka

komplikovane mehanizme uključujući i socijalne odnose i druge kontekste rada, domaćinstva i zajednice (Feinstein et al., 2006). Tako se recimo, izdvaja pozitivan i značajan uticaj obrazovanja majke na zdravlje deteta u zemljama u razvoju. Zdravija deca mogu biti produktivnija i uspešnija tokom školovanja, a to posredstvom pozitivnih eksternalija može imati uticaja na društvo i privredu kao celinu. Slično ovome, obrazovaniji roditelji smislenije planiraju porodicu, što se na kraju ogleda u manjoj veličini porodice (Dahlin, 2003, str. 5).

3. Podaci i metodologija

Za potrebe analize odnosa ulaganja u obrazovanje i privrednog rasta prikupljeni su podaci sa sajta Svetske banke. Tip podataka koji se koristi u ovom istraživanju su panel podaci. Panel podaci kombinuju karakteristike vremenskih serija i uporedne podatke, sačinjavajući tako višedimenzionalni skup podataka. Tokom prikupljanja podataka javilo se ograničenje u vidu nedostatka podataka. Naime, kod izvesnog broja zemalja ne postoje potpuni podaci za neke od varijabli korišćenih u ovoj analizi, što ovaj panel čini neizbalansiranim. Da bi se ovo pitanje rešilo, neke varijable su isključene iz analize, a neke praznine u podacima su interpolirane.

Zavisnu varijablu u modelu predstavlja godišnja stopa rasta društvenog bruto proizvoda, dok je ključna nezavisna varijabla potrošnja na obrazovanje, i predstavlja procenat BDP-a koji vlada troši na obrazovanje. Ostale nezavisne promenljive koje su uključene u analizu imaju ulogu kontrolnih varijabli. Promenljive koje imaju ulogu kontrolnih promenljivih su: GDP per capita, inflacija, javna potrošnja i otvorenost privrede. Analiza obuhvata 27 zemalja Evropske unije u periodu 1996-2022.

Model može da se predstavi na sledeći način:

$$GDPR_{it} = \beta_{0i} + \beta_1 GEED_{it} + \beta_2 INF_{it} + \beta_3 \log(GDPpc)_{it} + \beta_4 \Delta GES_{it} + \beta_5 \Delta TOP_{it} + \varepsilon_{it}, \quad (1)$$

gde je:

GDPR – godišnja stopa rasta BDP

GEED – ulaganja u obrazovanje (% BDP)

INF – stopa inflacije

$\log(GDPpc)$ – BDP per capita (logaritamska vrednost)

GES – javna potrošnja (% BDP)

TOP – trgovinska razmena (% BDP)

β_{0i} - slobodan član za i-tu jedinicu posmatranja,

ε_{it} - slučajna greška

4. Rezultati analize i diskusija rezultata

Utvrđivanje odgovarajućeg panel modela kojim bi se opisao odnos ekonomskog rasta i ulaganja u obrazovanje podrazumeva proveru pretpostavki na kojima se bazira ovaj model. U tom smislu, Breusch-Pagan test homoskedastičnosti je pokazao da ova pretpostavka nije narušena činjenicom da su p -vrednosti kod ovog testa veće od 0,05. Stacionarnost je pretpostavka koju treba proveriti u slučaju da je broj perioda veći od 10. U tom smislu je korišćen test jediničnog korena za proveru stacionarnosti u podacima vremenske serije. Prema Dickey-Fuller testu, jedinični koreni su sadržani u varijablama Javna potrošnja i Trgovinska razmena. Nakon prve diferencije, ove dve serije su postale stacionarne. Za izbor odgovarajućeg modela, sa fiksnim ili slučajnim efektima, korišćen je Hausman-ov test. Ovaj test je pokazao da je primerenije koristiti model sa fiksnim efektima. Analiza je sprovedena korišćenjem statističkog softvera Eviews. Rezultati panel analize dati su u Tabeli 1.

Tabela 1 Model panel podataka za 27 zemalja EU

	Bez zaostajanja	5 godina zaostajanja	10 godina zaostajanja	15 godina zaostajanja	20 godina zaostajanja
C	29.704 (.000)	12.040 (.019)	-37.845 (.000)	-78.584 (.000)	-99.622 (.000)
GOVEDU	-0.526 (.037)	0.207 (.370)	0.459 (.109)	0.646 (.041)	0.521 (.176)
INFLATION	-0.022 (.000)	-0.006 (.874)	-0.092 (.111)	-0.350 (.000)	-0.414 (.000)
LOG(GDPPC)	-1.855 (.000)	-1.230 (.003)	3.478 (.001)	8.431 (.000)	10.055 (.000)
Δ (GOVEXP)	-0.602 (.000)	-2.341 (.000)	-2.687 (.000)	-2.735 (.000)	-3.248 (.000)
Δ (TRADE)	0.030 (.000)	0.047 (-.004)	0.047 (.011)	0.066 (.003)	0.042 (.057)
R ²	0.263	0.443	0.492	0.596	0.777

Nezavisna promenljiva: GDPR

Izvor: Izračunavanja autora

Odnos između ekonomskog rasta i ulaganja u obrazovanje, prema literaturi i teoriji, možda nije direktan ili kratkoročan, već samo može postati očigledan na duži rok. Imajući u vidu podatke Tabele 1, nalazimo da ukoliko se posmatra odnos ulaganja u obrazovanje i ekonomski rast, godina za godinom, na kratak rok (bez zaostajanja), onda postoji negativna veza između ove dve pojave, tj. povećanje ulaganja u obrazovanje nema za posledicu povećanje stope rasta BDP. U ovom slučaju, model objašnjava svega 26,3 % varijabiliteta u rastu BDP. Takođe, nije dokazana statistička značajnost uticaja ulaganja u obrazovanje na stopu rasta BDP.

U nastavku su razmatrana još 4 modela, pri čemu su se kašnjenja kretala od 5 do 20 godina (razmak na po 5 godina); rezultati ovog pristupa su sumirani u Tabeli 1. Vrednosti koeficijenta koji opisuje odnos između ulaganja u obrazovanje i privrednog rasta menjaju se tokom godina iz negativnog u pozitivan. Već nakon 5 godina zaostajanja, ovaj koeficijent dobija pozitivan predznak. Naime, povećanje ulaganja u obrazovanje za 1% BDP, nakon 5 godina imaće za posledicu povećanje stope rasta GDP za 0,207%. Modelom je objašnjeno

Ulaganje u obrazovanje i ekonomski rast: analiza panel podataka

44,3% varijabiliteta. Međutim, ni u ovom slučaju nije dokazana statistička značajnost ovog koeficijenta. Nakon 10 godina zaostajanja, vrednost ovog koeficijenta je takođe pozitivna, ali i dalje nije značajna. Koeficijent determinacije je neznatno povećan, pa objašnjeni varijabilitet učestvuje sa 49,2%.

Posebno je interesantna vrednost koeficijenta koji opisuje odnos ulaganja u obrazovanje i stope rasta BDP u slučaju koraka zaostajanja od 15 godina. Naime, u ovom slučaju, ovaj koeficijent ima pozitivnu vrednost, a uz to je i statistički značajan. Objašnjeni varijabilitet učestvuje sa 59,6% u ukupnom varijabilitetu. Već nakon 20 godina zaostajanja, apsolutna vrednost ovog koeficijenta opada, pa isti više nije statistički značajan. U tom smislu, nalazimo da je najjači uticaj ulaganja u obrazovanje na BDP ostvaren nakon 15 godina zaostajanja.

5. Zaključak

Debata o ekonomskom rastu i obrazovanju je izuzetno intenzivna i otkriva važnost teorijske i empirijske analize međuzavisnosti i uticaja između ljudskog kapitala, izraženog kroz kvalitativne i kvantitativne dimenzije, i ekonomskog rasta, odnosno, dugoročnog ekonomskog razvoja i nacionalnog blagostanja. Rezultati pokazuju izuzetno važan uticaj ljudskog kapitala na privredni rast, čime se potvrđuje uzročno-posledična veza na obrazovno-ekonomski rast. Postoji nekoliko mehanizama posredstvom kojih obrazovanje i ljudski kapital utiču na privredni rast. Prvi mehanizam se odnosi na povećanje produktivnosti rada, a drugi i treći na uvećanje inovativnosti/kreativnosti i sposobnosti za prihvatanje novih tehnologija, odnosno na generisanje tehnološkog progressa. Zemlje koje unapređuju svoje obrazovne sisteme sposobnije su da menjaju i druge oblike politike koje podstiču ekonomski rast. Efekti obrazovanja naročito dolaze do izražaja u zemljama koje tradicionalno imaju nedovoljno obrazovano stanovništvo. Osim toga, postoje ubedljivi dokazi da ljudski kapital uvećava produktivnost i da obrazovanje ne vrši samo signalnu funkciju. Obrazovanje, odnosno ljudski kapital, značajno i pozitivno utiče na ekonomski rast, ali ne toliko snažno kako se dugo smatralo.

U tom smislu, naši rezultati naglašavaju da unutar Evropske unije postoji jasan pozitivan uticaj obrazovanja na privredni rast, izražen kroz povećanje stope rasta BDP. Istovremeno, dobijeni rezultati konvergiraju sa onima koji se nalaze u literaturi. Štaviše, rezultati predstavljaju smernice za buduća istraživanja ekonomskog rasta i ulaganja u obrazovanje, u smislu uzimanja većeg uzorka zemalja i indikatora, i uključivanjem potencijalnog pozitivnog uticaja međunarodne radne migracije na obrazovanje i ekonomski rast.

Ova studija naglašava važnost obrazovne politike kao ključnog faktora ekonomskog razvoja u EU i predlaže povećanje javnih izdataka za obrazovanje kao strategiju za dugoročni ekonomski rast. U tom smislu, veće investicije u obrazovanje, posebno kada su usmerene na poboljšanje kvaliteta obrazovanja, značajno doprinose rastu BDP-a.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Literatura

- Aghion, P., Boustan, L., Hoxby, C. and Vandenbussche, J. (2009). The Causal Impact of Education on Economic Growth: Evidence from U.S. In D. Romer and J. Wolfers, (eds.), *Brookings Papers on Economic Activity*. http://scholar.harvard.edu/files/aghion/files/causal_impact_of_education.pdf.
- Barro, R. (2000). Education and Economic Growth. *International Handbook on the Economics of Education*, 1-36.
- Dahlin, B.G. (2002). The Impact of Education on Economic Growth: Theory, Findings, and Policy Implications. <http://www.ssc.wisc.edu/~munia/475/dahlin0202.pdf>.
- Feinstein, L., Sabates, R., Anderson, T. M., Sorhaindo, A., & Hammond, C. (2006). *What are the effects of education on health?* Measuring the effects of education on health and civic engagement: proceedings of the Copenhagen symposium. March 2006, Copenhagen, Denmark.
- Hanushek, E., & Wößmann, L. (2007). The Role of Education Quality in Economic Growth. *World Bank Policy Research Working Paper 4122*, 1-29.
- Hanushek, E.A. and Woessmann, L. (2007). The Role of School Improvement in Economic Development. NBER Working Paper No. 12832.
- Islam, N. (1995). Growth Empirics: A Panel Data Approach. *The Quarterly Journal of Economics*, 11.
- Levine, R., & Renelt, D. (1992). A Sensitivity Analysis of Cross-Country Growth Regressions. *The American Economic Review*, 82(4), 942-963.
- Lucas, R.E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics*, 22, 3-42.
- Mankiw, N.G, Romer, D. and Weil, D.N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107(2), 407-37.
- Vukotić, V., Šuković, D., Rapvić, M., Maksimović, S., Goati, V. (2013). *Obrazovanje i razvoj*. Institut društvenih nauka Centar za ekonomska istraživanja, Beograd.

INVESTMENT IN EDUCATION AND ECONOMIC GROWTH: A PANEL DATA ANALYSIS

Abstract: *This paper investigates the impact of investment in education on economic growth in European Union countries using panel data analysis. The analysis is based on data for 27 countries of the European Union that were observed in the period 1996-2022, according to 6 different indicators. The paper examines GDP growth as a function of allocations for education, while other independent variables - GDP per capita, inflation, public spending, and openness of the economy - play the role of control variables. The results show that in the European Union, there is a positive impact of education on economic growth, with a lag of at least 5 years.*

Keywords: *Education, economic growth, panel analysis, EU*

SESSION 2



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**THE TRANSITION TOWARDS SUSTAINABILITY THROUGH
CIRCULAR BUSINESS MODELS**

Dr Suzana Stefanović*

Dr Maja Ivanović Đukić•

Miljana Talić•

Andela Milenković•

***Abstract:** Circular business models have emerged as one of the approaches for transitioning to businesses that will have less negative consequences for the environment in which they operate. As awareness grows about the importance of involving as many actors as possible in reducing the global problems of environmental degradation, circular business models are also becoming more popular. The aim of the paper is to analyze circular business models as an instrument for achieving sustainability and to present the differences between traditional and circular business models.*

***Keywords:** circular business models, sustainability, circular economy.*

1. Introduction

Numerous environmental and social problems that have occupied the world in recent decades have also led businesses to reconsider their business policies and implement certain practices that will be more appropriate in today's world. It became clear that it is necessary

* University of Nis, Faculty of Economics, Serbia; ORCID 0000-0001-7799-6385,

✉ suzana.stefanovic@eknfak.ni.ac.rs

• University of Nis, Faculty of Economics, Serbia; ORCID 0000-0002-0547-7209,

✉ maja.djukic@eknfak.ni.ac.rs

• Innovation Center, University of Nis, Serbia; ORCID 0000-0003-1017-8788,

✉ miljanatalic@gmail.com

• Innovation Center, University of Nis, Serbia; ORCID 0000-0001-5779-1526,

✉ milenkovic.andjela998@gmail.com

UDK 338.1:502.131.1

to change the way of doing business and management and that it is important to include all categories of companies in the process of transitioning to businesses that will take more care of the environment in which they operate.

Nikolaou et al. (2021) emphasise that there are two important streams in the literature that explore ways for continuous, stable and justice economic development. The first stream refers to the concept of sustainability i.e. sustainable development, which is an older concept, and the second stream refers to the circular economy, which appeared in the last decade.

Sustainability is an area receiving considerable academic and policy attention and which permeates through different spheres, and has also found its place in the business sphere. The requirement for sustainable development is increasingly changing the business world and becoming one of the key elements of business success. The emergence of innovative business models that influence the change in business practices and shape the future business environment is noticeable (OECD, 2019). One of the approaches proposed to achieve sustainability goals is the circularity of business model. It implies a design, production and reuse approach that aims to keep resources in use as long as possible (European Commission, 2022). Since circularity can be seen as an instrument for achieving sustainability, this indicates a close connection between these two concepts, so the circular model relies on the basic principles of sustainable development. However, sustainability does not always lead to circularity, just as a circular business model does not always ensure the improvement of social, environmental and economic factors (Pavlović et al., 2023).

So, the aim of the paper is to analyze circular business models as an instrument for achieving sustainability and to present the differences between traditional and circular business models. After introduction, the following part of the paper will introduce the very concept of circular economy as well as a notion of sustainability, and try to connect these two concepts. The next part of the paper will try to explain the transition from traditional to circular business models as a path to achieve sustainability in business. At the end of the paper the final concluding remarks will be given.

2. The concept of circular economy as an element of sustainability

The concept of circular economy (CE) implies a major paradigm shift and the way how human society relates to the nature (Geissdoerfer et al., 2017). It is a relatively new approach created with the aim of replacing the existing linear model in business. It can be said that circular economy is the part of the broader concept of sustainable development, and it is often mentioned as an approach for the operationalization of sustainable development. The definition of sustainable development indicates its goal “to meet the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). The dimensions covered by this concept are: environmental, economic and social sustainability. The increasing popularization of the concept of sustainability has influenced the emergence of business models that are oriented towards sustainability. According to one of the approaches, such models aim at a triple contribution to sustainable development through their environmental, social and economic impact (triple bottom line contribution) (Elkington, 1997; Lüdeke-Freund et al., 2024). One type of business models that is oriented towards sustainability is the circular model. Economic growth while simultaneously preserving the environment in which business is conducted is

The Transition Towards Sustainability Through Circular Business Models

the main goal of applying the circular economy concept. But, for now, the impact on social equality and thinking about future generations' welfare is not in the focus of those who implement the concept of circular economy (Kirchherr et al., 2017).

The circular economy is a concept based on the assumption that resources are used in a way that increases the value of the product or service, while, on the other hand, reducing waste. The goal is to make maximum use of resources, and at the end of the product's use cycle, it should be returned to the production process in order to create new value (Geissdoerfer et al., 2017). The circular economy is most often defined as a combination of reduction, reuse and recycling.

In the EU Action Plan (European Commission, 2015), the circular economy is described as economic model "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised." According to Ellen MacArthur Foundation (2013, p. 7), a circular economy is "an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models." The aim is to "enable effective flows of materials, energy, labour and information so that natural and social capital can be rebuilt" (Ibid.).

Referring to relevant literature sources, Nikolaou et al. (2021) point out that there are two main trends that explain the link between the circular economy and sustainability. While the first trend views sustainable development as a process that encourages a linear model of thinking among economic actors, the second trend views the circular economy and sustainability in a similar way. Emphasizing that sustainability has clearly defined goals, the authors state that the circular economy can be seen more as a tool for promoting sustainability goals. However, the key difference between these concepts is that the circular economy does not emphasize the social dimension, which is one of the main elements of sustainability.

Namely, critics believe that the circular economy focuses too much on the economic aspect, that the social dimension is insufficiently represented, and that the issue of environmental protection is oversimplified (Corvellec et al., 2022). Also, Valenzuela and Bohm (2017) believe that the concept of circular economy is too politicized. They especially emphasize that waste and the amount of waste created are manipulated, using a subjective approach. Their view is that there is too much talk about the circular economy in order to score points and less as a way to solve real problems.

3. Transition to circular business models in order to achieve sustainability

Until the middle of the 20th century, the linear model was considered the optimal production model. However, the increase in population at the global level leads to a greater demand for raw materials and other resources, which conditions their more efficient use. Also, the financial crisis, frequent conflicts and wars, as well as climate changes, lead to the need to change the model. The production process in the linear business model begins with the phase of gathering and preparing raw materials, followed by the process of production and service provision. After that, the output is distributed and then consumed, followed by

the last phase, the creation of waste. Unlike this model, in the circular business model, there is an extension of the process, through the collection of generated waste, its selection and processing and then recycling (Munitlak-Ivanović, 2019). The concept of circular business models has existed for some time, and it should be mentioned that some circular business models have existed for centuries (such as reusing of clothes).

According to a study by the European Union (EU) in 2023, only 7.2% of the global economy is circular, meaning that linear economy is still the dominant, characterized by unsustainable production and consumption. This indicates the necessity for changes in the direction of sustainability and circularity (EU, 2023). The transition to a circular economy represents a systemic change that requires changes in all areas: economic, political and socio-cultural. In order to re-orient to the circular model, new behavioral models must be adopted at multiple levels (society and businesses, as well as individuals).

Circular business models require a changing transaction, the type of organizational change that is needed because value is created from waste (Bocken et al., 2014). Circular business models close resource loops and thus prevent excessive waste generation by recovering, recycling, reusing or reducing resources (Lüdeke-Freund et al., 2019). Embracing circular economy principles requires a systemic change in the way companies create and deliver value and the way value is generated and captured (Bocken et al., 2016). There are numerous attempts to define a circular business model, and one of the most comprehensive is the one proposed by Geissdoerfer et al. (2020, p. 7), according to which they are “business models that circulate, expand, intensify and/or dematerialize material and energy loops to reduce resource inputs into and discharges of waste and emissions.”

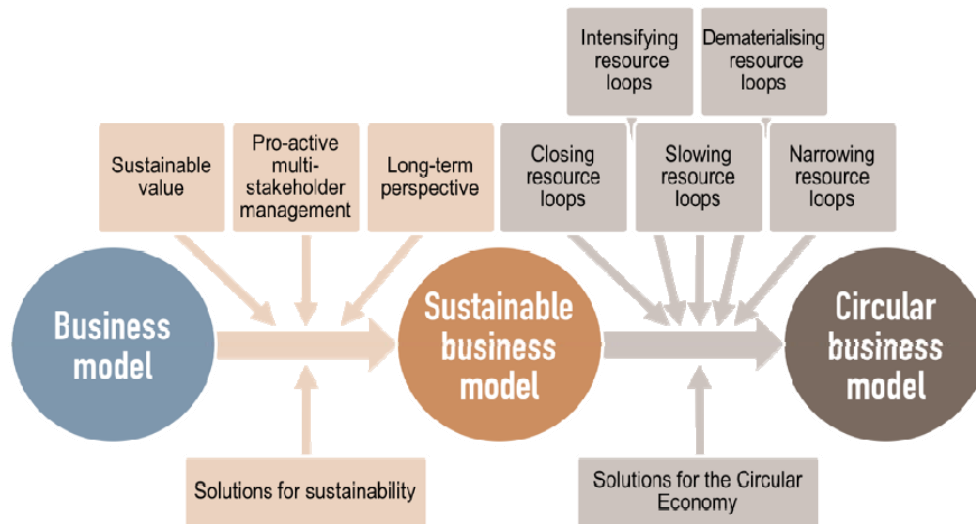
The transition to a circular business model can be achieved through business model innovation (BMI), defined as “the conceptualisation and implementation of new business models that can comprise the development of entirely new business models, the diversification into additional business models, the acquisition of new business models, or the transformation from one business model to another” (Geissdoerfer et al., 2018a).

Five basic circular models can be distinguished: 1) circular supply chain model; 2) resource recovery model; 3) product life extension model; 4) sharing model, and 5) production service system model (Accenture, 2015). According to Susur and Engvall (2023), the transition to circular business models is based on four structural components (technology and infrastructure, networks, institutions and social actors) and offers seven innovation mechanisms (experimentation, visioning, network-building, learning, protection, resource mobilization and legitimization).

In order to implement the circular model, changes are needed in the way of treating limited resources. According to this concept, the traditional linear business model is changed to a circular one, using the principles of reduction, reuse and recycling (Prieto-Sandoval et al., 2018). One of the biggest differences between traditional business models and circular ones is reflected in the way value is created and delivered. Figure 1 shows a comparative analysis of traditional, sustainable and circular business models.

The Transition Towards Sustainability Through Circular Business Models

Figure 1: Comparison of traditional, sustainable, and circular business models



Source: Geissdoerfer et al. (2018a)

Unlike traditional business models, which are based on the assumption that a larger volume of production is a source of competitive advantage, circular business models strive to increase profitability and efficiency (Uvarova et al., 2019).

As we can see in Figure 1, in addition to solutions for ensuring circularity, aimed at closing, slowing, narrowing, intensifying and dematerializing resource loops, in order to achieve the sustainability of the business model, a long-term perspective, pro-active management of stakeholders, as well as the sustainability of the created value are needed. In fact, in their paper, Geissdoerfer et al. (2018a) argue that all three elements of a business model (value proposition, value creation and delivery, and value capture) must be circular in order to achieve optimal sustainability performance within a circular economy.

Referring to the authors who indicated the connection between the circular economy and the goals of sustainable development, i.e. the circular economy and the concept of sustainability, Nikolaou et al. (2021, p. 7) highlight the conclusion that “CE simultaneously promotes many environmental (e.g. clean water, clean energy, life on land), social (decent work and affordable energy) and economic goals (responsible consumption and production).”

Eco-innovations also have a positive effect on the company's path towards circularity. They can be technical or non-technical. Apart from eco-innovations which are technical and imply a change in technology, they also refer to organizational, social and systemic changes. In addition to having favorable effects on the environment, it also enables the creation of a competitive advantage. Although they can enable greater production and the creation of new green sectors and products, there is a danger of increased consumption. Therefore, it is necessary to systematically look at the role of eco-innovations as a driver of the circular economy (Vence & Pereira, 2019).

4. Conclusion

Only 7.2% of the global economy is circular, which indicates that the linear model characterized by unsustainable production and consumption is still dominant. Given the low rate of application of circular business models, it is necessary to develop awareness of the importance of environmental protection, develop mechanisms that enable the application of the circular economy, train personnel for application and understand the advantages that the circular way of doing business provides. During the transition, various challenges arise that the actors of change need to overcome. One of the biggest challenges is how to maximize the value of products and materials, while at the same time reducing the use of natural resources in the way that has a positive impact on society and the environment.

When discussing the contribution of circular business models to sustainability, it is noticeable that, although circular business models can be seen as a tool to promote sustainability, many circular business models focus only on the environmental or technological contribution to sustainability, instead of all dimensions simultaneously. That is, there is not always an overlap between sustainability and circular business models (Geissdoerfer et al., 2018b). For example, circular business models can have a negative impact on one of the dimensions of sustainability even though they have a positive effect on others. The social dimension is mostly neglected in the circular economy (Murray et al., 2015). So not all circular models are sustainable. Even in the literature, when analyzing circular business models, their contribution to improving environmental performance is mostly emphasized, and a holistic approach is missing (Geissdoerfer et al., 2017). Therefore, it is necessary to further explore the topic of the connection between circular business models and sustainability.

Acknowledgment: This research was financially supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contracts No. 451-03-66/2024-03/200371 and No. 451-03-65/2024-03).

References

- Accenture (2015). *Waste to Wealth. Executive Summary*. Retrived from: <https://thecirculars.org/content/resources/Accenture-Waste-Wealth-Exec-Sum-FINAL.pdf>. Accessed on: 15.11.2023.
- Bocken, N., Short, S., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production*, 65, 42–56.
- Bocken, M.P.N., de Pauw, I., Bakker, C. & van der Grinten, B. (2016). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308-320, DOI:10.1080/21681015.2016.1172124
- Corvellec, H., Stowell, A.F. & Johansson, N. (2022). Critiques of the circular economy. *Journal of Industrial Ecology*, 26 (2), 369-666.
- Elkington, J. (1997). *Cannibals with forks: The triple bottom line of 21st century business*. Capstone.
- Ellen MacArthur Foundation (EMF) (2013). *Towards the circular economy: Economic and business rationale for an accelerated transition*. Retrived from: <https://emf.thirdlight.com/file/24/xTyQj3oxiYNMO1xTFs9xT5LF3C/Towards%20the>

The Transition Towards Sustainability Through Circular Business Models

- %20circular%20economy%20Vol%201%3A%20an%20economic%20and%20business%20rationale%20for%20an%20accelerated%20transition.pdf. Accessed on: 10.12.2023.
- EU (2023). *The Circularity Gap Report 2023*. Retrived from: https://assets.website-files.com/5e185aa4d27bcf348400ed82/63c69d048f937c2921c0285c_CGR%202023%20-%20Executive%20Summary.pdf. Accessed on: 15.06.2024.
- European Commission (2015). *Closing the Loop - An EU Action Plan for the Circular Economy*, Com (2015) 614 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.
- European Commission (2022). *Annual report on European SMEs 2021/2022 SMEs and environmental sustainability*, Luxembourg: Publications Office of the European Union.
- Geissdoerfer, M., Morioka, S. N., de Carvalho, M. M. & Evans, S. (2018a) Business models and supply chains for the Circular Economy. *Journal of Cleaner Production*, 190, 712-721. DOI: 10.1016/j.jclepro.2018.04.159
- Geissdoerfer, M., Vladimirova, D. & Evans, S. (2018b). Sustainable business model innovation: A review. *J. Clean. Prod.* 198, 401-416. doi: 10.1016/j.jclepro.2018.06.240
- Geissdoerfer, M., Savaget, P., Bocken, N.M. & Hultink, E.J. (2017). The Circular Economy—A new sustainability paradigm? *J. Clean. Prod.*, 143, 757-768.
- Geissdoerfer, M., Pieroni, M.P., Pigosso, D.C. & Soufani, K. (2020). Circular business models: A review. *Journal of Cleaner Production*, 277, 123741.
- Kirchherr, J., Reike, D. & Hekkert, M.P. (2017). Conceptualizing the Circular Economy: An Analysis of 114 Definitions. *Resources, Conservation and Recycling*, 127, 221-232.
- Lüdeke-Freund, F., Gold, S., & Bocken, N. M. P. (2019). A Review and Typology of Circular Economy Business Model Patterns. *Journal of Industrial Ecology*, 23(1), 36-61. <https://doi.org/10.1111/jiec.12763>
- Lüdeke-Freund, F., Froese, T., Dembek, K., Rosati, F., & Massa, L. (2024). What Makes a Business Model Sustainable? Activities, Design Themes, and Value Functions. *Organization & Environment*, 37(2), 194-220. <https://doi.org/10.1177/10860266241235212>
- Munitlak-Ivanovic, O. (2019). Ecological responsibility and sustainable development as preconditions for development of the concept of circular economy. *Green Business: Concepts, Methodologies, Tools, and Applications*, IGI Global, 1-16.
- Murray, A., Skene, K., & Haynes, K. (2015). The circular economy: An interdisciplinary exploration of the concept and application in a global context. *J. Bus. Ethics*, 140, 369-380. doi: 10.1007/s10551-015-2693-2
- Nikolaou, E. I., Jones, N. & Stefanakis, A. (2021). Circular Economy and Sustainability: the Past, the Present and the Directions. *Circular Economy and Sustainability*, <https://doi.org/10.1007/s43615-021-00030-3>
- OECD (2019), *OECD SME and Entrepreneurship Outlook 2019*, OECD Publishing, Paris, <https://doi.org/10.1787/34907e9c-en>
- Pavlović, D., Milenković, A., Talić, M., Vukojević, V. & Milosavljević, P. (2023). Current trends in the development of micro, small and medium enterprises. Proceedings of *The 6th International conference: Mechanical engineering in XXI century*. Faculty of Mechanical Engineering, University of Niš, 321-326.
- Prieto-Sandoval, V., Jaca, C. & Ormazabal, M. (2018). Towards a consensus on the circular economy. *J. Clean. Prod.*, 179, 605-615.
- Susur, E. & Engwall, M. (2023). A transitions framework for circular business models. *Journal of Industrial Ecology*, 27 (1), 1-37. DOI: 10.1111/jiec.13363

- Uvarova, I., Atstaja, D., Grinbergs, U., Petersons, J., Gegere-Zetterstroma, A. & Kraze, S. (2019). Transition to the circular economy and new circular business models – an in-depth study of the whey recycling. IOP Conf. Series: *Earth and Environmental Science*, doi:10.1088/1755-1315/578/1/012019.
- Valenzuela, F. & Böhm, S. (2017). Against wasted politics: a critique of the circular economy. *Ephemera: Theory & Politics in Organization*, 17 (1), 23-60.
- Vence, X. & Pereira, A. (2019). Eco-innovation and Circular Business Models as drivers for a circular economy. *Contad. Adm.*, 64(1), <https://doi.org/10.22201/fca.24488410e.2019.1806>
- World Commission on Environment and Development (WCED) (1987). *Our common future*, Oxford: Oxford University Press.

TRANZICIJA KA ODRŽIVOSTI KROZ CIRKULARNE POSLOVNE MODELE

Rezime:: Cirkularni poslovni modeli pojavili su se kao jedan od pristupa za tranziciju ka poslovanju koje će imati manje negativnih posledica po okruženje. Kako raste svest o važnosti uključivanja što većeg broja aktera u smanjenje globalnog problema degradacije životne sredine, cirkularni poslovni modeli postaju sve popularniji. Cilj rada je da se analizira koncept cirkularnih poslovnih modela kao instrument za postizanje održivosti i da se predstave razlike između tradicionalnih i cirkularnih poslovnih modela.

Ključne reči: cirkularni poslovni modeli, održivost, cirkularna ekonomija.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**CHALLENGES AND OPPORTUNITIES FOR CIRCULAR
ECONOMY: EVIDENCE FROM DECIDE PROJECT IN SERBIA**

Nemanja Berber, PhD*

Goran Vasić, PhD*

Milica Vračarić, MA*

Abstract: *Circular Economy (CE) is relatively young in terms of definitions, research, and implications. It promotes responsible and cyclical usage of resources, and it is related to the sustainable development concept. Nowadays more and more governments at all levels, companies, NGOs, etc. are engaging in different CE initiatives to make different and positive effects related to the usage of resources, environmental pollution decrease, creation of new green products, etc. However, CE is not without serious challenges and issues that need to be considered. Therefore, the main aim of this research paper was to investigate the challenges and opportunities for the concept of circular economy in Serbia. The research was made as a part of the activities on the DECIDE Danube region international project that is in its implementation phase, lasting for 30 months. Qualitative research was made in May and June 2024 in the Republic of Serbia, by conducting interviews with 19 participants who are engaged in CE initiatives in their business and research areas. The data were analyzed to get information on potential challenges they are facing, and opportunities that they see for the development and implementation of CE initiatives.*

Keywords: *Circular economy, challenges, opportunities, DECIDE project, Serbia.*

* University of Novi Sad, Faculty of Economics in Subotica, Serbia; ORCID 0000-0002-1433-6416, ✉ nemanja.berber@ef.uns.ac.rs and Regional Agency for the Development of Small and Medium Size Enterprises Alma Mons Ltd. Novi Sad, Republic of Serbia.

• Bioeconomy Cluster, Serbia, ✉ goran.vasic@bioeconomy.rs

• Regional Agency for the Development of Small and Medium Size Enterprises Alma Mons Ltd. Novi Sad, Serbia, ✉ milica.vracaric@almamons.rs

UDC 338.1:502.131.1(497.11)

1. Introduction

Circular Economy (CE) is an approach to promote the responsible and cyclical use of resources. CE strategies may promote innovative business models that go beyond product preservation. Strategies for redundancy, multifunctionality, or use intensification of products promote CE by preventing the consumption of new products or creating new consumption patterns (Moraga et al., 2019, p. 452). CE is seen as a key strategy in achieving sustainable development and the United Nations Sustainable Development Goals (SDGs). To seize the potential of CE, public and private organizations need to evaluate and communicate their progress in moving away from the non-sustainable paradigm of “take–make–dispose” towards circularity (Droege et al., 2021, p. 1).

The main aim of this research paper was to investigate challenges and opportunities for the concept of circular economy (CE) in Serbia. The research was made as a part of the activities on the DECIDE Danube region international project that is in its implementation phase, lasting for 30 months. Qualitative research was made in May and June 2024 in the Republic of Serbia, by conducting interviews with 19 participants who are engaged in CE initiatives in their business and research areas. The data were analyzed to get information on potential challenges they are facing, and opportunities that they see for the development and implementation of CE initiatives in theory business.

The paper consists of three sections. Section one is related to the theoretical background, explaining the concept of circular economy. The second section represents the methodology of the research, explaining the sample, procedures, context, data collection, and questionnaire, and the results of data analysis, with discussion. The third section obtains conclusions and theoretical and practical implications.

2. Circular economy

While the concept of the circular economy emerged about five decades ago and has received popularity recently, it is believed that its roots cannot be traced back to any specific point in time. The core underlying drivers for the rise of the concept of circular economy are scarcity of resources, increased extraction, rising resource prices, climate change, and changing attitudes towards the issue (Nadeem et al., 2018). Kirchherr et al. (2017) first identified 114 definitions later even 221 CE definitions (2023).

The definition of the EMF is the first to set light on the term: “A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the ‘end-of-life’ concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models” (EMF, 2013, p. 7).

Kirchherr et al. (2017) propose another definition, summing up the review of academic sources: “Circular economy describes an economic system that is based on business models which replace the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), to accomplish sustainable development, which

Challenges and opportunities for circular economy: Evidence from DECIDE project in Serbia

implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations.” (Kirchherr et al. 2017, p. 224-225)

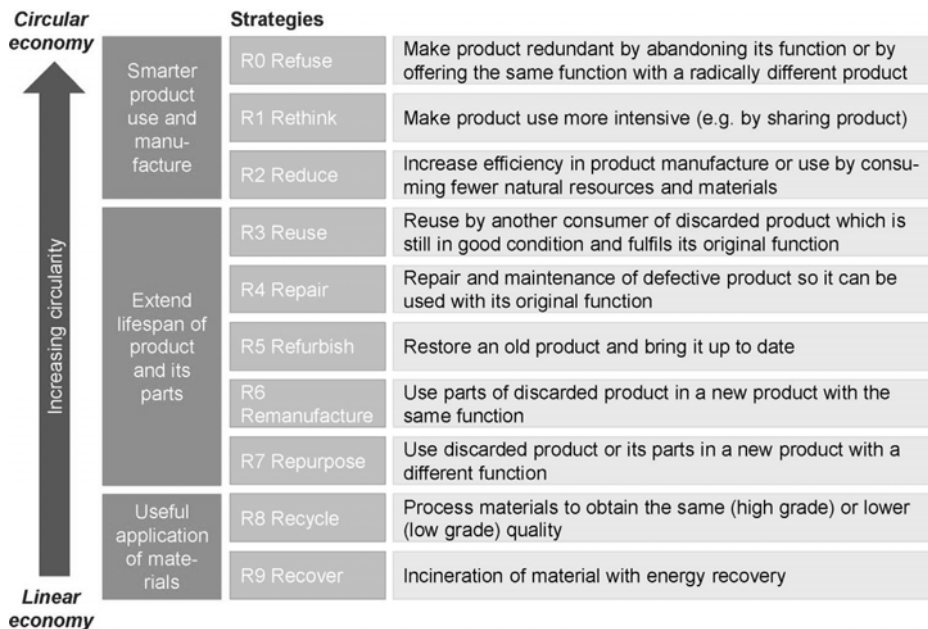
In the new analysis of CE definitions, Kirchherr et al. (2023) conclude that scholars increasingly recommend a fundamental systemic shift to enable CE, particularly within supply chains. Sustainable development is frequently considered the principal aim of CE, but still there are considerations how feasible is the interplay between environmental sustainability and economic development. Finally, recent studies argue that CE transition relies on a broad alliance of stakeholders, including producers, consumers, policymakers, and scholars, focusing on more ecosystem view.

The EU Commission definition to Circular Economy is as follows: A circular economy aims to maintain the value of products, materials, and resources for as long as possible. This is achieved by returning them into the product cycle at the end of their use. As a result, this minimizes the generation of waste. The fewer products we throw away and the less materials we extract from the environment to produce new products, the better for our environment.

It is important to consider the scope of the CE definitions:

- 3Rs: reduction, reuse and recycling (Ranta, Aarikka-Stenroos and Mäkinen, 2018).
- 4Rs: reduction, reuse, recycling and recovery (Allwood et al., 2011).
- 5Rs: reduce, reuse, refurbish, repair and recycle (Lacy and Rutqvist, 2015).
- 9Rs: refuse, rethink, redefine, reuse, reform, remanufacture, redefine, recycle and recover (Van Buren et al., 2016).

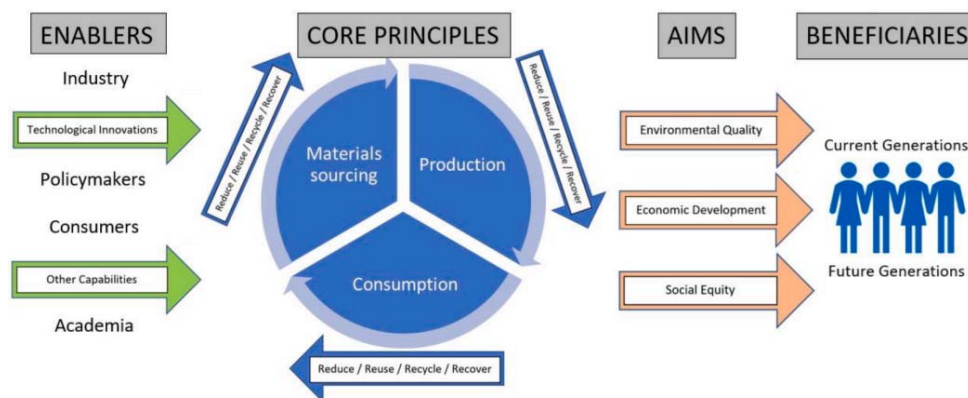
Figure 1. From linear to circular economy



Source: Kirchherr et al (2017, p. 224)

Most recent definition of the CE is that “circular economy is a regenerative economic system which necessitates a paradigm shifts to replace the end of life concept with reducing, alternatively reusing, recycling, and recovering materials throughout the supply chain, with the aim to promote value maintenance and sustainable development, creating environmental quality, economic development, and social equity, to the benefit of the current and future generations. It is enabled by an alliance of stakeholders (industry, consumers, policymakers, academia) and their technological innovations and capabilities” (Kirchherr et al., 2023, p. 4).

Figure 2. Circular economy framework



Legend: Core principles Aims Enablers

Source: Kirchherr et al (2023, p. 4)

The circular economy emerged as a top-down and policy-level concept, focusing on better utilization of resources and resource efficiency, sustainability and waste reduction. It is closely linked to Sustainable Development Pillars (Environment, Economic and Social) and Sustainable Development Goals (SDG, UN), addressing mainly the constantly aggravating systematic environmental problems. In this perspective, circular economy thinking aims to define system-level economy transformations, creating closed-loop systems where resources are reused, recycled, or repurposed to minimize waste and environmental impact. The European Union and other developed countries play a leading role in this movement, considering the long-term global effect on the existing economic practices of production, consumption and international trade. Other international organizations such as OECD, UN, EU, WEF and others, pay similar attention to defining CE policy documents and frameworks.

Since 2015, the European Union (EU) has adopted strategic document in the field of sustainable development, an action plan for circular economy and thus began with more active promotion of this business model. As a result of the CE Action Plan, legislative documents for defining this area such as: European stakeholders' platform for the circular economy and Urban agenda for EU partnership on circular economy were created, too. In order to adapt to the new as efficiently as possible business model, the European Commission accelerated is working on the creation of a circular economy action plan which will represent the program in which they are key actors: companies, consumers, citizens and representatives of non-governmental organizations, which aims to create a clean and competitive economies of the EU (Bogetić et al., 2021, p. 66).

Challenges and opportunities for circular economy: Evidence from DECIDE project in Serbia

Although it is pronounced as a new developmental paradigm, CE is not without limitations. Some of those are emphasized in the research of Korhonen et al. (2018, p. 41) as six limits and challenges for the circular economy concept.

1. Thermodynamic limits
 - a. Cyclical systems consume resources and create wastes and emissions
2. System boundary limits
 - a. Spatial: problems are shifted along the product life cycle
 - b. Temporal: short term non-renewables use can build long-term renewable infrastructure
3. Limits posed by physical scale of the economy
 - a. Rebound effect, Jevon's paradox, boomerang effect
4. Limits posed by path-dependency and lock-in
 - a. First technologies retain their market position despite of in-efficiency
5. Limits of governance and management
 - a. Intra-organizational and intra-sectoral management of inter-organizational and inter-sectoral physical flows of materials and energy
6. Limits of social and cultural definitions
 - a. The concept of waste has a strong influence on its handling, management and utilization
 - b. The concept is culturally and socially constructed
 - c. The concept of waste is always constructed in a certain cultural, social and temporal context and this context is dynamic and changing.

3. Evidence from DECIDE project on circular economy in Serbia

This research includes a sector-specific analysis highlighting challenges, opportunities, and key learnings for circular economies in the food, battery, textile, packaging, and smart city sectors in the Republic of Serbia. This is a part of a wide set of deliverables in the DECIDE project - Digital Services for Circular Economy – a Toolbox for Regional Developers & SME¹ funded by Interreg Danube Region program. The DECIDE project aims at the identification and implementation of successful circular economy business models within the Danube Region (DR) using innovative tools and methods to contribute to sustainable development goals (SDG) in the EU (Timus & Ciucan-Rusu, 2024).

The Danube region project DECIDE with 16 international partners from ten countries along the Danube aims to make the European economy greener and more digital by mid-2026. To this end, DECIDE aims to provide small and medium-sized enterprises (SMEs), start-ups and business developers in the Danube region with methods and tools for developing successful business models for the circular economy. These models are crucial for achieving the goals of the European Green Deal by making sustainable products the norm, finding ways to transform resource-intensive sectors and making the circular economy usable in practice. The project lasts for 30 months and it started at the beginning of 2024.

¹ <https://interreg-danube.eu/projects/decide>

3.1. Methodology

The first activity to be carried out by the project marks a crucial step towards understanding the specific contexts and dynamics of circular economies in the areas of food, battery, textile, packaging and smart city within the Danube Region. It focuses on conducting thorough research to identify the specific challenges and opportunities that exist in these areas with respect to circular economies and derive requirements for the analysis and development of circular economies and respective business models using innovative digital tools (Timus & Ciucan-Rusu, 2024).

Partner from Serbia, the Regional agency for development of SMEs Alma Mons Ltd. Novi Sad made interviews with selected participants, based on their responsibilities and accountabilities, business and/or research fields, operations and business results, as well as previously established cooperation relations. We used questionnaire that has been developed for the purpose of mapping challenges, issues, interests, and opportunities in the area of CE.

We interviewed 19 experts in the fields mentioned. Those were people from predefined target groups by the project (academic, SMEs in area of CE, public authority, NGOs, and business support bodies). Inside SMEs, predefined areas were food, battery, and textile, packaging and smart city. The interviews were conducted at the end of May and beginning of June 2024.

Table 1. Sample of respondents

	Frequency	Percent	Valid Percent
Academics (University / Vocational School)	6	31.6	31.6
NGO/Business Support Organization	4	21.1	21.1
Public Authority (local/regional administration)	4	21.1	21.1
SMEs (Small & Medium Company)	5	26.3	26.3
Smart-City (IoT)	1		
Packaging	1		
Food	2		
Textile	1		
Total	19	100.0	100.0

Source: Authors own calculations

3.2. Results

According to the data from interviews, about 70% of experts told that their institutions were included in different initiatives of CE, and 73% of them were engaged in training and workshops on CE. The main barriers/challenges that limit their involvement in the CE are presented in Table 2.

Among the barriers, respondents pointed out lack/inconsistency of legislation and public policies and strategies, training level of employees, and lack of interest of residents, as well as coordination problems between companies.

Among the positive measures, the most prominent is financing, that is, the conception of certain incentive measures by the administration that would help entrepreneurs in the implementation of projects based on the principles of circular economy. Respondents believe that innovations in this area should be more significantly supported, as well as the positive effects that these projects have on increasing

**Challenges and opportunities for circular economy:
Evidence from DECIDE project in Serbia**

competitiveness. The vast majority notice the positive effects of these projects on the protection of the environment and its preservation.

Table 2. The main barriers/challenges that limit involvement in CE activities in Serbia

Factors	Number of responses	Rang
lack/inconsistence of legislation and public strategy	12	1
the training level of employees	9	2
lack of interest of the residents in your area	7	3
coordination problems between companies	7	4
supply chain complexities	6	5
profitability issues	5	6
high start-up/ investment costs	5	7
quality issues in recycled materials	3	8

Source: Authors own calculations

Table 3. The opportunities that will motivate higher involvement in CE activities in Serbia

Factors	Number of responses	Rang
Financing opportunities (grants, subsidies, etc)	14	1
Environment protection	14	1
Stimulate innovation	12	2
Increased competitiveness	10	3
Reduce raw material dependence	4	4
Jobs creation	3	5

Source: Authors own calculations

Table 4. Most prominent industries that could generate added value as Circular Economy Business Model in Serbia

Which industries could generate more added value as Circular Economy Business Model in the region (range from 1 to 5)					
	Food	Battery	Textile	Packaging	Smart-City (IoT)
Mean	4.68	3.00	3.68	4.11	3.74
Std. Deviation	.671	1.054	1.204	1.049	1.195

Source: Authors own calculations

When we talk about industries that could generate more added value as a circular economy business model in our region, the respondents highlight agriculture, the food industry and general food production in the foreground. It is probably connected with the strong agricultural tradition and the high representation of agriculture and the food industry in the economy of Serbia. In the second place, respondents emphasize packaging industry, followed by third, that is the concept of smart cities and especially the problem of generating large amounts of waste food, and they see this as a potential for which the circular economy could provide a solution.

Table 5. Activities that are the most appropriate and easy to implement in organizations of CE respondents in Serbia

Factors	Number of responses	Rang
Reuse waste	9	1
Prioritise circular materials and approaches	8	2
Buy what you need	8	2
Make the most of what already exists	7	3
Extend the lifetime of machinery, equipment and goods	6	4
Mainstream regenerative agriculture	4	5
Put healthier and satiating foods first	4	5
Go local, seasonal and organic	2	6
Mainstream industrial symbiosis and efficiency	1	7

Source: Authors own calculations

Respondents from Serbia mostly agree that the reuse of waste, prioritizing circular materials and approaches, and buying only what you need are activities that they could manage to implement as soon as possible in terms of CE concept in their business or research area.

Finally, we asked our respondents to rate how well is CE promoted in Serbia, at different levels.

Table 6. How well are promoted and implemented the policies on the CE topic within the SMART specialization strategy at the regional level

	Frequency	Percent	Valid Percent
Well promoted but not implemented in organizations	5	26.3	26.3
Do not exist on CE topic	2	10.5	10.5
Do not know / do not respond	4	21.1	21.1
Exists but are not promoted well	8	42.1	42.1
Total	19	100.0	100.0

Source: Authors own calculations

Table 7. How well are promoted and implemented the policies on the CE topic within the SMART specialization strategy at the national level

	Frequency	Percent	Valid Percent
Well promoted but not implemented in organizations	6	31.6	31.6
Do not exist on CE topic	1	5.3	5.3
Do not know / do not respond	5	26.3	26.3
Exists but are not promoted well	7	36.8	36.8
Total	6	31.6	31.6

Source: Authors own calculations

Respondents from Serbia mostly agree that CE is not well promoted (42% at regional and 36.8% at national level), or if it is, then it is not implemented. Also, more than 20% do not know anything about the promotion of CE at regional and national level. Among the barriers, respondents pointed out lack/inconsistency of legislation and public policies and strategies, training level of employees, and lack of interest of residents, as well as coordination problems between companies.

Challenges and opportunities for circular economy: Evidence from DECIDE project in Serbia

Respondents from Serbia stated also that the topic of circular economy is quite new for them. Most have general, basic information and have a positive attitude towards the concept of circular economy. Indirectly, this defines the conclusion that significant efforts must be made to promote this topic and raise the general awareness of citizens, entrepreneurs and decision makers about this topic. This conclusion is followed by the observation that the population's lack of information is one of the key obstacles identified.

5. Conclusion

From all-above mentioned, we can conclude that the topic of circular economy is quite new for most of the stakeholders in Serbia. Most of them have general, basic information and positive attitudes towards the concept of circular economy.

Among the identified barriers, respondents highlighted the lack and inconsistency of legislation, inadequacies in public policies and strategies, insufficient training levels of employees, disinterest among residents, and coordination challenges between companies. Regarding opportunities to enhance involvement in circular economy (CE) activities in Serbia, the most prominent factor is financing, specifically the development of incentive measures by the administration to support entrepreneurs in implementing CE projects. Respondents advocate for stronger support for innovations in this area and emphasize the positive effects of these projects on increasing competitiveness. The majority also recognize the beneficial impacts of these projects on environmental protection and preservation. The food and packaging industries are identified as the most suitable for CE implementation in Serbia. Respondents generally agree on the feasibility of implementing waste reuse, prioritizing circular materials and approaches, and adopting a consumption model focused on buying only what is necessary. However, there is a consensus that CE is poorly promoted or inadequately implemented. Additionally, over 20% of respondents are unaware of any CE promotion efforts at regional and national levels.

Future research should be devoted to the promotion of this topic and raise the general awareness of citizens, entrepreneurs and decision and policy makers. Widening of the qualitative and quantitative research and new international and national projects including all stakeholders could be a beneficial for the CE in Serbia, too.

Acknowledgment:

This paper is a part of the research project „ DECIDE - Digital Services for Circular Economy - a Toolbox for Regional Developers & SME“, financed by the Danube Region Programme – Interreg Danube Program, European Union.

References

- Allwood, J. M., Ashby, M. F., Gutowski, T. G., & Worrell, E. (2011). Material efficiency: A white paper. *Resources, Conservation and Recycling*, 55(3), 362-381.
- Bogetić, S., Đorđević, D., Čočkalović, D., Đorđević, L., & Bakator, M. (2021). The circular economy and global market challenge. *Ecologica*, 28(101), 65-71.
- DECIDE - Digital Services for the Circular Economy - a Toolbox for Regional Developers & SME (2024). <https://interreg-danube.eu/projects/decide> Accessed on July 15th 2024.

- Droege, H., Raggi, A., & Ramos, T. B. (2021). Overcoming current challenges for circular economy assessment implementation in public sector organisations. *Sustainability*, 13(3), 1182.
- Ellen MacArthur Foundation (EMF). (2013). *Towards the circular economy*. Report. Retrieved from: https://www.werktrends.nl/app/uploads/2015/06/Rapport_McKinsey-Towards_A_Circular_Economy.pdf Accessed on 15 July 2015.
- Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, 127, 221-232.
- Kirchherr, J., Yang, N. H. N., Schulze-Spüntrup, F., Heerink, M. J., & Hartley, K. (2023). Conceptualizing the circular economy (revisited): an analysis of 221 definitions. *Resources, Conservation and Recycling*, 194, 107001.
- Korhonen, J., Honkasalo, A., & Seppälä, J. (2018). Circular economy: the concept and its limitations. *Ecological Economics*, 143, 37-46.
- Lacy, P., & Rutqvist, J. (2015). *Waste to wealth: The circular economy advantage* (Vol. 91). London: Palgrave Macmillan.
- Moraga, G., Huysveld, S., Mathieux, F., Blengini, G. A., Alaerts, L., Van Acker, K., ... & Dewulf, J. (2019). Circular economy indicators: What do they measure?. *Resources, Conservation and Recycling*, 146, 452-461.
- Nadeem, S.P., Garza-Reyes, J.A., Glanville, D. (2018). *The Challenges of the Circular Economy*. In: Conway, E., Byrne, D. (eds) *Contemporary Issues in Accounting* (pp. 37-60). Palgrave Macmillan, Cham.
- Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. J. (2018). Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe. *Resources, Conservation and Recycling*, 135, 70-82.
- Timus, M., & Ciucan-Rusu, L. (2024). *D.1.1.01 Maturity Report with Gap Analysis (SWOT)*. Report from DECIDE project.
- Van Buren, N., Demmers, M., Van der Heijden, R., & Witlox, F. (2016). Towards a circular economy: The role of Dutch logistics industries and governments. *Sustainability*, 8(7), 647.

IZAZOVI I MOGUĆNOSTI CIRCULARNE EKONOMIJE: DOKAZI IZ PROJEKTA DECIDE U SRBIJI

Rezime: Cirkularna ekonomija (CE) je relativno mlada u smislu definicija, istraživanja i implikacija. Promoviše odgovorno i ciklično korišćenje resursa, a odnosi se na koncept održivog razvoja. Danas se sve više vlada na svim nivoima, kompanija, nevladinih organizacija, itd. uključuje u različite CE inicijative sa ciljem da ostvare različite i pozitivne efekte u vezi sa korišćenjem resursa, smanjenjem zagađenja životne sredine, stvaranjem novih zelenih proizvoda, itd. CE nije bez ozbiljnih izazova i pitanja koja treba razmotriti. Stoga je glavni cilj ovog istraživačkog rada bio da se ispituju izazovi i mogućnosti koncepta cirkularne ekonomije u Srbiji. Istraživanje je urađeno u okviru aktivnosti na međunarodnom projektu DECIDE Dunavskog regiona koji je u fazi realizacije i traje 30 meseci. Kvalitativno istraživanje je sprovedeno u maju i junu 2024. godine u Republici Srbiji, intervjuisanjem 19 učesnika koji su angažovani u CE inicijativama u svojim poslovnim i istraživačkim oblastima. Podaci su analizirani kako bi se dobile informacije o potencijalnim izazovima sa kojima se suočavaju i mogućnostima koje vide za razvoj i implementaciju inicijativa CE.

Ključne reči: Cirkularna ekonomija, izazovi, mogućnosti, DECIDE projekat, Srbija.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**CIRCULAR ECONOMY AS A CHANCE FOR THE
DEVELOPMENT OF GREEN JOBS**

MSc Aleksandar Đolić •

PhD Biljana Đorđević *

MSc Sandra Milanović Zbiljić•

Abstract: *At the end of the 20th century, the concept of sustainable development and the rational consumption of resources became very important in all spheres of the global economy. Climate changes and their negative consequences for the environment have influenced the need to transition the economy from a linear one to a greener and more sustainable one, since the former is becoming one of the main polluters of the environment. In order to eliminate or, at least, suppress environmental problems, the concept of circular economy has been developed, which results in reducing the risk of environmental pollution and degradation while improving well-being and social equality. The transition to a green economy also leads to significant changes in the labour market. There is the creation of new workplaces, but also the redesign of existing ones, with the need to adapt to new requirements. This implies the need for continuous research in order to acquire new knowledge and create skills. Bearing in mind the above, the goal of this paper is to emphasise the role and importance of the circular economy in creating green jobs, both in the world and in Serbia.*

Keywords: *green jobs, circular economy, environmental protection.*

• PhD student, Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0009-0000-2976-9671, ✉ aleksandar199751@gmail.com

* Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0000-0001-7148-4821, ✉ biljana.djordjevic@eknfak.ni.ac.rs

• Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0000-0002-0582-045X, ✉ sandra.milanovic@eknfak.ni.ac.rs

UDC 338.1:502.131.1
331.5:502

1. Introduction

Challenges related to climate change, resource depletion and environmental degradation have contributed to the strengthening of the need for an accelerated transition to a green economy. The principles on which the green economy is based are directed towards a sustainable and environmentally responsible future and are based on the abolition of traditional resource-intensive economic models. In that line, many environmental economics experts are recently focused on building a sustainable economy. Their ambition is to change the system so that markets all around the world do not only benefit those who "extract" profit, but also all people, as well as the planet itself as such. Many of them have high hopes for the so-called green growth (growth that does not negatively affect the environment). In this regard, its supporters also refer to the history of innovation waves that have contributed to the revolutionary improvement of mankind's life possibilities (Attenborough, 2020).

Generally speaking, the green transition arose as a response to negative climate change caused by environmental neglect and destruction. The European Union (EU) also recognized this problem by seeing it as an existential threat. Therefore, it directed its efforts towards the creation of the "Green Agenda", which was designed as a concept for preserving, protecting and reducing the negative impact on the environment.

In order to eliminate or at least suppress environmental problems, in the literature the concept of circular economy has emerged. The main aims that this concept promotes are reducing the risk of environmental pollution and degradation on one side and, on the other, improving well-being and social equality. At the same time, it turned out that the development of the circular economy model has a positive effect on the increase in the number of so-called green jobs, both in developed and developing countries. Green jobs, as the embodiment of sustainable development that humanity strives for, are expected to contribute to the preservation and restoration of the environment, both in traditional sectors such as industry and construction as well as in new emerging green sectors such as renewable energy and sustainable agriculture. Therefore, they have a positive impact on reducing pollution, minimising the generation of new waste, reducing the emission of greenhouse gases, and lastly, but most importantly for human health, they support adaptation to climate change (Blagojević, 2022).

Bearing in mind the above, the goal of this paper is to show the importance and role of green workplaces, but also the entire context of the green economy, as the only rational solution in the current conditions of climate change.

The paper is structured by first giving an overview of the circular economy and its basic characteristics. After that, we will talk about the nature and importance of green jobs and then about the spread of green jobs in the Republic of Serbia. Concluding remarks will be given at the end of the paper.

2. Circular economy as ground for green jobs creation

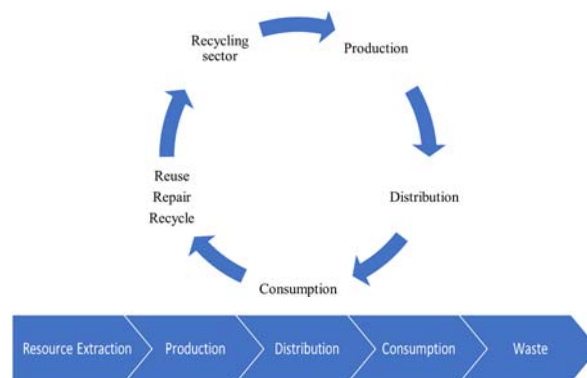
The circular economy is attracting more and more attention from both theoreticians and practitioners, and numerous definitions of this category have appeared. According to one of them, the circular economy means "long-term investment in raw materials and energy efficiency, with reduction of harmful emissions, replacement of fossil fuels with renewable energy sources, and production and trade of sustainable products, which closes the cycle

Circular Economy as a Chance for the Development of Green Jobs

product-waste-product" (Mitrović et al., 2015). On the other hand, some authors emphasise the economic side of the circular economy and point out that it represents an economic model that tries to extract the greatest possible value from the materials and energy used in products in order to avoid unnecessary and excessive consumption of raw materials and energy (Aleksić et al., 2023).

With its focus on reducing the gap between production processes and natural ecosystems, the circular economy represents a radical turn in relation to the traditional, linear economy. Namely, in the circular economy model, the main goal is that the product after use is not viewed as waste but as a raw material that is used again in the production process. On the other hand, in the linear economy model, when the final product is consumed, it is disposed of and becomes waste (Figure 1). In this way, a double loss occurs: a resource is lost and a negative impact on the environment is manifested.

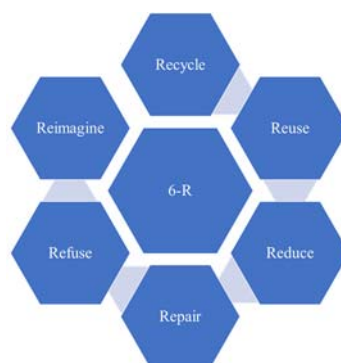
Figure 1. Circular economy vs. linear model of the economy



Source: Mitrović et al. (2015, pp. 9-10)

Although the circular economy emphasises the reuse of waste as raw material, this model of economy should not be equated with the practice of waste management. Circular economy is above the process of waste management because it is based on a completely new approach to use, i.e., use of resources. This approach is known as the “6-R” model (Figure 2).

Figure 2. 6-R model of circular economy



Source: Ministarstvo zaštite životne sredine Republike Srbije (2020, p. 11).

As it can be seen from Figure 2, the "6-R" model is a sustainable approach that includes six key strategies: Refuse (declining unnecessary resources or wasteful products), Reduce (minimising resource use and waste), Reuse (finding ways to use products multiple times), Repair (fixing items to extend their lifecycle), Recycle (reprocessing materials to create new products), and Rethink (reassessing consumption habits and sustainable alternatives) (Jawahir & Bradley, 2016).

The circular economy also exerts a strong influence on the labour market. In this regard, the jobs that may arise as a result of the greater participation of the circular economy in the overall economy of a country can be classified into several groups. According to Mitorvić & Jandrić (2021), these groups of jobs are the following:

1. Jobs that are directly related to circular economy activities (e.g., jobs related to renewable energy sources, waste management),
2. Jobs related to activities that support the circular economy (e.g., product design, application of digital technologies, etc.),
3. Jobs indirectly related to the circular economy (e.g., education).

The impact of the circular economy is certainly greater in certain activities. This impact is most evident in activities such as collection, treatment, and disposal of waste; reuse of waste materials; rehabilitation; reclamation; and other services in the field of waste management. Therefore, it is natural that the largest number of employees are in them. The following table shows the rates of municipal waste recycling, indirectly indicating the level of employment in this area (Table 1).

Table 1. Municipal waste recycling rate

<i>Country</i>	<i>Municipal waste recycling rate</i>		
	<i>2020</i>	<i>2021</i>	<i>2022</i>
Germany	70.3	69.3	61.1
France	41.7	43.8	41.8
Sweden	38.3	39.5	39.7
The Netherlands	56.9	57.8	57.5
Serbia	15.4	16.8	17.6

Source: Authors based on Eurostat database.

As can be seen from Table 1, the municipal waste recycling rate in Serbia is significantly behind the rates in developed EU countries. Although it is slightly increasing, the opportunities for growth of this activity, as well as employment, are still insufficiently used.

Bearing in mind that one of the conclusions of EU Agenda 21 is that the inclusion of organised recycling in the waste management system is a necessity, it is expected that there will be an increase in employment in this area. Some estimates say that this growth in the EU (including Great Britain) could amount to 0.3%, i.e., that the number of employees will increase by about 700,000.

Regardless of the final net effect on employment, the transition to a circular economy would lead to a significant redistribution of employment across sectors. Estimates of the impact on individual sectors, published by the International Labour Organisation (ILO), are shown in Table 2.

Circular Economy as a Chance for the Development of Green Jobs

Table 2. Sectors that will be most affected by the circular economy in terms of employment

<i>Activities with the largest increase in the number of employees (%)</i>		<i>Activities with the largest decrease in the number of employees (%)</i>	
<i>Sector</i>	<i>Workplace (%)</i>	<i>Sector</i>	<i>Workplace (%)</i>
Processing of secondary lead into new lead, zinc and tin	15	Production of electricity using coal	-0.9
Processing of secondary precious metals into new ones precious metals	11.2	Crude oil extraction and related services connected, except supervision	-0.9
Production of electricity using solar energy cell	4.9	Extraction, liquefaction and regasification of petroleum and of other gaseous materials	-0.9
Processing of secondary copper into new copper	4.3	Oil refineries	-0.8
Processing of secondary wood material into new wood material	4.2	Gas production and gas fuel distribution through pipelines	-0.8
Processing of secondary steel into new steel	3.1	Extraction of coal and lignite; peat extraction	-0.8
Processing of secondary aluminum into new aluminum	2.7	Extraction of natural gas and related services extraction of natural gas, except for supervision	-0.8

Source: Mitrović & Jandrić (2022, p. 4).

The activities in which there will be an increase in employment also represent a reservoir for the creation of green jobs, whose nature and potentials for creation will be discussed in more detail in the next part of the paper.

3. Nature and potentials for green jobs creation

The ILO defines green jobs as decent jobs that contribute to the preservation or restoration of the environment, either in traditional sectors, such as manufacturing and construction, or in new, emerging green sectors, such as which are renewable energy sources and energy efficiency (ILO, 2016). The ILO includes one additional criterion in defining green jobs, namely the fact that such jobs must meet the criteria for decent work, i.e., that workers should be adequately paid for their work, have guaranteed labour rights, and participate in social dialogue. and that they have the right to social protection (Filipović, 2022).

In practice, there is often a discrepancy between the number of jobs that meet the criteria of environmental protection but do not provide conditions for dignified work and cannot be considered green jobs in the sense of the ILO. One study conducted in Bangladesh

estimated that of the 3.5 million jobs in green sectors, less than a quarter (800,000) could be classified as green and decent jobs (Statista, 2024).

Green jobs have multiple importance. These jobs lead to improved efficiency in the use of energy and raw materials, contribute to the limitation of greenhouse gas emissions, reduce waste and pollution, enable the protection and restoration of eco-systems, reduce climate change, etc. (ILO, 2016).

Millions of green jobs already exist in industrialised and developing countries. According to data from 2020, the country with the largest number of employees in this field is China with 5.5 million workers, followed by the EU with 1.54 million workers, followed by Brazil with 1.4 million, the USA with 994,000, and India with 998,000 employees (Statista, 2024). The following table (Table 3) shows the number of green workplaces in certain European countries.

Table 3. Number of green workplaces by states

<i>Country</i>	<i>2020</i>	<i>2021</i>	<i>2022</i>
Denmark	81,845	85,652	89,232
Spain	461,480	504,736	530,979
Switzerland	159,639	165,901	167,735
Serbia	35,550	36,244	/

Source: Authors based on Eurostat database.

As can be seen from Table 3, the number of green jobs is growing from year to year both in the world and in our country, which is a good indicator of the commitment of countries in order to restore and protect the environment.

Although there is already significant employment in green jobs, the potential for further growth in the number of these jobs is huge. Especially in areas such as renewable energy sources, transport, recycling, and agriculture. Some predictions say that by 2030, employment in the field of energy production with the help of wind will increase by 2 million, while in the field of solar energy production there will be an increase of 6 million new jobs (ILO, 2016).

Generally speaking, employment growth can occur within three categories of green occupations. They are (Jandrić et al., 2024):

1. ***Occupations for which demand has increased due to the green transition (e.g., green enhanced demand).*** This group includes green occupations that already exist and for which the demand is increasing, but for which there are no significant changes in the way of working and the requirements for performing the work. In these occupations, the work context may change, but the tasks themselves do not change significantly.
2. ***Occupations in which the tasks, skills, and necessary knowledge change significantly (green enhanced skills).*** This category of occupations is characterised by a significant change in the requirements for performing the existing occupation. This impact may or may not lead to an increase in demand for the occupation, but the tasks, skills, and knowledge required have been changed by green economy activities and technologies.

Circular Economy as a Chance for the Development of Green Jobs

3. *Newly created occupations (e.g., green new and emerging).* This category of occupations includes occupations that have been generated under the influence of the circular economy. It can be a completely new occupation or an occupation born from an existing one.

Green jobs are less and less a choice and more and more a real market need as a result of a growing branch of the economy. A significant potential for the creation of green jobs is found in the sectors of renewable energy sources as well as green industries.

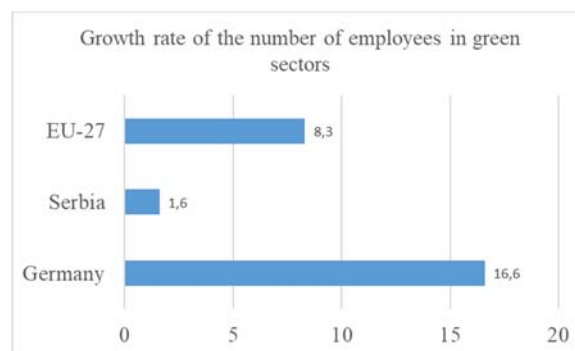
4. Green jobs in Serbia

The Republic of Serbia has defined EU accession as one of its highest goals. In addition to numerous requirements for harmonisation with EU policy and legislation, Serbia is expected to harmonise its environmental protection policy with the Sustainable Development Agenda until 2030 and other important documents that regulate the given area.

The largest part of employees in green business in Serbia is in activities such as water supply, waste water management, control of waste disposal processes, and waste collection (about 75%). The share in other activities that are significant for this sector is at a significantly lower level than in Germany. It is interesting to note that participation in professional, scientific, innovative, and technical activities in total employment is negligible. Such differences in the structure of employment could be an indication that green jobs in Serbia are represented above average in segments that require a lower level of education (Mitrović & Jandrić, 2022).

Figure 3 shows the growth rates of the number of employees in green sectors in the period from 2015-2019. It can be seen that there is noticeable growth in Serbia, but at a significantly lower level compared to Germany and the EU as a whole.

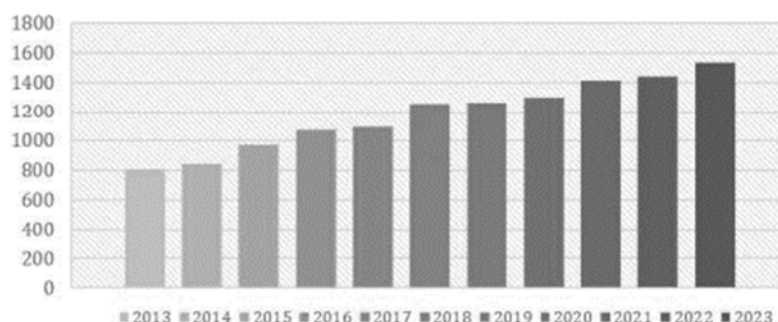
Figure 3. Change in the number of employees in green sectors from 2015-2019



Source: Mitrović & Jandrić (2022, p. 6).

By analysing workplaces in Serbia, it can be noticed a constant increase in the number of employees in the hazardous waste collection sector (Figure 4), which is a good indicator of progress in the field of environmental protection and preservation.

Figure 4. Number of employees in the collection of hazardous waste in Serbia in the period from 2013-2023



Source: Vukadinović et al. (2023).

As a result of many years of economic activity based on a linear economy, there are still over 3,500 illegal dumpsites and only 8 rehabilitated regional landfills in Serbia. In addition, only 5-7% of waste is recycled, while on an annual level, material worth 50 million euros is disposed of in unsanitary landfills (Arsić & Premović, 2021).

In accordance with EU policies, Serbia adopted the "Waste Management Program for the period 2022-2031." This program aims to improve the municipal waste management system through (EU for you, 2024):

- Increased rate of recycling,
- Reduced disposal of biodegradable waste in landfills,
- Reduced disposal of waste in unsanitary landfills.

The main goals of this program are to increase the recycling rate to 25% by 2025 and to 30% by 2030. In addition, the goal is to increase the use of recycled materials up to 60% by the end of 2030 and reduce the disposal of biodegradable waste by 75% in the same period. At the same time, this will enable the creation of around 30,000 new jobs.

5. Conclusion

Sustainable development, environmental protection, and the transition from a linear to a circular economy represent a new social and economic reality in the world. The green transition that is underway and whose effects will manifest in the future is a reality to which the public and private sectors must adapt. At the same time, this means the opening of a large number of green jobs that require special knowledge and skills to perform specific activities. In order for this plan to be successful in practice, it is necessary to adapt society and the governments of the countries, which will facilitate the adaptation process itself through incentives for transition and subsidies. Also, it is necessary to transform the educational system in certain areas so that it is possible for individuals to acquire specific (green) knowledge and skills. The change in the awareness of individuals about the importance of environmental protection and the need to involve the entire society is also significant. When it comes to Serbia, some of the recommendations for further development are as follows (Ministarstvo zaštite životne sredine Republike Srbije, 2020):

Circular Economy as a Chance for the Development of Green Jobs

1. The transition to a circular economy will contribute to faster economic growth, greater well-being, and better health for citizens and future generations.
2. Serbia cannot become a member of the European Union without changing policies and sustainable use of resources.
3. Systematic development of creation and implementation of sustainable resource policy and transition to circular economy business models is needed.
4. Changing the energy policy and promoting sustainable energy sources is part of a successful, systematic, and strategic transition.
5. Institutional support for the inclusion of all identified actors for the circular economy on the path of transition will enable the continuity and efficiency of the initiated process of circular transition.

In order to achieve the transition from a conventional to a circular economy, it is necessary to implement and implement changes in the entire life cycle of products, starting from product design to new business and market models, as well as new ways of converting waste into resources. All these activities should create a positive climate for the application of the concept of sustainable development, and this will enable the opening of an increasing number of green jobs and investments in both the public and private sectors. Serbia has a huge potential in the development of the green and circular economy, which is directly related to green jobs and increasing the employment rate. The circular economy represents a chance for the accelerated development of Serbia, greater competitiveness of Serbia and the creation of new jobs. This requires the application of new technologies and the modernization of society, greater involvement of all actors, a change in awareness, but also in the previous patterns of behaviour and business models. Green jobs have and will certainly have far-reaching effects on employment and the functioning of the labour market, because the issue of sustainable development is one of the most important for all countries in the world.

References

- Aleksić, I., Vujović, T., & Arsić, L. (2023). Zelena i cirkularna ekonomija kao simboli brige o zaštiti životne sredine. *Green and circular economy as symbols of environmental protection*, 30(110), 180-188.
- 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*, (pp. 155-167).
- Attenborough, D. (2020). *A life on our planet: My witness statement and a vision for the future*. Random House.
- Blagojević, S. (2022). Evolucija koncepta i značaj zelenih poslova kao pokretača održivog razvoja. In *16. Međunarodni simpozijum o korporativnom upravljanju* (pp. 473-495). Finrar doo Banja Luka.
- EU for you (2024). *EU FOR ENVIRONMENT- Promoting waste source separation in 4 regions*. Available at: <https://www.euzatebe.rs/en/projects/eu-for-environment--promoting-waste-source-separation-in-4-regions> (accessed September 20, 2024).
- Eurostat (2024). Eurostat database. Available at: <https://ec.europa.eu/eurostat/databrowser/> (accessed September 5, 2024).
- Filipović, S. (2022). Analiza-zelena tranzicija u privredi i efekti na obrazovni sistem u Srbiji.
- ILO (2016). The green jobs programme. Available at: <https://www.ilo.org/media/442286/download> (accessed September 16, 2024).

- Jandrić, M., Mitrović, Đ., Tanasković, S., & Fabian, V. (2024). Zelena ekonomija i tržište rada—primer Srbije. In Conference proceeding “Cirkularna (bio)ekonomija teorijski i praktični aspekti” (pp. 155-167).
- Jawahir, I. S., & Bradley, R. (2016). Technological elements of circular economy and the principles of 6R-based closed-loop material flow in sustainable manufacturing. *Procedia Cirp*, 40, 103-108.
- Ministarstvo zaštite životne sredine Republike Srbije (2020). *Mapa puta za cirkularnu ekonomiju*. Available at: <https://www.ekologija.gov.rs/sites/default/files/2021-01/mapa-puta-za-cirkularnu-ekonomiju-u-srbiji.pdf> (accessed September 10, 2024).
- Mitrović, Đ. & Jandrić, M. (2022). *Tranzicija ka cirkularnoj ekonomiji i izazovi za tržište rada*. Beograd: Friedrich Ebert Stiftung. Available at: <https://library.fes.de/pdf-files/bueros/belgrad/19702.pdf> (accessed September 15, 2024).
- Mitrović, Đ., & Jandrić, M. (2021). Tranzicija ka cirkularnoj ekonomiji i promene na tržištu rada. *Praščević, A., Fabris, N. (urednici) Stanje i perspective ekonomske misli—uticaj ekonomskih recesija u prvim decenijama XXI veka, tematski zbornik radova* (151-167).
- Mitrović, S., Radosavljević, I., & Veselinov, M. (2015). *Cirkularna ekonomija u Srbiji: Prilika za budući razvoj održivog društva*. OEBS. Available at: <https://www.osce.org/files/f/documents/a/5/292311.PDF> (accessed on September 20, 2024).
- Statista (2024). *Number of renewable energy related-jobs worldwide*. Available at: <https://www.statista.com/statistics/243274/number-of-renewable-energy-related-jobs-worldwide> (accessed September 16, 2024).
- Vukadinović, S., Andrejević Panić, A., & Jesić, J. (2023). Zelena tranzicija, tržište rada i inflacija u Republici Srbiji. In *Proceedings from the scientific conference “Green transition in the economy-situation and perspectives” 12. oktobar 2023, Sremska Kamenica* (pp. 118-126). Univerzitet Educons.

CIRKULARNA EKONOMIJA KAO ŠANSZA ZA RAZVOJ ZELENIH RADNIH MESTA

Rezime: Krajem 20. veka, koncept održivog razvoja i racionalna potrošnja resursa postali su veoma važni u svim sferama globalne ekonomije. Klimatske promene i njihove negativne posledice po životnu sredinu uticali su na potrebu tranzicije ekonomije od linearne ka zelenijoj i održivoj budućnosti da ova prva postaje jedan od glavnih zagađivača životne sredine. U cilju eliminisanja ili, barem, suzbijanja ekoloških problema, razvijen je koncept cirkularne ekonomije koji rezultira smanjenjem rizika od zagađenja i degradacije životne sredine, uz poboljšanje dobrobiti i društvene jednakosti. Tranzicija ka zelenoj ekonomiji dovodi i do značajnih promena na tržištu rada. Dolazi do kreiranja novih radnih mesta, ali i redizajniranja postojećih, uz potrebu prilagođavanja novim zahtevima. To podrazumeva i potrebu kontinuiranog istraživanja u cilju sticanja novih znanja i kreiranja veština. Imajući u vidu navedeno, cilj rada je da se naglasi uloga i značaj cirkularne ekonomije u kreiranju zelenih radnih mesta, kako u svetu, tako i u Srbiji.

Ključne reči: zelena radna mesta, cirkularna ekonomija, zaštita životne sredine.



Faculty of Economics, University of Niš
13 October 2023

International Scientific Conference
**SMART AND SUSTAINABLE ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**MOTIVIES OF WOMEN TO START ENTREPRENEURIAL
ACTIVITY IN MANUFACTURING**

Danijela Stošić Panić, PhD*

Aleksandra Anđelković, PhD*

***Abstract:** The study provides evidence on women's motivations to engage in entrepreneurship. In doing this, it researches women entrepreneurs in a developing country and a masculinized manufacturing sector, enriching the theory with results from under-researched contexts. The study, based on a sample of 300 female entrepreneurs in the Serbian manufacturing industry, reveals a diversified motivational base of women to start businesses. The motives of women entrepreneurs are a mix of pull and push motives, and the push ones are not dominating the spectrum. The importance of some of the motives is different depending on women's education, work status, prior experience, and age.*

Keywords: female, entrepreneurship, gender, production, Serbia

1. Introduction

The importance of an individual's motivation for starting and carrying out an entrepreneurial activity is unquestionable. Motives determine the choice of an occupation, job satisfaction, performance, and success of female entrepreneurs (Cabrera & Mauricio, 2017; Carree and Verheul 2012; Kabbara, 2023; Sullivan & Meek, 2012). Women's choice of industry for carrying out entrepreneurial activity depends on their motivation (Anna et al., 2000). Motivation affects the attitude toward business growth, and entrepreneurs' perception of business success (Morris et al., 2006; Weber 2014). It determines the choice of the form of entrepreneurial activity, especially in specific niches such as social entrepreneurship or the so-called mumpreneurship (Cardella et al., 2020; Rodrigues et al., 2022).

* University of Niš, Faculty of Economics, Serbia; ✉ danijela.stosic@eknfak.ni.ac.rs

* University of Niš, Faculty of Economics, Serbia,

✉ aleksandra.andjelkovic@eknfak.ni.ac.rs

UDC 334.722-055.2

Although the importance of motives is undoubted, there is no consensus on which motives are key for women's entrepreneurial activity. Research on women entrepreneurs' motivation offers mixed results. This leads to the conclusion that entrepreneurs are motivated by a dynamic mix of motives, both financial and social. Nevertheless, the complexity of women entrepreneurs' motives is blurred by the dominance of two push motives: flexibility to obtain work-family balance and the escape from the glass ceiling (Dean et al., 2019). Despite the heterogeneous spectrum of entrepreneurial motives, entrepreneurship is still seen primarily in the light of its economic functions and contributions. Popular media romanticize *gazelles* and the superhero entrepreneurs who lead them. In contrast to mainstream studies that emphasize these functions, in the ghettoized fields of entrepreneurship research (such as women entrepreneurship), the heterogeneity of motives is more visible (Baker & Welter, 2017).

Every form of entrepreneurship is embedded in certain social, cultural, and political institutions that influence the values, norms, motives, and behaviors of individuals (McAdam, 2023). The context in which entrepreneurial activity takes place is important because it affects the motives, attitudes, and entrepreneurial goals (Baker & Welter, 2017; Coleman & Robb, 2012). That is why a comprehensive theory of entrepreneurship requires extensive evidence from different sociological, cultural, and economic environments (Treanor, 2022). For example, the main entrepreneurial motives differ in developed and less developed societies (Love et al., 2023; Moreira et al., 2019). Nevertheless, most of the research on entrepreneurship has been conducted in developed countries, with research in the Anglo-Saxon context being the dominant one (Cabrera & Mauricio, 2017; Henry et al., 2016). This shortcoming is particularly pronounced in the research on women's entrepreneurial activity. Moreover, the literature lacks research on female entrepreneurs in gender-atypical activities such as manufacturing (Henry et al., 2016). The present study fills these gaps.

To explore the motives of women to start entrepreneurial activity in the manufacturing industry, this paper is structured as follows. After these introductory remarks, a literature review and research hypotheses are presented. Research results are elaborated within the third section of the paper, which then ends with a brief conclusion.

2. Literature review and hypotheses development

Entrepreneurship is a process, rather than a one-time activity or event. It begins with motivation and continues with identifying opportunities, securing resources, and achieving certain performances, after which an entrepreneur may leave the business (Cabrera & Mauricio, 2017). Acknowledging Baron's and Henry's (2011) framework, the present study aims to explore women entrepreneurs' motivation in the prelaunch phase of the entrepreneurial process.

The motivation of women to start an entrepreneurial activity is heterogeneous (Henry et al., 2021), and there is no consensus on the dominant motives (Corrêa et al., 2022). Motives of women to start a business can be financial and non-financial, such as independence, challenge, and the possibility of combining work and family obligations (Carree & Verheul, 2012). These heterogeneous motives of women to start an entrepreneurial activity are often categorized as *push* and *pull* motives, and both can be from the internal (personal) and external environment of future entrepreneurs (Dawson & Henley, 2012). Thus, for example, lack of alternative opportunities and unemployment are

Motives of Women to Start Entrepreneurial Activity in Manufacturing

external push factors, while market opportunities are pull factors from the external environment. An internal push motive can be dissatisfaction with the existing job, and the desire for autonomy and challenges can be considered an internal pull motive for starting an entrepreneurial activity.

Entrepreneurship is chosen by women who want to have control over their advancement (avoiding the glass ceiling), control over performance, and those who want to create a better work environment (Sullivan & Meek, 2012). Women are also motivated by the possibility of flexible working hours to balance their work and family obligations. Although women also value financial success, they do so to a lesser extent than men. Jamali (2009) argues that push motives are more significant for women and that entrepreneurship is a survival strategy for them to face constraints in the labor market or balance their multiple roles. Nevertheless, the so-called pull motives, including independence, challenge, satisfaction, and success, are also important for women entrepreneurs. Women see entrepreneurship as a way to overcome the glass ceiling, to achieve autonomy and independence, and balance their business and family activities more effectively. They expect different outcomes of entrepreneurial success, with secondary importance of financial motives and dominance of those that refer to quality of life (Sullivan & Meek, 2012). Because they expect broad benefits from entrepreneurship, it is argued that women have diverse motives to start entrepreneurial activity.

It is no secret that there is a gender-based segregation of occupations and that certain sectors, such as production or hi-tech, are masculinized (Anna et al., 2000; Cabrera & Mauricio, 2017; Cardella et al., 2020; Elam & Terjesen, 2010; McAdam, 2023). This affects the motivation of women to start a business in those sectors. Also, there is evidence that suggests that the motivation of female entrepreneurs may differ depending on whether they operate in traditionally female industries or in industries that are atypical for women. For example, Anna et al. (2000) find that women entrepreneurs who operate in the so-called traditional industries are attracted to entrepreneurship by some business opportunities, while the women owners in industries nontraditional for women are pushed into entrepreneurship by some negative events. Moreover, the motivation of entrepreneurs can be influenced by their age, education, and prior experience (Hailemariam & Kroon, 2018; Huarng et al., 2012). Also, motivation may differ with different working choices in entrepreneurship, such as the length of working hours or working from home (McAdam, 2023). Within the presented review, we expect that:

H1. Female entrepreneurs have diverse motives to start businesses in manufacturing.

H2. The importance of motives for entering entrepreneurship will differ based on female entrepreneurs' education, prior experience, work status, and age.

3. Methodology

3.1. Data and variables

3.1.1. Dataset

The target research population consists of business entities whose founders and legal representatives are women, and whose activity is predominantly in the Manufacturing Industry. The database of the Serbian Agency for Business Registers is used as a sample

frame. A stratified simple random sample is chosen. The stratification is obtained in the intersection of the legal form (limited liability companies, entrepreneurs, and others), size (up to 10, 10-49, 50-249, and more than 250 employees), and region (Vojvodina, Beogradski, Šumadija and Zapadna Srbija, Južna and Istočna Srbija).

A questionnaire with a combination of open and closed questions is used to collect data. A Likert 5-point scale is used for scaling. An agency for public opinion research was hired to conduct telephone interviews with sample units. A total of 300 filled questionnaires are obtained. The research was carried out during January and February 2024.

3.1.2. Variables

Dependent variables are measured on a 5-point Likert scale (1-not important at all, 5-highly important) and they refer to different motives to start the entrepreneurial activity, including the following: higher earnings, the flexibility of working hours, being own boss (independence and autonomy), entrepreneurship as the only option for employment, inability for career advancement, desire for success and self-affirmation, continuity of the family tradition, status, and prestige, contribution to the society.

The difference in the importance of the motives for starting their own business in manufacturing is assessed between the following independent groups of respondents: education (level and field), working hours, work from home, previous work experience, and the age of female entrepreneurs.

3.2. Methods

One-sample t-test is used to evaluate the importance of certain motives for female entrepreneurs, whereby the value 3 (as the central point on the used Likert scale) was taken as the test value. The one-way multivariate analysis of variance (one-way MANOVA) is used to determine whether there are any differences between independent groups on dependent variables. SPSS v. 29 is used as technical support for statistical analysis.

4. Results and Discussion

Table 1 presents basic descriptive statistics on women entrepreneurs in the Serbian manufacturing sector. On average, a female entrepreneur in the Serbian manufacturing sector is a middle-aged woman, most likely with a secondary or higher education. Social and humanistic sciences are their dominant field of education, while less than one-third of female entrepreneurs are educated in the field of natural and technical-technological sciences. The largest number of female entrepreneurs in the Serbian manufacturing sector work full time, while almost half of them work from home, producing to order. For most female entrepreneurs, owning and operating their own business is not their first work experience. Before starting their own business, female entrepreneurs spent an average of 9 years in some other employment status. Nevertheless, almost a third of women in manufacturing started an entrepreneurial activity without previous work experience.

Table 1. Descriptive statistics on women entrepreneurs in manufacturing (n=300)

Age	<i>Minimum</i> 20		<i>Maximum</i> 79	<i>Mean</i> 49	<i>St. Dev.</i> 10.47
Education (level) %	<i>Without school</i> 0	<i>Elementary school</i> 2	<i>Secondary school</i> 59	<i>College</i> 7	<i>Faculty</i> 32
Education (field)* %	<i>Interdisciplinary</i> 1	<i>Arts</i> 2	<i>Medicine</i> 6	<i>Natural sciences</i> 6	<i>Technical science</i> 32
					<i>Social sciences and humanities</i> 45
Previous work experience**	<i>Minimum</i> 0		<i>Maximum</i> 40	<i>Mean</i> 9	<i>St. Dev.</i> 9.77
Full-time work %				<i>Yes</i> 88	<i>No</i> 12
Work from home %				<i>Yes</i> 46	<i>No</i> 54
Production processes %	<i>Unique</i> 13		<i>To order</i> 56	<i>Serial</i> 23	<i>Mass</i> 7

Note: * Field of education of 8% of women entrepreneurs is unknown; ** 93 women entrepreneurs didn't have any working experience before starting their own business.

Source: Authors' calculations

Except for two (inability of career advancement and continuation of family tradition), the mean score of the importance of all other motives is statistically significantly higher than 3, which implies a wide range of important motives that stimulate women to enter entrepreneurship in manufacturing (Table 2). Independence and autonomy in work (to be their own boss) are the most important motives for women to start an entrepreneurial activity in manufacturing. This is followed by two also affirmative motivations for entrepreneurship, including the desire for success and self-affirmation, and the ability to contribute to society. The continuation of a family tradition is the least significant motive for women to start their own manufacturing business. These results support previous findings that the motivational base of female entrepreneurs is wide (Baker & Walter, 2017; Henry et al., 2021; Irene, 2018; Lisowska & Leszczynski, 2023), and that it represents a combination of push and pull motives (Jamali, 2009). This confirms the first hypothesis. With the flexibility of working hours being in the middle of the list, while the inability to advance is the second most unimportant motive, our results also support Dean's et al. (2019) argument to reject overestimation of the importance of work-time flexibility and escape into entrepreneurship from the paid-employment glass ceiling.

As for the second hypothesis, motives are equally important for female entrepreneurs regardless of whether they work from home or not, and regardless of their level and field of education. Nevertheless, for women with less than a higher education and those with a degree in a field other than social sciences and humanities, entrepreneurship was to a greater extent the only employment option. Moreover, for the latter, entrepreneurship was chosen to a greater extent because of the impossibility of advancing in the paid employment sector. These results imply that education affects the motivation and work circumstances of women entrepreneurs, as suggested by Huarng et al. (2012).

There is a statistically significant difference in the importance of entrepreneurial motives based on women entrepreneurs' prior work experience, length of their working hours, and their age. Thus, becoming an entrepreneur to continue family tradition is more important for female entrepreneurs without prior work experience. There is evidence showing that a family entrepreneurial background stimulates an individual to become an entrepreneur (Sullivan & Meek, 2012). So, our results are somewhat expected, since the lack of previous work experience may indicate that these women gained their first work experience in the family business, which they then continued to run as their own.

Female entrepreneurs who work full-time are motivated to establish their own businesses to a greater extent by the possibility of earning more, but also to achieve the status and prestige that entrepreneurship brings. Moreover, entrepreneurship was largely the only employment option for them. Since the length of working hours affects entrepreneurial performance (Cabrera & Mauricio, 2017; Henry et al., 2017; Panda, 2018; Watson et al., 2017), it is not surprising that women who are motivated by higher earnings, perform full-time entrepreneurial activities. Moreover, the absence of other employment options for this group of women entrepreneurs motivates them to allocate the full working hours to the business they own. On the other hand, it is possible that women who have other employment options also perform some other job, in addition to running their own business with part of their working time.

Table 2. Women entrepreneurs' motives to start own business in manufacturing

		Higher earnings	Working hours flexibility	Be own boss	Only employment option	Inability for career advancement	Desire for success and self-affirmation	To continue family tradition	Status and prestige	Contribution to society
All		3.65***	3.93***	4.39***	3.33***	3.07	4.18***	2.90	3.24**	4.15***
Level of education	Secondary	3.68	3.87	4.39	3.59***	3.12	4.22	2.88	3.32	4.19
		3.61	4.02	4.39	2.92***	3.01	4.11	2.92	3.13	4.09
	Higher						F (9, 290)=1.836, p=.062, Wilk's Λ =.946, partial η^2 =.054			
Field of education	Social sciences and humanities	3.79	3.94	4.38	3.12*	2.86*	4.10	2.87	3.18	4.15
	Other	3.55	3.92	4.37	3.56*	3.30*	4.28	2.91	3.27	4.18
							F (9, 268)=1.307, p=.233, Wilk's Λ =.958, partial η^2 =.042			
Previous work experience	Yes	3.64	3.84	4.30	3.25	3.13	4.15	2.75*	3.25	4.15
	No	3.69	4.12	4.58	3.51	2.95	4.23	3.21*	3.23	4.15
							F (9, 290)=2.145, p=.026, Wilk's Λ =.938, partial η^2 =.062			
Full-time work	Yes	3.73*	3.89	4.41	3.44**	3.12	4.16	2.91	3.32*	4.16
	No	3.13*	4.22	4.24	2.57**	2.73	4.27	2.81	2.73*	4.12
							F (9, 290)=2.850, p=.003, Wilk's Λ =.919, partial η^2 =.081			
Work from home	Yes	3.56	4.06	4.38	3.41	3.12	4.24	2.82	3.33	4.17
	No	3.72	3.81	4.39	3.25	3.03	4.12	2.96	3.17	4.14
							F (9, 290)=.897, p=.528, Wilk's Λ =.973, partial η^2 =.027			
Age	up to 49	3.78	4.25***	4.58**	3.15	3.07	4.34*	3.13*	3.26	4.23
	50+	3.53	3.63***	4.21**	3.49	3.08	4.00*	2.68*	3.22	4.08
							F (9, 290)=3.520, p<.001, Wilk's Λ =.902, partial η^2 =.098			

Notes: *p<.05; **p<.01; ***p<.001

Source: Authors' calculations

Finally, for younger female entrepreneurs (up to 49 years old), the flexibility of working hours, autonomy, and independence that this employment option entails is of greater importance for starting an entrepreneurial activity. Also, they are motivated to a greater extent by the desire for success and personal achievement, as well as by the desire to continue the family tradition. These results support the argument that the age of entrepreneurs affects their motivations (Hailemariam & Kroon, 2018). Overall, the second hypothesis is partially confirmed.

5. Conclusions

Women have diverse motives to enter entrepreneurship in manufacturing. To be independent, or to be own boss is the most important motive for them to start a business, while continuation of a family tradition is the last reason to engage in entrepreneurial activities. Overall, women's motivational background for entrepreneurship is a mixture of a variety of pull and push motives. Nevertheless, women entrepreneurs are not a homogeneous population. So, they differ in terms of dominant motives for entrepreneurship. Thus, the education that women have will determine the importance of motives that reflect their choice of entrepreneurship due to their unfavorable position on the labor market (impossibility of employment for salary and advancement in the sector of paid employment). Women's motives to start a business in manufacturing differ based on their age, previous experience, and the fact whether they choose to work full-time or not.

This study explores the motives of women entrepreneurs in a developing country and in manufacturing which is an untypical industry for women entrepreneurship. Thus, it provides evidence from under-researched contexts and contributes to a holistic perspective on entrepreneurs and entrepreneurship. The study is a response to the call to better understand entrepreneurs' motives because the personal and business goals of an entrepreneur are more interconnected than in the case of a manager of a large company (Watson, 2020). In addition to theory development, this is also important for practitioners because when defining policies or providing advisory support, one should be aware of the different motives and goals that entrepreneurs have (Watson et al., 2017).

Acknowledgment:

This research was supported by the Science Fund of the Republic of Serbia, Grant #1012, Researching Women Entrepreneurs' Management Practice in order to Improve their Competences to Achieve Business Success – WE-Succeed

References

- Anna, A. L., Chandler, G. N., Jansen, E. W. & Mero, N. P. (2000). Women business owners in traditional and non-traditional industries. *Journal of Business Venturing*, 15 (3), 279–303. [https://doi.org/10.1016/s0883-9026\(98\)00012-3](https://doi.org/10.1016/s0883-9026(98)00012-3)
- Baker, T. & Welter, F. (2017). Come on out of the ghetto, please! – Building the future of entrepreneurship research. *International Journal of Entrepreneurial Behaviour & Research*, 23 (2), 170–184. <https://doi.org/10.1108/ijebr-02-2016-0065>
- Baron, R. & Henry, R. (2011). Entrepreneurship: the genesis of organizations. In: Zedeck, S. (Ed.), *APA handbooks in psychology®. APA Handbook of industrial and organizational*

Motives of Women to Start Entrepreneurial Activity in Manufacturing

- psychology, Vol. 1. Building and developing the organization* (pp. 241–273). Washington DC: American Psychological Association APA.
- Cabrera, E. M. & Mauricio, D. (2017). Factors affecting the success of women's entrepreneurship: a review of literature. *International Journal of Gender and Entrepreneurship*, 9 (1), 31–65. <https://doi.org/10.1108/ijge-01-2016-0001>
- Cardella, G. M., Hernández-Sánchez, B. R. & Sánchez-García, J. A. (2020). Women Entrepreneurship: A Systematic Review to Outline the Boundaries of Scientific Literature. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.01557>
- Carree, M. & Verheul, I. (2012). What Makes Entrepreneurs Happy? Determinants of Satisfaction Among Founders. *Journal of Happiness Studies*, 13 (2), 371–387. <https://doi.org/10.1007/s10902-011-9269-3>
- Coleman, S. and Robb, A.M. (2012). *A Rising Tide: Financing Strategies for Women-Owned Firms*. Stanford, California: Stanford University Press.
- Corrêa, V. S., De Lima, R. M., Da Silva Brito, F. R., Machado, M. C. & Nassif, V. M. J. (2022). Female entrepreneurship in emerging and developing countries: a systematic review of practical and policy implications and suggestions for new studies. *Journal of Entrepreneurship in Emerging Economies*. <https://doi.org/10.1108/jeee-04-2022-0115>
- Dawson, C. and Henley, A. (2012). 'Push' versus 'Pull' entrepreneurship: an ambiguous distinction? *International Journal of Entrepreneurial Behavior & Research*, 18 (6), 697–179.
- Dean, H., Larsen, G., Ford, J. & Akram, M. (2019). Female Entrepreneurship and the Metanarrative of Economic Growth: A Critical Review of Underlying Assumptions. *International Journal of Management Reviews*, 21 (1), 24–49. <https://doi.org/10.1111/ijmr.12173>
- Elam, A. & Terjesen, S. (2010). Gendered Institutions and Cross-National Patterns of Business Creation for Men and Women. *The European Journal of Development Research*, 22 (3), 331–348. <https://doi.org/10.1057/ejdr.2010.19>
- Hailemariam, A. & Kroon, G. (2018). Redefining success beyond economic growth and wealth generation: the case of Ethiopia. In: Yousafzai, S., Fayolle, A., Lindgreen, A., Henry, C., Saeed, S. & Sheikh, S. (Eds.), *Women Entrepreneurs and the Myth of Underperformance* (pp. 3-19). Cheltenham, UK: Edward Elgar.
- Henry, C., Coleman, S., Foss, L., Orser, B. & Brush, C. G. (2021). Richness in diversity: Towards more contemporary research conceptualizations of women's entrepreneurship. *International Small Business Journal*, 39 (7), 609–618. <https://doi.org/10.1177/02662426211020608>
- Henry, C., Foss, L. & Ahl, H. (2016). Gender and entrepreneurship research: A review of methodological approaches. *International Small Business Journal*, 34 (3), 217–241. <https://doi.org/10.1177/0266242614549779>
- Henry, C., Orser, B., Coleman, S. & Foss, L. (2017). Women's entrepreneurship policy: a 13 nation cross-country comparison. *International Journal of Gender and Entrepreneurship*, 9 (3), 206–228. <https://doi.org/10.1108/ijge-07-2017-0036>
- Huang, K.-H., Mas-Tur, A. & Yu, T. H.-K. (2012). Factors affecting the success of women entrepreneurs. *International Entrepreneurship and Management Journal*, 8 (4), 487–497. <https://doi.org/10.1007/s11365-012-0233-4>
- Irene, B. (2018). Women entrepreneurs in South Africa: maintaining a balance between culture, personal life and business. In: Yousafzai, S., Fayolle, A., Lindgreen, A., Henry, C., Saeed, S. & Sheikh, S. (Eds.), *Women Entrepreneurs and the Myth of Underperformance* (pp. 90-106). Cheltenham, UK: Edward Elgar.
- Jamali, D. (2009). Constraints and opportunities facing women entrepreneurs in developing countries. *Gender in Management: An International Journal*, 24 (4), 232–251. <https://doi.org/10.1108/17542410910961532>

- Kabbara, D. (2023). Female Entrepreneurship: Typologies, Drivers and Value Creation. In: Cullen, U. A. (Ed.), *New Horizons and Global Perspectives in Female Entrepreneurship Research* (pp. 93-112). Emerald Publishing Limited.
- Lisowska, E. & Leszczynski, D. (2023). Barriers to women's entrepreneurship in Poland and institutional support. In: Henry, C., Coleman, S. & Lewis, K. (Eds.), *Women's Entrepreneurship Policy* (pp. 162-191). Cheltenham, UK: Emerald Publishing Limited.
- Love, I., Nikolaev, B. & Dhakal, C. (2023). The well-being of women entrepreneurs: the role of gender inequality and gender roles. *Small Business Economics*. <https://doi.org/10.1007/s11187-023-0076Kak9-z>
- McAdam, M. (2023). *Women's Entrepreneurship*. Abingdon, Oxon: Routledge.
- Moreira, J., Marques, C. S., Braga, A. & Ratten, V. (2019). A systematic review of women's entrepreneurship and internationalization literature. *Thunderbird International Business Review*, 61 (5), 635-648.
- Morris, M. H., Miyasaki, N. N., Watters, C. E. & Coombes, S. M. (2006). The Dilemma of Growth: Understanding Venture Size Choices of Women Entrepreneurs. *Journal of Small Business Management*, 44 (2), 221-244. <https://doi.org/10.1111/j.1540-627x.2006.00165.x>
- Panda, S. (2018). Constraints faced by women entrepreneurs in developing countries: review and ranking. *Gender in Management: An International Journal*, 33 (4), 315-331. <https://doi.org/10.1108/gm-01-2017-0003>
- Rodrigues, M., Daniel, A. D. & Franco, M. (2022). What is important to know about mumpreneurship? A bibliometric analysis. *The International Journal of Organizational Analysis*. <https://doi.org/10.1108/ijoa-05-2022-3293>
- Sullivan, D. M. & Meek, W. R. (2012). Gender and entrepreneurship: a review and process model. *Journal of Managerial Psychology*, 27 (5), 428-458. <https://doi.org/10.1108/02683941211235373>
- Treanor, L. (2022). Gender, STEM women and entrepreneurship: a review and future research directions. *International Journal of Gender and Entrepreneurship*, 14 (4), 499-520. <https://doi.org/10.1108/ijge-06-2022-0094>
- Watson, J. (2020). Exposing/correcting SME underperformance myths. *International Journal of Gender and Entrepreneurship*, 12 (1), 77-88. <https://doi.org/10.1108/ijge-04-2019-0086>
- Watson, J., Stuetzer, M. & Zolin, R. (2017). Female underperformance or goal-oriented behaviour? *International Journal of Gender and Entrepreneurship*, 9 (4), 298-318. <https://doi.org/10.1108/IJGE-03-2017-0015>
- Weber, P.G. (2014). Gender related perceptions of SME success. *International Journal of Gender and Entrepreneurship*, 6 (1), 15-27.

MOTIVI ZA PREDUZETNIČKU AKTIVNOST ŽENA U PROIZVODNOM SEKTORU

Rezime: Studija obezbeđuje evidenciju o motivima žena za otpočinjanje preduzetničke aktivnosti. Ona istražuje preduzetnice u zemlji u razvoju i u maskuliniziranom sektoru proizvodnje, obogaćujući na taj način teoriju rezultatima iz konteksta koji su manje istraživani. Na uzorku od 300 preduzetnica u prerađivačkoj industriji u Srbiji, studija pronalazi da je motivaciona baza žena za osnivanje sopstvenog posla diverzifikovana. Motivi preduzetnica predstavljaju miks motiva koji guraju i vuku u preduzetništvo, pri čemu motivi koji guraju u preduzetništvu nisu dominantni u ovom setu motiva. Značaj pojedinih motiva se razlikuje u zavisnosti od obrazovanja, radnog statusa, prethodnog iskustva i starosti žena.

Ključne reči: žene, preduzetništvo, rod, prerađivačka industrija, Srbija



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

ANALIZA PERFORMANSI MALIH PREDUZEĆA U REPUBLICI SRBIJI

Dr Ljilja Antić*

Dr Tatjana Stevanović*

Dr Bojana Novicević Čečević*

Rezime: Značajan pokretač razvoja jedne nacionalne ekonomije jesu mala i srednja preduzeća. Veličina ovih preduzeća i njihova povećana inovativnost i fleksibilnost obezbeđuju dovoljni potencijal da unaprede svoj poslovni proces i konkurentnost. Samim tim vrlo je značajna analiza njihovog poslovanja. Cilj rada je da se uz primenu odgovarajućih metoda statističke analize ispita da li postoji razlika u performansama ovih preduzeća (Ukupnog prihoda, Neto dobitka i Dodate vrednosti po zaposlenom) kada se ona podele po odgovarajućim kategorijama.

Keywords: performance, ukupan prihod, neto dobitak, statistička analiza

1. Uvod

Uspeh i konkurentnost nacionalne ekonomije jedne zemlje zavisi od podsticaja i kreiranja uslova za osnivanje malih i srednjih preduzeća. Osnovna komparativna prednost malih i srednjih preduzeća u odnosu na velika preduzeća, ogleda se u njihovoj fleksibilnosti, odnosno brznoj adaptaciji na prisutne promene i brzini reagovanja na aktuelne zahteve kupaca na tržištu (Jović & Djordjević, 2009). U mnogim zemljama, a na osnovu prednosti koje imaju, mala i srednja preduzeća postaju subjekat raznih vidova podrške od strane država koje su prepoznale njihovu ulogu i značaj.

* Univerzitet u Nišu, Ekonomski fakultet; Srbija, ORCID 0000-0001-8796-4619,
✉ ljilja.antic@eknfak.ni.ac.rs

* Univerzitet u Nišu, Ekonomski fakultet; Srbija, ORCID 0000-0003-1270-7129,
✉ tatjana.stevanovic@ekonomski.rs

* Univerzitet u Nišu, Ekonomski fakultet; Srbija, ORCID 0000-0002-4269-0586,
✉ bojana.novicevic@eknfak.ni.ac.rs
UDK 334.012.63/.64(497.11)

U Sjedinjenim Američkim Državama sektor MSP zapošljava oko 120 miliona ljudi, što predstavlja skoro 80 % poslova koji se obavljaju u njoj (Antić & Novićević Čečević, 2023). U Republici Srbiji prema zvanično dostupnim podacima malih preduzeća je u 2022. godini bilo 13.422 (odnosno 13 % ukupnih privrednih društava u Republici Srbiji), a oni su zapošljavali 339.893 ljudi tj. blizu 30 % zaposlenih. Broj malih preduzeća u 2023. godini se povećao na 14.309, dok je broj zaposlenih opao na 332.928 (<https://apr.gov.rs>).

Prema važećem Zakonu o računovodstvu (<https://www.paragraf.rs/propisi/zakon-o-racunovodstvu-2020.html>) u mala preduzeća se razvrstavaju ona preduzeća koja na datum bilansa prelaze vrednosti dva od navedena tri kriterijuma:

- 1) prosečan broj zaposlenih 50;
- 2) poslovni prihod 8.000.000 evra u dinarskoj protivvrednosti;
- 3) vrednost ukupne aktive na datum bilansa 4.000.000 evra u dinarskoj protivvrednosti.

Rad je podeljen u tri dela. U prvom delu rada ukazano je na set finansijskih izveštaja koje prema računovodstvenim standardima treba da sastave mala i srednja preduzeća, a koje su osnova za ocenu njihovih performansi. Metodologija istraživanja objašnjena je u drugom delu rada, dok su u poslednjem delu rada analizirani rezultati empirijskog istraživanja sprovedenog uz pomoć statističkih metoda.

2. Teorijska osnova

Poslovanje malih preduzeća ima određene specifičnosti u poređenju sa drugim vrstama preduzeća. Na početku poslovanja pažnja malih preduzeća je usmerena na proizvod i osmišljavanje strategije prodaje. Glavnu ulogu u ovom procesu ima vlasnik preduzeća koji kontroliše skoro sve funkcije u preduzeću, od nabavke sirovina do plasmana proizvoda. Porast performansi malog preduzeća na početku nije istovremeno praćen i porastom preduzeća i podelom funkcija. Često prođe dosta vremena dok vlasnik preduzeća prepusti obavljanje pojedinih funkcija menadžerima sa odgovarajućim znanjima i veštinama.

Jedna od funkcija koju vlasnik malog preduzeća prvu poverava drugoj osobi ili u početku eksterno angažuje, jeste računovodstvena funkcija. Kao i velika i srednja preduzeća, mala preduzeća imaju obavezu sastavljanja finansijskih izveštaja. Cilj finansijskih izveštaja malih preduzeća je da se obezbede informacije o finansijskoj poziciji, performansama i tokovima gotovine koje su korisne za donošenje ekonomskih odluka raznovrsnih korisnika finansijskih izveštaja. Prilikom sastavljanja finansijskih izveštaja moraju se poštovati odredbe Međunarodnog standarda finansijskog izveštavanja za mala i srednja pravna lica (MSFI za MSP). Ovaj standard odobren je od Odbora za međunarodne računovodstvene standarde (IASB), čiji je prevod utvrdilo i objavilo Ministarstvo Republike Srbije. MSFI za MSE predstavlja sažetu verziju MSFI u širem smislu, kao skupa dokumenata sa oznakama MSFI, MRS (standardi), IFRIC i SIC (tumačenja), utemeljenih u Konceptualnom okviru finansijskog izveštavanja (Obradović, 2018). U tom smislu, kompletan set finansijskih izveštaja po ovom standardu obuhvata (MSFI za MSP):

- izveštaj o finansijskoj poziciji na datum izveštavanja,
- izveštaj o ukupnom rezultatu,

Analiza performansi malih preduzeća u Republici Srbiji

- zasebni bilans uspeha i zasebni izveštaj o ukupnom rezultatu,
- izveštaj o promenama na kapitalu za izveštajni period,
- izveštaj o tokovima gotovine za izveštajni period i
- napomene, koje čini kratak pregled značajnih računovodstvenih politika i druga objašnjenja.

Zbog značaja koji imaju mala preduzeća za jednu nacionalnu ekonomiju veoma je bitno sagledavanje njihovih performansi. Međutim, kada je u pitanju deo izveštavanja koji se odnosi na performanse, standardom je predviđeno da one predstavljaju odnos prihoda i rashoda preduzeća tokom izveštajnog perioda. Kao mera performansi za mala preduzeća obično se koristi Ukupni zbirni rezultat i dobitak ili gubitak. Iz tog razloga pokušali smo da izvršimo analizu poslovanja malih preduzeća u Republici Srbiji uz primenu statističkih metoda. Prikupljeni podaci su analizirani u statističkom paketu za društvene nauke IBM SPSS Statistics 20.0 (*Statistical Package for Social Sciences - SPSS, Version 20.0*). Ispitivanje normalnosti rasporeda varijabli vršeno je uz pomoć računskih (Kolmogorov-Smirnovog testa i Shapiro-Wilkovog testa) i grafičkih metoda. Zbog neispunjenja uslova za primenu t-testa i ANOVE, u radu smo koristili njihove neparametarske zamene *Man-Vitnijev U test* i *Kruskal Wallisov Test*. U cilju ispitivanja definisali smo sledeće hipoteze:

H1: Performanse malih preduzeća značajno se razlikuju kod preduzeća u vlasništvu muškaraca i preduzeća u vlasništvu žena;

H2: Postoje razlike u ostvarenim performansama u zavisnosti od regiona u kome posluje preduzeće;

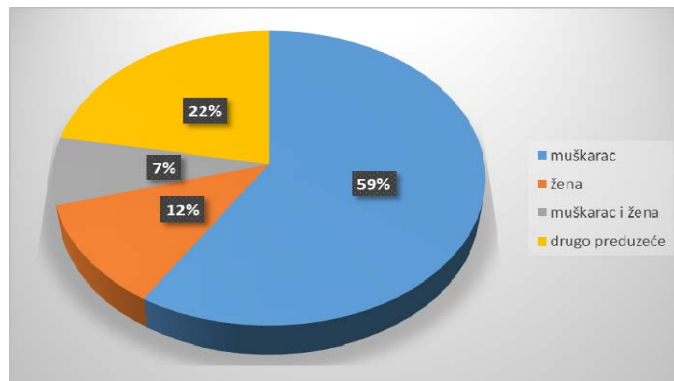
H3: Delatnost kojoj preduzeće pripada utiče na nivo ostvarenih performansi.

3. Metodologija istraživanja

Prvobitni uzorak autora obuhvatao je 99 malih preduzeća koja posluju na teritoriji Republike Srbije. Ova preduzeća nalaze se na listi najuspešnijih u 2022. godini. Listu je objavila bonitetna kuća Company wall (<https://www.companywall.rs/>). Prilikom rangiranja malih preduzeća korišćene su osnovne finansijske performanse dobijene iz godišnjih finansijskih izveštaja kao što su ukupan prihod, neto dobitak, indeks rasta prihoda i dodata vrednost po zaposlenom. Lista najuspešnijih malih preduzeća za 2023. godinu još uvek nije objavljena pa su autori listu iz 2022. godine smatrali relevantnom za potrebe istraživanja u ovom radu. Autori su podatke za analizu prikupljali sa sajta Company wall i sajta Agencije za privredne registre (APR). Prilikom dolaženja do podataka primećena su neslaganja kod matičnih brojeva preduzeća i iznosima performansi na ovim sajtovima pa je četiri preduzeća isključeno iz analize, tako da je konačno istraživanje rađeno na uzorku od 95 malih preduzeća. Na Slici 1 prikazane su karakteristike uzorka sa aspekta vlasništva.

Od ukupno 95 malih preduzeća u skoro 60 % odnosno u njih 56 vlasnik preduzeća je muškog pola. U 12 % preduzeća (11 preduzeća) kao vlasnik preduzeća pojavljuje se žena, dok se 7,4 % preduzeća javlja više vlasnika koji su i muškog i ženskog pola. Drugo preduzeće kao vlasnik malog preduzeća sa liste najuspešnijih u 2022. godini može se naći kod 21 preduzeća odnosno u 22% preduzeća.

Slika 1. Vlasnička struktura preduzeća



Izvor: Obračun autora

Ukoliko uzorak posmatramo sa aspekta regiona u kome preduzeće posluje imamo sledeću strukturu prikazanu u Tabeli 1:

Tabela 1. Karakteristike uzorka

Varijabla	Broj	Procenat %	Kumulativni %
Region			
Beograd	50	52,6 %	52,6
Vojvodina	33	34,7 %	87,4
Centralna Srbija	4	4,2 %	91,6
Južna Srbija	2	2,1 %	93,7
Zapadna Srbija	6	6,3 %	100
Ukupno	95		

Izvor: Obračun autora

Posmatrano po regionima dominantno je učešće preduzeća koja imaju sedište u Beogradu (njih 50, odnosno 52,6 %). Na teritoriji Vojvodine sedište ima 33 preduzeća (34,7%), dok 4 preduzeća (4,2%) posluje u regionu Centralne Srbije. Svega dva preduzeća (2,1%) posluje na teritoriju Južne Srbije. Jedno od ova dva preduzeća je iz Nišu („Alba doo Niš“), dok je drugo preduzeće sa prostora Kosova i Metohije. Sa prostora Zapadne Srbije na listi najuspešnijih preduzeća nalazi se 6 preduzeća (odnosno 6,3 %). Zanimljivo je da iz Istočne Srbije na listi 99 najuspešnijih malih preduzeća nema nijednog preduzeća, dok kada se uzme u obzir lista velikih preduzeća u Republici Srbiji na njoj se nalazi čak dva preduzeća iz Istočne Srbije.

Analiza uzorka prema broju zaposlenih može se videti u Tabeli 2.

Najveći broj preduzeća u uzorku, njih 49 (odnosno 51,6%) ima do 10 zaposlenih. U ovoj grupi je i pet preduzeća koji su u vlasništvu nekog drugog preduzeća, a koji nemaju nijednog zaposlenog. Sva ova preduzeća obavljaju poslovanje koje je vezano za nekretnine, bilo za izgradnju, kupovinu ili iznajmljivanje istih. Veliki broj preduzeća, njih 27 (28,4 %) ima između 11 i 20 zaposlenih. Sedam preduzeća ima između 31-40, a po šest preduzeća ima od 21-30 i od 41-50 zaposlenih.

Analiza performansi malih preduzeća u Republici Srbiji

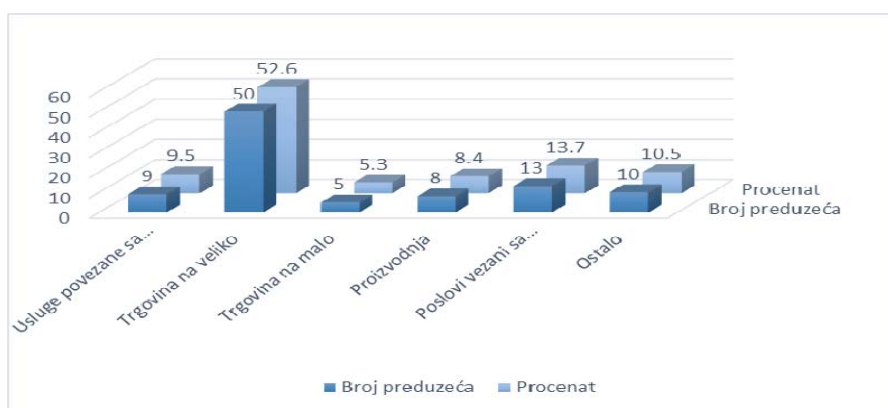
Tabela br.2. Struktura preduzeća prema broju zaposlenih

Varijabla	Broj	Procenat %	Kumulativni %
Broj zaposlenih			
do 10	49	51,6 %	51,6
11-20	27	28,4 %	80,0
21-30	6	6,3 %	86,3
31-40	7	7,4 %	93,7
41-50	6	6,3 %	100
Ukupno	95		

Izvor: Obračun autora

Kada je u pitanju delatnost i poslovi koje obavljaju analizirana mala preduzeća situacija je vrlo raznolika. Autori su poslove sistematizovali prema sličnosti, a struktura je data na Slici 2.

Slika 2. Struktura preduzeća prema delatnostima i poslovima koji se obavljaju



Izvor: Obračun autora

Dominantno učešće kada su u pitanju delatnosti i poslovi kojima se bave mala preduzeća ima Trgovina na veliko i to 50 preduzeća (52,6%). Od ovog broja najveći broj preduzeća obavlja delatnost pod šifrom 46.21 Trgovina na veliko žitom, sirovim duvanom, semenjem i hranom za životinje, njih 14, dok 11 preduzeća obavlja delatnost pod šifrom 46.90 Nespecijalizovana trgovina na veliko. Preduzeća koja obavljaju poslove vezane za nekretnine u uzorku ima 13 (13,7 %). Ova preduzeća se bave Iznajmljivanjem vlastitih ili iznajmljenih nekretnina i upravljanjem njima, kao i izgradnjom stambenih i nestambenih zgrada. Što se ostalih poslova tiče preduzeća sa liste obavljaju: Konsultantske aktivnosti u vezi s poslovanjem i ostalim upravljanjem, Pravne poslove, Ponovna upotreba razvrstanih materijala, Istraživanje i razvoj u ostalim prirodnim i tehničko-tehnološkim naukama i slično. Uslugama povezanim sa prevozom bavi se 9 preduzeća, dok se 8 preduzeća bave proizvodnjom. Čak dva preduzeća se bave Proizvodnjom nakita i srodnih predmeta, a jedno je vodeće na listi najuspešnijih preduzeća („Zlatara Gold Beograd-Vračar“).

4. Rezultati istraživanja i diskusija

Za potrebe analize izabrali smo sledeće varijable: Ukupan prihod, Neto dobitak i Dodata vrednost po zaposlenom. Cilj je da se ispita da li postoji statistički značajna razlika u pogledu ovih performansi po različitim kategorijama. Za testiranje normalnosti rasporeda varijabli koristili smo računske metode Skjunis i Kurtosis, kao i Kolmogorov-Smirnov test i Shapiro-Wilkov test. Takođe, da bismo ustanovili da li postoji normalna raspodela koristili smo i grafičke metode (Histogram, Box Plot i Normalni Q-Q dijagram). Kriterijum za potvrđivanje pretpostavke o normalnosti rasporeda kod Kolmogorov-Smirnov testi i Shapiro-Wilkov testa je nivo značajnosti (Sig.) veći od 0,05 (Manasijević, 2011). Na osnovu rezultata računske i vizuelne metode zaključili smo da podaci nemaju normalnu raspodelu, pa smo se za potrebe daljeg istraživanja odlučili za korišćenje neparametarske zamene odabranih metoda analize. Deskriptivna statistika za varijable, Ukupan prihod, Neto dobitak i Dodata vrednost po zaposlenom dati su u Tabeli 3:

Tabela 3. Deskriptivna statistika varijabli za uzorak

	Ukupan prihod	Neto dobitak	Dodata vrednost po zaposlenom
Mean	1.735.699.347	101.440.663	12.814.735
Median	1.587.941.000	42.375.000	3.688.516
Minimum	694.889.000	720.000	0
Maximum	5.885.932.000	562.594.000	17.021.600

Izvor: Obračun autora

Prvi cilj istraživanja jeste da se testira da li postoji statistički značajna razlika u pogledu određenih performansi (ukupnih prihoda, neto dobiti i dodate vrednosti po zaposlenom) kod preduzeća koja su u vlasništvu muškaraca i kod preduzeća koja su u vlasništvu žena. Ukupan uzorak sada iznosi 67 preduzeća, jer ostala preduzeća nisu mogla da se svrstaju ni u jednu od ove dve kategorije. Imajući u vidu da normalnost raspodele kod izabranih varijabli ne postoji koristili smo neparametarsku alternativu *Man-Vitnijev U* test. Rezultati analize dati su u Tabeli 4.

Tabela 4. Testiranje značajnosti^a

	Ukupan prihod	Neto dobitak	Dodata vrednost po zaposlenom
Mann-Whitney U	287.000	306.000	285.000
Wilcoxon W	353.000	1902.000	351.000
Z	-.355	-.034	-.389
Asymp. Sig. (2-tailed)	.722	.973	.697

a. Grupiranje: Vlasnik

Izvor: Obračun autora

Na osnovu rezultata u Tabeli 4 možemo da vidimo da nema statistički značajne razlike u pogledu Ukupnih prihoda, Neto dobitka i Dodate vrednosti po zaposlenom u preduzećima u kojima su vlasnici muškog pola i u preduzećima u kojima su vlasnici ženskog pola (Sig > 0,05, p= 0,722, p= 0,973, p= 0,697). Analizom deskriptivne statistike

Analiza performansi malih preduzeća u Republici Srbiji

uočavamo da su preduzeća čiji su vlasnici muškog pola ostvarili prosečan ukupan prihod od 1.889.633.821 rsd, dok je u preduzećima čiji su vlasnici ženskog pola prosečan ukupni prihod 1.671.892.364 rsd. Kako je za potrebe statističkog testiranja korišćena neparametarska alternativa potrebno je sagledati i vrednost medijane. Medijalni prihod u preduzećima gde su vlasnici muškarci iznosi 1.634.918.000 rsd a u preduzećima gde su vlasnici žene 1.655.303.000 rsd. Na osnovu podataka dobijenih statističkom analizom možemo da zaključimo da ne postoji statistički značajna razlika u ukupnom prihodu u preduzećima gde su vlasnici muškog i u preduzećima gde su vlasnici ženskog pola. Deskriptivna statistika za varijable Neto dobitak i Dodata vrednost po zaposlenom po kategorijama data je u Tabeli 5:

Tabela 5. Deskriptivna statistika za Neto dobitak i Dodatu vrednost po zaposlenom

Elementi	Neto dobitak		Dodata vrednost po zaposlenom	
	Vlasnik muškog pola	Vlasnik ženskog pola	Vlasnik muškog pola	Vlasnik ženskog pola
minimum	4.506.000	6.343.000	281.625	352.389
maksimum	562.594.000	503.239.000	170.216.000	167.746.333
mean	84.999.750	83.724.818	14.979.910	18.975.635
median	34.350.500	46.329.000	4.964.013	3.990.500

Izvor: Obračun autora

Medijalni Neto dobitak koji je ostvaren u preduzećima čiji su vlasnici muškog pola je 34.350.500 rsd, dok je u preduzećima u kojima su vlasnici ženskog pola nešto viši i iznosi 46.329.000 rsd. Takođe, i dodata vrednost po zaposlenom u ovim kategorijama preduzeća se razlikuje, ali ona nije posledica strukture vlasništva.

Da bismo testirali pretpostavku da postoje statistički značajne razlike u performansama (Ukupan prihod, Neto dobitak i Dodata vrednost po zaposlenom) po okruzima u kojima preduzeća imaju svoje sedišta primenili smo univarijantnu jednofaktorsku analizu varijanse (ANOVU). Takođe, zbog nepostojanja normalnosti raspodele kod varijabli primenili smo Kruskal Wallisov Test, kao adekvatnu neparametarsku zamenu (Coakes, 2013).

Tabela 6. Testiranje značajnosti^{a,b}

	Ukupan prihod	Neto dobitak	Dodata vrednost po zaposlenom
Chi-Square	2.266	7.109	8.302
df	4	4	4
Asymp. Sig.	.687	.130	.081

a. Kruskal Wallis Test; b. Grupisanje: Okrug

Izvor: Obračun autora

Na osnovu podataka iz Tabele 6 možemo da zaključimo da okrug u kome preduzeće ima sedišta značajno ne utiče na visinu ostvarenog ukupnog prihoda, neto dobitka i dodate vrednosti po zaposlenom (Sig > 0,05, p= 0,687, p= 0,130, p= 0,081). Iznos medijalnog ukupnog prihoda po sektorima je sledeći: Beograd 1.542.0930.000 rsd, Vojvodina 1.596.353.000 rsd, Centralna Srbija 1.454.939.000 rsd, Južna Srbija 2.213.548.000 rsd i Zapadna Srbija 1.621.622.000 rsd. Nastale razlike u ukupnom

prihodu nisu posledica okruga u kome preduzeće ima sedište. Kada je u pitanju Neto dobitak razlike u medijalnim iznosima su malo veće ali takođe nisu posledica okruga u kome preduzeće ima sedište (Beograd 58.156.500 rsd, Vojvodina 36.116.000 rsd, Centralna Srbija 13.571.500 rsd, Južna Srbija 51.548.000 rsd i Zapadna Srbija 34.830.500 rsd). Najveća medijalna neto dobit ostvarena je u okrugu Južne Srbije, međutim, moramo imati u vidu da u uzorku imamo samo dva preduzeća i da su to najuspešnija preduzeća po parametrima koji su dati na listi. Medijalna dodata vrednost po okruzima iznosi: Beograd 5.020.885 rsd, Vojvodina 3.034.364 rsd, Centralna Srbija 798.323 rsd, Južna Srbija 3.352.338 rsd i Zapadna Srbija 908.655 rsd. Imajmo na umu da u uzorku imamo pet preduzeća koja nemaju nijednog zaposlenog i koja su u vlasništvu nekog drugog preduzeća. Ova preduzeća su iz okruga Beograd i Vojvodina i bave se poslovima vezanim za nekretnine i u samom su vrhu po ostvarenim performansama. Kada bismo preduzeća koja nemaju zaposlene uklonili iz uzorka i ponovili testiranje postojala bi statistički značajna razlika u ostvarenoj dodatoj vrednosti po zaposlenom među okruzima. Prosečna i medijalna dodata vrednost u okrugu Beograd i Vojvodina bi se značajno povećala, dok bi u ostatku uzorka vrednosti bile iste.

Na kraju smo proveravali da li postoji statistički značajna razlika između sektora kojima pripadaju preduzeća po pitanju navedenih performansi. Analiza je data u Tabeli 7.

Tabela 7. Test Statistics^{a,b}

	Ukupan prihod	Neto dobitak	Dodata vrednost po zaposlenom
Chi-Square	18.671	28.864	3.695
df	5	5	5
Asymp. Sig.	.002	.000	.594

a. Kruskal Wallis Test; b. Grupisanje: Sektor

Izvor: Obračun autora

Kao što se može videti u Tabeli 7, postoji statistički značajna razlika između sektora po pitanju ostvarenog ukupnog prihoda i neto dobitka ($\text{Sig} < 0,05$; $p = 0,002$ i $p = 0,000$). Kada se posmatra dodata vrednost po zaposlenom primećujemo da razlike koje postoje nisu statistički značajne ($p = 0,594$). Deskriptivna statistika Ukupnog prihoda i po sektorima data je u Tabeli 8.

Tabela 8. Deskriptivna statistika – Ukupan prihod po sektorima

	minimum	maximum	mean	median
Usluge povezane sa prevozom	1.320.499.000	2.886.310.000	1.880.663.778	1.655.303.000
Trgovina na veliko	736.975.000	5.315.535.000	1.723.706.300	1.588.429.500
Trgovina na malo	1.682.597.000	3.548.200.000	2.248.204.400	1.758.941.000
Proizvodnja	704.013.000	5.885.932.000	2.066.342.250	1.550.086.500
Poslovi vezani za nekretnine	694.889.000	2.800.549.000	1.171.552.923	925.294.000
Ostalo	926.138.000	3.618.816.000	1.877.820.100	1.852.061.000

Izvor: Obračun autora

Analiza performansi malih preduzeća u Republici Srbiji

Iznos medijalnog ukupnog prihoda najviši je za sektor Ostalo i iznosi 1.852.061.000 rsd, a najniži za sektor Poslovi povezani sa nekretninama i iznosi 925.294.000 rsd. Najviši iznos prihoda u 2022. godini ostvarilo je preduzeće „Zlatara Gold Beograd-Vračar“ u iznosu od 5.885.932.000 rsd (sektor Proizvodnje), a najniži prihod ostvaren je u sektoru Poslova povezanih sa nekretninama („Treca Petoletka doo, Beograd“) u iznosu 694.889.000 rsd. Kada analiziramo rast prihoda preduzeća iz uzorka u 2022. godini u odnosu na 2021. godinu najviši porast zabeležen je u sektoru nekretnina. Preduzeća u uzorku koja se bave ovim poslovima ima ukupno 13, a polovina preduzeća ostvarila je prihod do navedenog medijalnog iznosa, a druga polovina iznad. Lider u rastu prihoda je preduzeće „La Maison“ koje je svoje prihode povećalo za čak 92,57 %, slede preduzeća „Neo Properties doo Beograd“, „Diplomat IRP doo“ i „Md inženjering Su doo Subotica“ čiji je rast bio oko 5 %. U ostalim sektorima najveći rast prihoda u 2022. godini imala su preduzeća: „Tabex doo macvanski pricinovic“ 10,89 % (Proizvodnja), „AU Hygia“ 5,67 % (Trgovina na malo), „Nutra doo“ 19,71 % (Trgovina na veliko) i „IVBC doo“ 4,19 % (Usluge povezane sa prevozom).

Pregled deskriptivne statistike za varijablu Neto dobitak po sektorima dat je u Tabeli 9.

Tabela 9. Deskriptivna statistika- Neto dobitak po sektorima

	minimum	maximum	mean	median
Usluge povezane sa prevozom	4.506.000	152.064.000	54.575.333	46.329.000
Trgovina na veliko	720.000	562.594.000	55.147.040	24.221.000
Trgovina na malo	13.343.000	100.636.000	58.926.600	62.708.000
Proizvodnja	17.419.000	482.462.000	129.774.500	64.123.000
Poslovi vezani za nekretnine	58.335.000	551.158.000	332.443.615	363.428.000
Ostalo	17.209.000	325.413.000	73.373.700	35.033.500

Izvor: Obračun autora

Najviši medijalni iznos Neto dobitka je u sektoru Poslova povezanih sa nekretninama i iznosi 363.428.000 rsd dok je najniži medijalni iznos u sektoru Ostalo. Najniži iznos Neto dobitka u sektoru nekretnina ostvarilo je preduzeće „Diplomat IRP doo“, a najviši iznos preduzeće „Neo Properties doo Beograd“.

Najviši iznos neto dobitka ostvarilo je preduzeće „Koefik doo Beograd“ u iznosu od 562.594.000 rsd i ovo preduzeće se bavi trgovinom na veliko. Ovom sektoru pripada i preduzeće sa najnižim neto dobitkom. Na osnovu sprovedene statističke analize možemo zaključiti da je razlika u Neto dobitku direktna posledica sektora kome pripadaju preduzeća iz uzorka.

4. Zaključak

Mogućnost otvaranja novih radnih mesta u kratkom vremenskom periodu, koja zahtevaju male kapitalne izdatke, povećana mogućnost za zapošljavanje žena, visoka fleksibilnost u poslovanju i značaj ličnih kontakata za razvoj preduzeća, nepostojanje potpunog razdvajanja

vlasničke i upravljačke funkcije, skroman obim aktivnosti, samo su neke od karakteristika malih preduzeća zbog kojih oni čine glavni pokretač razvoja privrede jedne zemlje.

U radu su uz primenu odgovarajućih statističkih metoda u statističkom paketu za društvene nauke IBM SPSS Statistics 20.0 testirane postavljene hipoteze o postojanju razlike u ostvarenim performansama malih preduzeća na teritoriji Republike Srbije po odgovarajućim kategorijama. Za istraživanje su izabrane varijable po kojima je APR vršio rangiranje ovih kompanija a to su Ukupan prihod, Neto dobitak i Dodata vrednost po zaposlenom. Istraživane kategorije bile su vlasništvo preduzeća, okrug u kome preduzeće ima sedište i delatnost kojom se bavi preduzeće. Prilikom testiranja hipoteza nisu pronađene statistički značajne razlike u performansama preduzeća kada je u pitanju vlasništvo. Takođe, okrug u kome preduzeće ima sedište statistički nije značajno za ostvarivanje datih performansi. Međutim, kod ukupnog prihoda i neto dobitka posmatranog po delatnostima su pronađene statistički značajne razlike.

Lista koja je uzeta kao polazna osnova za prikupljanje podataka je iz 2022. godine. U ovom trenutku nije publikovana lista najuspešnijih malih preduzeća za 2023. godinu. Pitanje je koliko će preduzeća ostati na ovoj listi i u narednoj godini, jer je došlo do pada performansi. U oko šezdeset preduzeća koja su na listi najuspešnijih u 2022. godini, došlo je do pada prihoda u 2023. godini. Kod preduzeća „La Maison“ koje je imalo najveći porast prihoda u 2022. godinu, za 2023. zabeležen je njihov pad za oko 30 %. Pad prihoda prisutan je i kod preduzeća „Nutra doo“. Takođe, nijedno preduzeće sa liste nije značajno povećalo svoje prihode kao što je to bio slučaj sa ova dva navedena preduzeća za 2022. godinu. Performanse malih preduzeća koja budu na listi najuspešnih za 2023. godinu biće predmet istraživanja u nekom od narednih radova autora.

Acknowledgment:

This research was supported by the Science Fund of the Republic of Serbia, #1012, Researching Women Entrepreneurs' Management Practice in Order to Improve Their Competencies to Achieve Business Success – WE-Succeed

References

- Antić, Lj., & Novićević Čečević, B. (2023). Obračun troškova po aktivnostima kao informaciona osnova za upravljanje malim i srednjim preduzećima. *International Scientific Conference: Smart and sustainable economy: trends and perspectives* (pp. 391-399). Niš: Faculty of Economics, University of Niš.
- Bilten agencije za privredne registre (<https://apr.gov.rs>)
- Coakes, S. (2013). *SPSS, analiza bez muke*. Wiley.
- <https://www.companywall.rs/>
- Jović, N., & Djordjević, D. (2009). Uloga malih i srednjih preduzeća u poboljšanju konkurentnosti srpske privrede. *Istraživanje i razvoj*, 97-100.
- Manasijević, D. (2011). *Statistička analiza u SPSS programu*. Bor: Tehnološki fakultet.
- Mudjunarodni standard finansijskog izveštavanja za mala i srednja pravna lica.
- Obradović, V. (2018). Međunarodni standard finansijskog izveštavanja za male i srednje entitete u republici srbiji. *Ekonomski horizonti*, 229 - 242
- Zakon o računovodstvu, Službeni glasnik RS, br. 73/219 i 44/20211 (<https://www.paragraf.rs/propisi/zakon-o-racunovodstvu-2020.html>)

PERFORMANCE ANALYSIS OF SMALL ENTERPRISES IN THE REPUBLIC OF SERBIA

Abstract: *Small and medium-sized enterprises are a significant growth driver of a national economy. The size of these companies and their increased innovation and flexibility provide sufficient potential to improve their business process and competitiveness. Therefore, the analysis of their business performance is very important. The aim of the paper is to examine, with the application of appropriate methods of statistical analysis, whether there is a difference in the performance of these companies (Total revenue, Net profit and Added value per employee) when they are divided into appropriate categories.*

Keywords: *performance, total income, net profit, statistical analysis*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**UTICAJ KORPORATIVNOG UPRAVLJANJA NA FINANSIJSKE
PERFORMANSE KOMANIJA**

Ivana Vuković*

Dr Dejan Jovanović*

Rezime: Korporativno upravljanje je pojam koji podrazumeva sistem za usmeravanje kompanija i regulisanje odnosa između vlasnika kompanije, rukovodilaca kompanije i ostalih stejkholdera. Osnovni cilj istraživanja jeste utvrditi da li korporativno upravljanje utiče na finansijske performanse kompanija. Istraživanje se sprovodi metodama indukcije i dedukcije, dok se praktični deo rada zasniva na statističkoj analizi podataka primenom deskriptivne statistike, korelacije i višestruke regresije. Kao glavni zaključak ovog istraživanja ističe se to da ne postoji statistički značajan uticaj korporativnog upravljanja, iskazanog kroz veličinu odbora direktora, strukturu odbora direktora i broj sastanaka direktora, na finansijske performanse kompanija u posmatranom periodu od 2021. do 2023. godine.

Ključne reči: korporativno upravljanje, odbor direktora, finansijske performance.

1. Uvod

Korporativno upravljanje je fraza kojom se do nedavno bavila nekolicina naučnika, a u današnje vreme postala je glavna tema diskusije širom sveta. Među važnijim događajima koji su uticali na povećano interesovanje za korporativno upravljanje su talasi finansijskih kriza i korporativni skandali. Zapravo, tokom talasa finansijskih kriza 1998. godine u Ruskoj Federaciji, Aziji i Brazilu, ponašanje korporativnog sektora uticalo je na sve ekonomije, a nedostaci korporativnog upravljanja ugrozili su stabilnost globalnog finansijskog sistema. Samo tri godine kasnije, poverenje u korporativni sektor je narušeno skandalima korporativnog upravljanja u Sjedinjenim Američkim Državama i Evropi, a koji su pokrenuli neke od najvećih insolventnosti u istoriji (Claessens, 2006).

* Istraživač-pripravnik, Univerzitet u Kragujevcu, Ekonomski fakultet, Srbija; ORCID: 0009-0007-7595-0624, ✉ ivana.vukovic@ef.kg.ac.rs

* Univerzitet u Kragujevcu, Ekonomski fakultet, Srbija; ORCID: 0000-0002-0424-0656, ✉ djovanovic@kg.ac.rs

UDK 005.21:334.72.021

Korporativno upravljanje je širok pojam koji opisuje procese, običaje, politike, zakone i institucije koji usmeravaju organizacije i korporacije na način na koji deluju, administriraju i kontrolišu svoje poslovanje. Korporativno upravljanje se bavi odgovornošću pojedinaca, kroz mehanizam koji smanjuje principal-agent problem u organizaciji (Khan, 2011). Korporativno upravljanje obezbeđuje održavanje odgovarajuće ravnoteže odgovornosti između tri ključna "igrača", odnosno između vlasnika kompanije (kao principala), rukovodilaca kompanije (kao agenata) i trećih strana (Herbert & Agwor, 2021). Postoje brojni mehanizmi korporativnog upravljanja, ali mehanizmi koji se često razmatraju su: odbor direktora, struktura odbora direktora, dualitet generalnog direktora, sastanci odbora direktora i stepen koncentracije akcionara (Puni & Anlesinya, 2019). Generalno, odbor direktora ima dužnost da zaštiti prava akcionara i, kao takva, dužnost postaje mehanizam za praćenje, s obzirom na to da odbor ocenjuje aktivnosti izvršnih direktora i zamenjuje menadžere koji ne rade u najboljem interesu akcionara. Efikasnost praćenja bi trebalo da podstakne rukovodioce da poboljšavaju performanse kompanija i povećavaju koristi vlasnika (Al Farooque i ostali, 2020).

Korporativno upravljanje predstavlja jedan od tri stuba ESG koncepta (*Environmental, Social and Governance - ESG*). Prvi stub ESG koncepta se odnosi na ekološki aspekt poslovanja, drugi stub se odnosi na socijalni aspekt poslovanja, dok se treći stub odnosi na korporativno upravljanje (Deloitte, 2022). Samim tim, korporativno upravljanje je značajno i sa aspekta nefinansijskog izveštavanja. Pregledom preko 1.000 studija objavljenih u periodu od 2015. do 2020. godine, pronađena je pozitivna veza između ESG performansi i finansijskih performansi kompanija, merenih stopom prinosa na ukupnu aktivu (*Return on asset - ROA*), stopom prinosa na uloženi kapital (*Return on equity - ROE*) ili cenom akcija, u 58% posmatranih studija, neutralan uticaj ESG performansi na finansijske performanse je utvrđen u 13% studija, negativna veza je utvrđena u 8% studija, dok su u 21% posmatranih studija uočeni mešoviti rezultati, budući da su iste studije ukazivale na pozitivne, neutralne ili negativne rezultate (Whelan, Atz, & Clark, 2021). Međutim, kada je u pitanju uticaj korporativnog upravljanja, odnosno komponente G (*Governance*) ESG koncepta na finansijske performanse kompanija, empirijske studije su pomešane i neubedljive u svojim nalazima. Međunarodne smernice smatraju da dobro korporativno upravljanje osigurava odgovornost, poboljšava performanse i predstavlja izvor konkurentske prednosti (Ho, 2005).

Polazeći od navedenog, osnovni cilj istraživanja jeste utvrditi da li korporativno upravljanje, iskazano kroz veličinu odbora direktora, strukturu odbora direktora i broj sastanaka direktora, utiče na finansijske performanse kompanija.

S obzirom na to da je tematika koja se tiče korporativnog upravljanja i njegovog uticaja na finansijske performanse kompanija veoma aktuelna u svetu, ovaj rad doprinosi upotpunjavanju postojeće domaće literature i širenju baze znanja u vezi sa ovim pitanjima. Ova istraživanje pruža nove nalaze koji mogu doprineti otklanjanju nedostataka koji se tiču neusaglašenosti rezultata istraživanja o uticaju korporativnog upravljanja na finansijske performanse. Ovo istraživanje je sprovedeno na uzorku od 95 kompanija u Republici Srbiji, koje pripadaju prerađivačkoj industriji, a koje prema Zakonu o računovodstvu imaju obavezu obelodanjivanja nefinansijskih izveštaja pa, samim tim, imaju obavezu da izveštavaju o ekološkim, socijalnim i upravljačkim aspektima poslovanja. S obzirom na to, moguće je izvesti određene zaključke o uticaju ESG koncepta, konkretno, komponente koja se odnosi na korporativno upravljanje (komponente G) na finansijske performanse kompanija u Republici Srbiji.

Uticaj korporativnog upravljanja na finansijske performanse kompanija

Teorijsko istraživanje se sprovodi metodama indukcije i dedukcije, dok se praktični deo rada zasniva na statističkoj analizi podataka primenom deskriptivne statistike, korelacije i višestruke regresije, pomoću programa SPSS (*Statistical Package for Social Sciences*). Pored navedenih metoda, tumačenje rezultata i izvođenje zaključaka zasniva se na korišćenju metode analize, sinteze i komparacije.

Rad je strukturiran tako da se sastoji od pet delova. Pored uvoda i zaključka, u radu će biti prikazan pregled literature, metodologija, kao i rezultati istraživanja i analiza dobijenih rezultata.

2. Pregled literature i razvoj hipoteza

2.1. Uticaj veličine i strukture odbora direktora na finansijske performanse kompanija

Odbor direktora igra važnu ulogu u sprovođenju dobrih mera korporativnog upravljanja. Assenga i ostali (2018) su došli do nalaza koji ukazuju na nepostojanje statistički značajnog uticaja veličine odbora direktora, strukture odbora direktora i broja stranih direktora na finansijske performanse kompanija. Roffia i ostali (2022) sprovedli su istraživanje u kojem su ispitivali uticaj atributa odbora direktora na finansijske performanse, fokusirajući se na tri aspekta: veličinu odbora direktora, strukturu odbora direktora i profil upravnog odbora, u smislu veština i kompetencija. Kada su u pitanju velike kompanije, uočena je veza između posmatranih aspekata i finansijskih performansi. S druge strane, veličina odbora direktora i struktura odbora direktora, nisu imali statistički značajan uticaj na finansijske performanse malih i srednjih kompanija. Glavno istraživačko pitanje studije koju su sprovedli Makki i ostali (2013), ticalo se utvrđivanja strukturnih veza i rezultujućih uticaja korporativnog upravljanja na finansijske performanse kompanija. Kao pokazatelji korporativnog upravljanja korišćeni su: procenat udela direktora, procenat nezavisnih direktora u odboru direktora, naknade direktora, procentualni udeo izvršnih direktora i broj akcionara. Rezultati ove studije odbacili su pretpostavku postojanja pozitivne korelacije između korporativnog upravljanja i finansijskih performansi. Bouaziz i Triki (2013) analizirali su uticaj korporativnog upravljanja na finansijske performanse merene stopom prinosa na ukupnu imovinu, stopom prinosa na uloženi kapital i Tobinovim Q. Rezultati sprovedenog istraživanja pokazali su da struktura odbora direktora ima pozitivan uticaj na finansijske performanse merene stopom prinosa na ukupnu imovinu. Pored toga, analizom odnosa veličine odbora direktora i finansijskih performansi, pomoću linearne regresije, došlo se do kontradiktornog rezultata, odnosno uočen je negativan uticaj veličine odbora direktora na finansijske performanse, merene stopom prinosa na ukupnu imovinu. Kyere i Ausloos (2020) su sprovedli istraživanje analizirajući insajdersko vlasništvo, veličinu odbora direktora, strukturu odbora direktora, dualitet izvršnih direktora i broj sastanaka komiteta za reviziju. Sagledavanjem uticaja korporativnog upravljanja na finansijske performanse, došlo se do zaključka da struktura odbora direktora pozitivno utiče na finansijske performanse. Takođe, došlo se do zaključka da nezavisni odbor jeste jedno od rešenja za agencijski problem. Kada je u pitanju veličina odbora direktora, utvrđeno je da postoji pozitivna veza između veličine odbora direktora i finansijskih performansi merenih stopom prinosa na ukupnu imovinu i Tobinovim Q, odnosno povećanje broja direktora dovodi do poboljšanja finansijskih performansi.

Polazeći od napred navedenih istraživanja, u radu će biti testirane sledeće hipoteze:

H1: Veličina odbora direktora ima statistički značajan pozitivan uticaj na finansijske performanse kompanija.

H2: Struktura odbora direktora ima statistički značajan pozitivan uticaj na finansijske performanse kompanija.

2.2 Uticaj broja sastanaka direktora na finansijske performanse kompanija

Jedna od značajnijih karakteristika odbora direktora jeste, pored ostalog, i broj sednica odbora direktora, odnosno broj sastanaka odbora, na godišnjem nivou. Posmatrano sa aspekta kodeksa korporativnog upravljanja, svi odbori direktora bi trebalo da se sastanu najmanje četiri puta godišnje, sa najkraćim razmakom između dva sastanka od četiri meseca (Al-Matari, 2019). Kanakriyah (2021) je u svom istraživanju, koje se ticalo uticaja karakteristika odbora direktora na finansijske performanse, došao do zaključka da broj sastanaka direktora pozitivno utiče na performanse kompanija, odnosno da povećanje broja sastanaka dovodi do povećanja nadzora i kontrole, a samim tim i do poboljšanja finansijskih performansi. Učestalost sastanaka odbora u velikoj meri će obezbediti njegovu efikasnost. Al-Matari (2019) je istraživanjem došao do zaključka da postoji negativna veza između broja sastanaka odbora i korporativnih performansi. Saleh i ostali (2020) su u svojoj studiji pokazali da broj sastanaka odbora direktora ima pozitivan uticaj na finansijske performanse kompanija. Dakle, što je bolja kontrola koju sprovodi odbor direktora, to su bolje performanse kompanije. Koristeći uzorak od 169 južnoafričkih kompanija, Ntim i Osei (2011) istraživali su uticaj broja sastanaka odbora direktora na korporativne performanse. Ovo se poklapa sa periodom tokom kojeg su vlasti Južne Afrike sprovele reforme korporativnog upravljanja, a koje su prvenstveno imale za cilj poboljšanje nezavisnosti odbora i nadzorne moći. Nalazi ovih istraživača ukazuju na statistički značajnu i pozitivnu povezanost između učestalosti sastanaka korporativnog odbora i korporativnih performansi, odnosno na statistički značajan pozitivan uticaj broja sastanaka odbora direktora na finansijske performanse kompanija, što implicira da odbori direktora koji se sastaju češće imaju tendenciju da generišu bolje finansijske performanse. Buchdadi i ostali (2019) su dokazali da broj sastanaka direktora značajno poboljšava performanse kompanija, zasnovane na tržišnim vrednostima, dok nivo posećenosti sastanaka od strane direktora značajno poboljšava performanse kompanije zasnovane na računovodstvenim pokazateljima. Dakle, što je bolja kontrola koju sprovodi odbor direktora, to su bolje performanse kompanije. Ovo je impliciralo predlaganje Vladi uredbe o potrebnom broju sednica odbora direktora godišnje, kao i uvođenje potrebnog prisustva članova odbora na sednicama. El Mehdi (2007) je ukazao na činjenicu da broj sastanaka odbora direktora nije povezan sa finansijskim performansama kompanija, odnosno da broj sastanaka nema uticaja na finansijske performanse kompanija. Kao moguće objašnjenje za dobijeni rezultat navodi se činjenica da su prednosti čestih sastanaka odbora direktora najvidljivije onda kada je potrebno glasati o konkretnom pitanju, kao što je predlog akvizicije ili zamena generalnog direktora. Horváth i Spirollari (2012) su, takođe, istraživanjem zaključili da sastanci direktora nemaju uticaj na finansijske performanse kompanija.

Polazeći od napred navedenih istraživanja, u radu će biti testirana sledeća hipoteza:

H3: Broj sastanaka direktora ima statistički značajan pozitivan uticaj na finansijske performanse kompanija.

3. Metodologija

U skladu sa definisanim ciljem istraživanja i postavljenim hipotezama, u delu rada, koji se odnosi na empirijsko istraživanje primenjena je kvantitativna metodologija. Empirijsko istraživanje sprovedeno je na uzorku od 95 kompanija u Republici Srbiji, koje pripadaju prerađivačkoj industriji i koje prema Zakonu o računovodstvu imaju obavezu obelodanjivanja nefinansijskih izveštaja. Istraživanje je sprovedeno kroz prikupljanje i analizu sekundarnih podataka u trogodišnjem periodu, odnosno u periodu od 2021. do 2023. godine. Podaci su prikupljeni iz dostupnih izveštaja koji se nalaze na sajtu Agencije za privredne registre, iz statuta, osnivačkih akata, godišnjih izveštaja posmatranih kompanija, kao i sa sajtova posmatranih kompanija. Empirijski deo rada se zasniva na statističkoj analizi podataka primenom deskriptivne statistike, korelacije i višestruke regresije, pomoću programa SPSS (*Statistical Package for Social Sciences*). Na osnovu dobijenih rezultata izvršice se izvođenje zaključaka primenom metode analize, sinteze i komparacije.

4. Rezultati i analiza istraživanja

U nastavku rada biće predstavljeni rezultati empirijskog istraživanja, gde će se uz pomoć deskriptivne statistike, korelacije i višestruke regresije, doći do odgovora na pitanje da li korporativno upravljanje, iskazano kroz veličinu odbora direktora, strukturu odbora direktora i broj sastanaka direktora, utiče na finansijske performanse kompanija. U skladu sa prethodnim istraživanjima, polazi se od pretpostavke da veličina odbora direktora, struktura odbora direktora i broj sastanaka direktora imaju statistički značajan pozitivan uticaj na finansijske performanse kompanija (Roffia i ostali, 2022; Bouaziz & Triki, 2013; Kyere & Ausloos, 2020; Kanakriyah, 2021; Saleh i ostali, 2020; Ntim & Osei, 2011; Buchdadi i ostali, 2019). Finansijske performanse u ovom radu su merene stopom prinosa na ukupnu imovinu i stopom prinosa na uloženi kapital. Pored toga, važno je reći da je veličina odbora direktora merena brojem direktora, dok je struktura odbora direktora iskazana brojem nezavisnih direktora.

U Tabeli 1 biće prikazane minimalne i maksimalne vrednosti, aritmetičke sredine i standardne devijacije zavisnih i nezavisnih varijabli.

Tabela 1. Prikaz minimalne i maksimalne vrednosti, aritmetičke sredine i standardne devijacije zavisnih i nezavisnih varijabli

Varijable	N	Minimum	Maksimum	Aritmetička sredina	Standardna devijacija
ROA	95	-2.77	1.36	0.0194	0.33538
ROE	95	-3.82	1.05	0.0534	0.47667
Veličina odbora direktora	95	1	9	2.42	1.608
Struktura odbora direktora	95	0	3	0.28	0.639
Broj sastanaka direktora	95	0	12	0.83	1.920

Izvor: Autor

Na osnovu Tabele 1 mogu se videti aritmetičke sredine, standardne devijacije, minimalne i maksimalne vrednosti stope prenosa na ukupnu imovinu i stope prinosa na uloženi kapital, kao pokazatelja finansijskih performansi, kao i aritmetičke sredine,

standardne devijacije, minimalne i maksimalne vrednosti nezavisnih varijabli, odnosno veličine odbora direktora, iskazane brojem direktora, zatim, strukture odbora direktora, iskazane brojem nezavisnih direktora i broja sastanaka direktora posmatranih kompanija, u trogodišnjem periodu. Najmanji broj direktora u posmatranom uzorku je 1, samim tim kompanije kojima upravlja samo jedan direktor nemaju nezavisne direktore u svom sastavu, a ni sastanke direktora, pa je minimalna vrednost broja nezavisnih direktora i broja sastanaka direktora 0. Maksimalna vrednost broja direktora u posmatranom uzorku je 9, broja nezavisnih direktora 3, a broja sastanaka direktora na godišnjem nivou 12.

Kako bi se utvrdila jačina veze između posmatranih varijabli, u Tabeli 2 biće prikazani rezultati korelacione analize.

Tabela 2. Korelacija između zavisnih i nezavisnih varijabli

Varijable		Veličina odbora direktora	Struktura odbora direktora	Broj sastanaka direktora	ROA	ROE
Veličina odbora direktora	Pearson Correlation	1	0.651**	0.697**	-0.099	0.125
Struktura odbora direktora	Pearson Correlation	0.651**	1	0.381**	-0.116	0.079
Broj sastanaka direktora	Pearson Correlation	0.697**	0.599**	1	-0.146	0.094
ROA	Pearson Correlation	-0.099	-0.116	-0.146	1	0.090
ROE	Pearson Correlation	0.125	0.079	0.094	0.090	1

Izvor: Autor

Na osnovu Tabele 2. može se zaključiti da između veličine odbora direktora i finansijskih performansi iskazanih stopom prinosa na ukupnu imovinu postoji negativna slaba korelacija, ali statistički beznačajna. Između veličine odbora direktora i finansijskih performansi iskazanih stopom prinosa na uloženi kapital postoji pozitivna slaba korelacija, ali ipak statistički beznačajna. Posmatrajući odnos između strukture odbora direktora i finansijskih performansi iskazanih stopom prinosa na ukupnu imovinu, može se uočiti da postoji statistički beznačajna negativna slaba korelacija, dok između strukture odbora direktora i finansijskih performansi iskazanih stopom prinosa na uloženi kapital, postoji statistički beznačajna pozitivna slaba korelacija. Sagledavanjem korelacije između broja sastanaka direktora i finansijskih performansi iskazanih stopom prinosa na ukupnu imovinu, može se uočiti negativna slaba, statistički beznačajna korelacija i statistički beznačajna pozitivna slaba korelacija između broja sastanaka direktora i finansijskih performansi iskazanih stopom prinosa na uloženi kapital.

U Tabeli 3 i 4, biće prikazani rezultati višestruke regresije, na osnovu kojih se može sagledati uticaj veličine odbora direktora, strukture odbora direktora i broja sastanaka direktora na finansijske performanse iskazane stopom prinosa na ukupnu imovinu i stopom prinosa na uloženi kapital.

Uticaj korporativnog upravljanja na finansijske performanse kompanija

Tabela 3. Prikaz uticaja veličine odbora direktora, strukture odbora direktora i broja sastanaka direktora na stopu prinosa na ukupnu imovinu

Varijable	Model 1- ROA	Sig.	VIF
Veličina odbora direktora	0.032	0.849	2.338
Struktura odbora direktora	- 0.056	0.705	1.862
Broj sastanaka direktora	- 0.135	0.390	2.091
R Square	0.323		

Izvor: Autor

Vrednost koeficijenta determinacije pokazuje koliko je dobar regresioni model (koji u ovom slučaju ima tri nezavisne varijable – veličinu odbora direktora, strukturu odbora direktora i broj sastanaka direktora i jednu zavisnu varijablu – stopu prinosa na ukupnu imovinu. Naime, koeficijent determinacije pokazuje koliki procenat varijabiliteta zavisne varijable je opisan regresionim modelom. Na osnovu Tabele 3, može se uočiti da je $R \text{ Square} = 0.323$, što znači da je 32.3% varijabiliteta stope prinosa na ukupnu imovinu, opisano regresionim modelom, odnosno pod uticajem ova tri faktora. Posmatranjem vrednosti Beta (standardizovanog regresionog koeficijenta) može se uočiti da je $\beta = 0.032$, kada je u pitanju varijabla veličina odbora direktora. Naravno važno je da vrednost β koeficijenta bude statistički značajna, međutim, u ovom slučaju vrednost β koeficijenta nije statistički značajna, što nam ukazuje Sig. vrednost, budući da je $\text{Sig.} > 0.05$, samim tim, ne postoji statistički značajan uticaj veličine odbora direktora na finansijske performanse iskazane stopom prinosa na ukupnu imovinu. Posmatranjem uticaja strukture odbora direktora i broja sastanaka direktora, takođe, može se uočiti da ne postoji statistički značajan uticaj na finansijske performanse iskazane stopom prinosa na ukupnu imovinu, s obzirom na to da je $\text{Sig.} > 0.05$.

Tabela 4. Prikaz veličine odbora direktora, strukture odbora direktora i broja sastanaka direktora na stopu prinosa na uloženi kapital

Varijable	Model 2 - ROE	Sig.	VIF
Veličina odbora direktora	0.134	0.495	2.799
Struktura odbora direktora	-0.025	0.884	2.193
Broj sastanaka direktora	0.012	0.943	2.201
R Square	0.316		

Izvor: Autor

Na osnovu Tabele 4, može se uočiti da je 31.6% varijabiliteta stope prinosa na uloženi kapital, opisano regresionim modelom, odnosno pod uticajem ova tri faktora. Posmatranjem vrednosti Beta, može se uočiti da je $\beta = 0.134$ kada je u pitanju varijabla veličina odbora direktora. Međutim, vrednost β koeficijenta nije statistički značajna, budući da je $\text{Sig.} > 0.05$, samim tim, ne postoji statistički značajan uticaj veličine odbora direktora na finansijske performanse iskazane stopom prinosa na uloženi kapital. Posmatranjem uticaja strukture odbora direktora i broja sastanaka direktora, takođe, može se uočiti da ne postoji statistički značajan uticaj na finansijske performanse iskazane stopom prinosa na uloženi kapital, s obzirom na to da je $\text{Sig.} > 0.05$.

Na osnovu prikazanih rezultata istraživanja, može se uočiti da nema statistički značajnog uticaja korporativnog upravljanja na finansijske performanse kompanija. S obzirom na to da je istraživanjem utvrđeno nepostojanje statistički značajnog uticaja veličine odbora direktora i strukture odbora direktora na finansijske performanse kompanija, prva i druga hipoteza se ne mogu prihvatiti. Dobijeni rezultati su suprotni od rezultata istraživanja koje su sprovedi Roffia i ostali (2022), budući da su u svom istraživanju ovi istraživači došli do zaključka da kod velikih kompanija postoji veza između posmatranih aspekata korporativnog upravljanja i finansijskih performansi. Pored toga, dobijeni rezultati su u suprotnosti sa rezultatima do kojih su dosli Bouaziz i Triki (2013) i Kyere i Ausloos (2020). Međutim, rezultati se podudaraju sa rezultatima do kojih su došli Assenga i ostali (2018) i Makki i ostali (2013). Dobijene rezultate je moguće objasniti time što velikim brojem kompanija iz posmatranog uzorka upravlja jedan direktor, samim tim, u sastavu direktora nema nezavisnih direktora koji bi bili u mogućnosti da potpuno objektivno i nepristrasno prosuđuju prilikom donošenja odluka i upravljanja kompanijom. Dakle, kao mogući razlozi za utvrđeno nepostojanje statistički značajnog uticaja veličine odbora direktora i strukture odbora direktora na finansijske performanse kompanija mogu se navesti: neadekvatan broj direktora, neadekvatan broj nezavisnih direktora i neodgovarajuće upravljanje kompanijom. Testiranjem treće hipoteze, dobijeni rezultati ukazali su na nepostojanje statistički značajnog uticaja broja sastanaka direktora na finansijske performanse kompanija, samim tim, treća hipoteza se, takođe, odbacuje. Ovakvi rezultati su u suprotnosti od rezultata do kojih su došli Kanakriyah (2021), Saleh i ostali (2020), Ntim i Osei (2011) i Buchdadi i ostali (2019), ali se podudaraju sa rezultatima do kojih su došli El Mehdi (2007) i Horváth i Spirollari (2012) u svojim istraživanjima. Usled činjenice da kompanije u posmatranom uzorku, kojima upravlja jedan direktor nemaju sastanke direktora u određenim periodima u toku godine, moglo bi se reći da ne postoji optimalan nadzor i kontrola kompanija što, posledično, ne dovodi do poboljšanja finansijskih performansi. Dakle, nedovoljan broj sastanaka direktora se može navesti kao glavni razlog za utvrđeno nepostojanje statistički značajnog uticaja broja sastanaka direktora na finansijske performanse kompanija.

5. Zaključak

Svrha istraživanja u ovom radu jeste utvrditi da li postoji statistički značajan uticaj korporativnog upravljanja, iskazanog kroz veličinu odbora direktora, strukturu odbora direktora i broj sastanaka direktora na finansijske performanse kompanija. Polaznu osnovu čine postavljene hipoteze. Na osnovu rezultata istraživanja, može se zaključiti da korporativno upravljanje nema statistički značajan uticaj na finansijske performanse kompanija. Prethodna istraživanja sprovedena u svetu ukazivala su, u velikom broju slučajeva, na postojanje pozitivnog uticaja korporativnog upravljanja na finansijske performanse (Roffia i ostali, 2022; Bouaziz & Triki, 2013; Kyere & Ausloos, 2020; Kanakriyah, 2021; Saleh i ostali, 2020; Ntim & Osei, 2011; Buchdadi i ostali, 2019). Razlozi za rezultate dobijene u ovom radu mogu biti korišćenje relativno malog uzorka i to što određenim brojem kompanija upravlja samo jedan direktor, samim tim, takve kompanije nemaju mogućnost sastanaka odbora direktora koji bi doprineli uvećanom nadzoru i kontroli poslovanja kompanije.

Istraživanje sprovedeno u ovom radu ima određene teorijske i praktične implikacije. S obzirom na to da je tematika koja se tiče korporativnog upravljanja i njegovog uticaja na

Uticaj korporativnog upravljanja na finansijske performanse kompanija

finansijske performanse kompanija veoma aktuelna u svetu, ovaj rad doprinosi upotpunjavanju postojeće domaće literature i širenju baze znanja u vezi sa ovim pitanjima. Ovo istraživanje je značajno i sa aspekta korišćenog uzorka, budući da je istraživanje sprovedeno na uzorku kompanija u Republici Srbiji, koje prema Zakonu o računovodstvu imaju obavezu obelodanjivanja nefinansijskih izveštaja, odnosno, imaju obavezu da izveštaju o ekološkim, socijalnim i upravljačkim aspektima poslovanja. Pored toga, kada je u pitanju ESG koncept, moguće je sagledati prirodu uticaja komponente G, odnosno komponente koja se tiče korporativnog upravljanja, na finansijske performanse kompanija u Republici Srbiji. Kada su u pitanju praktične implikacije, važno je napomenuti da rezultati prikazani u ovom radu pružaju uvid različitim stejkholderima i široj javnosti u vezi sa karakteristikama kompanija u Republici Srbiji i ulogom veličine odbora direktora, strukture odbora direktora i broja sastanaka direktora u korporativnom poboljšanju performansi. Pored toga, ovaj rad doprinosi promovisanju svesti uprave kompanije o efektima raznolikosti odbora direktora na finansijske performanse kompanija. Na kraju, važno je napomenuti da ovaj rad ima implikacije i na naučnike i istraživače, ali i na investitore, budući da karakteristike menadžmenta mogu privući pažnju investitora, kada je u pitanju odabir kompanija za investiranje.

Istraživanje sprovedeno u radu ima određena ograničenja koja, mogu predstavljati dobru osnovu za buduća istraživanja u ovoj oblasti. Neka od ograničenja koja su uočena prilikom analize i obrade podataka su: relativno mali uzorak, budući da je istraživanjem obuhvaćeno 95 kompanija u Republici Srbiji, koje pripadaju prerađivačkom sektoru, korišćenje samo sekundarnih podataka dostupnih na sajtu Agencije za privredne registre i podataka dostupnih na sajtovima uzorkom obuhvaćenih kompanija i razmatranje samo tri aspekta korporativnog upravljanja (veličine odbora direktora, strukture odbora direktora i broja sastanaka direktora). Kao pravci daljih istraživanja mogu se navesti: uključivanje primarnih podataka u analizu, prikupljenih uz pomoć intervjua ili anketa, upućenih direktorima posmatranih kompanija, obuhvatanje kompanija koje pripadaju i drugim sektorima, izvan prerađivačkog sektora, ali i razmatranje dodatnih aspekata korporativnog upravljanja.

Reference

- Al Farooque, O., Buachoom, W. & Sun, L. (2020). Board, audit committee, ownership and financial performance – emerging trends from Thailand. *Pacific Accounting Review*, 32 (1), 54-81.
- Al-Matari, E. M. (2019). Do characteristics of the board of directors and top executives have an effect on corporate performance among the financial sector? Evidence using stock. *Corporate Governance*, 20 (1), 16-43.
- Assenga, M., Aly, D. & Hussainey, K. (2018). The impact of board characteristics on the financial performance of Tanzanian firms. *Corporate Governance (Bingley)*, 18, 1089–106.
- Bouaziz, Z. & Triki, W. M. (2013). The Impact of the Board of Directors on the Financial Performance of Tunisian Companies. *International Journal of Managerial and Financial Accounting*, 5 (2), 178-201.
- Buchdadi, D. A., Ulupui, I., Dalimunthe, S., Pamungkas, G. B. & Fauziyyah, Y. (2019). Board of director meeting and firm performance. *Academy of Accounting and Financial Studies Journal*, 23 (2), 1-7.
- Claessens, S. (2006). Corporate Governance and Development. *The World Bank Research Observer*, 21 (1), 91-122.

- Delloite (2022). *What is ESG?*, Preuzeto sa: <https://www.deloitte.com/ce/en/services/consulting/perspectives/esg-explained-1-what-is-esg.html>, Pristupljeno dana 10.08.2024.
- El Mehdi, K. I. (2007). Empirical Evidence on Corporate Governance and Corporate Performance in Tunisia. *Corporate Governance: An International Review*, 15 (6), 1429-1441.
- Herbert, E. W. & Agwor, C. T. (2021). Corporate governance disclosure and corporate performance of Nigerian banks. *Journal of Research in Emerging Markets*, 3 (3), 14-36.
- Ho, K. C. (2005). Corporate Governance and Corporate Competitiveness: an international analysis. *Corporate Governance An International Review*, 13 (2), 211-253.
- Horváth, R. & Spirollari, P. (2012). Do the board of directors' characteristics influence firm's performance? The U.S. evidence. *Prague Economic Papers*, 21 (4), 470-486.
- Kanakriyah, R. (2021). The Impact of Board of Directors' Characteristics on Firm Performance: A Case Study in Jordan. *Journal of Asian Finance, Economics and Business*, 8 (3), 341–350.
- Khan, H. (2011). A Literature Review of Corporate Governance. *International Conference on E-business, Management and Economics*, 25, 1-5.
- Kyere, M. & Ausloos, M. (2020). Corporate governance and firms financial performance in the United Kingdom. *International Journal of Finance Economics*, 26 (2), 1871-1885.
- Makki, A. M. M. & Lodhi, A. S. (2013). Impact of Corporate Governance on Financial Performance. *Pakistan Journal of Social Sciences*, 33 (2), 265-280.
- Ntim, G. K. and Osei, A. K. (2011). The Impact of Corporate Board Meetings on Corporate Performance in South Africa. *African Review of Economics and Finance*, 2 (2), 83-103.
- Puni, A. & Anlesinya, A. (2019). Corporate governance mechanisms and firm performance in a developing country. *International Journal of Law and Management*, 62 (2), 147 - 169.
- Roffia, P., Simón-Moya, V. & García, S. J. (2021). Board of director attributes: effects on financial performance in SMEs. *International Entrepreneurship and Management Journal*, 18, 1141-1172.
- Saleh, M. W. A., Shurafa, R., Shukeri, N. S., Nour, I. A. & Maigosh, S. Z. (2020). The effect of board multiple directorships and CEO characteristics on firm performance: evidence from Palestine. *Journal of Accounting in Emerging Economies*, 10 (4), 637-654.
- Whelan, T., Atz, U. & Clark, C. (2021). *Esg and financial performance*, Preuzeto sa: https://sri360.com/wp-content/uploads/2022/10/NYU-RAM_ESG-Paper_2021-2.pdf, Pristupljeno dana 10.08.2024.

THE IMPACT OF CORPORATE GOVERNANCE ON FINANCIAL PERFORMANCE

Abstract: *Corporate governance means directing companies in a way to satisfy the interests of all stakeholders, i.e. interested parties. The main goal of the research is to determine whether corporate governance affects the financial performance of companies. The research is conducted using induction and deduction methods, while the practical part of the work is based on statistical data analysis using descriptive statistics, correlation and multiple regression. The main conclusion of this research is that there is no statistically significant impact of corporate governance, expressed through the number of directors, the number of independent directors and the number of directors' meetings, on the financial performance of companies.*

Keywords: *corporate governance, board of directors, financial performance.*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**BANKRUPTCY PREDICTION IN THE TRANSITION ECONOMY:
A CASE OF NON-FINANCIAL COMPANIES IN SERBIA**

Aleksandra Radojević, MA[•]

Milan Čupić, PhD^{*}

Stefan Vržina, PhD[♦]

***Abstract:** The main objective of the research is to identify indicators that may significantly contribute to bankruptcy prediction and the development of a bankruptcy prediction model. We aim to determine whether indicators of liquidity, profitability, activity and leverage as well as non-financial indicators may suggest the possible problems in a company. We use logit regression. Research results indicate that the logit model encompassing four financial variables for bankruptcy prediction have an accuracy of 91.67%.*

***Keywords:** bankruptcy, logistic regression, financial indicators, non-financial indicators, macroeconomic indicators.*

1. Introduction

The main objective of the paper is to identify indicators that may significantly contribute to bankruptcy prediction and the development of a bankruptcy prediction model. We aim to determine whether liquidity, profitability, activity and leverage indicators as well as non-financial indicators may suggest the possible problems in a company. Bankruptcy prediction models are mostly studied in developed, while research on this issue in transition economies is still relatively scarce (Mihalović, 2016). Transition economies face important changes and specific problems, so the application of bankruptcy prediction models designed in developed economies may be difficult (Zvarikova et al., 2017).

[•] University of Kragujevac, Faculty of Economics, Serbia, 0000-0001-8000-9248,
✉ aleksandra.radojevic@ekonomski.org

^{*} University of Kragujevac, Faculty of Economics, Serbia, 0000-0002-0150-6682,
✉ mcupic@kg.ac.rs

[♦] University of Kragujevac, Faculty of Economics, Serbia, 0000-0001-8372-591X,
✉ stefan.vrzina@kg.ac.rs

The paper contributes to the literature in several ways. First, the paper contributes to the creation of a model and identification of variables that are significant for bankruptcy prediction in a transition economy. Many authors aimed to create a bankruptcy prediction model using several statistical methods and models such as logit, probit, LDA, neural networks and others. The need for the creation of new models and improvement of current models is a result of specific features of each economy. The results of this paper may be a basis for the development of a new bankruptcy prediction model adapted to the specific features of a transition economy.

Second, the paper combines different types of variables to predict bankruptcy. Most studies employ only financial indicators as they are easily accessible. However, non-financial indicators may also be significant and enable more efficient bankruptcy prediction. In this paper, we examine whether the impact of these variables exists and whether some of these variables contribute to bankruptcy prediction.

The paper consists of five parts. After the introduction, we give a literature review. The third part of the paper presents the research methodology, while the fourth part presents the research results and discussion. The fifth part of the paper concludes.

2. Previous research

Bankruptcy prediction models enable assessment of the financial health of a company, based on the past results of a company (Kovacova et al., 2019). Most bankruptcy prediction models include four to seven variables, though some of them include as much as eighteen (Zvarikova et al., 2017). Kitowski et al. (2022) argue that most models are designed using logit regression or discriminant analysis.

2.1. Variables used for bankruptcy prediction

Bankruptcy prediction models mostly include financial indicators (Jovanovic et al., 2017; Klietnik et al., 2020; Le et al., 2018) on a sample of companies divided into two subsamples, those that are bankrupt and those that are not (Agarwal & Taffler, 2008, 1542). Financial indicators may suggest the problems and the possible bankruptcy (Klietnik et al., 2020) and, the most important are the indicators of profitability, liquidity, solvency and activity (Altman, 1968, 590; Lukason & Camacho-Miñano, 2019). Xu et al. (2014) suggest that using such indicators may enable the prediction of financial problems and failure of a company.

Using the logit model, Ben Jabeur (2017) points to nine indicators useful for bankruptcy prediction of French companies, one year before filing for bankruptcy. Canbas et al. (2005) identify twelve indicators useful for bankruptcy prediction of Turkish companies. Liquidity, profitability and leverage indicators are mostly used in bankruptcy prediction models in Slovakia and the Czech Republic (Kovacova et al., 2019; Mihalovič, 2016; Valaskova et al., 2018). Kovacova et al. (2019) argue that profitability, activity and leverage indicators are usually used in Hungary. On a sample of Russian companies and using a logit model, Fedorova et al. (2013) identify eight variables useful for bankruptcy prediction. Klietnik et al. (2020) argue that the choice of financial indicators in transition economies is considerably influenced by political, market and economic conditions under which companies operate.

Bankruptcy Prediction in the Transition Economy

Vlaović-Begović et al. (2020, 515) argue that problems with liquidity, leverage and profitability may suggest bad financial health and possible bankruptcy of Serbian companies. Bešlić Obradović et al. (2018) conclude that financial indicators may be useful for the development of a bankruptcy research model for Serbian companies. In line with the research objective and based on the prior research results, we formulate the first research hypothesis as follows:

Hypothesis 1: Financial variables significantly contribute to bankruptcy prediction.

Zelenkov et al. (2017, 400) argue that the accuracy of bankruptcy prediction models may be improved by using indicators from the external environment of a company. Models that combine financial and non-financial variables may better predict bankruptcy than models that use only financial or non-financial indicators (Bandyopadhyay, 2006; Grunert et al., 2005, 523). Non-financial variables such as engagement of Big 4 audit firms (Jan, 2021), size and age of a company, membership in a certain corporate group, holding an ISO certificate and industry in which a company is primarily engaged (Bandyopadhyay, 2006; Jones et al., 2017) may be employed. Hernandez Tinoco & Wilson (2013) show that models that combine different types of variables may offer more information and are more accurate in the bankruptcy prediction of British companies. Considering the results of prior research, we formulate the second research hypothesis as follows:

Hypothesis 2: Non-financial variables significantly contribute to bankruptcy prediction.

2.2. Bankruptcy prediction models

Many statistical methods such as linear discriminant analysis (LDA), multiple discriminant analysis (MDA), logit and probit regressions, decision trees and neural networks are widely used to develop bankruptcy prediction models (Ben Jabeur, 2017). In addition, models based on discriminant analysis, logit regression and neural networks appear to be highly accurate in bankruptcy prediction (Du Jardin, 2015).

Lin (2009, 3515) concludes that models based on logit and probit regressions and neural networks are more accurate in bankruptcy prediction than MDA. Jones et al. (2017) argue that traditional models based on logit regression and LDA have good predictive ability. Hernandez Tinoco & Wilson (2013) argue that the accuracy of the logit model and neural networks in bankruptcy prediction is nearly similar. On the other hand, Barboza et al. (2017) point out that machine learning models may predict bankruptcy more accurately than traditional models such as logit and LDA. Ahmadpour Kasgari et al. (2013) find the accuracy of the probit model of 77.45% on the training sample and 85.30% on the test sample. Li et al. (2011) find that logit is slightly more accurate (78.70%) than the probit model (78.67%) for Chinese companies.

However, logistic regression is probably the most widely used technique for bankruptcy prediction (Nikolic et al., 2013, 598). It is used to examine the relation between input and output data, based on probability theory, while the relation between input and output is presented as a clear function (Tseng & Lin, 2005, 90). This model is flexible, supporting both financial and non-financial factors in bankruptcy prediction (Bandyopadhyay, 2006, 258). However, most logit, probit and MDA models do not include specific features of the industry, the size of a company and the economic environment in which companies operate (Nwogugu, 2007), often relying only on the accounting data.

One year before filing for bankruptcy, the logit model has the accuracy of bankruptcy prediction of 77.01% in Iran (Bateni & Asghari, 2020), 88.4% in Serbia (Bešlić Obradović et al., 2018), 86.4% in Taiwan (Lin, 2009) and around 77% in Italy (Cohen et al., 2017). In France, the accuracy of prediction varies between 93.75% and 93.25% on training and test samples, respectively (Ben Jabeur, 2017). Therefore, such research results indicate that the logit model may be adequate and successful in predicting possible problems and bankruptcy of a company. Based on the results of prior research findings, we formulate the third research hypothesis as follows:

Hypothesis 3: The Logit model is efficient in predicting company bankruptcy.

2. Methodology

We sampled 360 non-financial companies from Serbia, using data from the Serbian Business Registers Agency and the Bankruptcy Supervision Agency. First, we chose 60 companies that filed for bankruptcy in 2022 and, then, we included companies that did not file for bankruptcy.

Table 1. Sample

Firm size	Micro	Small	Medium	Large	Pooled
Companies that filed for bankruptcy					
Number of firms	39	15	3	3	60
Average value of total assets (RSD 000)	61,938	358,170	1,389,418	2,890,800	343,813
Average value of total revenues (RSD 000)	22,229	194,511	3,556,684	2,344,962	358,159
Average number of employees	1	20	161	93	19
Companies that did not file for bankruptcy					
Number of firms	190	69	26	15	300
Average value of total assets (RSD 000)	87,340	8,712,775	8,677,505	20,793,257	3,850,967
Average value of total revenues (RSD 000)	48,010	546,428	5,057,510	11,796,851	1,184,245
Average number of employees	4	29	105	696	53

Note: Data are retrieved from the reports from the Serbian Business Registers Agency (www.apr.gov.rs) and the Bankruptcy Supervision Agency (alsu.gov.rs).

Regarding the companies that did not file for bankruptcy, we sampled them using size criteria, so the share of micro, small, medium and large companies in the total sample is equal for companies that filed and that did not file for bankruptcy. We used publicly accessible data from individual financial statements of companies. In this regard, we used balance sheet and income statement data for 2021, retrieved from the official website of the Serbian Business Registers Agency. Table 1 presents the structure of the sample.

To produce the bankruptcy prediction model, we divide the sample into training and test samples in 80:20 proportion (Du Jardin, 2016; Zoričák et al., 2020). The model is designed through the training sample, while its validity is tested through the test sample. The dependent variable is a dummy variable with a value of 0 if a company filed for bankruptcy and a value of 1 otherwise, in line with many prior research (for instance Canbas et al., 2005; Kitowski et al., 2022; Ninh et al., 2018).

Most of the prior research that created bankruptcy prediction model employed financial indicators, primarily liquidity (Du Jardin, 2016; Hernandez Tinoco & Wilson, 2013;

Bankruptcy Prediction in the Transition Economy

Jones et al., 2017; Klietk et al., 2020; Kovacova et al., 2019; Mihalovič, 2016; Psillaki et al., 2010; Valaskova et al., 2018; Xu et al., 2014; Zoričák et al., 2020). Additionally, profitability (Du Jardin, 2016; Jan, 2021; Jones et al., 2017; Klietk et al., 2020; Kovacova et al., 2019; Mihalovič, 2016; Psillaki et al., 2010; Valaskova et al., 2018; Xu et al., 2014; Zoričák et al., 2020), activity (Bešlić Obradović et al., 2018; Du Jardin, 2016; Jones et al., 2017; Kovacova et al., 2019; Psillaki et al., 2010; Zoričák et al., 2020) and leverage indicators (Bešlić Obradović et al., 2018; Du Jardin, 2016; Hernandez Tinoco & Wilson, 2013; Jan, 2021; Jones et al., 2017; Klietk et al., 2020; Kovacova et al., 2019; Mihalovič, 2016; Valaskova et al., 2018; Xu et al., 2014; Psillaki et al., 2010; Zoričák et al., 2020) are also often employed.

The predictive ability of bankruptcy prediction models may be improved with non-financial variables (Hernandez Tinoco & Wilson, 2013; Jan, 2021; Ninh et al., 2018). The most widely used non-financial indicators are company age (Bandyopadhyay, 2006; Jones et al., 2017; Lukason & Camacho-Miñano, 2019) and its size (Grunert et al., 2005; Jones et al., 2017; Lukason & Camacho-Miñano, 2019; Psillaki et al., 2010). Table 2 presents the independent variables employed in the research.

Table 2. Variables definition

Group of indicators	Label	Definition
Liquidity	CR	Current assets / Short-term liabilities
	QR	(Current assets – Inventory) / Short-term liabilities
	CASH	Cash and cash equivalents / Short-term liabilities
	NWC	Current assets – Short-term liabilities
Profitability	NIM	Net income / Total income
	ROA	Net income / Total assets
	ROE	Net income / Equity
Activity	TAT	Total revenue / Total assets
	IT	Total sales / Inventory
	CAT	Total revenue / Current assets
Leverage	DR	Total liabilities / Total assets
	DE	Total liabilities / Equity
Non-financial variables	AGE	Company age (number of years from the company establishment)
	SIZE	Company size (natural logarithm of total assets)

We used logistic regression to create the bankruptcy prediction model for Serbian companies and identify relevant variables. This method is widely used in prior research (Bateni & Asghari, 2020; Ben Jabeur, 2017; Bešlić Obradović et al., 2018; Cohen et al., 2017; Lin, 2009). In line with Kitowski et al. (2022), Li et al. (2021) and Mihailović (2016), the logistic model may be presented as follows:

$$L = \beta_0 + \beta_1 X_1 + \dots + \beta_k X_k$$

where X_1 to X_k are independent variables (predictors).

3. Results and discussion

Multicollinearity analysis conducted using Tolerance and VIF suggests that each employed variable has a value within the allowed limits. VIF values are not higher than 10,

while Tolerance values are not lower than 0.1 (Lavery et al., 2019). To identify untypical points and extreme values, we calculated maximal Cook's Value of 0.343, which is considerably lower than the upper limit of 1 (Pallant, 2009; Tabachnick & Fidell, 2019). The sample size is also an important assumption for the regression analysis since the sample size should be larger than $50 + 8$ times number of independent variables (Pallant, 2009; Tabachnick & Fidell, 2019). This implies that we needed to include more than 162 companies, which is lower than our actual sample of 360 companies.

Omnibus Tests of Model Coefficients indicate that the model accurately predicts results as results are statistically significant ($p = 0.000$). The Chi-square is 78.514 with 14 degrees of freedom. Calculated results are confirmed with Hosmer and Lemeshow test with a chi-square of 9.240 with a significance of 0.322. In this regard, calculated results are within the allowed limits for the interpretation of logistic regression results (Pallant, 2009; Tabachnick & Fidell, 2019).

Table 3. Logit regression estimates

Variable	B	Wald	Exp(B)
CR	1.114*	4.182	3.047
QR	-0.729	1.481	0.482
CASH	3.189*	3.993	24.263
NWC	0.000	1.474	1.000
NIM	0.261	1.521	1.298
ROA	1.412*	4.590	4.103
ROE	1.077*	5.948	2.935
TAT	-0.072	0.209	0.931
IT	0.000	0.075	1.000
CAT	0.069	0.570	1.072
DR	0.180	0.508	1.197
DE	0.059	1.814	1.060
AGE	-0.014	0.711	0.986
SIZE	-0.047	0.362	0.954
Constant	0.955	0.790	2.599

Note: Statistically significant at the level of 0.05 (*).

Table 3 presents logistic regression estimates with the contribution of each independent variable to the bankruptcy prediction. Each variable that contributes to the predictive ability of the model is statistically significant at the level of 0.05. As presented in Table 3, four variables have statistically significant impact – two liquidity and two profitability indicators. Companies with larger values of CR, CASH, ROA and ROE are less likely to file for bankruptcy. Logistic regression estimates do not confirm the contribution of non-financial variables to the bankruptcy prediction. Based on the presented results, we formulated the following logit model:

$$\pi = \frac{EXP(1.114 \times CR + 3.189 \times CASH + 1.412 \times ROA + 1.077 \times ROE)}{1 + EXP(1.114 \times CR + 3.189 \times CASH + 1.412 \times ROA + 1.077 \times ROE)}$$

The presented model is tested on the test sample. The accuracy of the presented model is 50% for companies that filed for bankruptcy and 100% for companies that did not file for bankruptcy. In total, the model accurately classifies 91.67% of companies.

Bankruptcy Prediction in the Transition Economy

Although many prior research (Hernandez Tinoco & Wilson, 2013; Jan, 2021; Ninh et al., 2018) find that non-financial variables contribute to the bankruptcy prediction, our research did not confirm such findings. This may be explained by the cross-national differences in the external environment and the level of economic development. Results may be associated with the fact that different variables influence bankruptcy prediction in different countries (Zelenkov & Volodarskiy, 2021).

Our research suggests that financial variables contribute to the bankruptcy prediction of Serbian companies, thus confirming that financial variables have the largest impact in bankruptcy prediction models (Ben Jabeur, 2017; Klietk et al., 2020; Kovacova et al., 2019; Valaskova et al., 2018) and enable the development of model useful for Serbian companies (Bešlić Obradović et al., 2018). Regarding liquidity indicators, CR and CASH contribute to bankruptcy prediction, which is in line with Kovacova et al. (2019), Mihalović (2016) and Valaskova et al. (2018). Regarding profitability indicators, ROA and ROE contribute to bankruptcy prediction. Similar results have been presented by Klietk et al. (2020), Kovacova et al. (2019) and Valaskova et al. (2018) for ROE and Kovacova et al. (2019) and Mihalović (2016) for ROA. Companies with higher liquidity and profitability are less likely to file for bankruptcy (Psillaki et al., 2010; Vlaović-Begović et al., 2020).

4. Conclusion

Considering the significant consequences that bankruptcy may have both for a company and a national economy, as well as the fact that bankruptcy may be predicted before it occurs, many researchers strived to develop a bankruptcy prediction model. This paper had an objective to identify indicators that may significantly contribute to the bankruptcy prediction and to develop a bankruptcy prediction model for Serbian companies. In this regard, we sampled 360 companies, where a bankruptcy has been filed in 60 of them. We used logit regression, employing financial and non-financial variables. Research results indicate that the logit model includes four financial variables useful for bankruptcy prediction with an accuracy of 91.67%.

Research results should be interpreted in the light of certain limitations, thus implying the possible directions for future research. We used only the logit model, with significant results, but these results might be different if some other bankruptcy prediction model was used. A further limitation may be found in the period of prediction as we used data for only one year before filing for bankruptcy. In addition, we sampled only companies headquartered in Serbia. Future research may compare results for Serbian companies with the results for companies from other transition countries. Future research may also examine the accuracy of different bankruptcy prediction models during the COVID-19 pandemic.

References

- Agarwal, V. & Taffler, R. (2008). Comparing the Performance of Market-based and Accounting-based Bankruptcy Prediction Models. *Journal of Banking & Finance*, 32 (8), 1541-1551.
- Ahmadpour Kargari, A., Divsalar, M., Javid, M. & Ebrahimian, S. (2013). Prediction of Bankruptcy Iranian Corporations through Artificial Neural Network and Probit-based Analyses. *Neural Comput & Applications*, 23 (3-4), 927-936.

- Altman, E. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *The Journal of Finance*, 23 (4), 589-609.
- Bandyopadhyay, A. (2006). Predicting Probability of Default of Indian Corporate Bonds: Logistic and Z-score Model Approaches. *The Journal of Risk Finance*, 7 (3), 255-272.
- Barboza, F., Kimura, H. & Altman, E. (2017). Machine Learning Models and Bankruptcy Prediction. *Expert Systems with Applications*, 83 (1), 405-417.
- Bateni, L. & Asghari, F. (2020). Bankruptcy Prediction Using Logit and Genetic Algorithm Models: A Comparative Analysis. *Computational Economics*, 55 (1), 335-348.
- Ben Jabeur, S. (2017). Bankruptcy Prediction Using Partial Least Squares Logistic Regression. *Journal of Retailing and Consumers Services*, 36 (1), 197-202.
- Bešlić Obradović, D., Jakšić, D., Bešlić Rupiće, I. & Andrić, M. (2018). Insolvency Prediction Model of the Company: The Case of the Republic of Serbia. *Economic research - Ekonomska istraživanja*, 31 (1), 139-157.
- Canbas, S., Cabuk, A. & Kilic, S. (2005). Prediction of Commercial Bank Failure via Multivariate Statistical Analysis of Financial Structures: The Turkish Case. *European Journal of Operational Research*, 166 (2), 528-546.
- Cohen, S., Costanzo, A. & Manes-Rossi, F. (2017). Auditors and Early Signals of Financial Distress in Local Governments. *Managerial Auditing Journal*, 32 (3), 234-250.
- Du Jardin, P. (2015). Bankruptcy Prediction Using Terminal Failure Processes. *European Journal of Operational Research*, 242 (1), 286-303.
- Du Jardin, P. (2016). A Two-stage Classification Technique for Bankruptcy Prediction. *European Journal of Operational Research*, 254 (1), 236-252.
- Fedorova, E., Gilenko, E. & Dovzhenko, S. (2013). Bankruptcy Prediction for Russian Companies: Application of Combined Classifiers. *Expert Systems with Application*, 40 (18), 7285-7293.
- Grunert, J., Norden, L. & Weber, M. (2005). The Role of Non-financial Factors in Internal Credit Ratings. *Journal of Banking & Finance*, 29 (2), 509-531.
- Hernandez Tinoco, M. & Wilson, N. (2013). Financial Distress and Bankruptcy Prediction among Listed Companies Using Accounting, Market and Macroeconomic Variables. *International Review of Financial Analysis*, 30 (1), 394-419.
- Jan, C. (2021). Financial Information Asymmetry: Using Deep Learning Algorithms to Predict Financial Distress. *Symmetry*, 13 (3), 1-22.
- Jones, S., Johnstone, D. & Wilson, R. (2017). Predicting Corporate Bankruptcy: An Evaluation of Alternative Statistical Frameworks. *Journal of Business Finance & Accounting*, 44 (1-2), 3-34.
- Jovanović, D., Todorović, M., & Grbić, M. (2017). Financial Indicators as Predictors of Illiquidity. *Journal for Economic Forecasting*, 20 (1), 128-149.
- Kitowski, J., Kowal-Pawul, A. & Lichota, W. (2022). Identifying Symptoms of Bankruptcy Risk Based on Bankruptcy Prediction Models – A Case Study of Poland. *Sustainability*, 14 (3), 1416-1433.
- Kliestik, T., Valaskova, K., Lazaroiu, G., Kovacova, M. & Vrbka, J. (2020). Remaining Financially Healthy and Competitive: The Role of Financial Predictors. *Journal of Competitiveness*, 12 (1), 74-92.
- Kovacova, M., Kliestik, T., Valaskova, K., Durana, P. & Juhaszova, Z. (2019). Systematic Review of Variables Applied in Bankruptcy Prediction Models of Visegrad Group Countries. *Oeconomia Copernicana*, 10 (4), 743-772.

Bankruptcy Prediction in the Transition Economy

- Lavery, M., Acharya, P., Sivo, S. & Xu, L. (2019). Number of Predictors and Multicollinearity: What Are Their Effects on Error and Bias in Regression? *Communications in Statistics-Simulation and Computation*, 48 (1), 27-38.
- Le, T., Lee, M., Park, J. & Baik, S. (2018). Oversampling Techniques for Bankruptcy Prediction: Novel Features from a Transaction Dataset. *Symmetry*, 10 (4), 79-91.
- Li, H., Lee, Y., Zhou, Y. & Sun, J. (2011). The Random Subspace Binary Logit (RSBL) Model for Bankruptcy Prediction. *Knowledge-Based Systems*, 24 (8), 1380-1388.
- Li, Z., Crook, J., Andreeva, G. & Tang, Y. (2021). Predicting the Risk of Financial Distress Using Corporate Governance Measures. *Pacific-Basin Finance Journal*, 68 (1), 1-12.
- Lin, T. (2009). A Cross Model Study of Corporate Financial Distress Prediction in Taiwan: Multiple Discriminant Analysis, Logit, Probit and Neural Networks Models. *Neurocomputing*, 72 (16-18), 3507-3516.
- Lukason, O. & Camacho-Miñano, M. (2019). Bankruptcy Risk, Its Financial Determinants and Reporting Delays: Do Managers Have Anything to Hide? *Risks*, 7 (3), 77-92.
- Mihalovič, M. (2016). Performance Comparison of Multiple Discriminant Analysis and Logit Models in Bankruptcy Prediction. *Economics and Sociology*, 9 (4), 101-118.
- Nikolic, N., Zarkic-Joksimovic, N., Stojanovski, D. & Joksimovic, I. (2013). The Application of Brute Force Logistic Regression to Corporate Credit Scoring Models: Evidence from Serbian Financial Statements. *Expert Systems with Applications*, 40 (15), 5932-5944.
- Ninh, B., Do Thanh, T. & Hong, D. (2018). Financial Distress and Bankruptcy Prediction: An Appropriate Model for Listed Firms in Vietnam. *Economic Systems*, 42 (4), 616-624.
- Nwogugu, M. (2007). Decision-making, Risk and Corporate Governance: A Critique of Methodological Issues in Bankruptcy/Recovery Prediction Models. *Applied Mathematics and Computation*, 185 (1), 178-196.
- Pallant, J. (2009). *SPSS priručnik za preživljavanje*. Beograd, Srbija: Mikro knjiga.
- Psillaki, M., Tsolas, I. & Margaritis, D. (2010). Evaluation of Credit Risk Based on Firm Performance. *European Journal of Operational Research*, 201 (3), 873-881.
- Tabachnick, B. & Fidell, L. (2019). *Using Multivariate Statistics*, 7th ed. Boston, MA: Pearson Education.
- Tseng, F. & Lin, L. (2005). A Quadratic Interval Logit Model for Forecasting Bankruptcy. *Omega: International Journal of Management Science*, 33 (1), 85-91.
- Valaskova, K., Kliestik, T. & Kovacova, M. (2018). Management of Financial Risks in Slovak Enterprises Using Regression Analysis. *Oeconomia Copernicana*, 9 (1), 105– 121.
- Vlaović-Begović, S., Bonić, L. & Jovin, S. (2020). A Comparison of the Bankruptcy Prediction Models on a Sample of Serbian Companies. *Teme*, 44 (2), 503-518.
- World Bank (2021). *Serbia – Data*. Retrieved from: data.worldbank.org/country/serbia
- Xu, W., Xiao, Z., Dang, X., Yang, D. & Yang, X. (2014). Financial Ratio Selection for Business Failure Prediction Using Soft Set Theory. *Knowledge-Based Systems*, 63 (1), 59-67.
- Zelenkov, Y. & Volodarskiy, N. (2021). Bankruptcy Prediction on the Base of the Unbalanced Data Using Multi-objective Selection of Classifiers. *Expert Systems with Applications*, 185 (1), 1-12.
- Zelenkov, Y., Fedorova, E. & Chekrizov, D. (2017). Two-step Classification Method Based on Genetic Algorithm for Bankruptcy Forecasting. *Expert Systems with Applications*, 88 (1), 393-401.
- Zoričák, M., Gnip, P., Drotár, P. & Gazda, V. (2020). Bankruptcy Prediction for Small- and Medium-sized Companies Using Severely Imbalanced Datasets. *Economic Modelling*, 84 (1), 165-176.

Zvarikova, K., Spuchlakova, E. & Sopkova, G. (2017). International Comparison of the Relevant Variables in the Chosen Bankruptcy Models Used in the Risk Management. *Oeconomia Copernicana*, 8 (1), 145–157.

PREDVIĐANJE STEČAJA U TRANZICIONOJ PRIVREDI: SLUČAJ NEFINANSIJSKIH PREDUZEĆA U SRBJI

Apstrakt: Cilj istraživanja je identifikovanje pokazatelja koji mogu značajno doprineti predviđanju stečaja, odnosno razvoj modela za predviđanje stečaja. Radom želimo da ispitamo da li pokazatelji likvidnosti, profitabilnosti, aktivnosti i zaduženosti, kao i nefinansijski pokazatelji mogu ukazati na potencijalne probleme preduzeća. Korišćenjem logit regresije, uzeli smo u obzir finansijske i nefinansijske varijable. Rezultati istraživanja ukazuju na to da logit model uključuje četiri finansijske varijable značajne za predviđanje stečaja sa tačnošću od 91,67%.

Ključne reči: stečaj, logistička regresija, finansijski pokazatelji, nefinansijski pokazatelji, makroekonomski pokazatelji.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**TELEWORKING AND ORGANIZATIONAL OUTCOMES:
THE CRANET RESEARCH RESULTS IN SERBIA**

Nemanja Berber, PhD*

Agneš Slavić, PhD*

Dimitrije Gašić, PhD*

Abstract: *The modern business environment, characterized by a high level of technological development, influenced different changes in job design. A large number of companies moved from traditional job designs to more flexible designs. One of the flexible work arrangements that is more and more interesting for business companies is teleworking or remote work. As a type of flexible working arrangement, teleworking is a work arrangement in which employees perform their work mainly from locations that do not refer to a traditional office environment, even not their homes. The main goal of the research is to investigate the effects that remote work or teleworking causes on organizational outcomes in the Republic of Serbia. The research is based on a sample from the Cranet data research network in Serbia. The data from 106 Serbian business companies were collected by using a standardized Cranet questionnaire in 2021 and 2022. The authors used a t-test to investigate the proposed goal, in the SPSS software. Results showed that companies that use teleworking to a greater extent have higher levels of organizational outcomes.*

Keywords: *Teleworking, flexible work arrangements, human resource management, Cranet, Serbia.*

* University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia, ORCID 0000-0002-1433-6416, ✉ nemanja.berber@ef.uns.ac.rs

• University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia, ORCID 0000-0001-8730-9884, ✉ agnes.slavic@ef.uns.ac.rs

• University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia, ORCID 0000-0002-9068-0593, ✉ dimitrije.gasic@ef.uns.ac.rs
UDK 331.103:004.738.5(497.11)

1. Introduction

The modern business environment, characterized by a high level of technological development, influenced different changes in job design. A large number of companies moved from traditional job design (8-hours working time, in the office, under strict control of supervisors) to more flexible designs that are characterized by flexible time, location, and more autonomy. Flexible working arrangements are mutually beneficial arrangements between employers and employees in which both parties agree on when, where, and how employees will work to meet the needs of the company (Thompson et al., 2015; Bjärntoft et al., 2020).

One of them is the way the job is done by employees in terms of location. One type of flexible working arrangement is remote work. Remote work (teleworking/remote work) is a work arrangement in which employees perform their work tasks mainly from their homes or any other location that does not refer to a traditional office environment, i.e. in the company office (Saragih et al., 2021; Beckel & Fisher, 2022). Čudanov, Cvetković & Săvoiu (2022) point out that remote work is gaining importance due to the emergence of the Kovid-19 pandemic. More and more companies are using it as a response to technological changes, economic issues like inflation and recession, and political instability. People can work from anywhere now, but this is also filled with new challenges like insufficient control, monitoring, team consistency, and human relations in general. Therefore, it is interesting to investigate the effects of remote work on several organizational outcomes.

The main goal of the research is to investigate the effects that remote work or teleworking causes on organizational outcomes in the Republic of Serbia. The research is based on a sample from the Cranet data research network in Serbia. The data were collected by using a standardized Cranet questionnaire in 2021 and 2022. The authors used a t-test to investigate the proposed goal, in the SPSS software.

The research consists of four parts, the first part refers to the theoretical background of the research and consists teleworking definition, an explanation of positive and negative effects on employees, and a presentation of previous research results on this topic. The second part refers to the research methodology, in which the sample, coding, and analysis of the data using the IBM SPSS program for data processing is presented. In the third part, the results of the research are presented. After the analysis, there is a concluding part in which the theoretical and empirical research is summarized, as well as suggestions for future research are highlighted.

2. Teleworking and organizational outcomes

As teleworking is becoming more and more present in each type of organization today, it is necessary to investigate what effect will it have on the outcomes of organizations Morgan (2004) stated that the “basis of flexible working is captured by the expression: work is not a place where you go but rather something you do!” (p. 344). Telework is perceived to increase productivity, secure retention, strengthen organizational commitment, and improve performance within the organization (Harker Martin & MacDonnell, 2012).

Teleworking and organizational outcomes: The Cranet research results in Serbia

Teleworkers can be described as “those who use information and communications technologies thereby enabling them to carry out work from a distance from the place where the work results are needed or traditionally the physical location where the work would otherwise have been carried out” (Morgan, 2004, p. 346). Teleworking occurs when employees perform all or a substantial part of their work physically separated from the location of their employer, using IT for operation and communication (Baruch, 2001, p. 114). Categories of telework are:

“**Mobile telework** – a worker is not located at any one site but travels between, for example, customer or employer premises to maximize the delivery of services or capabilities.

Home-based telework - “telecommuting” - a worker carries out their work-based activities from their home instead of personally visiting an employer’s office, customer site, or other similar location.

Telecentres - local facilities where people seek to reduce the burden and cost of commuting to a central location.

Functional relocation - business functions (and processes) are concentrated and delivered from a distance such as sales activities conducted by telephone or computer network or customer service that can be conducted anywhere using remote access to systems.

(5) **Telecottages**. Distinct from telecentres, these facilities are locally-based and offer the teleworking community the opportunity for personal interaction, skills development, and high-performance ICTs” (Morgan 2004, p. 346; Catană et al., 2022, p. 2).

Teleworking has numerous benefits for employees like reduced interruptions during professional activities, fewer distractions, the rest time necessary for work recovery, a higher level of control over working time, flexibility, together with a greater perceived level of control in terms of task performance, organization and carrying out one’s daily work resulting in better concentration, professional efficiency, performance and productivity, reduced stress, higher job satisfaction, and commitment (Vayre et al., 2022, p. 2; Gašić, 2023).

However, some research pointed out that there are some issues or negative effects of teleworking on employees, like fewer opportunities for affiliation, detachment from social interactions, less influence over people and events at the workplace, questionable job security and status, work-related use of private space and resources, job insecurity, even health issues (Baruch, 2001, p. 119). When it comes to the organizational level, teleworking is related positively to cost savings (no fixed office cost of renting, no bills for electricity, internet connection, telephone, travel cost for employees to reach the office, less use of paper and less use of fuel and less gas emission), followed by increased productivity, lower level of absenteeism and turnover.

For example, Vlčková et al. (2019) showed that a company that uses telework is a company with a higher ratio of liabilities and therefore lower ratio of equity, a lower ratio of fixed assets, higher sales, lower inventory, higher labor productivity and higher value-added per employee, higher return on equity, higher personnel costs, higher average wages. Martínez Sánchez et al. (2007) found that firm performance (8 variables) is positively related to teleworking adoption. Neu et al. (2024) showed that “individual telework access

is associated with greater levels of firm performance because it prompts social exchange processes between the employee and employer, resulting in lower employee turnover intentions. Also, organizational telework dispersion is associated with lower firm performance because it prompts social identity processes; high dispersion in access to telework creates a psychological gap within an organization that is associated with lower levels of collective positive affective tone” (p. 1). Moll and de Leede (2016) found that telecommuting is beneficial for innovativeness, especially for opportunity exploration/research and idea generation as it allows employees to better concentrate and focus when working from home. Flexible working hours provide an opportunity for employees to plan their tasks and spontaneously engage in innovative work behavior when they feel ready for it, it also influences employees to be more relaxed and energetic and improves efficiency and the likelihood of applying innovative work behavior.

Even without adding more previous research into this theoretical part of the paper, it is clear that teleworking is a very important new trend and that it is necessary to investigate it in a domestic business environment.

3. Methodology

The methodology of this research is based on the well-known methodology of the Cranet research network. This international organization is managed by the Center for International Human Resource Studies at Penn State University in the USA. It organizes comparative research on the policies and practices of HRM, using a standardized questionnaire. The CRANET network leads the largest research of HRM practices in the world, based on the well-developed methodology, as a multi-country, multi-time-point survey undertaken regularly over the past 30 years in more than 40 countries (Parry et al., 2021). For this study, the Cranet database from the 2021/2022 research round was used.

The methodology is based on the questionnaire that is filled out by HR managers and experts in organizations. It is a single-respondent methodology. Only organizations with more than 50 employees are taken into account. The main sections of the questionnaire are HRM activity in the organization, staffing process, career development and training, rewards, employee relations, and communication. The survey collects “hard” HR data, like percentages, ratios, and concrete numbers, and avoids attitudinal information. All participating countries used the same questionnaire, with the application of the translation-retranslation technique in every survey round. To avoid bias, there are specific approaches for collecting the data and a few country-specific questions (Berber et al., 2024).

3.1. Variables

The authors used the following variables from the Cranet research:

- Independent variable: Teleworking – as a percentage of employees that are using teleworking possibility in a company. It was recoded, since there were 4 possibilities: 0 - none, 1 – from 1 to 5%, 2- from 6-20%, 3 – from 21-50%, and 4 - more than 50%. The variable is coded 1-less than 20% of employees and 2- more than 20% of employees are using teleworking.

Teleworking and organizational outcomes: The Cranet research results in Serbia

- Dependent variables: Organizational outcomes – a level of different organizational outcomes measured by subjective comparison with the main competitors on the market. Those are rate of profitability, productivity, rate of innovation, service quality, and environmental performance. The scale was from 1 – poor to 5 – superior in comparison with main competitors.

3.2. Sample

The Faculty of Economics in Subotica, University of Novi Sad is the official representative of the Republic of Serbia in the Cranet. The sample in the 2021 research round consists of 106 organizations. Data in Table 1 presents the sample.

Table 1: The size of the organizations

Organization size (by number of employees)	%
1-249	34.9
250-1000	46.2
1000+	18.9
Total	100.0

Source: Authors based on Cranet data 2021/2022

According to the data, 65% of analyzed organizations are large companies, while 35% are small and medium-sized companies.

Table 2: The sector of the organizations

Sector	%
Public	15.1
Private	84.9
Other	0.0
Total	100.0

Source: Authors based on Cranet data 2021/2022

Based on the data in Table 2, 85% of organizations work in the private sector and 15% in the public sector. About 55% of responding companies operate in the service sector and 45% in the manufacturing sector. The average number of employees in companies is 975 employees. About 30% of companies are foreign subsidiaries of large international companies, while 22% are headquarters of national companies, and 30% are subsidiaries of national companies. The largest share of organizations works on worldwide markets, while 22.6% work on regional and 21% on national markets. Companies that operate on local and continent-wide markets are around 10% for each.

4. Results and discussion

Table 3 presents the data on the differences in the level of organizational outcomes concerning the usage of teleworking in the company (less than 20% or more than 20% of employees). Table 4 presents the results of the independent T-test for comparing two groups concerning the level of teleworking usage and organizational outcomes.

Table 3. Descriptive statistics

	Teleworking	N	Mean	Std. Deviation	Std. Error Mean
Rating of service quality	Low usage	83	4.01	.653	.072
	Higher usage	21	4.52	.602	.131
Rating of level of productivity	Low usage	83	3.81	.653	.072
	Higher usage	21	4.33	.730	.159
Rating of profitability	Low usage	81	3.80	.797	.089
	Higher usage	22	4.23	.813	.173
Rating of rate of innovation	Low usage	82	3.63	.824	.091
	Higher usage	21	4.19	.928	.203
Rating of environmental matters	Low usage	81	3.90	.831	.092
	Higher usage	21	4.33	.856	.187

Source: Authors based on Cranet data 2021/2022

According to the data in Tables 3 and 4, companies that used teleworking options for their employees at higher levels had higher levels of organizational outcomes. The differences between those companies are statistically significant in all cases. This test showed companies that use teleworking more had statistically significantly higher levels of service quality ($M=4.52$; $SD=0.602$) compared to those that used teleworking to a lesser extent ($M=4.01$; $SD=0.653$), $t(102) = 3.256$, $p=0.002$. Companies that use teleworking more had statistically significantly higher levels of productivity ($M=4.33$; $SD=0.730$) compared to those that used teleworking to a lesser extent ($M=3.81$; $SD=0.653$), $t(102) = 3.222$, $p=0.002$. In the case of profitability, companies that use teleworking more had statistically significantly higher levels ($M=4.23$; $SD=0.813$) compared to those that used teleworking to a lesser extent ($M=3.80$; $SD=0.797$), $t(101) = 2.208$, $p=0.030$. Companies that use teleworking more had statistically significantly higher levels of rate of innovation ($M=4.19$; $SD=0.928$) compared to those that used teleworking to a lesser extent ($M=3.63$; $SD=0.824$), $t(101) = 2.689$, $p=0.008$. Companies that use teleworking more had statistically significantly higher levels of environmental performances ($M=4.33$; $SD=0.856$) compared to those that used teleworking to a lesser extent ($M=3.90$; $SD=0.831$), $t(100) = 2.111$, $p=0.037$.

Teleworking and organizational outcomes: The Cranet research results in Serbia

Table 4. Results of the T-test for independent samples

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Rating of service quality	Equal variances assumed	1.102	.296	-3.256	102	.002
	Equal variances not assumed			-3.421	32.995	.002
Rating of level of productivity	Equal variances assumed	1.447	.232	-3.222	102	.002
	Equal variances not assumed			-3.011	28.611	.005
Rating of profitability	Equal variances assumed	.145	.704	-2.208	101	.030
	Equal variances not assumed			-2.183	32.827	.036
Rating of rate of innovation	Equal variances assumed	.602	.440	-2.689	101	.008
	Equal variances not assumed			-2.505	28.601	.018
Rating of environmental matters	Equal variances assumed	.859	.356	-2.111	100	.037
	Equal variances not assumed			-2.073	30.496	.047

Source: Authors based on Cranet data 2021/2022

As expected, all indicators of firm performance (productivity, profitability, innovativeness, service quality, and environmental performances) are at a higher level if companies implement teleworking at a higher level, too.

5. Conclusion

Teleworking is not a novel approach to flexible work arrangements, but it gained popularity recently, during the pandemic of Covid-19. Besides the pandemic, other factors like the presence of different generations (X, Y, Z), economic downturns, strong technical development and innovations in the ICT sector, political instability, and environmental concerns also influenced changes in the labor market, especially in terms of job design and workplace flexibility. Since it is implemented widely around the world, it is necessary to investigate and understand potential benefits and obstacles, and its effects on individual and organizational outcomes.

The goal of this paper was to investigate differences between companies that use teleworking to a greater extent in contrast to those that use it on a small scale concerning organizational outcomes, productivity, profitability, rate of innovation, service quality, and

environmental performances. Results of the conducted T-test showed that companies that used teleworking options for their employees at higher levels had higher levels of organizational outcomes. The differences between those companies are statistically significant in the case of all performance indicators.

The main practical and managerial implication of this paper lies in the fact that teleworking can be beneficial for their business, but with a specific strategy and action plan how to implement it. As stated in the theoretical part of the paper, among many good sides, there are problems related to desocialization, teamwork, and lack of control among employees when they telework.

This research was based on the data from the Cranet project, for Serbia, incorporating large and SMEs companies, with more than 50 employees. However, it would be beneficial to investigate this idea in SMEs and entrepreneurial companies, with fewer employees, since those create more than 90% of the Serbian economy. Also, this was a management point of view, single-respondent methodology. Adding the views of employees would be important to understand their attitudes toward teleworking.

Acknowledgment:

This paper is a part of the research project „Effects of flexible working arrangement on the performance and sustainability of organizations“, financed by the Provincial Secretariat for Higher Education and Scientific Research of the Autonomous Province of Vojvodina, Republic of Serbia. Project Number: 000885375 2024 09418 003 000 000 001 04 002.

References

- Baruch, Y. (2001). The status of research on teleworking and an agenda for future research. *International Journal of Management Reviews*, 3(2), 113-129. Doi: <https://doi.org/10.1111/1468-2370.00058>
- Beckel, J. L., & Fisher, G. G. (2022). Telework and worker health and well-being: A review and recommendations for research and practice. *International Journal of Environmental Research and Public Health*, 19(7), 3879. Doi: <https://doi.org/10.3390/ijerph19073879>
- Berber, N., Slavić, A., Gašić, D. (2024). *Digitalization in HRM in Serbia: The Role of Strategic HRM Involvement*. XIX International symposium SymOrg 2024 - Unlocking the hidden potentials of organization through merging of humans and digitals, Zlatibor, June 12-15, 2024 (hybrid), pp. 688-695, Faculty of Organizational Science.
- Bjärntoft, S., Hallman, D. M., Mathiassen, S. E., Larsson, J., & Jahncke, H. (2020). Occupational and individual determinants of work-life balance among office workers with flexible work arrangements. *International journal of environmental research and public health*, 17(4), 1418. Doi: <https://doi.org/10.3390/ijerph17041418>
- Catană, Ș. A., Toma, S. G., Imbrișcă, C., & Burcea, M. (2022). Teleworking impact on wellbeing and productivity: A cluster analysis of the Romanian graduate employees. *Frontiers in Psychology*, 13, 856196. Doi: <https://doi.org/10.3389/fpsyg.2022.856196>

Teleworking and organizational outcomes: The Cranet research results in Serbia

- Gašić, D. (2023). *Fleksibilni radni aranžmani u kontekstu savremenog poslovanja i uticaja na stavove i ponašanja zaposlenih u Republici Srbiji. Doktorska disertacija*. Subotica: Ekonomski fakultet u Subotici.
- Harker Martin, B., & MacDonnell, R. (2012). Is telework effective for organizations? A meta-analysis of empirical research on perceptions of telework and organizational outcomes. *Management Research Review*, 35(7), 602-616. Doi: <https://doi.org/10.1108/01409171211238820>
- Martínez Sánchez, A., Pérez Pérez, M., de Luis Carnicer, P., & José Vela Jiménez, M. (2007). Teleworking and workplace flexibility: a study of impact on firm performance. *Personnel Review*, 36(1), 42-64. Doi: <https://doi.org/10.1108/00483480710716713>
- Moll, F., & de Leede, J. (2016). *Fostering innovation: The influence of new ways of working on innovative work behavior*. In New Ways of Working Practices (Vol. 16, pp. 95-143). Emerald Group Publishing Limited. Doi: <https://doi.org/10.1108/S1877-636120160000016006>
- Neu, M., Barton, L., Shantz, A., & Bruch, H. (2024). Telework and Firm Performance: Individual Access versus Organizational Dispersion. *Academy of Management Proceedings*, 18957. Doi: <https://doi.org/10.5465/AMPROC.2024.261bp>
- Parry, E., Farndale, E., Brewster, C., & Morley, M. J. (2021). Balancing rigour and relevance: The case for methodological pragmatism in conducting large-scale, multi-country and comparative management studies. *British Journal of Management*, 32(2), 273-282. Doi: <https://doi.org/10.1111/1467-8551.12405>
- Saragih, S., Setiawan, S., Markus, T., & Rhian, P. (2021). Benefits and challenges of telework during the covid-19 pandemic. *International Research Journal of Business Studies*, 14(2), 129-135. Doi: <https://doi.org/10.21632/irjbs>
- Thompson, R. J., Payne, S. C., & Taylor, A. B. (2015). Applicant attraction to flexible work arrangements: Separating the influence of flextime and flexplace. *Journal of Occupational and Organizational Psychology*, 88(4), 726-749. Doi: <https://doi.org/10.1111/joop.12095>
- Vayre, É., Morin-Messabel, C., Cros, F., Maillot, A. S., & Odin, N. (2022). Benefits and risks of teleworking from home: The teleworkers' point of view. *Information*, 13(11), 545. Doi: <https://doi.org/10.3390/info13110545>
- Vlčková, M., Frantíková, Z., & Vrchota, J. (2019). Relationship between the Financial Indicators and the Implementation of Telework. *Danube*, 10(1), 45-66.

TELEWORKING I ORGANIZACIONI ISHODI: REZULTATI CRANET ISTRAŽIVANJA U SRBIJI

Rezime: *Savremeno poslovno okruženje, koje karakteriše visok nivo tehnološkog razvoja, uticalo je na različite promene u dizajnu poslova. Veliki broj kompanija je prešao sa tradicionalnog dizajna poslova na fleksibilnije oblike. Jedan od fleksibilnih aranžmana rada koji je sve interesantniji poslovnim kompanijama je teleworking ili rad na daljinu. Kao vrsta fleksibilnih radnih aranžmana, rad na daljinu je radni aranžman u kojem zaposleni obavljaju svoj posao uglavnom sa lokacija koje se ne odnose na tradicionalno kancelarijsko okruženje, čak ni iz svojih domova. Osnovni cilj istraživanja je da se ispituju efekti koje rad na daljinu izaziva na organizacione ishode u Republici Srbiji. Istraživanje je zasnovano na uzorku Kranet istraživačke mreže u Srbiji. Podaci iz 106 srpskih privrednih društava prikupljeni su korišćenjem standardizovanog Kranet upitnika tokom 2021. i 2022. godine. Autori su koristili t-test za istraživanje predloženog cilja, u softveru SPSS. Rezultati su pokazali da kompanije koje u većoj meri koriste rad na daljinu imaju viši nivo organizacionih ishoda.*

Ključne reči: *Teleworking, fleksibilni radni aranžmani, menadžment ljudskih resursa, Kranet, Srbija.*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

MEDIA EFFECTS EVALUATION AND MEDIA BUDGETING

Nenad Đokić, PhD*

Nikola Milićević, PhD •

Ines Đokić, PhD °

***Abstract:** Media budgeting might be based on the evaluation of effects of different media in the context of a set business goal. Hereby, the sales can be stressed as especially important, but there are also other effects of promotion, like purchase intention and brand recall, that might be considered. This paper deals with the complexity of that issue. The authors conduct secondary marketing research. In the first part they present theoretical aspects of the topic. Then, they present a possible approach for evaluating different media effectiveness based on a customized collection app which usage is described in the literature. The topic can be important for both academics and practitioners in the field of marketing.*

***Keywords:** media effects, media budgeting, customized collection app*

1. Introduction

Media budgeting might be based on the evaluation of effects of different media in the context of a set business goal (e.g. Saboo et al., 2016; Jin et al., 2017). Hereby, the sales can be stressed as especially important. As Nelson-Field (2020), among others, suggests, the significance of sales in business is undeniable; without sales, survival is challenging. Furthermore, in addition to sales, there are other effects of promotion that might be considered. Nelson-Field (2020) lists purchase intention and brand recall as those effects. However, she stresses that these legacy measures are used since evaluating advertising's influence on aggregated sales poses significant difficulties for marketers as well as because those measures allow consistency in measurement and low-cost collection. She also adds that those traditional individual-level measures may not accurately reflect sales impact.

* University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia, ORCID 0000-0001-8229-8354, ✉ nenad.djokic@ef.uns.ac.rs

• University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia, ORCID 0000-0003-4834-6994, ✉ nikola.milicevic@ef.uns.ac.rs

° University of Novi Sad, Faculty of Economics in Subotica, Republic of Serbia, ORCID 0000-0002-0920-0469, ✉ ines.djokic@ef.uns.ac.rs

The authors of this paper conduct secondary marketing research. In the first part they present additional theoretical aspects of the topic. Then, they present a possible approach for evaluating different media effectiveness based on a customized collection app which usage is described in the literature. The topic can be important for both academics and practitioners in the field of marketing.

2. Literature review

2.1. Different promotional effects as criteria for media evaluation

Within the literature there might be some different emphasis on how promotion affects sales. It can arise, among others, from promotion consisting of different instruments. For example, when it comes to sales promotion, its effects on sales are clear to a large extent. Dawes et al. (2018) suggest that modeling the effects of price promotions is often straightforward due to the immediate and significant impact on sales caused by a temporary price reduction. When a product is offered at a lower price for a limited time, there is typically a rapid increase in sales. However, this uplift in sales is also short-lived, ceasing promptly once the promotional pricing period concludes. Therefore, the relationship between price promotions and sales can be easily modeled to capture this temporary surge and subsequent return to baseline levels post-promotion.

On the other side, the effects of advertising on sales are much more complex. Previous remark can be first brought in connection to understanding the mechanism of that effect. For example, Scriven and Goodhardt (2012), when discussing the legacy of a scientist Ehrenberg, contrast his view of advertising with a different understanding of that topic. According to his (and his followers') perspective, advertising primarily functions to publicize and promote brand awareness, reminding buyers of a brand's existence and reinforcing existing attitudes towards it, rather than solely focusing on persuasion. The argument is that few advertisements are explicitly designed to be strongly persuasive. Instead, the emphasis is on enhancing a brand's salience, which is its likelihood of being recalled or considered at the time of purchase. In this view, advertising plays a predominantly reinforcing and defensive role. It helps to encourage repeat purchasing from existing customers, especially those who may be infrequent buyers, rather than aiming to convert entirely new customers or cultivate high levels of brand loyalty among a large audience. The goal is to maintain and strengthen the relationship with current customers through consistent brand visibility and messaging, rather than solely seeking to acquire new customers or drastically change consumer behavior through persuasive tactics.

Second, the relation of advertising and sales is especially complicated when it comes to its quantifying. Aleksandrovs et al. (2015) suggest that the advertising literature extensively discusses the challenges of modeling sales-response to quantify the impact of advertising budgets on sales or market shares. The mentioned authors support the thesis that this relationship, as highlighted by Bass, back in 1969, is deemed one of the most difficult, complex, and controversial issues in marketing. Determining the influence of advertising on sales is particularly challenging when considering not only the overall advertising effort but also the differential effects of allocating this effort across different media channels. The complexity increases as researchers seek to understand how advertising in specific media impacts consumer behavior and sales outcomes, requiring nuanced models to capture these dynamics accurately. Dawes et al. (2018) suggest that when it comes to consumer packaged

Media Effects Evaluation and Media Budgeting

goods, a significant portion of buyers are categorized as "light" or infrequent purchasers. This means that the majority of consumers who are exposed to a brand's advertising will not make a purchase shortly after being exposed to the ad. This pattern reflects the reality that advertising often targets a broad audience, including many individuals who do not buy the product regularly or immediately after exposure to the advertisement. Therefore, when analyzing the impact of advertising on consumer behavior in this context, it's important to consider the delayed or indirect effects that advertising can have over time, especially for brands with a diverse customer base that includes both frequent and occasional buyers.

When it comes to legacy measures mentioned within Introduction section of this paper i.e. purchase intention and brand recall, it should be stressed that they are based on models such as the AIDA which suggest a sequence of awareness, interest, desire, and action triggered by advertising. Further considerations of these effects are also according to Nelson-Field (2020).

Purchase intention, a common proxy for action, assumes that advertising directly persuades consumers to buy, although this assumption may oversimplify the complex relationship between cognition and behavior.

AIDA models sometimes substitute awareness with attention, emphasizing the need to capture and sustain consumer attention before influencing behavior. However, confusing awareness with attention reveals a theoretical misunderstanding of these constructs. Moreover, intention scales often overstate actual behaviors, with only about half of consumers intending to buy actually following through. Intenders are typically previous buyers of the brand, emphasizing the importance of understanding baseline usage behaviors to interpret intention accurately.

Recall, a measure of explicit memory requiring consumers to consciously retrieve advertising memories, has been used since the 1950s under the belief that high recall leads to behavior change. However, there is scant evidence linking recall directly to sales, particularly given that users of a brand are more likely to recall its advertising. Failure to account for brand size and user behavior can skew recall studies, leading to misinterpretations of data.

In the real-world application of recall metrics, disparities in platform performance can be attributed to differences in brand size and user base rather than advertising effectiveness. While recall is valuable for measuring explicit memory under focused attention conditions, it does not accurately capture divided attention scenarios or implicit memory. In an era of pervasive distraction, most advertising attention occurs at lower cognitive levels, where even incidental exposure can influence consumer decisions and consideration sets.

Understanding these nuances of attention and memory is crucial for accurate advertising evaluation, recognizing that recall is not a universal proxy for attention or behavior change. The complexity of consumer responses to advertising necessitates a comprehensive approach that considers varying levels of attention and consciousness in advertising reception.

2.2. A possible approach for media effects' evaluation

The approach presented below is developed and described by Nelson-Field (2020). The process is based on a customized collection app that participants download onto their devices. After download, there are several steps that occur.

Hereby, the app directs the participant to the appropriate viewing session, whether it's on Facebook, YouTube, Twitter, TV channels, or another platform. The session duration matches typical platform use, and the impact is measured by average seconds to avoid biases. Once the participant is on the platform, the app activates the user-facing camera when an ad appears. It collects facial footage at five frames per second, converting it to binary data using one of attention models. This model is adjusted for each device type to include screen information, determining where the participant's face is looking on the screen.

When the research involves exposing viewers to test advertising material, the app is designed to intercept and replace the natural ad load on digital platforms in real-time. Instead of the ads they would normally see (through targeting), participants view selected test ads. This interception ensures that the ad viewing experience remains similar to what the user would naturally encounter, as they are served an ad in the expected position. This method allows maintaining consistent creative content across platforms, which is essential for accurately distinguishing between differences in platform performance and creative effectiveness in advertising. It also controls for the varying targeting nuances across platforms. The technology can intercept both video and static ads for any placement type (for example, mid-roll, pre-roll, in-feed). For linear TV, test ads are edited into the content before exposure.

The app tags all advertisements that the participant sees, whether they are test ads or naturally occurring ones. This labeling allows monitoring various ad elements, such as the pixels displayed on the screen, their display duration, the percentage of the screen they occupy as the viewer scrolls, and whether the sound is on or off, including the volume. Once the viewing session ends, the app redirects the participant to a virtual store with choice tasks for each test brand category. Here, the participant is asked to select between the test brand and several competitor brands (shown in a random order). The approach represents a validated methodology for examining actual choice behavior and has been extensively applied in experimental research across various fields. The method is employed to identify potential differences in overall behavioral preferences for advertised brands between distinct exposure groups.

Short-Term Advertising Strength (STAS) is calculated following the collection of choice data from a viewer session. The STAS metric is derived in three steps. Firstly, it can be started by determining the proportion of category buyers who purchased a specific brand without exposure to the brand's advertising. Those buyers belong to control group. Secondly, proportion of category buyers who were exposed to the same brand's advertising (i.e. test group) is determined. Finally, two proportions are compared. By collecting purchasing data from a non-exposed control group of participants, it becomes possible to distinguish between the actual effects of advertising and the influence of brand size on purchasing propensity. This methodology serves as a critical differentiator from many of the sales or brand lift studies currently available in the market. A STAS score of 100 indicates no advertising impact, suggesting that those exposed to the advertising were equally likely to purchase the product as those who were not. Conversely, a score exceeding 100 demonstrates that the advertising had a tangible incremental effect on sales.

In addition to aspects related to product choice, other pertinent information about the respondents is gathered. This includes details on whether they are typical, heavy, or light users of both the brands they selected and the test brand. These metrics are then triangulated with attention and product choice data to enhance the validity of the findings. Furthermore, basic demographic information is collected at this stage, with permission, through questioning.

Media Effects Evaluation and Media Budgeting

Finally, upon completion of the respondent's session, the app becomes redundant on their device.

It should also be stated that the method of data collection for television differs in some extent from that of online platforms. A second phone is placed in the home, using hardware provided by researchers, to stream content to the participant's television. This device is equipped with a user-facing camera. Participants are free to move around and engage in their usual behavior as they would in a natural television viewing experience. The technology employs Adaptive Bitrate Streaming (similar to Netflix) to ensure that participants with average Wi-Fi capabilities can still complete the session.

At this moment, there should be presented relevant details regarding machine learning use within the process. Before that, several remarks about attention should be provided. Early studies on media attention, particularly in the context of television, which began in the early 2000s, identified three primary types of attention: active watching, passive viewing, and avoidance. In this regard, authors sought to ethnographically investigate where viewers directed their gaze during TV advertising. Such efforts were driven by the reasonable assumption that Peoplemeter panelists were likely not providing precise records of their attentiveness during TV watching, introducing potential measurement errors related to the accurate pressing of buttons.

In the approach described here, custom machine learning models are utilized to convert recorded webcam footage into a second-by-second measurement of attention. Here is generated an output attention score that represents an average measure per second, reflecting the extent to which participants' eyes were focused on both the screen and the advertisement. This focus is tracked via a pixel reference point associated with an ad tag. This average is particularly important for comparison purposes, especially given the differences in advertisement lengths.

In this context, there can be specially examined: active attention, passive attention and non-attention. Active Attention should be related to answering the question whether the participant was directly focused on the advertisement. On the other hand, Passive Attention should resolve the issue whether the participant was "in eye shot" but not directly fixated on the advertisement. Finally, Non-Attention deals with whether the participant moved away from the TV or completely diverted his/her gaze from the mobile screen during the advertisement.

The design of measurement methodology is underpinned by insights from the literature on gaze tracking which highlights several essential factors for effective measurement, including accuracy, reliability, robustness, non-intrusiveness, allowance for free head movement, and real-time responsiveness. Therefore, models are calibrated to consider device orientation, recognizing that individuals frequently rotate their devices depending on the type of content they are viewing.

At the end, all data are matched at the level of individual viewers. That incorporates not only "viewability" metrics but also related variables such as sound and brand selection. Although the data may provide initial answers, the final phase of analysis requires human interpretation to yield comprehensive insights. The developers of the solution stress that at present, no machine is capable of fully replicating this level of nuanced interpretation.

3. Conclusion

This manuscript deals with media effects use as a basis for media budgeting. It incorporates two aspects of the problem which are mutually connected.

The first aspect is theoretical and considers different effects that can be evaluated. In addition to sales, purchase intention and brand recall are also considered. The reason for their use as well as some challenges related to them are considered. Part of the challenges arises from the difficulty and expensiveness of measuring media effects. It presents the introduction into the second part of the paper.

In the second part of the paper is presented a potential solution for before mentioned challenges which has its own theoretical foundations and is already implemented in business practice. It relies on using a specially designed app in the first phase and machine learning models together with human interpretation in the second.

The topics considered in this manuscript can be of special importance for both academic and business audiences.

References

- Aleksandrovs, L., Goos, P., Dens, N. & de Pelsmacker, P. (2015). Mixed-Media Modeling May Help Optimize Campaign Recognition and Brand Interest. *Journal of Advertising Research*, 55 (4), 443–457.
- Dawes, J., Kennedy, R., Green, K. & Sharp, B. (2018). Forecasting advertising and media effects on sales: Econometrics and alternatives. *International Journal of Market Research*, 60 (6), 611–620.
- Jin, Y., Wang, W., Sun, Y., Chan, D. & Koehler, J. (2017). *Bayesian methods for media mix modeling with carryover and shape effects*. Retrieved from: <https://research.google/pubs/bayesian-methods-for-media-mix-modeling-with-carryover-and-shape-effects/> Accessed on 15 May 2024.
- Nelson-Field, K. (2020). *The attention economy and how media works. Simple Truths for Marketers*. Singapore: Palgrave Macmillan.
- Saboo, A. R., Kumar, V. & Park, I. (2016). Using Big Data to Model Time-Varying Effects for Marketing Resource (Re) Allocation. *MIS Quarterly*, 40 (4), 911–940.
- Scriven, J. & Goodhardt, G. (2012). The Ehrenberg Legacy. *Journal of Advertising Research*, 52 (2). 198-202.

EVALUACIJA EFEKATA MEDIJA I BUDŽETIRANJE MEDIJA

Apstrakt: Budžetiranje medija može biti zasnovano na evaluaciji efekata različitih medija u kontekstu postavljenog poslovnog cilja. Ovde se prodaja može naglasiti kao posebno važna, ali postoje i drugi efekti promocije, kao što su namera kupovine i prisećanje brenda, koji se mogu uzeti u obzir. Ovaj rad se bavi kompleksnošću tog problema. Autori sprovode sekundarno marketinško istraživanje. U prvom delu predstavljaju teorijske aspekte teme, a tim predstavljaju mogući pristup za evaluaciju efikasnosti različitih medija zasnovan na prilagođenoj aplikaciji za prikupljanje podataka, čija je upotreba opisana u literaturi. Tema može biti važna i za akademsku zajednicu i za praktičare u oblasti marketinga.

Cljučne reči: efekti medija, budžetiranje medija, prilagođena aplikacija za prikupljanje



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

**ALGORITHMIC AND HUMAN MANAGEMENT:
A COMPLEMENTARY APPROACH**

Ivana Simić, PhD*

Abstract: *In the rapidly evolving environment of the digital platform economy, algorithmic management has emerged as a transformative force, increasingly automating tasks traditionally performed by human managers. While algorithmic management offers unparalleled efficiencies and operational advantages, its dominance in platform-based organizations raises concerns about transparency, worker well-being, and the potential dehumanization of the workplace. This paper argues for a complementary approach that integrates both algorithmic and human management systems. This hybrid management system, termed humanistic algorithmic management, addresses the limitations of purely algorithmic management, fosters a more sustainable and worker-centric environment, and enhances overall organizational effectiveness.*

Keywords: *algorithmic management, human management, humanistic algorithmic management, platform-based organizations.*

1. Introduction

Algorithmic management is a defining feature of platform organizations and the platform economy. This relatively new managerial system, which emerged alongside the rise of digital platforms, relies on algorithms, defined as “simply mathematical rules which produce pre-defined outputs” (Rolf, 2024, p. 5). Although algorithmic management predominates in platform-based organizations, it is also present, albeit to a lesser extent, in traditional (also termed conventional or regular) organizations (Bujond et al., 2022, p. 1; Rolf, 2024, p. 5; Baiocco et al., 2022, p. 12; Jarrahi, 2021, p. 2), where human management remains the dominant system.

The widespread use of algorithmic management in platform-based organizations does not imply that the platform economy is devoid of human management. This paper highlights the necessity of complementarity between algorithmic and human management, particularly

* Faculty of Economics, University of Niš, Republic of Serbia, ORCID 0000-0002-2167-9791

✉ ivana.simic@eknfak.ni.ac.rs

UDC 005.5:004

005.96

in addressing the shortcomings of algorithmic systems. The paper aims to emphasize that the synergy between these two management systems can enhance organizational efficiency, improve the work environment, and provide a more sustainable, employee-centric management model.

2. From Human to Algorithmic Management

Numerous definitions of algorithmic management can be found in the literature (Lamers et al., 2024, p. 10; Bucher et al., 2020, p. 4). One of the earliest definitions was provided by Min Kyung Lee and his colleagues, who describe algorithmic management as “software algorithms that assume managerial functions and surrounding institutional devices that support algorithms in practice” (Lee et al., 2015, p. 1603). Mareike Möhlmann and her colleagues define algorithmic management as “the large-scale collection and use of data on a platform to develop and improve learning algorithms that carry out coordination and control functions traditionally performed by managers” (Möhlmann et al., 2021, p. 2001). Antoine Bujond and his colleagues describe algorithmic management as “powerful algorithmic systems that... have the capacity to automate tasks typically performed by managers” (Bujond et al. 2022, p. 1).

The provided definitions, like many others, directly or indirectly suggest that algorithmic management is responsible for executing, planning, organizing, leading, and controlling, standard managerial functions typically handled by human managers in traditional organizations (see: Baiocco et al., 2022, p. 12).

According to Alexander Benlian and his colleagues, the reasons for the greater attractiveness of algorithmic management compared to human management lie in specific characteristics that make algorithms more appealing alternatives to humans (Benlian et al., 2022, p. 829):

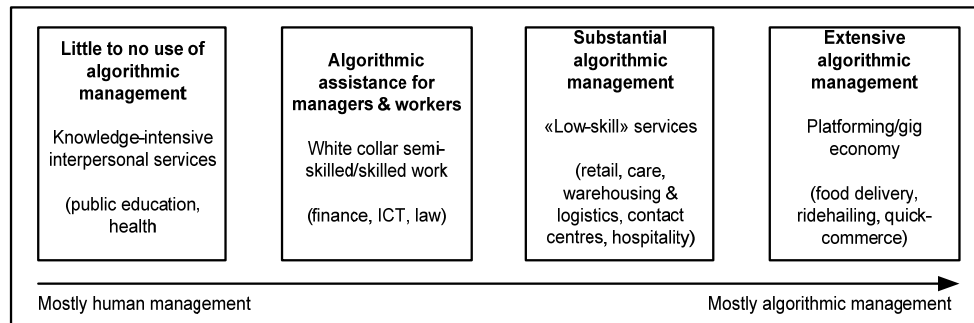
- They are well-ordered;
- They perform unambiguous operations and can compute them effectively;
- They are designed to produce specific outputs for given inputs within a finite amount of time.

With numerous other advantages inherent to algorithmic management (e.g., high degrees of precision, flexibility, autonomy and task variety in a digital environment governed by algorithms; reliance on comprehensive information from various sources; instantaneous performance assessments; efficient interactions among multiple parties; effective task-worker matching; enhanced operational efficiency and economic value, etc.) (Bucher et al., 2020, p. 4; Cui et al., 2024, p. 1), it is not surprising that both platform-based and traditional organizations are increasingly implementing algorithmic management (Rolf, 2024, p. 4). It is important to keep in mind that the extent of algorithmic management varies among organizations, and that a higher level of algorithmic management generally results in a lower level of human management. In this context, within platform-based organizations, algorithmic management has significantly displaced human management (Benlian et al., 2022, p. 829).

Through a detailed analysis of service sector organizations, Steven Rolf (Rolf, 2024, p. 7) identified different levels of algorithmic management implementation (see Figure 1).

Algorithmic and Human Management: A Complementary Approach

Figure 1: Different levels of algorithmic management in service organizations



Source: compare to Rolf, 2024, p. 7.

The levels of algorithmic management identified by Rolf align significantly with the classification of automation in algorithmic management, originally proposed by Alex Wood (2021), and later expanded by Sara Baiocco and her colleagues (2021). Namely, emphasizing that certain managerial tasks and functions remain non-automatable, Sara Baiocco and her colleagues identify four levels of automation in algorithmic management (see: Baiocco et al., 2021, p. 7):

- No automation (“with fully human management”);
- Management assistance (“using algorithms to assist human managers”);
- Partial-conditional automation (“using algorithms to make some decisions, with human managers retaining some key functions and intervening when necessary”);
- Full automation (added for analytical purposes; has no real application).

It is noteworthy that Baiocco et al. viewed the level of “full automation” as having no practical application (Baiocco et al., 2021, p. 7). This perspective is supported by Alex J. Wood, who argued that human managers must retain a “meaningful” influence, as fully automated decision-making with significant impacts on individuals, without any human managerial input, could potentially be illegal in the EU and UK (Wood, 2021, p. 11). Baiocco et al. also highlighted the challenges of fully automating the management process, particularly in the area of planning. According to these authors, while planning is “at least assisted by algorithms in digital platforms”, key strategic business decisions remain under the control of human managers (Baiocco et al., 2022, p. 12).

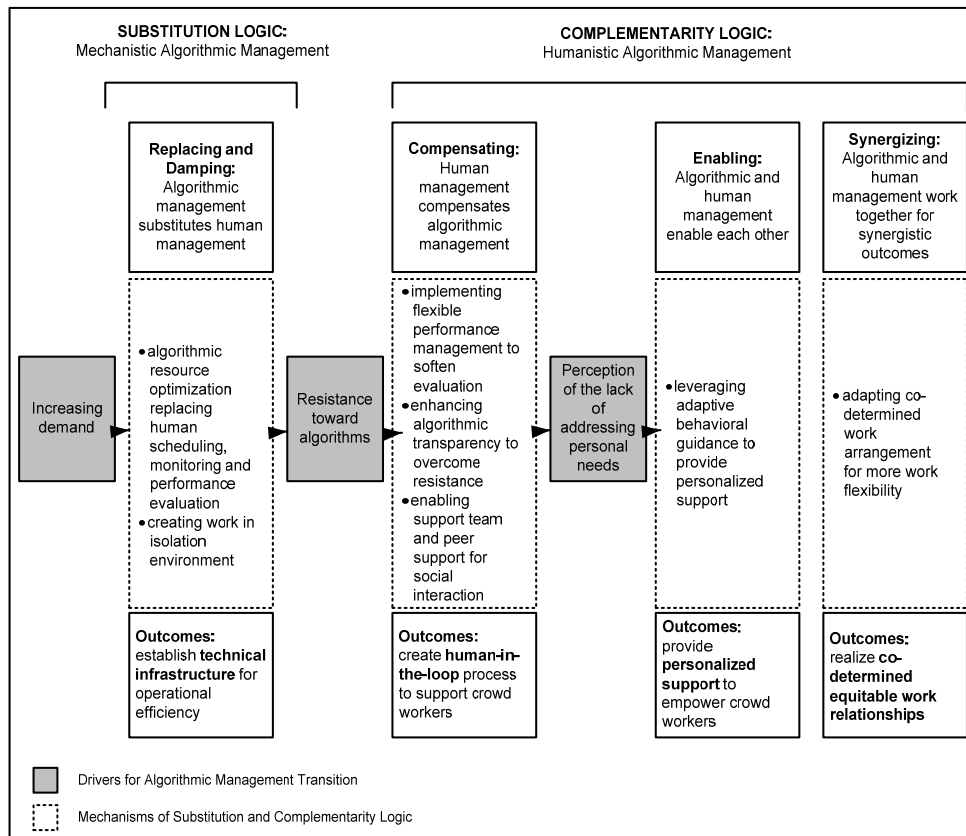
3. From Algorithmic to Humanistic Algorithmic Management

The aforementioned points, along with numerous shortcomings currently attributed to algorithmic management (e.g. lack of transparency, worker anxiety, frustration, demoralization, perceived injustice, social isolation, irregular hours, work overload, opacity symbolized by “black-boxed” performance evaluations, etc.) (Benlian et al., 2022, p. 829; Bujond et al., 2022, p. 2; Jarrahi et al., 2023, p. 2; Bucher et al., 2020, p. 4; Cui et al., 2024, p. 1), highlight the necessity of human management as a complementary support to algorithmic management, even within platform organizations.

Algorithmic management that incorporates human-technology interactions, and the complementarity of “human” management (involves human managers who actively engage with employees, understand their unique needs, and provide support, guidance, and oversight, has the potential to boost employee attitudes and behaviors, including work motivation, organizational commitment, and skill development) and algorithmic management (refers to a system in which managerial tasks and decision-making processes are predominantly automated and driven by algorithms), is referred to by Tigran Cui and his colleagues as “humanistic algorithmic management” (Cui et al., 2024, p. 10-11). According to Cui et al., humanistic algorithmic management “shapes the future workplace by integrating the best of human and algorithmic management” (Cui et al, 2024, p. 11).

To explain the transition from so-called “mechanistic” algorithmic management, defined as “the most rudimentary form of algorithmic management, where algorithms replace human management” (Cui et al., 2024, p. 11), to “humanistic” algorithmic management, Cui and his colleagues developed a process model of humanistic algorithmic management (Figure 2) (Cui et al., 2024, p. 11).

Figure 2: A Process Model of Humanistic Algorithmic Management



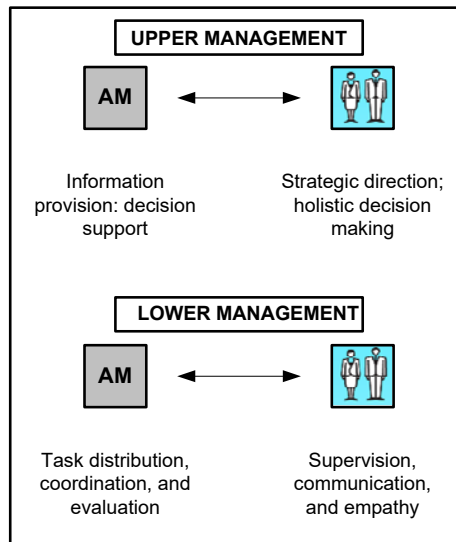
Source: compare to Cui et al., 2024, p. 10.

Algorithmic and Human Management: A Complementary Approach

This transition process demonstrates how human management can progressively complement algorithmic management to create a more sustainable, worker-centric work environment, leading to increasingly better outcomes. The process involves four key mechanisms (replacing and damping, compensating, enabling, synergizing), representing “a systematic and organized set of actions that describe how a particular transformation is produced” (Cui et al., 2024, p. 12). These mechanisms are categorized into two groups: mechanisms of substitution and mechanisms of complementarity logic. The first group (mechanisms of substitution) explains how algorithmic elements replace human management components, resulting in a shift from human-led to algorithm-driven processes (Cui et al., 2024, p. 12). The second group (mechanisms of complementarity) illustrates how algorithmic and human management can collaborate, enhancing each other’s strengths and mitigating their weaknesses (Cui et al., 2024, p. 12).

Pointing out the necessary symbiosis between algorithmic and human management, Hossein Jarrahi and his colleagues (Jarrahi et al., 2023) analyze this relationship across different levels of management and various managerial tasks (Figure 3). According to Jarrahi et al., at lower managerial levels, algorithmic management enhances task coordination by handling the disaggregation, distribution, aggregation, and evaluation of tasks, while human managers focus more on supervision and interpersonal interactions. At higher managerial levels, algorithmic management provides insights by analyzing information from internal and external environments, crucial for decision-making, whereas human managers, drawing on their strategic and holistic perspective, make key decisions essential for the organization’s operation (Jarrahi et al., 2023, p. 3).

Figure 3: Algorithmic-human partnership at different management levels



Source: compare to Jarrahi et al., 2023, p. 3.

4. Conclusion

The interaction between algorithmic and human management is crucial for advancing the efficiency and sustainability of managerial practices within platform-based organizations. Although algorithmic management offers significant advantages (e.g. precision, flexibility, efficiency, etc.), its inherent limitations (particularly in areas requiring empathy, ethical judgment, and nuanced decision-making) highlight the need for the complementary role of human management.

This paper emphasizes the critical importance of integrating these two management systems. By fostering a collaborative relationship between algorithmic and human management, organizations can capitalize on the strengths of both, effectively mitigating the limitations of each. This complementary approach can enhance operational outcomes as well as improve employee well-being, motivation, and engagement, leading to a more holistic and resilient digital organizational environment.

Acknowledgement:

The paper is a result of research based on the Agreement (number 451-03-65/2024-03) signed in 2024 by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia and the Faculty of Economics, University of Niš.

References

- Baiocco, S., Fernández-Macías, E., Rani, U. & Pesole, A. (2022). *The Algorithmic Management of Work and its Implications in Different Contexts*. Seville: European Commission, 2022, JRC129749.
- Benlian, A., Wiener, M., Cram, W. A., Krasnova, H., Maedche, A., Möhlmann, M., Recker, J. & Remus, U. (2022). Algorithmic Management Bright and Dark Sides, Practical Implications, and Research Opportunities. *Business & Information Systems Engineering*, 64 (6): 825–839. <https://doi.org/10.1007/s12599-022-00764-w>
- Bucher, E. L., Schou, P. K. & Waldkirch, M. (2020). Pacifying the algorithm – Anticipatory compliance in the face of algorithmic management in the gig economy. *Organization, Special Issue: Dark Side of Digitalization*, 1-24. <https://doi.org/10.1177/1350508420961531>
- Bujond, A., Parent-Rochelleau, X. & Gaudet, M. C. (2022). Opacity behind the wheel: The relationship between transparency of algorithmic management, justice perception, and intention to quit among truck drivers. *Computers in Human Behavior Reports*, 8: 1-14. <https://doi.org/10.1016/j.chbr.2022.100245>
- Cui, T., Tan, B. & Shi, Y. (2024). Fostering humanistic algorithmic management: A process of enacting human-algorithm complementarity. *Journal of Strategic Information Systems*, 33: 1-20. <https://doi.org/10.1016/j.jsis.2024.101838>
- Jarrahi, M. H., Möhlmann, M. & Lee, M. K. (2023). Algorithmic Management: The Role of AI in Managing Workforces. *MIT Sloan Management Review*. https://bentleydownloads.s3.amazonaws.com/general/Updated+MIT_Sloan_Mareike_Mohlmann.pdf
- Jarrahi, M. H., Newlands, G., Lee, M. K., Wolf, C. T., Kinder, E. & Sutherland, W. (2021). Algorithmic management in a work context. *Big Data & Society*, July-December, 1-

14. <https://doi.org/10.1177/20539517211020332>
- Lamers, L., Meijerink, J. & Rettagliata, G. (2024). Blinded by “algo economicus”: Reflecting on the assumptions of algorithmic management research to move forward. *Human Resource Management*, 1-14. <https://doi.org/10.1002/hrm.22204>
- Lee, M. K., Kusbit, D., Metsky, E. & Dabbish, L. (2015). Working with Machines: The Impact of Algorithmic and Data-Driven Management on Human Workers. In: *CHI '15 Proceedings of the 33rd Annual ACM SIGCHI Conference*, Seoul, South Korea, 18–23 April. New York: ACM Press, 1603–1612. <https://doi.org/10.1145/2702123.2702548>
- Möhlmann, M., Zalmanson, L. & Henfridsson, O. (2021). Algorithmic Management of Work on Online Labor Platforms: When Matching Meets Control. *MIS Quarterly*, 45 (4): 1999-2022. <https://doi.org/10.25300/MISQ/2021/15333>
- Rolf, S. (2024). *AI and algorithmic management systems in European service work: Prevalence, overview and functions*. Belgium: Friedrich-Ebert-Stiftung.
- Wood, A. J. (2021). *Algorithmic Management: Consequences for Work Organisation and Working Conditions*. JRC Working Papers, Series on Labour, Education and Technology, 2021/07. Seville: European Commission, EU Science Hub.

ALGORITAMSKI MENADŽMENT I MENADŽMENT KOJI OBAVLJAJU LJUDI: KOMPLEMENTARNI PRISTUP

Rezime: U veoma promenljivoj ambijentu digitalne platformске ekonomije, algoritamski menadžment se pojavio kao transformaciona snaga koja u sve većoj meri automatizuje zadatke koje su tradicionalno obavljali menadžeri-ljudi. Iako algoritamski menadžment nudi neuporedivu efikasnost i brojne operativne prednosti, njegova dominacija u organizacijama baziranim na platformama izaziva zabrinutost, pored ostalog i u vezi sa transparentnošću, dobrobiti radnika i potencijalnom dehumanizacijom radnog mesta. U ovom se radu zagovara komplementarni pristup koji integriše sistem algoritamskog menadžmenta sa sistemom u kojem funkcije menadžmenta obavljaju ljudi. Ovaj hibridni model, nazvan humanistički algoritamski menadžment, fokusiran prvenstveno na ograničenja algoritamskog menadžment sistema, podstiče održivije okruženje koje je usmereno na zaposlene i koje poboljšava ukupnu efikasnost organizacije.

Ključne reči: algoritamski menadžment, menadžment koji obavljaju ljudi, humanistički algoritamski menadžment, organizacije zasnovane na platformama.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**STUDENTS' PERSONALITY TRAITS AND LEARNING
PREFERENCES: CASE OF SIX UNIVERSITIES**

Ivana Marjanović, PhD*

MSc Sandra Milanović Zbiljić •

Georgios Tsaples, PhD •

Georgios Aretoulis, PhD •

Abstract: *This study explores the relationship between students' personality traits and fellow students' learning preferences, focusing on a sample of 646 respondents from six universities. Utilizing the Big Five personality model - Extraversion, Neuroticism, Agreeableness, Conscientiousness, and Openness to Experience - correlation analysis was conducted to examine how these traits influence individual learning preferences. Results indicate that Openness to Experience and Conscientiousness are positively correlated with learning preferences, suggesting that through conscientious and openness to experiences students adapt well to various instructional methods. Conversely, Extraversion and Neuroticism show negative correlations with certain learning preferences, implying potential challenges for students high in these traits. Interestingly, no significant correlation was found between Agreeableness and any learning preference, marking it as an exception among the traits studied. The findings highlight the nuanced ways personality shapes educational experiences, offering valuable insights for tailoring teaching methods to diverse student needs and improving educational outcomes in higher education settings.*

Keywords: *personality traits, learning preferences, students, universities.*

* Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0000-0002-9526-0467,
✉ ivana.veselinovic@eknfak.ni.ac.rs

• Faculty of Economics, University of Niš, Niš, Serbia, ORCID: 0000-0002-0582-045X,
✉ sandra.milanovic@eknfak.ni.ac.rs

• University of Macedonia, Department of Business Administration, Thessaloniki, Greece,
ORCID: 0000-0002-6979-3884, ✉ gtsaples@gmail.com

• Aristotle University of Thessaloniki, Department of Civil Engineering, Thessaloniki,
Greece, ORCID: 0000-0002-9248-3454, ✉ garet@civil.auth.gr

UDC 316.613-057.875

159.953-057.875

1. Introduction

Technology is evolving and impacting remote education's context and content more and more. It has the power to change and revolutionize distance learning. Academicians have to basically rethink their roles as a result of these changes. It is true that teachers are serving as facilitators in this new setting, but it is also appropriate to note that they are responsible for leading the pupils. Students, however, also have to adjust to a new educational world. They now attend virtual classrooms rather than traditional ones. Not only do they prefer different educational context and content, they also have different personalities to be taken into account when designing educational materials. Additionally, their distinct personalities - such as being introverted or extroverted, risk-averse or open to experimentation - affect how they interact with educational materials and environments, necessitating tailored strategies to optimize their learning experiences.

In today's rapidly evolving educational landscape and with the emergence of COVID-19 pandemic, the traditional approach to teaching and learning is being redefined and reorganized to better align with new technological, social, and environmental demands. However, despite these changes, there is a growing need to understand how individual differences - particularly personality traits - affect students' learning preferences and their interactions with peers in educational settings. The lack of alignment between educational methods and diverse learner profiles may hinder optimal learning outcomes and student engagement. Therefore, the aim of this paper is to explore and empirically test the relationship between students' personality traits and their fellow students' learning preferences. By examining these connections, the study seeks to provide insights into how personality-driven dynamics influence learning in group settings, ultimately offering recommendations for more personalized and effective educational practices.

Paper structure is as follows: after introduction, literature review of theoretical framework of Big five personality traits and learning preferences such as VARK model will be elaborated. Secondly, methodology of research will be presented and results obtained. Lastly, conclusion and discussion along with recommendations, paper limitations and future research directions will be given.

2. Literature Review

Personality traits are often perceived from the point of view of the Big five or Myers and Briggs concept of personality traits. No matter the approach taken for exploring personality traits, they all can be related to learning preferences (Komarraju et al., 2011; Kamal & Radhakrishnan, 2019). When it comes to the Big five personality traits conscientiousness, neuroticism, extraversion, openness to experience, and agreeableness. Conscientiousness as a trait is characterized by being disciplined, organized, and achievement-oriented. Individuals high in conscientiousness tend to be reliable and goal-directed, which can positively influence their academic performance. Neuroticism refers to the degree of emotional stability, impulse control, and anxiety. Individuals high in neuroticism may experience negative emotions more frequently, which can adversely affect their learning and academic outcomes. Extraversion is associated with sociability, assertiveness, and talkativeness. Extraverted individuals may engage more actively in social learning environments, which can enhance their learning experiences. Openness to

Students' Personality Traits and Learning Preferences: Case of Six Universities

experience as a trait reflects intellectual curiosity and a preference for novelty and variety. Individuals high in openness are more likely to engage in creative and reflective learning processes, which can lead to better academic performance. Lastly, agreeableness is characterized by being helpful, cooperative, and sympathetic towards others. Agreeable individuals may work well in collaborative learning settings, which can enhance their educational experiences (Komarraju et al., 2011).

The VARK model, developed by Neil Fleming, categorizes learners into four primary types based on their preferred modes of receiving and processing information. Visual Learners (V) as learners prefer to see and visualize information. They benefit from diagrams, charts, graphs, and other visual aids. Visual learners often find it easier to understand and remember information when it is presented in a visual format. Auditory learners (A) learn best through listening. They prefer lectures, discussions, and audio materials. These learners often retain information better when they hear it spoken, and they may benefit from reading aloud or discussing topics with others. Reading/Writing Learners (R) prefer to engage with text. They learn best through reading and writing activities, such as reading textbooks, taking notes, and writing essays. These learners often excel in environments where they can read and write extensively. Kinesthetic learners (K) prefer hands-on experiences and learning through doing. They learn best when they can engage in physical activities, experiments, or simulations. These learners often benefit from practical applications and real-world experiences. The VARK model emphasizes that individuals may have a dominant learning style but can also exhibit preferences for multiple styles (bimodal or trimodal learners). Understanding these learning preferences can help educators design more effective teaching strategies that cater to the diverse needs of students, ultimately enhancing their learning experiences and academic outcomes (Abouzeid et al., 2021).

When it comes to relationship between personality traits and learning styles of students, the study of Komarraju et al. (2011) found that conscientiousness and agreeableness were positively related to all four learning styles (synthesis-analysis, elaborative processing, methodical study, and fact retention), while neuroticism was negatively related to these learning styles. Openness was positively related to elaborative processing, indicating that individuals who are more open to new experiences tend to engage in deeper learning strategies. For instance, kinesthetic learning style was notably prevalent among the students, and there was a significant relationship between this learning style and the personality trait of openness (Abouzeid et al., 2021). Seyal et al. (2019) also found that extraversion is not linked to any specific learning style. However, there is a strong connection between openness to experience and the agreeableness trait with the kinaesthetic learning style. This suggests that students who are more open and willing to engage in discussions tend to prefer learning through practical, hands-on methods. Likewise, students with a conscientious personality tend to favor reading as their primary learning style. Lastly, there is a significant relationship between neuroticism and the visual learning style.

While previous studies have explored the relationship between personality traits and learning styles, there are still gaps that need to be addressed. Komarraju et al. (2011) and Seyal et al. (2019) examined how traits like conscientiousness, openness, and neuroticism relate to different learning styles, but their research focused primarily on broad categories or specific styles like kinaesthetic or visual learning. However, there is limited exploration of how these personality traits interact with emerging learning environments, such as digital or hybrid platforms. Additionally, research on the role of extraversion remains inconclusive,

with Seyal et al. (2019) finding no link between extraversion and any learning style, while other studies suggest this trait may influence group-based or interactive learning in ways that have yet to be fully examined. Furthermore, little attention has been paid to cultural differences or educational settings outside traditional frameworks, leaving room to investigate how personality traits impact learning styles in diverse, global contexts. Therefore, the paper will seek to fill this gap and to answer research question:

R1: How do Big five personality traits influence learning styles in multicultural learning environments?

3. Methodology of research

Research Design: The ODLEP questionnaire was developed for the purpose of collecting responses from students. Respondents were enrolled at project partners' universities in Greece, Serbia, Romania and Italy. Survey collected 646 responses from university students across six participating universities during 2023 (i.e, three Greek, one Serbian, one Romanian and one Italian universities) in order to identify statistically significant correlations among the learning preferences of the fellow students and their personality traits. Students were contacted through their teachers involved in the project activities to fill in the questionnaire. Therefore, convenient sampling method was employed.

Data Collection Instruments: For data collection purposes both paper-based and online tools such as Google form and Limesurvey were used. An initial part of the questionnaire was designed to record the characteristics of the students (general attributes – profile) such as gender, nationality and level of study. The subsequent phase involved the introduction of essential learning styles by fellow students, which were derived from the foundational work of Sternberg and Zhang (Sternberg & Zhang, 2005; Zhang & Sternberg, 2002). This framework was further expanded through the complementary approach proposed by Arbabisarjou et al. (2016). In this regard, Sternberg and Zhang (2005) introduced several key dimensions of learning styles within the context of mental self-government theory, which includes:

- Three functions of government: legislative, executive, and judicial;
- Four forms of mental self-government: monarchic, hierarchic, oligarchic, and anarchic;
- Two levels of mental self-government: local and global;
- Two scopes of mental self-government: internal and external;
- Two types of learning in mental self-government: liberal and conservative.

Following this, the learning style model proposed by Arbabisarjou et al. (2016) draws on the VARK learning styles framework, which classifies learners into four categories: kinesthetics, auditory, read/write, and visual. Additionally, Arbabisarjou et al. (2016) emphasized the possibility of utilizing multiple learning styles simultaneously. The VARK model specifically highlights four modes of learning: visual, aural, reading/writing, and kinaesthetic. In total, this part of the survey had 17 items that participants ranked using a Likert scale (1 not at all, 5 completely).

Questionnaire for measuring students' personality traits was intended to assess the Big five personality traits and facets by using 56-items questionnaire that participants ranked using a Likert scale (1 not at all, 5 completely). Students were answering the survey as they

Students' Personality Traits and Learning Preferences: Case of Six Universities

are now, not what they wish to be in the future. An example of question measuring personality trait is „I am not easily frustrated“. In this way, five students' personality traits “extraversion“, “neuroticism“, “openness to experience“, “conscientiousness” and “agreeableness” were assessed.

Data Analysis Methods: A corresponding database was created in SPSS 29, including 124 variables (columns) and 646 responses (lines). A following descriptive statistics analysis has taken place and in addition a correlation analysis (crosstab analysis). The analyses succeeded in identifying the dominant learning preferences as stated by the university students and also recorded what students prefer in their fellow students regarding learning preferences.

4. Results

The research sample comprised 48.3% female participants, 51.4% male participants, and 0.3% of participants who did not provide a response. In terms of nationality, 46.9% were Greek, 1.1% Cypriot, 0.3 Albanian, 34.4% Italian, 9.1 Romanian, 7.9% Serbian and 0.3 Georgian students. The majority of students were attending undergraduate level of studies (72.4%), while 24.3% were master students. Table 1 presents descriptive statistics of students' personality traits.

Table 1. Descriptive statistics

Personality trait	N	Minimum	Maximum	Mean	Std. Dev.
Extraversion	646	1.67	4.67	3.2807	.50806
Neuroticism	646	1.00	4.88	2.5878	.67648
Openness to Experience	646	1.95	4.95	3.6833	.51499
Conscientiousness	646	1.80	5.00	3.7946	.63638
Agreeableness	646	2.00	4.83	3.3968	.49390

Source: Authors' calculation.

Mean values of personal traits range from 0 to 5, and higher values indicate a more pronounced students' personal trait on average. Respondents reported above the average personality trait “conscientiousness” (mean = 3.7946), followed by “openness to experience” (mean = 3.6833), “agreeableness” (mean = 3.3968) and “extraversion” (mean = 3.2807). The mean value of students' personal trait “neuroticism” was 2.5878.

Tables 2-5 below summarize the correlations among fellow students' learning preferences and students' personality traits. In Table 2 the relationship between fellow students' learning preferences and personality trait *extraversion* is presented.

The findings in Table 2 suggest that students with higher levels of extraversion tend to prefer different learning styles compared to their peers. Specifically, more extroverted students may favor interactive, group-based activities, while their peers may prefer quieter, more individualized learning environments. This creates a negative correlation, where extraversion is inversely related to the preferred learning style of fellow students, particularly those who thrive in less socially dynamic settings.

Table 2. Relationship between fellow students' learning preferences and personality trait *extraversion*

Learning Preference / Personality Trait	EXTRAVERSION	
	Pearson Correlation	Sig. (1-tailed)
Students that have preference for tasks, projects, and situations that allow focusing fully on one thing or aspect at a time and staying with that thing until it is complete.	-,102**	0,009
Students that have preference for tasks, projects, and situations that allow creation of a hierarchy of goals to fulfill. These students will often make lists, and sometimes even lists of lists.	-,087*	0,027
Students that have a preference for tasks, projects, and situations that allow them to work independently of others.	-,094*	0,017
Students that have a preference for tasks, projects, and situations that require adherence to and observance of existing rules and procedures. These students like to minimize change and avoid ambiguity.	-,122**	0,002

Source: Authors' calculation.

In Table 3 the relationship between fellow students' learning preferences and personality trait *neuroticism* is presented.

Table 3. Relationship between fellow students' learning preferences and personality trait *neuroticism*

Learning Preferences / Personality Trait	NEUROTICISM	
	Pearson Correlation	Sig. (1-tailed)
Students that better discern the material through watching a demonstrative presentation of the information.	-0,077	0,051
Students that can understand the material better through listening and oral teaching methods.	-,090*	0,023
Students that can better conceive the instructional material through performing the practical, experimental and object manipulation via something more of a physical process (simulated or real).	-,104**	0,008
Students that have preference for tasks, projects, and situations that require creation, formulation, planning of ideas, strategies. These students like to decide what to do and how to do it, rather than to be told.	-,125**	0,002
Students that have preference for tasks, projects, and situations that require evaluation, analysis, comparison–contrast, and judgment of existing ideas, strategies and projects. These students tend to like evaluative essays, commenting on other people's others' strengths and weaknesses	-,092*	0,020
Students that have preference for tasks, projects, and situations that allow creation of a hierarchy of goals to fulfill. These students will often make lists, and sometimes even lists of lists.	-,087*	0,028
Students that have preference for tasks, projects, and situations that allow working with competing approaches, with multiple aspects or goals that are equally important.	-,078*	0,047
Students that have preference for tasks, projects, and situations that lend themselves to great flexibility of approaches, and to trying anything when, where, and how they please (work asystematic or even antisystematic).	-,122**	0,002

Students' Personality Traits and Learning Preferences: Case of Six Universities

Students that have preference for tasks, projects, and situations that require engagement with specific, concrete details. These students tend to enjoy tasks that require keeping track of details and to focus on concrete specifics of a situation.	-,095*	0,016

Source: Authors' calculation.

Neuroticism, a personality trait characterized by emotional instability and anxiety, tends to negatively correlate with various learning preferences (Table 3). This means that individuals with higher levels of neuroticism are less likely to engage in or prefer certain learning styles, possibly due to stress, fear of failure, or low confidence. As expected, these correlations suggest that neuroticism may hinder a broad range of adaptive learning approaches.

In Table 4 the relationship between fellow students' learning preferences and personality trait *openness to experience* is presented.

Table 4. Relationship between fellow students' learning preferences and personality trait *openness to experience*

Learning Preferences / Personality Trait	OPENNESS TO EXPERIENCE	
	Pearson Correlation	Sig. (1-tailed)
Students that can better learn the teaching materials through taking notes and reading the written contexts and texts.	,156**	0,000
Students that can better conceive the instructional material through performing the practical, experimental and object manipulation via something more of a physical process (simulated or real).	,113**	0,004
Students that have preference for tasks, projects, and situations that require creation, formulation, planning of ideas, strategies. These students like to decide what to do and how to do it, rather than to be told.	,080*	0,042
Students that have preference for tasks, projects, and situations that require evaluation, analysis, comparison–contrast, and judgment of existing ideas, strategies and projects. These students tend to like evaluative essays, commenting on other people's strengths and weaknesses	,108**	0,006
Students that have preference for tasks, projects, and situations that allow working with competing approaches, with multiple aspects or goals that are equally important.	,104**	0,008

Source: Authors' calculation.

The findings in Table 4 suggest that students who score high in "openness to experience" tend to prefer learning environments that encourage exploration, creativity, and diverse perspectives. These students are more likely to engage with novel concepts and enjoy varied teaching methods. As a result, their openness aligns well with learning preferences that emphasize innovation and flexibility.

In Table 5 the relationship between fellow students' learning preferences and personality trait *conscientiousness* is presented.

Table 5. Relationship between fellow students' learning preferences and personality trait *conscientiousness*

Learning Preference / Personality Trait	CONSCIENTIOUSNESS	
	Pearson Correlation	Sig. (1-tailed)
Students that can better learn the teaching materials through taking notes and reading the written contexts and texts.	,103**	0,009
Students that can better conceive the instructional material through performing the practical, experimental and object manipulation via something more of a physical process (simulated or real).	,083*	0,036
Students that have preference for tasks, projects, and situations that require evaluation, analysis, comparison–contrast, and judgment of existing ideas, strategies and projects. These students tend to like evaluative essays, commenting on other people's strengths and weaknesses	,087*	0,027
Students that have preference for tasks, projects, and situations that allow focusing fully on one thing or aspect at a time, and staying with that thing until it is complete.	,082*	0,037

Source: Authors' calculation.

In the context of conscientiousness, all learning preferences - whether visual, auditory, kinesthetics, or reading/writing - are positively linked to this personality trait (Table 5). Conscientious individuals tend to be disciplined, organized, and goal-oriented, which makes them adaptable and open to various learning styles that support their achievement. Their attention to detail and focus on quality likely enhances their ability to benefit from diverse learning approaches.

“Extraversion” and “neuroticism” are personality traits that tend to show negative correlations with various learning preferences, meaning individuals high in these traits may struggle with certain learning styles. “Openness to experience” means that students tend to be more open to new ideas and appreciate diverse instructional approaches. “Conscientiousness”, on the other hand, is positively associated with all learning preferences, suggesting that conscientious individuals can adapt to various educational approaches. Interestingly, correlations between personality traits and students' learning preferences are found for all traits except for “agreeableness”. This implies that “agreeableness” does not significantly influence how students prefer to learn. “Neuroticism”, often linked to emotional instability, may hinder adaptive learning, while “extraversion”, associated with sociability, could create challenges in focused or independent study environments. Overall, personality traits significantly shape learning preferences, but “agreeableness” remains an exception.

The paper highlighted the relationship between personality traits and learning preferences and it is in line with the previous research results. Personality traits like openness and conscientiousness are positively associated with adaptive learning styles, particularly regarding openness to new ideas and conscientiousness' ability to adjust to different educational approaches. However, the results indicate that extraversion and neuroticism tend to negatively impact learning preferences, an observation consistent with findings by Komarraju et al. (2011), where neuroticism was linked to negative outcomes across learning styles. This reinforces the idea that neuroticism can impede adaptive learning.

What is particularly interesting in the comparison that agreeableness does not significantly influence learning preferences in the new text, contrasting with Komarraju et al. (2011) findings, which suggest that agreeableness is positively related to all learning styles.

Students' Personality Traits and Learning Preferences: Case of Six Universities

This inconsistency highlights a potential area of inquiry: whether the role of agreeableness in shaping learning preferences is overstated in previous research, or if it may vary depending on the specific context or methodology of the study.

Another notable point is the deeper exploration of how extraversion, linked to sociability, might cause difficulties in independent or focused study environments. This contrasts with Seyal et al. (2019), who found no clear link between extraversion and any specific learning style, adding complexity to the understanding of this trait's impact on learning. These differences emphasize the need to investigate extraversion's nuanced effects, especially in collaborative versus independent learning environments.

5. Conclusion

This study explored the relationship between fellow students' learning preferences and students' personality traits among 646 students across six universities using the Big Five personality framework. The findings reveal that "Extraversion" and "Neuroticism" are negatively correlated with various learning preferences, indicating that students with these traits may face challenges in adapting to certain learning environments. In contrast, "Openness to experience" and "Conscientiousness" is positively associated with all learning preferences, suggesting that conscientious individuals are flexible and capable of thriving under different teaching approaches, while openness to experience means that students grasp to learn something new in different way. Surprisingly, "Agreeableness" was not significantly correlated with any learning preference, marking it as an outlier among the traits studied. These results underscore the significant role of personality in shaping students' learning experiences and offer valuable insights for educators looking to tailor instruction to diverse student profiles.

The findings of this study have important implications for educators seeking to enhance student learning outcomes. Understanding the relationship between personality traits and learning preferences can help instructors tailor their teaching strategies to accommodate the diverse needs of their students. For instance, strategies that promote flexibility and adaptability can be particularly beneficial for students high in conscientiousness and openness to experience. Additionally, awareness of the challenges faced by students with high levels of Extraversion and Neuroticism can lead to the development of targeted support systems. Overall, these insights can foster a more inclusive and effective educational environment.

Several limitations should be noted. First, the study relied on self-reported data, which may introduce bias. Second, the research was conducted in six universities, potentially limiting generalizability across different educational contexts. Lastly, personality traits were analyzed as static, without considering potential changes over time or in different contexts.

Future research could address these limitations by expanding the sample to include a broader range of institutions and regions, increasing generalizability. Longitudinal studies could examine how personality traits and learning preferences evolve over time. Additionally, exploring the interaction between personality traits and external factors, such as teaching styles and environmental influences, could provide a more holistic understanding of how these dynamics affect learning outcomes.

Acknowledgement:

This research was co-funded by the State Scholarship Foundation (IKY) in Greece (E+ National Agency) in the context of the E+ project: ODLEP-Optimizing Distance Learning Educational Programs (Erasmus+ Programme Cooperation Partnership Key Action 2, 2022-1-EL01-KA220-HED-000089152).

The paper is the result of research based on the obligations under the Contract on the transfer of funds for the financing of scientific research work in 2024 (registration number 451-03-65/2024-03), signed between the Ministry of Science, Technological Development and Innovation of the Republic of Serbia and the Faculty of Economics of the University of Niš.

References

- Abouzeid, E., Fouad, S., Wasfy, N. F., Alkhadragey, R., Hefny, M., & Kamal, D. (2021). Influence of personality traits and learning styles on undergraduate medical students' academic achievement. *Advances in medical education and practice*, 769-777.
- Arbabisarjou, A., Zare, S., Shahrakipour, M., & Ghoreishinia, G. (2016). The survey of the relationship between the learning style and academic performance in students of Medical Sciences. *Health Sciences*, 5(7S), 338-342.
- Kamal, A., & Radhakrishnan, S. (2019). Individual learning preferences based on personality traits in an E-learning scenario. *Education and Information Technologies*, 24(1), 407-435.
- Komaraju, M., Karau, S. J., Schmeck, R. R., & Avdic, A. (2011). The Big Five personality traits, learning styles, and academic achievement. *Personality and individual differences*, 51(4), 472-477.
- Seyal, A. H., Siau, N. Z., & Suhali, W. S. H. (2019). Evaluating students' personality and learning styles in higher education: Pedagogical considerations. *International Journal of Learning, Teaching and Educational Research*, 18(7), 145-164.
- Sternberg, R. J., & Zhang, L. F. (2005). Styles of thinking as a basis of differentiated instruction. *Theory into practice*, 44(3), 245-253.
- Zhang, L. F., & Sternberg, R. J. (2002). Thinking styles and teachers' characteristics. *International Journal of Psychology*, 37(1), 3-1.

OSOBI NE LIČNOSTI STUDENATA I PREFERENCIJE UČENJA: SLUČAJ ŠEST UNIVERZITETA

Abstract: Ova studija istražuje odnos između osobina ličnosti učenika i preferencija učenja, fokusirajući se na uzorak od 646 ispitanika sa šest univerziteta. Koristeći model ličnosti velikih pet – ekstraverzija, neuroticizam, prijetnost, savesnost i otvorenost prema iskustvu – sprovedena je korelaciona analiza kako bi se ispitalo kako ove osobine utiču na individualne preferencije učenja. Rezultati pokazuju da su otvorenost prema iskustvu i savesnost u pozitivnoj korelaciji sa preferencijama učenja, što sugerise da se savesni i otvoreni za iskustva učenici dobro prilagođavaju različitim metodama nastave. Nasuprot tome, ekstraverzija i neuroticizam pokazuju negativnu korelaciju sa određenim preferencijama učenja, što implicira potencijalne izazove za učenike sa visokim nivoom ovih osobina. Zanimljivo je da nije pronađena značajna korelacija između prihvatljivosti i bilo koje preferencije učenja, što je označilo kao izuzetak među proučavanim osobinama. Nalazi ističu nijansirane načine na koje ličnost oblikuje obrazovna iskustva, nudeći vredne uvide za prilagođavanje nastavnih metoda različitim potrebama učenika i poboljšanje obrazovnih ishoda u visokoškolskim ustanovama.

Cljučne reči: osobine ličnosti, preferencije učenja, studenti, univerziteti.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**PRIMENA VEŠTAČKE INTELIGENCIJE U MALIM I SREDNJIM
PREDUZEĆIMA: MOGUĆNOSTI I OGRANIČENJA**

Kristina Petrović, MSc*

Ognjen Obradović, BSc*

Abstract: *Veštačka inteligencija (engl. Artificial intelligence - AI) predstavlja revolucionarnu tehnologiju sa velikim potencijalom primene u različitim sektorima, posebno u poslovnom okruženju, gde doprinosi povećanju efikasnosti, produktivnosti i konkurentnosti. Ovaj rad istražuje mogućnosti primene veštačke inteligencije u malim i srednjim preduzećima (MSP) koja, iako uz ograničene resurse, mogu da optimizuju procese, poboljšaju korisničke usluge i unaprede donošenje odluka zasnovano na podacima. Algoritmi mašinskog učenja i obrada prirodnog jezika omogućavaju MSP da smanje troškove, automatizuju rutinske zadatke i prilagode usluge tržišnim potrebama. Prednosti primene veštačke inteligencije, kao što su personalizacija marketing aktivnosti i unapređenje korisničke podrške, značajno mogu da utiču na zadovoljstvo klijenata.*

Keywords: *veštačka inteligencija, mala i srednja preduzeća, mogućnosti i ograničenja.*

1. Uvod

Veštačka inteligencija predstavlja jednu od najznačajnijih tehnoloških inovacija savremenog doba, sa širokim spektrom primena u različitim sektorima poslovanja. Od unapređenja korisničke podrške do podrške u procesu donošenja odluka, ova tehnologija postala je alat i strateški resurs za povećanje efikasnosti i konkurentnosti preduzeća. Iako su velike korporacije prve prepoznale potencijal veštačke inteligencije i već je integrisale u svoje poslovne procese, sve više malih i srednjih preduzeća počinje da shvata njenu vrednost. Razvoj alata za mašinsko učenje, obradu prirodnog jezika i analizu velikih skupova podataka omogućava i manjim preduzećima da unaprede poslovne operacije, bolje

* Ekonomski fakultet Univerziteta u Nišu, student doktorskih akademskih studija,
✉ kristina.petrovic.eknfak@gmail.com

* Ekonomski fakultet Univerziteta u Kragujevcu, student master akademskih studija,
✉ ognjen_kg@hotmail.com

razumeju tržište i kvalitetnije odgovaraju na zahteve klijenata. U kontekstu globalizacije i ubrzane digitalizacije, primena veštačke inteligencije u poslovanju nije samo prilika, već i potreba za ostvarivanjem dugoročnog razvoja i održive konkurentnosti.

2. Veštačka inteligencija u poslovnom okruženju

Veštačka inteligencija, kao jedan od najrevolucionarnijih tehnoloških pronalazaka modernog doba, svoj potencijal ispoljava u različitim sektorima. "...Tokom poslednjih godina, veštačka inteligencija ostvarila je značajan napredak i postala ključni alat za mnoge kompanije u unapređenju njihovih operacija, korisničkog servisa i procesa donošenja odluka, čime se definisala kao popularna tehnologija u različitim poslovnim sektorima (Arman & Lamiyar, 2023, p. 65). U poslovnom okruženju današnjeg doba, veštačka inteligencija nije samo tehnološka inovacija, već i strateški resurs koji može značajno da doprinese povećanju efikasnosti, produktivnosti, i konkurentnosti preduzeća. "...Veštačka inteligencija i mašinsko učenje imaju ključnu ulogu u unapređenju poslovne inteligencije, zato što omogućavaju preduzećima da iz velike količine podataka izvuku značajne uvide, automatizuju operativne procese i poboljšaju tačnost predviđanja. Algoritmi mašinskog učenja analiziraju složene obrasce, prepoznaju korelacije i pružaju prediktivne modele bez potrebe za eksplicitnim programiranjem. U poslovnoj inteligenciji, ovi algoritmi omogućavaju naprednu analizu podataka i identifikaciju skrivenih obrazaca, čime pružaju temelje za donošenje odluka baziranih na relevantnim informacijama" (Bharadiya, 2023, p. 124). Sa razvojem alata za mašinsko učenje, obradu prirodnog jezika i analitiku velikog obima podataka, veštačka inteligencija postaje sve dostupnija malim i srednjim preduzećima, omogućavajući im da unaprede poslovne procese, bolje razumeju potrebe tržišta i kvalitetnije upravljaju odnosima sa klijentima. "...Generativna veštačka inteligencija unela je revolucionarne promene u poslovnu sferu, kroz pružanje značajnih pogodnosti koje se ispoljavaju u vidu unapredene dostupnosti, povećane efikasnosti i smanjenja troškova operativnih procesa. Empirijski rezultati istraživanja pokazuju da informacije generisane putem alata zasnovanih na veštačkoj inteligenciji imaju potencijal da unapred predvide sposobnosti preduzeća za upravljanje rizikom, kao i performanse njihovih akcija na tržištu" (Chen et al., 2023, p. 475). Generativna veštačka inteligencija predstavlja specifičnu granu veštačke inteligencije koja se bavi generisanjem novog sadržaja, uključujući tekst, slike i druge oblike medija. Iako generativna veštačka inteligencija deluje kao novi pristup, njen koncept se razvijao tokom prethodne decenije (Chuma & De Oliveira, 2023, p. 5).

Iako su velike korporacije predvodnici u primeni tehnologija koje uključuju veštačku inteligenciju, mala i srednja preduzeća sve više prepoznaju vrednost veštačke inteligencije u kontekstu poboljšanja konkurentne pozicije. Mala i srednja preduzeća mogu da koriste veštačku inteligenciju za različite namene, uključujući prilagođeni marketing, prediktivnu analitiku, unapređenje logistike, i slično. Tehnologije koje uključuju veštačku inteligenciju posebno su važne u kontekstu analize tržišta, zato što omogućavaju detaljan uvid u potrebe i ponašanje klijenata, čime se unapređuje sposobnost preduzeća da adekvatno odgovori na zahteve tržišta.

Veštačka inteligencija omogućila je unapređivanje efikasnosti i produktivnosti u različitim industrijama, kroz automatizaciju zadataka, smanjenje ljudske greške i pružanje analize podataka u realnom vremenu (Rakha, 2023, p. 4). Ona obuhvata raznovrsne algoritme

Primena veštačke inteligencije u malim i srednjim preduzećima: mogućnosti i ograničenja

i modele koji računarskim sistemima omogućavaju da analiziraju podatke, donose odluke i uče iz iskustva, a sve to bez potrebe za eksplicitnim programiranjem svakog pojedinačnog koraka. U poslovnom okruženju, ova sposobnost omogućava automatizaciju rutinskih i zadataka koji se ponavljaju, čime se stvara prostor za angažovanje na kompleksnijim aktivnostima i ujedno povećava operativna efikasnost preduzeća. Pored toga, tehnologije veštačke inteligencije pružaju mogućnost predviđanja trendova na osnovu istorijskih podataka, što je značajno za donošenje strateških odluka u poslovanju. Preduzeća na brz i jednostavan način mogu da dobiju uvid u buduće tokove i adekvatno planiraju aktivnosti. Postoji i deo veštačke inteligencije koji omogućava sistemima da prepoznaju i analiziraju slike i video zapise, što preduzećima donosi vrednost u kontekstu kontrole kvaliteta proizvoda ili usluga i primene mera bezbednosti u poslovnim procesima.

Sistemi upravljanja poslovnim procesima koji su obogaćeni veštačkom inteligencijom pozicionirali su se kao inovativna opcija informacionih sistema koji su svesni procesa i osnaženi pouzdanim tehnologijama veštačke inteligencije. Ovi sistemi kao cilj imaju unapređenje izvršenja poslovnih procesa, što ih čini prilagodljivijim, proaktivnijim i osetljivijim na kontekst, čime se omogućava efikasnije upravljanje i optimizacija poslovnih aktivnosti (Dumas et al., 2023, p. 5). Veštačka inteligencija je nesumnjivo prepoznata kao jedan od ključnih činilaca inovacije i efikasnosti u poslovnom okruženju. Njena korisnost se primarno ogleda u mogućnosti transformacije različitih aspekata poslovanja kroz automatizaciju, optimizaciju i naprednu analizu podataka.

Preduzeća nemaju iste mogućnosti za primenu veštačke inteligencije u okviru svog poslovanja. Njihova sposobnost prilagođavanja i pripreme za implementaciju u značajnoj meri zavisi od usklađivanja tehnološkog razvoja veštačke inteligencije sa konkretnom poslovnom primenom. Pomenuto usklađivanje predstavlja ključni faktor koji određuje brzinu i efikasnost implementacije AI rešenja u poslovne procese (Burström et al., 2021, p. 89). Implementacija veštačke inteligencije u poslovne procese može se posmatrati kao jedan od vodećih faktora koji omogućava kompanijama i preduzećima da održe konkurentnost i osnaže poziciju na tržištu kroz inovacije i proaktivno planiranje. Kompanije su u različitim sektorima već implementirale rešenja veštačke inteligencije, kako bi automatizovale rutinske zadatke, čime primarno smanjuju troškove, ali i značajno minimiziraju rizik od ljudskih grešaka.

Pored specifičnih operativnih i analitičkih koristi, veštačka inteligencija je prepoznata kao sredstvo koje omogućava detaljnije razumevanje potreba i preferencija klijenata, kao i bolje upravljanje odnosima sa klijentima. Višedimenzionalna analiza podataka koju veštačka inteligencija omogućava utiče na poboljšanje sistema odlučivanja na svim nivoima poslovanja, što je posebno značajno u periodu brzih promena i izražene dinamičnosti tržišta.

3. Mogućnosti primene veštačke inteligencije u malim i srednjim preduzećima

Veštačka inteligencija uključuje širok spektar tehnika koje mašinama omogućavaju da obavljaju kognitivne funkcije koje su povezane sa ljudskim umovima, uključujući percepciju, rasuđivanje, učenje, ali i demonstraciju kreativnosti. Navedene sposobnosti omogućavaju mašinama da imitiraju različite aspekte ljudskog mišljenja, što ih može učiniti relevantnim alatima za primenu u različitim disciplinama i industrijama (Weber et al., 2022, p. 93). Razvoj veštačke inteligencije malim i srednjim preduzećima pruža značajne

mogućnosti za unapređenje poslovnih procesa i poboljšanje konkurentnosti. Upotreba veštačke inteligencije u MSP omogućava optimizaciju resursa, automatizaciju rutinskih zadataka i donošenje informisanih odluka na osnovu podataka, što posebno koristi preduzećima sa ograničenim ljudskim i finansijskim resursima. Primena veštačke inteligencije u MSP je posebno značajna i dostupna u sledećim oblastima:

- Optimizacija procesa – alati veštačke inteligencije, kao što su mašinsko učenje i obrada prirodnog jezika, omogućavaju automatizaciju administrativnih i proizvodnih procesa. Ovo doprinosi smanjenju troškova i poboljšanju efikasnosti, čime se MSP oslobađaju od rutinskih aktivnosti i mogu se usresrediti na stratejski razvoj i inovacije.
- Podrška u donošenju odluka – Primena analitike velikih podataka zasnovane na veštačkoj inteligenciji omogućava preduzećima da iz obimnih skupova podataka izvuku ključne uvide o potrošačkim navikama, trendovima na tržištu i potencijalnim rizicima. Ovakvi uvidi pomažu menadžmentu u donošenju brzih i adekvatno osnovanih odluka, što je značajno za opstanak i rast MSP.
- Personalizacija usluga – Kroz primenu veštačke inteligencije u domenu analize podataka o potrošačima, MSP mogu da kreiraju personalizovane marketinške strategije koje poboljšavaju korisničko iskustvo i povećavaju zadovoljstvo klijenata.
- Prognoziranje tražnje i upravljanje zalihama – modeli veštačke inteligencije omogućavaju precizno prognoziranje tražnje na osnovu istorijskih podataka i analiza tržišnih trendova, čime se MSP omogućava bolje upravljanje zalihama i smanjenje nepotrebnih troškova skladištenja.
- Unapređenje korisničke podrške – Četbotovi i automatizovane platforme za korisničku podršku koje koriste veštačku inteligenciju mogu značajno da unaprede komunikaciju sa klijentima. MSP na ovaj način mogu da pruže konstantnu i efikasnu podršku klijentima, bez potrebe za velikim brojem zaposlenih u sektoru korisničke podrške.

Implementacija inicijalnih rešenja veštačke inteligencije može da posluži kao temelj za integraciju naprednih komplementarnih ponuda, uz efikasno korišćenje postojeće infrastrukture podataka i kapaciteta veštačke inteligencije (Sjodin et al., 2023, p. 11). Iako primena veštačke inteligencije zahteva inicijalna ulaganja i adaptaciju, prednosti koje nudi u pogledu operativne efikasnosti, prediktivnih kapaciteta i optimizacije odnosa sa klijentima čine je nezaobilaznim alatom za MSP koja teže dugoročnom održivom razvoju i konkurentnosti na savremenom tržištu.

Alati veštačke inteligencije koji su namenjeni primeni u poslovanju MSP razvijeni su sa ciljem da poboljšaju operativnu efikasnost, personalizuju korisničke usluge, optimizuju marketing aktivnosti i olakšaju donošenje poslovnih odluka. Neki od alata koja MSP mogu primeniti su:

- ChatGPT i Drift - Ovi alati za obradu prirodnog jezika popularni su za unapređenje korisničke podrške. Drift, kao alat za automatizovanu komunikaciju, omogućava personalizovani razgovor sa klijentima u realnom vremenu, što povećava efikasnost korisničke službe i dostupnost preduzeća. "...Naprednost ChatGPT-a u odnosu na tradicionalne četbotove nalazi se u njegovoj sposobnosti da razume prirodni jezik i kontekst, što omogućava pružanje personalizovanih i preciznih odgovora.

Primena veštačke inteligencije u malim i srednjim preduzećima: mogućnosti i ograničenja

Korišćenjem ChatGPT-a, preduzeća su u mogućnosti da simultano obrade neograničen broj upita korisnika, čime se značajno smanjuju troškovi zaposlenih, dok se istovremeno unapređuje kvalitet korisničkog servisa” (Arman & Lamiyar, 2023, p. 64).

- Tableau i Power BI - Oba alata razvijena su za analizu podataka i vizualizaciju. Uz pomoć veštačke inteligencije mogu da se analiziraju veliki skupovi podataka, nakon čega mogu da se prikažu u vidu preglednih grafikona i izveštaja. Ovi alati omogućavaju brzo i intuitivno sticanje uvida o potrošačkim trendovima i finansijskim pokazateljima, što je posebno korisno za donošenje strateških odluka u MSP. “Kapaciteti veštačke inteligencije u Power BI omogućavaju organizacijama da brzo i jednostavno dobiju inteligentnije uvide iz nestrukturiranih i strukturiranih podataka” (Diepeveen, 2022).
- HubSpot i Salesforce Einstein - Ova rešenja koriste veštačku inteligenciju za poboljšanje procesa u prodaji i marketingu, čime omogućavaju preduzećima da personalizuju svoj pristup klijentima i optimizuju prodajni tok. Ovi alati orijentisani su na implementaciju CRM-a u prodajne i marketinške aktivnosti. HubSpot koristi prediktivnu analitiku kako bi identifikovao potencijalne klijente, dok Einstein unutar Salesforce-a automatizuje procese u prodaji i predviđa ponašanje kupaca. “...HubSpot, kao jedan od vodećih alata za upravljanje odnosima sa kupcima (CRM), integriše funkcije veštačke inteligencije koje omogućavaju automatizaciju marketinga, analizu podataka i personalizaciju korisničkog iskustva, čime se poboljšava efikasnost malih marketinških timova” (Szenftner et al., 2024, p. 975).
- Zoho i QuickBooks - Ovi alati za automatizaciju računovodstvenih procesa i finansijsko izveštavanje koriste veštačku inteligenciju za analizu finansijskih podataka, upravljanje fakturama i optimizaciju novčanih tokova. MSP sa ograničenim resursima za računovodstvo mogu uz pomoć ovih alata značajno da smanje vreme i troškove posvećene administraciji.
- TensorFlow i H2O.ai - Za preduzeća koja žele da naprave prilagođene modele veštačke inteligencije za specifične potrebe, ovi okviri omogućavaju razvoj i implementaciju modela mašinskog učenja. TensorFlow, kao open-sors biblioteka, podržava širok spektar aplikacija veštačke inteligencije (Pang et al., 2020, p. 230), dok H2O.ai nudi prediktivnu analitiku i napredne alate za modeliranje podataka.
- Shopify i Wix sa integrisanim AI funkcionalnostima - Za MSP u e-trgovini, Shopify i Wix nude alate zasnovane na veštačkoj inteligenciji koji omogućavaju personalizovano poručivanje proizvoda i optimizaciju korisničkog iskustva na veb sajtovima (Monjur et al., 2023, p. 2391). Shopify, na primer, koristi veštačku inteligenciju za predviđanje potreba kupaca, a Wix ima AI pomoćnike koji automatski dizajniraju veb stranice i usklađuju ih sa potrebama brenda.
- Zapier i Automate.io - Ovi alati omogućavaju automatizaciju različitih poslovnih procesa. Sa mogućnostima koje veštačka inteligencija nudi za povezivanje i automatsko obavljanje različitih zadataka između aplikacija, oni pomažu preduzećima u uštedi vremena i poboljšanju efikasnosti, što je posebno značajno za preduzeća sa manjim brojem zaposlenih.

Primena ovih alata u malim i srednjim preduzećima može da doprinese boljoj organizaciji poslovnih procesa, većem zadovoljstvu korisnika i stvaranju konkurentске prednosti.

4. Izazovi i ograničenja primene veštačke inteligencije u malim i srednjim preduzećima

Iako veštačka inteligencija pruža značajne mogućnosti za poboljšanje poslovnih procesa, njena primena u MSP praćena je brojnim izazovima i ograničenjima. "...Jedan od ključnih izazova u primeni veštačke inteligencije u biznisu je potreba za velikim količinama visokokvalitetnih podataka, koje mnoge kompanije ne poseduju ili ih teško integrišu iz različitih izvora. Pored toga, implementacija AI zahteva značajne finansijske resurse i tehničku stručnost, što je često prepreka za manje organizacije. Uvođenje AI rešenja takođe može izazvati otpore unutar organizacije, posebno kada zahteva prilagođavanje postojećih procesa ili promenu uloga zaposlenih" (La Torre et al., 2023, p. 6). Neka od ograničenja koja se odnose na primenu veštačke inteligencije u poslovanju MSP biće predstavljena u nastavku.

Visoki troškovi implementacije - Uvođenje tehnologija koje uključuju veštačku inteligenciju zahteva značajna finansijska ulaganja u infrastrukturu, softver, i ekspertizu, što može predstavljati nepremostiv izazov za MSP sa ograničenim budžetima. Nabavka, instalacija i održavanje ovih tehnologija često zahtevaju resurse kojima MSP ne raspolažu.

Nedostatak kvalifikovane radne snage - Primena i održavanje alata veštačke inteligencije zahtevaju specifična tehnička znanja i stručnost u oblastima kao što su mašinsko učenje, analiza i upravljanje podacima. Nedostatak odgovarajuće kadrovske podrške u MSP predstavlja značajan problem, jer mala preduzeća često ne mogu privući ili zadržati tehnološki visoko kvalifikovan kadar.

Pristup velikim skupovima podataka – Veštačka inteligencija se u velikoj meri oslanja na analizu velikih skupova podataka, koji služe kao osnova za izgradnju i obuku modela mašinskog učenja. MSP, međutim, često nemaju pristup obimnim podacima neophodnim za efikasno funkcionisanje alata veštačke inteligencije, što ograničava preciznost i relevantnost analize.

Integracija sa postojećim sistemima - Često je potrebno da alati veštačke inteligencije budu integrisani sa postojećim softverskim i tehnološkim rešenjima unutar preduzeća, što može zahtevati značajne izmene infrastrukture. MSP se susreću sa izazovima zbog tehničke nekompatibilnosti, što može da dovede do dodatnih troškova ili odlaganja u implementaciji.

Pitanja bezbednosti i privatnosti podataka - obrada podataka u MSP posredstvom veštačke inteligencije može da naiđe na izazove u pogledu bezbednosti i zaštite podataka, naročito u kontekstu osetljivih i privatnih informacija o klijentima i partnerima. Mala preduzeća često nemaju dovoljno resursa za uspostavljanje naprednih bezbednosnih mera, što povećava rizik od narušavanja podataka i sajber napada.

Otpor prema tehnološkim promenama – Implementacija veštačke inteligencije u MSP često nailazi na otpor zaposlenih prema novim tehnologijama. Strah od gubitka posla ili nepoverenje u tehnologiju mogu da stvore barijere u prihvatanju rešenja veštačke inteligencije, što dovodi do neefikasne primene i nedovoljne iskorišćenosti potencijala veštačke inteligencije.

Ovi izazovi i ograničenja ukazuju na to da, uprkos potencijalu veštačke inteligencije za unapređenje efikasnosti i konkurentnosti, mala i srednja preduzeća moraju pažljivo a

Primena veštačke inteligencije u malim i srednjim preduzećima: mogućnosti i ograničenja

planiraju proces implementacije i usmeravaju resurse na prevazilaženje ključnih prepreka, kako bi se potencijal veštačke inteligencije u potpunosti iskoristio.

“Veštačka inteligencija (AI) je u poslednje vreme jedna od najčešće diskutovanih i debatovanih tema. Uprkos njenim brojnim prednostima i potencijalima, razvoj i implementacija AI su naišli na mnoge kritike. Te kritike obuhvataju etičke, društvene i tehnološke aspekte” (Kiradoo, 2023, p. 212). Kritičari ukazuju na potrebu za uspostavljanjem čvrstih etičkih smernica i regulatornih okvira koji bi osigurali odgovornu primenu AI tehnologije. Razumevanje ovih izazova postaje izuzetno značajno za dalji razvoj veštačke inteligencije koja će doprineti društvenom napretku, bez ugrožavanja osnovnih ljudskih vrednosti.

5. Zaključak

Veštačka inteligencija se ističe kao ključni tehnološki resurs u savremenom poslovnom okruženju, koji omogućava preduzećima da unaprede efikasnost, produktivnost i konkurentnost. Njen razvoj i primena transformišu način poslovanja kroz analizu podataka u realnom vremenu, automatizaciju zadataka i poboljšanu podršku u donošenju odluka. Iako su velike korporacije vodeće u implementaciji, i mala i srednja preduzeća sve više prepoznaju njen značaj, kroz korišćenje veštačke inteligencije za optimizaciju procesa, personalizaciju korisničkih usluga i bolje upravljanje resursima. Implementacija ovih tehnologija doprinosi prilagođavanju tržišnim promenama i dugoročnom održivom razvoju MSP, što naglašava potencijal veštačke inteligencije kao faktora za poboljšanje pozicije na tržištu.

Implementacija veštačke inteligencije pruža malim i srednjim preduzećima mogućnost da unaprede efikasnost poslovnih procesa, automatizuju rutinske zadatke i poboljšaju korisničko iskustvo, što im omogućava da konkurišu većim preduzećima koja poseduju značajne resurse. Veštačka inteligencija omogućava personalizovan pristup klijentima, što može biti od velikog značaja u procesu izgradnje lojalnosti kupaca i povećanja prodaje. Automatizacija korisničke podrške putem četbotova omogućava da se poboljša kvalitet usluga, smanji opterećenje zaposlenih i obezbedi dostupnost korisničke podrške u realnom vremenu. Pored toga, veštačka inteligencija ima značajnu ulogu u optimizaciji marketinških aktivnosti, jer omogućava planiranje kampanja prema specifičnim potrebama i preferencijama potrošača.

Bez obzira što primena veštačke inteligencije zahteva početna ulaganja, dugoročne koristi opravdavaju ove investicije. Veštačka inteligencija predstavlja tehnološku nadogradnju, a i izuzetno značajan strateški alat koji doprinosi održivosti i napretku preduzeća.

Literatura

- Chuma, E. L., & De Oliveira, G. G. (2023). Generative AI for business decision-making: A case of ChatGPT. *Management Science and Business Decisions*, 3(1), 5-11.
- Burström, T., Parida, V., Lahti, T., & Wincent, J. (2021). AI-enabled business-model innovation and transformation in industrial ecosystems: A framework, model and outline for further research. *Journal of Business Research*, 127, 85-95.
- Bharadiya, J. P. (2023). Machine learning and AI in business intelligence: Trends and opportunities. *International Journal of Computer (IJC)*, 48(1), 123-134.
- Chen, B., Wu, Z., & Zhao, R. (2023). From fiction to fact: the growing role of generative AI in business and finance. *Journal of Chinese Economic and Business Studies*, 21(4), 471-496.

- Arman, M., & Lamiyar, U. R. (2023). Exploring the implication of ChatGPT AI for business: Efficiency and challenges. *International Journal of Marketing and Digital Creative*, 1(2), 64-84.
- Rakha, N. A. (2023). The impacts of Artificial Intelligence (AI) on business and its regulatory challenges. *International Journal of Law and Policy*, 1(1).
- Dumas, M., Fournier, F., Limonad, L., Marrella, A., Montali, M., Rehse, J. R., ... & Weber, I. (2023). AI-augmented business process management systems: a research manifesto. *ACM Transactions on Management Information Systems*, 14(1), 1-19.
- Weber, M., Beutter, M., Weking, J., Böhm, M., & Krcmar, H. (2022). AI startup business models: Key characteristics and directions for entrepreneurship research. *Business & Information Systems Engineering*, 64(1), 91-109.
- Sjödin, D., Parida, V., & Kohtamäki, M. (2023). Artificial intelligence enabling circular business model innovation in digital servitization: Conceptualizing dynamic capabilities, AI capacities, business models and effects. *Technological Forecasting and Social Change*, 197, 122903.
- Diepeveen, M. J. (2022). Artificial Intelligence with Power BI: Take your data analytics skills to the next level by leveraging the AI capabilities in Power BI. Packet publishing.
- Szenftner, A., Stumpp, S., & Knopf, T. (2024, September). Exploring the potential of AI to increase productivity in small marketing teams. In European Conference on Innovation and Entrepreneurship (Vol. 19, No. 1, pp. 970-977).
- Pang, B., Nijkamp, E., & Wu, Y. N. (2020). Deep learning with tensorflow: A review. *Journal of Educational and Behavioral Statistics*, 45(2), 227-248.
- Monjur, M. E. I., Rifat, A. H., Islam, M. R., & Bhuiyan, M. R. (2023). The impact of artificial intelligence on international trade: Evidence from B2C giant e-commerce (Amazon, Alibaba, Shopify, eBay). *Open Journal of Business and Management*, 11(5), 2389-2401.
- La Torre, D., Appio, F. P., Masri, H., Lazzeri, F., & Schiavone, F. (2023). Impact of artificial intelligence in business and society: *Opportunities and Challenges*. Routledge.
- Kiradoo, G. (2023). Unlocking the potential of ai in business: Challenges and ethical considerations. *Recent Progress in Science and Technology*, 6, 205-220.

APPLICATION OF ARTIFICIAL INTELLIGENCE IN SMALL AND MEDIUM-SIZED ENTERPRISES: OPPORTUNITIES AND LIMITATIONS

Abstract: Artificial intelligence represents a revolutionary technology with great potential for application across various sectors, particularly in the business environment, where it contributes to increased efficiency, productivity and competitiveness. This paper explores the possibilities of implementing artificial intelligence in small and medium-sized enterprises (SMEs) that, despite limited resources can optimize processes, improve customer services and enhance data-driven decision-making. Machine learning algorithms and natural language processing enable SMEs to reduce costs, automate routine tasks and tailor services to market needs. The advantages of applying artificial intelligence, such as marketing activities personalization and improved customer support can significantly impact customer satisfaction.

Keywords: artificial intelligence, small and medium-sized enterprises, opportunities and limitations.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES

Pregledni naučni rad

ODREĐIVANJE OPTIMALNOG NIVOA TROŠKOVA KVALITETA

Aleksandra Stoilković Randelović *

Rezime: Sticanje i zadržavanje konkurentske prednosti savremenih preduzeća podrazumeva ispunjavanje očekivanja kupaca putem ponude kvalitetnijih proizvoda i usluga po razumnoj ceni. Povećanje nivoa kvaliteta obično se dovodi u vezu sa povećanjem troškova. Međutim, usmeravanje na troškove kvaliteta omogućava preduzeću ostvarenje porasta profita uz istovremeno unapređenje kvaliteta i smanjenje troškova kvaliteta. Stoga je neophodno identifikovati optimalni nivo kvaliteta za ukupne troškove kvaliteta. Navedeno upućuje na potrebu praćenja troškova kvaliteta ne samo u ukupnom iznosu, već i po pojedinim kategorijama troškova koje čine troškove kvaliteta, a to su: troškovi prevencije, troškovi detekcije, troškovi interno uočenih defekata i troškovi eksterno uočenih defekata. U cilju identifikovanja optimalne tačke ukupnih troškova kvaliteta značajan doprinos može dati implemenatacija Lean pristupa.

Ključne reči: kvalitet, troškovi kvaliteta, optimalna tačka, Lean.

1. Uvod

Kvalitet predstavlja jednu od determinanti prilikom donošenja odluke o kupovini proizvoda ili usluge od strane potrošača. Zahtevi potrošača u pogledu kvaliteta postaju sve stroži. S druge strane, postojanje i funkcionisanje preduzeća na globalnom tržištu zavisi od njegove sposobnosti da ponudi proizvode ili usluge koji ne samo da ispunjavaju zahteve kupaca, već su i konkurentni u pogledu kvaliteta, cene, vremena isporuke i distribucije (Sadkowski & Jedynak, 2022). Da bi ispunila ove uslove neophodno je da preduzeća identifikuju, mere i kontrolišu sve troškove vezane za kvalitet (Raßfeld et al., 2015).

Troškovi kvaliteta predstavljaju one troškove koji doprinose povećanju kvaliteta ili su posledica izostanka kvaliteta (Velkoska & Tomov, 2022). Ovi troškovi predstavljaju razliku između stvarnih i idealnih troškova za postizanje kvaliteta (Czajkowski, 2017). Različiti modeli upravljanja troškovima kvaliteta prisutni su u literaturi i praksi. Ovi modeli razlikuju se po tome kako kategorizuju, uključuju i naglašavaju pojedine kategorije

* Privatna kompanija, Leskovac, Srbija, ✉ aleksandras.randjelovic@gmail.com
UDK 006.83:657.471

troškova unutar troškova kvaliteta. Ukupni troškovi kvaliteta određuju se kroz razmatranje troškova svake od kategorija troškova. Upravljanjem troškovima kvaliteta preduzeća teže ka tome da ispune očekivanja kupaca u pogledu kvaliteta i cene i istovremeno povećaju profit. U tom cilju potrebna je identifikacija optimalne tačke ukupnih troškova kvaliteta.

Neophodnost razmatranja odnosa kvaliteta i troškova kvaliteta dovodi do toga da preduzeća uočavaju značaj određenih alata i tehnika. S tim u vezi, usvajanjem *Lean* pristupa preduzeća mogu da isporuče proizvode i pruže usluge sa manje defekata uz istovremeno smanjenje troškova kvaliteta.

U radu su predstavljene pojedine kategorije troškova kvaliteta i dat je prikaz odabranih modela troškova kvaliteta. Takođe, kako implementacija *Lean* pristupa ima za cilj ostvarenje optimalnog nivoa kvaliteta to je u radu ukazano i na uticaj primene ovog koncepta na visinu troškova kvaliteta.

1. Pojam i klasifikacija troškova kvaliteta

Polazna tačka u razmatranju troškova kvaliteta jeste upoznavanje sa pojmom kvaliteta. U literaturi filozofskih nauka pojam kvaliteta prvi put se pominje u V–IV vek pre nove ere. Platon je tvrdio da kvalitet predstavlja određeni stepen savršenstva koji se ne može definisati, već se može razumeti samo kroz iskustvo. Kasnije je Aristotel kvalitet posmatrao kao jednu od deset osnovnih filozofskih kategorija, koja ne zavisi od subjektivnog pogleda posmatrača, već određuje zašto je stvar ono što jeste (Sadkowski & Jedynak, 2022).

Konceptom kvaliteta bavili su se i drugi filozofi Descartes, Locke, Kant, Hegel, Locke. Značajan doprinos savremenoj teoriji i praksi kvaliteta dao je Shewhart (1931), čije promišljanje je predstavljao osnovu za radove tzv. Gurua kvaliteta: Deming, Juran, Crosby i Ishikawa. Njihove tvrdnje se ogledaju u tome da će poboljšanjem kvaliteta proizvoda ili usluge preduzeće smanjiti troškove, maksimizirati produktivnost i zadovoljstvo kupaca (Kau & Nel, 2019).

Prema Krosbiju (engl. Crosby) kvalitet predstavlja podudarnost sa zahtevima potrošača (Setijono & Dahlgaard, 2008). To podrazumeva da zahtevi potrošača moraju biti unapred poznati, kao i da merila performansi moraju biti prilagođena zahtevima potrošača. Inače, zahtevi potrošača mogu biti kvantitativni i kvalitativni, a tek kada su svi zadovoljeni smatra se da je postignut zahtevani kvalitet (Anđelković, 2009).

Troškovi kvaliteta odnose se na troškove povezane sa dizajnom, implementacijom i održavanjem efikasnog sistema osiguranja kvaliteta unutar preduzeća (Hakem et al., 2024). Troškovi kvaliteta obuhvataju dve grupe izdataka: izdatke za sprečavanje problema kvaliteta i izdatke koji nastaju zbog neostvarenja kvaliteta (Velkoska & Tomov, 2022). Ovi troškovi se mogu shvatiti kao razlika između stvarnih troškova proizvoda ili usluge i idealno potrebnih troškova za postizanje kvaliteta. Prema tome, troškovi kvaliteta obuhvataju kompleksan niz troškova za sprečavanje defekata i ispravljanje grešaka u pogledu kvaliteta (Hakem et al., 2024).

Fajgenbaum (engl. Feigenbaum) je razvio sistem za izveštavanje o troškovima kvaliteta još četrdesetih godina prošlog veka. Sve troškove kvaliteta svrstao je u četiri kategorije, a to su (Feigenbaum, 2005): troškovi prevencije, troškovi detekcije, troškovi interno uočenih i eksterno uočenih defekata. Troškovi prevencije podrazumevaju troškovi

provere, sprečavanja i smanjenja defekata, drugim rečima, troškovi za finansiranje aktivnosti koje pomažu da se identifikuju i izbegnu uzroci defekata. Troškovi detekcije podrazumevaju troškove nastale prilikom provere usaglašenosti proizvoda sa zahtevima kvaliteta odnosno troškovi finansiranja istraživanja neuspeha. Troškovi internih defekata obuhvataju troškove koji su nastali kada je proizvod van standarda pre isporuke kupcu, dok su troškovi eksternih defekata oni troškovi koji su nastali kada je proizvod van standarda nakon isporuke kupcu (Foulad et al., 2023).

Osim navedene podele troškova kvaliteta javlja se niz drugih podela ovih troškova. Zapravo reč je o drugačijim kriterijumima za grupisanje troškova. Podelu na direktne i indirektne troškove kvaliteta izvršio je Harrington (Harrington) (Foulad et al., 2023). Direktni troškovi kvaliteta obuhvataju troškove koji se javljaju usled nastalih grešaka i troškove obuke radi sprečavanja pojave grešaka. Indirektni troškovi kvaliteta vezuju se za nezadovoljstvo potrošača (troškovi telefonskih razgovora radi prijave defekata, troškove vraćanja defektnih proizvoda, izgubljeni korist usled čekanja na dostavljanje novih, ispravnih proizvoda i dr.), kao i oportunitetne troškove koji predstavljaju izgubljeni prihod usled lošeg imidža preduzeća (Anđelković, 2009; Hakem et al., 2024).

Značaj nematerijalnih ili oportunitetnih troškova posebno se naglašava (Foulad et al, 2023). Oportunitetni troškovi predstavljaju gubitak izazvan dejstvom oportunitetnih faktora. Juran (engl. Juran) prvi prepoznaje važnost nematerijalnih troškova koje smatra dugoročno bitnijim od direktnih troškova. Nematerijalni troškovi su troškovi koji se ne mogu proceniti kao što su profiti koji nisu zarađeni zbog gubitka volje kupaca i smanjenje prihoda zbog neusaglašenosti. Juran posmatra nematerijalne troškove kvaliteta kao „zlato u rudniku” i poziva preduzeća da ih istražuju (Foulad et al, 2023).

Pojedini autori troškove kvaliteta posmatraju kao vidljive i prikrivene troškove (Jones, 2004). Vidljivi su troškovi dodatnog rada radnika, koji je potreban kako bi se greške ispravile, troškovi materijala utrošenog pri ispravljanju grešaka, troškovi skladištenja dodatnog materijala, amortizacija zbog dodatne obrade defektnih proizvoda i sl. Prikriveni troškovi lošeg kvaliteta obuhvataju penale za kašnjenje u isporuci, troškove prijema i razmatranja žalbi potrošača, izgubljeni prihod, troškove obuke novih zaposlenih zbog odlaska nezadovoljnih zaposlenih iz preduzeća, troškove angažovanog kapitala, zbog potrebe dodatnog zaduživanja kod banaka i slično (Beckford, 2005). Navedene troškove je teško proceniti jer su slični uronjenom delu ledenog brega skrivenog ispod površine vode. Dok je ovaj nevidljivi deo ledenog brega izvor potonuća većine brodova koji su ga udarili, skriveni trošak kvaliteta najčešće negativno utiče na prihod preduzeća. Navedeni negativni efekat nastavlja se tokom vremena sve dok se preduzeće ne suoči sa ozbiljnim finansijskim poteškoćama usled pogoršanja imidža svog brenda (Jourabchi et al., 2014).

2. Upravljanje troškovima kvaliteta

Kontinuirano unapređenje kvaliteta proizvedenih proizvoda i pruženih usluga uz smanjenje troškova povezanih sa nedostacima kvaliteta predstavljaju konstantne ciljeve preduzeća. Za ostvarenje ovih ciljeva ključno je razumeti različite vrste troškova u vezi sa kvalitetom. Upravljanje troškovima kvaliteta podrazumeva njihovo identifikovanje, ali i analizu promene njihove veličine i strukture. Kao takvo pomaže preduzećima pri donošenju odluka o alokaciji resursa u cilju efikasnog unapređenja kvaliteta, smanjenja troškova lošeg kvaliteta i maksimiziranje koristi od kvaliteta.

Određivanje pojedinih kategorija troškova kvaliteta je srž upravljanja troškovima kvaliteta, dok modeli troškova kvaliteta pomažu preduzeću da prepozna povezanost pojedinih kategorija troškova i ostvarenog kvaliteta u svim aktivnostima uključenim u procese od dobavljača do kupca (Jourabchi et al., 2014). Među postojećim modelima troškova kvaliteta Model prevencije - detekcije - defekata (prevention-appraisal-failure (PAF)) i Optimalni model najčešće su pominjani u kontekstu određivanja optimalnog nivoa troškova kvaliteta. Stoga su ovi modeli detaljnije analizirani, dok su ostali predstavljeni ukratko.

Tabela 1: Prikaz odabranih modela upravljanja troškovima kvaliteta

Modeli upravljanja troškovima kvaliteta	Kategorije troškova
Model troškova procesa	Troškovi usaglašenosti Troškovi neusaglašenosti
Model oportunitetnih troškova	Troškovi usaglašenosti i troškovi neusaglašenosti; Materijali i nematerijalni troškovi; Troškovi prevencije, detekcije, internih i eksternih defekata i oportunitetni troškovi
Model zasnovan na aktivnostima	Troškovi aktivnosti koje dodaju vrednost Troškovi aktivnosti bez dodatne vrednosti

Izvor: Autor

3.1. PAF model

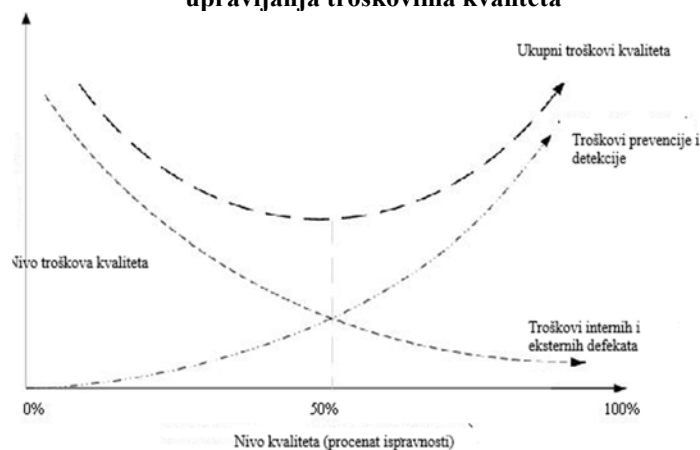
Model koji nalazi široku primenu u praksi jeste PAF model. Model je razvijen 1956. godine od strane Fajgenbauma (Schiffauerova & Thomson, 2006). Reč je o modelu koji integriše troškove prevencije, troškove detekcije i troškove defekata (internih i eksternih). Većina modela upravljanja troškovima kvaliteta bazirana je upravo na PAF klasifikaciji. Neki od troškova koji bi se mogli svrstati u te četiri kategorije su (Anđelković, 2006; Sharma et al., 2007; Hakem et al., 2024):

- troškovi prevencije: troškovi obuke zaposlenih, troškovi procene dobavljača, troškovi održavanja sredstava, troškovi razvoja programa unapređenja kvaliteta, troškovi analize i izveštavanja o nivou kvaliteta;
- troškovi detekcije: troškovi prijemne kontrole, troškovi procesne i završne kontrole, troškovi testiranja proizvoda, troškovi materijala potrebnog za proveru kvaliteta, troškovi opreme za proveru i ispitivanje;
- troškovi internih defekata: troškovi analize defekata, troškovi zamene, troškovi dorade i popravke, troškovi ponovne kontrole i ispitivanja, troškovi eliminisanja škart proizvoda, oportunitetni troškovi (vezani za izgubljeno vreme), troškovi škarta (resursi utrošeni za proizvodnju škarta);
- troškovi eksternih defekata: troškovi povlačenja proizvoda iz prodaje, izgubljeni prihod od prodaje, troškovi reklamacija u garantnom roku, troškovi transporta vraćenih proizvoda, troškovi servisiranja proizvoda.

3.2. Optimalni model troškova kvaliteta

Stari model troškova kvaliteta za optimalni trošak kvaliteta prvi je predložio Juran i u velikoj meri je bio primenjivan sve do 1990-ih (Jourabchi et al., 2014). Cilj modela jeste identifikovanje nivoa kvaliteta koji minimizira ukupne troškove kvaliteta. Polazeći od podele troškova po PAF modelu polazište ovog modela je da ulaganje u aktivnosti prevencije i detekcije vodi ka smanjenju troškova defekata, dok dalji izdaci po osnovu preventivnih aktivnosti dovode do smanjenja troškova detekcije. Prema ovom modelu optimalni kvalitet postoji na nivou na kome dalja ulaganja u obezbeđenje višeg kvaliteta nadmašuju prednosti poboljšanog kvaliteta. Optimalni nivo troškova kvaliteta se nalazi u preseku krive troškova prevencije i detekcije, s jedne i krive troškova interno i eksterno otkrivenih defekata, s druge strane, što jasno pokazuje slika 1.

Slika 1. Optimalni nivo troškova kvaliteta prema starom modelu upravljanja troškovima kvaliteta



Izvor: Rosiawan et al, 2019

Kriva ukupnih troškova kvaliteta ima oblik razvučenog latiničnog slova „U“. Naime, smanjenje troškova interno i eksterno uočenih defekata izraženije je nego što povećanje troškova prevencije i detekcije do tačke preseka kada je smanjenje troškova interno i eksterno uočenih defekata srazmerno povećanju troškova prevencije i detekcije. Potom sledi značajniji porast troškova prevencije i detekcije u odnosu na smanjenje troškova interno i eksterno uočenih defekata.

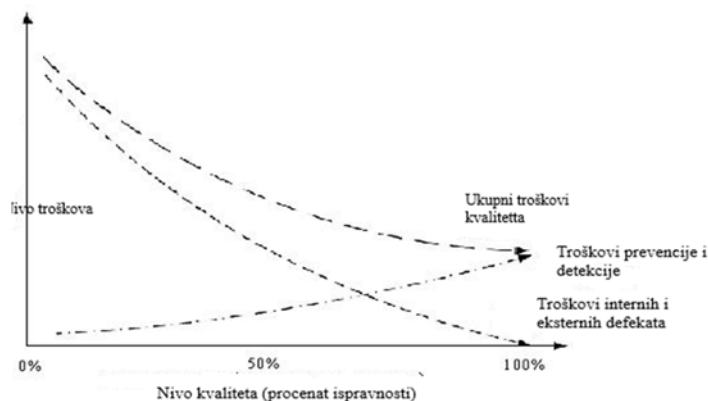
Očigledno je da predstavljeni model upravljanja troškovima kvaliteta ne inspiriše preduzeća da teže perfekciji, jer se optimalni nivo troškova kvaliteta dostiže na nivou manjem od 100% ispravnosti. Kritičari starog modela upravljanja troškovima kvaliteta navode da su troškovi prevencije uvek opravdani, a optimalni nivo kvaliteta je u stvari jednak “nuli” defekata (Rosiawan et al, 2019).

Takođe, model je statičan i stoga ne uzima u obzir dinamičke aspekte povećanja optimalnog nivoa kvaliteta (Kim & Nakhai, 2008). Kroz programe kontinuiranog unapređenja kvaliteta, prevencija i detekcija ne bi trebalo da zahtevaju onoliko ulaganja

koliko je potrebno na početku programa unapređenja kvaliteta. Ako se pretpostavi da se troškovi prevencije i detekcije smanjuju tokom vremena, ukupni troškovi kvaliteta će se smanjiti kako se trošak neuspeha proizvoda/usluge smanjuje kao rezultat unapređenja kvaliteta (Kerfai et al., 2016).

Novi model upravljanja troškovima kvaliteta prvi je predložio Gryna 1999. godine. Naime, u ovom modelu se menja oblik krive ukupnih troškova kvaliteta, kao posledica automatizacije procesa u preduzećima. Kriva ukupnih troškova kvaliteta u ovom modelu upravljanja troškovima kvaliteta degresivnog je karaktera, zbog jače degresije troškova internih i eksternih nedostataka od progresije troškova prevencije i detekcije. Položaj krive ukupnih troškova kvaliteta, krive troškova prevencije i detekcije, kao i krive troškova internih i eksternih nedostataka, u novom modelu upravljanja troškovima kvaliteta, prikazuje slika 2.

Slika 2: Optimalni nivo troškova kvaliteta prema novom modelu upravljanja troškovima kvaliteta



Izvor: Rosiawan et al, 2019

Novi model podrazumeva veći prioritet aktivnosti prevencije i inovacija što rezultira smanjenjem troškova detekcije i značajnim smanjenjem stope defekata proizvoda (Jourabchi et al., 2014). Kao što je uočljivo na slici 2 ukupni troškovi značajno opadaju, a optimalna tačka kvaliteta kreće se ka 100% ispravnosti ili "nula" defekata kao optimalnom nivou kvaliteta.

Nedostatak novog modela ogleda se u tome da ne meri odnos između troškova kvaliteta i ušteda ostvarenih realizacijom ciljeva operativnih performansi preduzeća (nivo kvaliteta proizvoda, isporuka na vreme, nivo kvaliteta sirovina i efikasnost proizvodnje) (Rosiawan et al, 2019).

3. Lean koncept u funkciji dostizanja optimalne tačke troškova kvaliteta

Prisustvo preduzeća na današnjem konkurentnom tržištu gde je moć kupaca izrazita, podstiče preduzeća ka razmatranju savršenstva kvaliteta. Dostizanje optimalne tačke

Media Effects Evaluation and Media Budgeting

kvaliteta prikazane novim modelom podrazumeva kretanje ka 100% ispravnosti ili “nula” defekata. U tom cilju primena odgovarajućih metoda osiguranja kvaliteta, kao što je *Lean*, može se biti značajna.

Lean koncept (*Lean* concept) je razvijen krajem osamdesetih i početkom devedesetih godina 20. veka od strane Eno & Shingo – inženjera i lidera japanskog preduzeća Tojota (engl. Toyota Motor Corporation, or Toyota Production System (TPS)). Koncept *Lean* nije proizašao iz teorije. Rezultat je prakse posmatranja u Tojoti, koja je ostvarila superiorne performanse u pogledu kvaliteta proizvoda, efikasnosti (sati po automobilu) i vremena isporuke novih proizvoda (Naveen, 2022).

Lean koncept preporučuje nekoliko ključnih principa, čija je primena moguća u svakom preduzeću (Nikiforova & Bicevska, 2018):

- Identifikovanje vrednosti,
- Mapiranje toka vrednosti (vizuelizacija aktivnosti i procesa),
- identifikovanje gubitaka (čekanje, zalihe, prekomerna proizvodnja, suvišan transport, neefikasan proces, defekti, suvišno kretanje, neiskorišćene mogućnosti, odsustvo zaposlenih (Radosavljević i saradnici, 2015),
- eliminisanje gubitaka (primenom nekog od alata ili tehnika – just-in-time, SMED (engl. Single-Minute Exchange of Dies), preventivno održavanje, proizvodnja bez variranja...),
- težnja ka savršenstvu preko kontinuiranih poboljšanja čak i u slučaju uspeha.

Glavna svrha *Lean* koncepta jeste da identifikuje i eliminiše izvor problema u toku vrednosti fokusiranom na očekivanja kupaca približavajući se savršenstvu vrednosti. Suština *Lean* filozofije nije samo u uklanjanju gubitaka, već i u naporu ka kontinuiranom poboljšanju i smanjenju troškova (slika 3) (Jourabchi et al., 2014; Naveen, 2022).

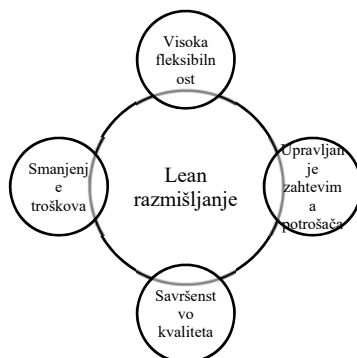
S tim u vezi, *Lean* alati (5S, Kaizen, Kanban, JIT) pomažu da se izglade poslovni procesi, kroz identifikaciju i eliminisanje bilo koje vrste otpada, koji će istovremeno dovesti do poboljšanja kvaliteta i smanjenja troškova i vremena (Breifogle, 2009). U osnovi, otpad se određuje kao nešto što ne dodaje vrednost iz perspektive kupaca (aktivnosti bez dodatne vrednosti). Drugim rečima, dijagnostikovanje i uklanjanje bilo koje vrste otpada, uključujući - čekanje, zalihe, prekomernu proizvodnju, suvišan transport, neefikasan proces, defekte, suvišno kretanje, neiskorišćene mogućnosti, odsustvo zaposlenih, dovešće do značajnog ublažavanja troškova i vremena aktivnosti. Jedan od najinicijativijih načina da se otpad izbaci iz poslovnog procesa uključuje obuhvat svih aktivnosti koje povezuju krajnjeg kupca kroz procese preduzeća i nazad do dobavljača tako što uključuje vremensku skalu koja pokazuje vreme dodatne vrednosti, kao i ukupno vreme trajanja za svaki podproces (Meisel, 2007).

Da bi se izbegli „problemi kvaliteta“, menadžment mora usmeravati zaposlene prema kvalitetu (Anđelković, 2009). Efikasna primena *Lean* koncepta zavisi od svih u preduzeću, počev od top menadžera do zaposlenih na najnižim nivoima, bez obzira o kojoj vrsti preduzeća da je reč (Grigg et al., 2018)

Dok je *Lean* fokusiran na sistematsko smanjenje otpada, on takođe podrazumeva značajnu promenu postojeće organizacione kulture (Erthal & Markues, 2018). Organizaciona kultura je zajednički sistem verovanja, vrednosti i navika koje zaposleni u preduzeću prihvataju (Dimitrantzou et al, 2021). *Lean* kultura naglašava razvoj zaposlenih tako što ih kontinuirano uključuje u inicijative za poboljšanje u celom preduzeću.

Najefikasniji je posao koji se kvalitetno obavi prvi put, odnosno koji ne zahteva ponavljanje zbog neadekvatnih rezultata. Zato kvalitet mora biti ugrađen u proizvode i procese, odnosno o kvalitetu se mora voditi računa još pri dizajniranju proizvoda i procesa.

Slika 3: Komponente *Lean* razmišljanja



Izvor: Naveen, 2022

Lean alati utiču na brzinu izvođenja programa unapređenja kvaliteta na pozitivan način. Ova brzina rezultat je implementacije alata, kao na primer 5S i Kaizen, za stvaranje bezbednog i efikasnog radnog okruženja kao i stimulisanje morala zaposlenih. Ovo podrazumeva uključivanje svakog zaposlenog u eliminisanje otpada što rezultira pozitivnim efektima poboljšanja na konkretnim radnim mestima. Odnosno, zadaci se tada obavljaju sa najnižim nivoom otpada obezbeđujući efikasan proizvodni tok za proizvode koje treba isporučiti sa najnižom stopom nedostataka. *Lean* pristup praćen jakom organizacionom kulturom obezbeđuje kreativno radno okruženje koje omogućuje proces proizvodnje sa 10% usaglašenosti.

Posmatrano sa stanovišta troškova kvaliteta potrebno je da menadžeri osiguraju da troškovi prevencije i detekcije čine veći deo ukupnih troškova kvaliteta. Na taj način ukupni troškovi kvaliteta ne samo da će biti niži već i predvidljiviji i upravljiviji. Stoga primena *Lean* alata za otkrivanje osnovog uzroka problema i eliminisanje otpada u proizvodima, uslugama, procesima dovodi do značajnog eliminisanja nedostataka i smanjenja ukupnih troškova kvaliteta.

Sa stanovišta troškova kvaliteta zadržavanje različitih vrsta otpada u procesu preduzeća može doprineti pojavi mnoštva prikrivenih troškova. Primena *Lean* dovodi do prepoznavanja i smanjenja prikrivenih troškova kroz eliminaciju otpada. *Lean* ukazuje na sistematski pristup u identifikaciji i eliminisanju otpada obezbeđivanjem proizvoda i usluga po želji kupca u potrazi za savršenstvom. Prednosti primene *Lean* koncepta ogledaju se u porastu produktivnosti, unapređenju kvaliteta, skraćanju vremena ciklusa proizvodnje i smanjenju troškova (Naveen, 2022).

4. Zaključak

Preduzeća posluju u veoma složenom okruženju jer se vremenom konkurencija menja i stoga je teško zadržati tržišni udeo. Održiva konkurentska prednost postiže se

ostvarenjem višeg kvaliteta i niže cene proizvoda i usluga. U tom smislu, potrebno je da preduzeća upravljaju troškovima kvaliteta primenom različitih alata za upravljanje kvalitetom. *Lean* pristup omogućava preduzećima da unaprede svoje procese eliminisanjem nepotrebnih aktivnosti, a samim tim i troškovi kvaliteta će se značajno smanjiti. Koraci bez dodatne vrednosti tokom operacija bi trebalo da budu eliminisani i stoga se principi *Lean* fokusiraju na ove korake.

U okviru upravljanja troškovima kvaliteta preduzeća identifikuju i vrše kategorizaciju troškova kvaliteta primenom određenog modela upravljanja troškovima kvaliteta. Model troškova optimalnog kvaliteta je pokušao da predstavi optimalni nivo ulaganja u kvalitet radi ostvarenja proizvodnje sa nula defekata. S tim u vezi, *Lean* alati, sa fokusom na eliminaciju otpada i težnji ka savršenstvu vrednosti, utiču na minimiziranje raznih skrivenih troškova i time na smanjenje ukupnih troškova kvaliteta. Temeljna evaluacija, redovno merenje i pravilno predstavljanje troškova vezanih za kvalitet omogućavaju menadžerima da donose odluke zasnovane na adekvatnim informacijama i kreiraju planove za poboljšanje kvaliteta uz istovremeno smanjenje troškova nekvaliteta.

Reference

- Anđelković Pešić M., (2009) *Modeli upravljanja troškovima kvaliteta*, Računovodstvo: časopis za računovodstvo, reviziju i poslovne finansije
- Beckford J., (2005). *Quality*, Routledge, Taylor & Francis Group, London
- Breyfogle, F. (2009). *New Paradigms. Integrating Lean and Six Sigma Process Improvement Tools*. Quality Digest Magazine.
- Crosby, Ph.B. (1979). *Quality Is Free*. New York: McGraw-Hill.
- Czajkowski, M. (2017). *Managing SME with an innovative hybrid cost of quality model*. Measuring Business Excellence 21(4):351-376.
- Dimitrantzou, Psomas, Bouranta & Kafetzopoulos (2021). *The role of organisational culture in total quality management adoption and cost of quality*, Total Quality Management & Business Excellence.
- Erthal, A., & Marques, L. (2018). *National culture and organisational culture in Lean organisations: a systematic review*. Production Planning & Control, 29(8), 668–687.
- Feigenbaum, A.V. (2005) *Total quality control: achieving productivity, market penetration and advantage in the global economy*, McGraw-Hill Higher Education.
- Gryna, F.M. (1999) *Quality and cost*, in Juran, J.M. and Godfrey, A.B. (Eds.): Juran's Quality Handbook, McGraw-Hill, New York.
- Jones S., (2004). Understanding Six Sigma, Quality.
- Jourabchi, S.M. M- & Arabian, T- & Leman, Z. & Ismail, Md. (2014). *Contribution of Lean and Six Sigma to effective cost of quality management*. International Journal of Productivity and Quality Management. 14.
- Kau, L. & Nel, H. (2019). *Cost of Quality: A Review and Future Research Directions*. International Journal of Social Ecology and Sustainable Development. 10. 28-52.
- Kerfai, N., Ghadhab, B. B., & Malouche, D. (2016). *Performance measurement and quality costing in Tunisian manufacturing companies*. The TQM Journal, 28(4), 588–596.
- Meisel, R.M., Babb, S.J., Marsh, S.F. and Schlichting J.P. (2007). *The Executive Guide to Understanding and Implementing Lean Six Sigma: The Financial Impact*, Milwaukee: American society of Quality, Quality Press.

- Naveen K., Syed Shahzeb H., Kunal S., Rayhan Akhtar, Rakesh K., Vikas K.. (2022) *Lean manufacturing techniques and its implementation: A review*, Materials Today: Proceedings, Volume 64, Part 3, 1188-1192.
- Nikiforova, A. & Bicevska, Z. (2018). *Application of Lean Principles to Improve Business Processes: a Case Study in a Latvian IT Company*. 6. 10.22364/bjmc.2018.6.3.03.
- Raßfeld, C., Behmer, F., Durlach, F., Jochem, R. (2015). *Do quality costs still matter?* Total Quality Management & Business Excellence, 26(9), pp. 1071–1082.
- Radosavljević, M., Bošković, G. & Mihajlović M. (2015). *Business orientation as a link between total quality management and Lean management*. Poslovna ekonomija 9.1. ctp. 277-294
- Rosiawan, M. & Singgih, M. & Widodo, E. (2019). *Model of quality costs and economic benefits of a business process of manufacturing companies*. Cogent Engineering. 6. , Muhammad & Singgih, Moses & Widodo, Erwin. (2019). *Model of quality costs and economic benefits of a business process of manufacturing companies*. Cogent Engineering.
- Sadkowski, W. & Jedynak. (2022). *Quality costs as a subject of research in management sciences*. 10.4324/9781003275022-2.
- Schiffauerova, A., & Thomson, V., (2006). *A review of research on cost of quality models and best practices*. International Journal of Quality and Reliability Management, 23(6): 647-669.
- Setijono, D. & Dahlggaard J.D. (2008). *The value of quality improvements*, International Journal of Quality & Reliability Management, Vol. 25, No. 3, pp.292–312.
- Sharma, R. K., Kumar, D., & Kumar, P. (2007). *Quality costing in process industries through QCAS: A practical case*. International Journal of Production Research, 45(15), 3381–3403.
- Shewhart, W.A. (1931). *Economic Control of Quality of Manufactured Products*. New York: Nostrand Co. Inc.
- Velkoska, C., & Tomov, M. (2021). *Costs of quality concept and measurement – does a reaffirmation in a new direction needed?* Vision International Scientific Journal, 6(1), 65–80.
- Velkoska, C., & Tomov, M. (2022). *Visualization of the process of tracking quality using costs of quality: an empirical study*. TEM journal, 971–980

DETERMINATION OF THE OPTIMAL LEVEL OF QUALITY

Summary: *Gaining and maintaining the competitive advantage of modern companies means meeting customer expectations by offering better quality products and services at a reasonable price. Increasing the level of quality is usually associated with increasing costs. However, focusing on quality costs allows the company to realize an increase in profits while simultaneously improving quality and reducing quality costs. Therefore, it is necessary to identify the optimal quality point for the total cost of quality. The above points to the need to monitor quality costs not only in the total amount, but also by individual categories of costs that make up quality costs, namely: prevention costs, detection costs, costs of internally observed defects and costs of externally observed defects. In order to identify the optimal point of total quality costs, a significant contribution can be made by the implementation of the Lean approach.*

Keywords: *quality, quality costs, optimal point, Lean.*

SESSION 3



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

HOW SUSTAINABLE ARE TRENDS ON A LOCAL HOUSING MARKET?

Srdan Marinković, PhD*

Jelena Radojičić, PhD*

Ognjen Radović, PhD*

Abstract: *The paper investigates dynamics of residential housing market of City of Niš and the South and East Serbia. Data confirm that newly built houses may systematically differ in prices from existing housing stock. The differences could be attributed to the weak efficacy of forces that are supposed to consolidate market. It appears that the secondary market rather than primary market leads in response of prices to demand shocks. Primary market follows the secondary market trend set ups and reversals with lags of up to four quarters.*

Keywords: *residential housing market, stock-flow model, housing prices.*

1. Introduction

Based on price development on the Serbian housing market one may conclude that demand is constantly in excess of supply. In last years, housing boom is Serbia is largely financed by changing structure of household wealth. Net financial asset of households was decreasing both because mortgage financing and large share of cash purchases (Marinković et al., 2023). Speed up of new construction appears could not keep up with booming demand. On the other side, it seems that demand of housing as durable consumption good (owner-occupied) is not responsible for having the seller's market. Namely, houses may serve also investment and speculative purposes, with those motives being the main contributors of a dynamic housing market, especially in the ambience of inflation and repressed financial market.

* Faculty of Economics, University of Niš, Serbia, ORCID 0000-0001-9012-9454,
✉ srdjan.marinkovic@eknfak.ni.ac.rs

* Faculty of Economics, University of Niš, Serbia, ORCID 0000-0003-3444-0138,
✉ jelena.radojicic@eknfak.ni.ac.rs

* Faculty of Economics, University of Niš, Serbia, ORCID 0000-0001-7428-565X,
✉ ognjen.radovic@gmail.com

In this paper we will investigate the current stance of a local housing market. To the extent that data are available, we will deal with housing market in City of Niš, or otherwise consider South East Serbia region, assuming that City of Niš, as the most vibrant part of the regional market, faces trends and regularities similar to other local market in the region. The idea is to look for answers on following questions. Is there a shortage of housing supply in city of Niš? What is prognosis for the housing price on this local market?

The paper first review basic identities that economic science uses to explain what determines housing demand and supply. Then we analyze how demand and supply forces mutually interact, and how those interactions help to set the prices that would clear the market. The analyses are based on contributions from market microstructure theory. Here we assume that the housing market is segmented market that tend to consolidate. In the fourth part we employed data analysis and found that in long-run newly built houses may systematically differ in prices from existing housing stock. The differences are non-trivial and persistent, and could be attributed to the weak efficacy of forces that are supposed to consolidate market. Final part concludes.

2. Snapshot on economics of housing market

The basic framework for macroeconomic analysis of housing market is a stock-flow model. The stock-flow model of housing market belongs to the specific class of economic models used to formalize markets for goods that are constantly produced (flow) and consumed in many years (stock). A stock-flow model differentiates between the stock of goods (capital goods or durable consumption goods), which is rigid in the short run, and the flow of new production, which reacts quicker to changes in economic conditions. The stock and the flow are linked together through two channels (Steiner, 2010). The existing stock of houses is the accumulation of new construction over time. Precisely, the rate of expansion of the stock is the difference between gross residential investments and the rate of depreciation. The housing stock depreciates at constant rate, while the new residential construction may vary over time. This variable speed of the positive and constant speed of the negative flows generates changes in net flow, which are responsible for variations in total housing supply over time. Moreover, since the ratio of the flow to the stock is very low, it rarely exceeds a couple of percent, the housing stock will show a sluggish adjustment to demand shocks. Even the new construction will not react immediately because it takes time to build a house, and investment decision are costly to reverse. The second channel has reverse way of influences. It goes from housing stock to the flow of housing investment, via housing prices. The total (existing) housing stock determines housing supply and prices, which further determines the flow of new constructions. Moreover, those determinants (of housing prices) have the heterogenous adjustment speed. Housing demand reacts the fastest, it follows the flow of new constructions (residential investment flow), and finally the housing stock, what contributes to volatile nature of housing prices, price bubbles, and disequilibria. Since the housing stock cannot adjust swiftly to shocks (e.g. demand shocks and shocks in costs of production), in short-time the housing price may differ from market clearing price, so that imbalance is inherent in the housing market.

The two-equation stock-flow model of housing market (Poterba, 1984; DiPasquale & Wheaton, 1994; Meen, 2002) depicts a housing demand and a housing supply function. Both functions are presumably determined by housing price, so that demand ultimately

How Sustainable are Trends on a Local Housing Market?

equals supply, and the housing market settles equilibrium with a clearing housing price. Housing demand will drive the prices up while supply will drive them down.

The model does not differentiate between prices of newly constructed houses and prices of existing housing stock. It comes out with a single price of housing unit that equates demand and supply. Let us look at the supply side first. Total supply is a sum of existing housing stock and the latest change in number of houses, which is per se the difference between new constructed houses, and the depreciation of existing housing stock. Depreciation itself is not pure accounting variable. It depends on variety of social and urbanistic developments in addition to engineering determinants (Rustempašić & Čaušević, 2014).

The new construction will depend on the mark up in building industry, or the difference between selling price and cost of construction per unit (labor, material, technology, financial cost etc.). It is obvious that the price that matters in this case is price on primary market, if we allow the prices on primary and secondary market to differ. The long-run demand is determined by housing prices, a vector of exogenous determinants, E (population, household income and wealth), and some other determinants (DiPasquale & Wheaton, 1994) that represent costs of renting a house as an alternative to buying one, e.g. rents, financial costs (relevant interest rates) etc.

Since the housing stock cannot adjust swiftly to shocks (e.g. demand shocks and shocks in costs of production) in short-time, the housing price may differ from market clearing price, so that imbalance is inherent in the housing market.

3. Housing market segmentation, consolidation and arbitrage

In the economic theory, primary market is a market segment on which an investor meets first buyer. Secondary market links first buyer with next buyers, on the way that first buyer now becomes a seller, and disinvest while the new buyer invests. The trade in secondary market is pure liquidity driven. The more trade will make market more liquid. Thus, a primary market transaction includes newly built houses, while the secondary market transactions include trade in existing housing stock. Sometimes, for statistical records, secondary market is defined to include even first sale transaction of houses that happens later than a year after construction. While the primary market is limited by construction activity, the secondary market is theoretically limitless. It can grow to sizes that are multiple times the size of primary market.

Another interesting issue is which market segment leads and which one follows in price determination. Based on the model of the housing market, construction costs are built into housing price. According to the model, it comes that the costs enter price equation only on primary market, since only there, costs are contemporaneous, while on secondary market an owner/seller may have some records, or remember historical costs, but those historical costs will not directly influence selling price, if only.

When it comes to the numbers of housing units in existence (secondary market) relative to newly built houses (primary market) it is the rule that the latter in large extent dominate the former. As already mentioned, ratio of the new houses to the existing stock is very low. For example, number of new constructed houses in city of Niš in the period of 2011–2021 never exceeded one percent of existing stock, averaging 0.67 percent for the period. However, while entire stock of new houses enters the market, only a fraction of old

houses appears on the market. However, how big is this fraction is what hugely matters for price developments. It is most volatile part of total supply. Existing housing stock represent a scope of latent supply. It is a reserve pool that can feed up supply if triggered by price. This part of supply is more speculative in nature. High prices would bring it up, while depressed prices would make this part of total supply nearly vanished. This way, both construction activity and existing stock supply on the market will have strong price dependence.

Leaving aside tax considerations, in terms of demand determinants, primary and secondary housing market can be considered almost perfect substitutes. Therefore, despite of differences that shape decision to build for sale relative to decision to sale already bought houses, the housing market must behave like a segmented market that tend to consolidate.

Three mechanisms consolidate a segmented market (Harris, 2003, p. 534). First, within each market segment, traders adjust their bids/offers to reflect information that they revealed in other segments. These adjustments cause prices to reflect information from all segments. Second, some traders route their trade to market segments where they expect to obtain the best prices. Sellers will choose a segment with higher price, while buyers will do the opposite. These trade-routing decisions help balance the supply and demand in market segments. Finally, arbitrageurs trade whenever prices in one segment are inconsistent with prices in another segment. The arbitrage equalizes prices across segments as it connects buyers in one segment to sellers in another segment. Thus, the arbitrageurs will help separated segments' equilibria to converge into an equilibrium of a consolidated market. Although the forces that consolidate a segmented market are strong and may be very effective, the process can be inhibited by impediments in information flows. The first mechanism is especially weak on information disturbances, but, in some extent, this is true for all mechanisms.

In residential housing market the first mechanism of consolidation will work efficiently if there are no significant impediments in flow of information. Real-estate agencies collect information from primary market sellers (investors) and secondary market sellers and make it public free of charge. Perspective buyers can easily access information. In addition to agencies, investors alone invest in direct sale through internet platforms and sale offices. The second mechanism works a bit different than in general consolidation case, since only buyers are free to choose between segments. Finally, housing market opens also some space for arbitrage to work. An arbitrage opportunity arises when the prices of correlated assets diverge from their normal relations. Arbitrageurs put on the arbitrage by taking a long position (buy) in relatively cheap asset (segment), and a short position in relatively expensive one. The arbitrageurs will profit if the prices converge. Then the arbitrageur should unwind or take off the arbitrage by shifting the positions, i.e. sell what previously bought, and buy what previously sold. For example, if secondary market is relatively expensive, an actor who sells his home in order to buy new one on primary market actually does the arbitrage. In industry's slang such transactions are named 'related', and it is believed that large share of total turnover originates in such transactions. However, only a part of related transactions is motivated with exploiting price differentials that arise from market inefficiencies. If secondary market is relatively cheap, investors may use proceeds from sale to invest on secondary market. Unfortunately, those are the only ways that arbitrage-like transactions can be accomplished in residential housing market. For an arbitrage to work perfectly we need that anyone can take any position anytime, needs no funds and exposes to no risk. In reality, this strategy is not easy to accomplished.

How Sustainable are Trends on a Local Housing Market?

Arbitrageurs are exposed to risk, do not have unlimited access to resources, short-sale is not possible, so that in this case the arbitrage has no potential to fully align prices on those two market segments.

If two assets are not perfect substitutes, the process of price equalization will still work, and eventually the market segments will attain separate equilibriums with two instead of one price that will differ to the extent to which market values the difference between them. The process and the trading strategy that rule exploiting arbitrage opportunity that arises within price differentials of two substitutes, which are supposed to have correlated prices, are known as risk arbitrage, speculative arbitrage or relative-value arbitrage (Stefanini, 2006).

The biggest source of differences between newly built and old houses is location. The location is not tradable source of value since already built location cannot be easily converted and used for new projects. Probably the best locations are already taken by existing housing stock, so that new projects have to be placed either in areas on the outskirts of cities, which are less attractive and often lacks in infrastructure, or in city's downtown where scarcity of usable land for building may limit size and architecture of the new projects ("build in someone's backyard").

The second difference is related to building standards and quality. In timespans of several decades the change in standards of living related to various definitions of comfort are clearly noticeable. An example of this developments are newly established energy efficiency and thermal comfort regulations. Since 2014. every new or reconstructed building has to satisfy more stringent regulation (Pravilnik o energetskejoj efikasnosti zgrada, 2011). The buildings are certified based on ranking granted based on precalculated consumption of energy for heating. To assess stringency of the new regulation it is worth to know that based on preliminary assessments (test certifications) and data (Agencija za energetiku Srbije, 2024), the existing housing stock consumes approximately 150 kWh/m² for heating purposes, while the regulation for newly built multi-apartment buildings allows no more than 60 kWh/m² ("C" rank in energy passport). Just for the sake of comparisons, in order to get one level better rank ("B" rank, or low-energy house), the energy consumption for heating purposes should be no more than a half of "C" rank, the same as for getting "A" rank (a passive house) an investor should guarantee no more than a half of consumption limit for "B" rank (Pravilnik o uslovima, sadržini i načinu izdavanja sertifikata o energetskejoj svojstvima zgrada, 2012). It is easy to calculate that an "A" rank building consumes at least ten times less energy for heating than an average existing building, and probably twenty times less than an old badly-maintained no-insulation building. Obviously, investors have to invest a lot in insulation (better materials, thickness, layout techniques) to reach those targets (Zbašnik-Senegačnik, 2010), what brings costs of building up. There is also regulation regarding acoustic comfort (level of noise), visual comfort and privacy, accessibility, number of parking lots, plot ratio etc. (Stoiljković, 2015). At the same time, the regulation concerning minimum size of apartments, rooms or dimensions, in comparison to short-lasting "golden" decade seems less restrictive (Pravilnik o uslovima i normativima za projektovanje stambenih zgrada i stanova, 2015). More than regulation, market trends themselves confirm that today's buyers prioritize small apartments and rooms, which directs new constructions. It is interesting that an average size of newly built apartments is lagging behind those build in "golden decade". It appears that pool of new constructed houses may systematically differ from existing housing stock in terms of price-

relevant features, in some periods of time probably more than in others. This may explain steady differences in average price on primary and secondary housing market, as well as differences in price developments, especially the slope of price trends.

Providing that the primary and secondary market are different segments of a housing market for essentially the same asset, and that tend to consolidate, an unjustified high price on secondary market (for instance due to a positive demand shock) should direct demand from secondary to primary market, raising the price on primary market and investors mark up. High mark-ups will further stimulate new construction, and bring housing supply closer to the new demand. Since the new residential investments cannot adjust swift enough to the level needed to establish new equilibrium, downward prices response will not be immediate, so that investors will partly exploit and partly correct market failure. Eventually, new housing supply will adjust to the new demand, and prices on primary market will align with the prices on secondary market.

If shocks come from the side of costs of production, price equalization will start from primary market. For instance, rising cost of construction will either bring price on primary market up, holding constant mark-up, or decrease mark-up and adjust residential housing investments downward. In the first case, secondary market prices would follow upward trend, whereas in the second case, secondary market prices would respond the same way but with a lag defined by the adjustment speed of new construction.

Let us now assume a stance of the market featured with a negative demand shock that leads to falling prices. This trend of falling prices can sustain as long as downward adjustment of residential construction investment align new housing supply to shrink of demand. The local residential construction industry is currently dominated by firms that can easily restrict activity in case of decreased mark ups. The dominance of non-specialized investors that may shift to other construction businesses or leave the construction industry entirely, makes local housing supply price-elastic. Therefore, slowing down of demand will be more likely reflected on downward adjustment of supply than on significant reduction of housing prices. Thus, shrinkage of the market is most probable outcome in case of curbing or fading demand. On the other side, housing demand tend to be strong even in the ambience of rising prices because of speculative and investment components of demand, since, in inflation and repressed financial markets, there is no many other viable inflation-hedge alternatives. Therefore, the only force that can bring housing prices down is significant increase of construction activity. But, unless built for non-profit purposes, new houses will be built only if the high markup is garnered to investors. This is why the local market will express resistance to downward adjustment of prices.

4. Housing market in City of Niš

4.1 Different source of data and data quality

Data on housing price can be assembled from various sources. Official statistics publish data on average price based on reported transaction prices for each individual sale. The second source of data is from real-estate agencies which assemble data on brokered items. Houses are priced based on seller's offer that is subject to bargaining and very often are contracted at prices lower than offered. It is actually an ask or offer price. On the other side, reported transaction price may be also unreal, since there is a practice to report lower

How Sustainable are Trends on a Local Housing Market?

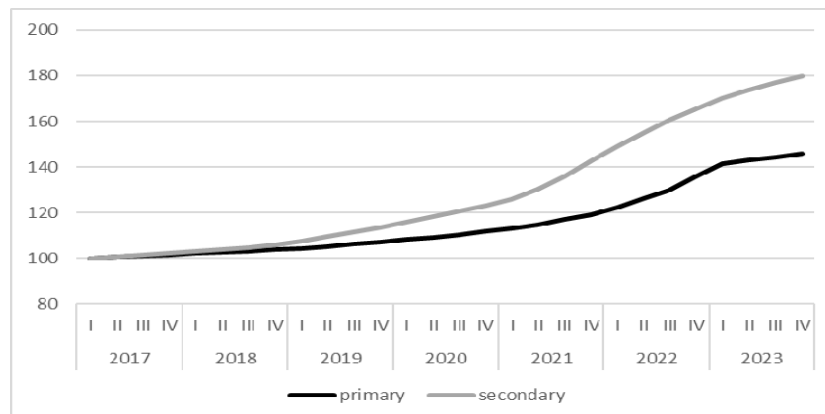
price in selling contracts in order to decrease capital gain and consequently personal income tax. This way a portion of total price is payable in cash and not reported in contract. This tax-evasion motivated mal-reporting is more likely in secondary markets. Moreover, sells on primary market are in large share arranged without intermediation of real-estate agencies, so that data on newly built houses are more reliable for analytical purposes.

Thanks to improvements in scientific methodology, we can now extract common price trends from large baskets of commodities that differ in many price-relevant features. There is statistical methodology able to operate with a number of housing features (including location, building quality etc.). It reports so-called time trend which represents the change of prices that cannot be explainable with changes in average housing quality. This methodology is based on hedonic price regressions (HPR). HPR-based price indices hold constant all price determinants that make individual houses differ in prices, and report only the change in common valuation determinants. Therefore, such indices are much better measures of housing price inflation than any indices produced with unfiltered transaction data, or indices based on ask/offer prices assembled from real-estate agencies.

4.2 Seller's market and overvaluation

Current level of residential investments is not enough to even offset for the accounting depreciation of existing housing stock in City of Niš. Regarding demographic trends that depicts housing demand in this city, several data should be underlined. Firstly, number of inhabitants per an apartment is continuously decreasing, from 2.28 in 2011 to 2.06 in year 2021. At the same time, number of households increased so that an average size of household continuously decreasing (2.58 members in 2021 relative to 2.9 in 2011), what gives an average number of houses per a household of 1.3. (RZS, 2022).

Graph 1. RGZ housing price index (2017 QI = 100)

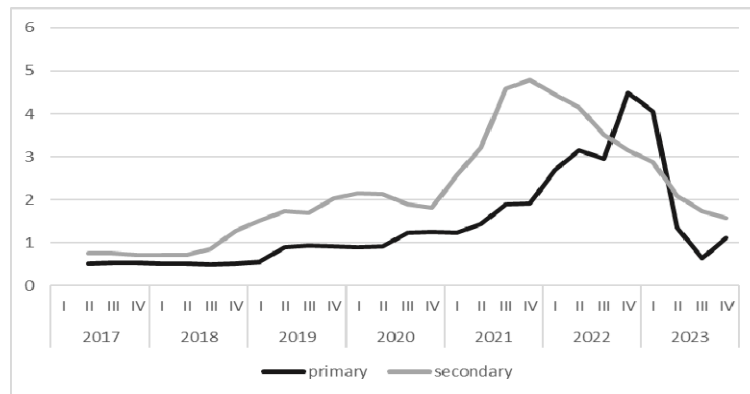


RGZ reports an HPR price index for the period 2017 onwards. The measure is sample-based since it does not include all sales transactions reported in the period, but is considered relevant. RGZ reports indices separately for primary and secondary housing market. Any difference in two indices thus represents different market conditions on those two segments. Providing that there was equilibrium between secondary and primary market

prices at the start of 2017, based on housing price index of RGZ (2024), at the end of 2023 secondary market of South and East Serbia is been overpriced relative to primary market for a quarter (179.63/145.67). The equilibrium assumption is doubtful since there is no reason to believe that market forces that are supposed to align secondary to primary market prices worked back in 2016. Thus, the real extent of overvaluation of secondary market is likely even higher.

The next graph (2) may give us some clue about the direction of causality. Either primary or secondary market segment may initiate price response on market's changes. The arbitrage forces will then act to align prices on those two segments. Based on time precedence it seems that the secondary market rather than primary market leads in response of prices. Primary market follows the secondary market trend set ups and reversals with lags of four quarters. The data visualization method is only indicative. In order to come with conclusive evidence, we need more rigorous statistical tests.

Graph 2. RGZ housing prices – quarterly growth rates



Since majority of new houses are sold in the early phase of construction, unsaturated demand finishes on secondary market pushing prices up. An excess demand heats secondary market first with tendency to spill over primary market and prices of new constructed houses. Whether market cooling is possible? If yes, where it will start? Let us assume slowing down of demand. Primary market will face slowing sales, with potential for prices and/or output to fall. For a given structure of the construction industry an output fall is more likely scenario. But if there will be some price decrease it will spill over to secondary market.

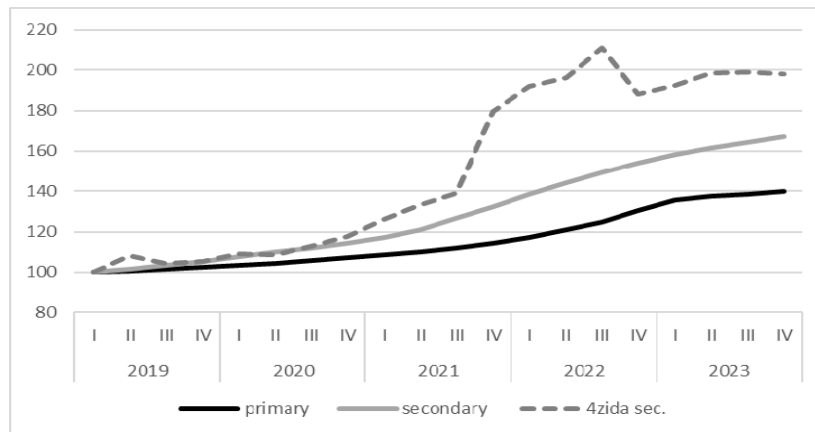
4.3 Seller's euphoria and price bubbles

The next graph (3) contains data on housing prices in City of Niš wider area (urban and rural settlements) as available from the real-estate agency 4zida. For the sake of comparisons, we entered data from RGZ relating to South and East Serbia. The indices are set to have the same base (2019 QI =100). As stated, RGZ reports on quality-adjusted transaction data, i.e. time trend or housing prices inflation, while the agency reports ask prices. From the very different patterns we can assume that the agency data do not provide a constant mix/average. After the third quarter of 2021 average prices set up a steep rising trend with a reversal in fourth quarter in following year. It can be a year-lasting speculative

How Sustainable are Trends on a Local Housing Market?

bubble, initiated by rising prices of new constructions. High prices brought up on the market latent supply from the existing housing stock. Fear of inflation generated excess demand for houses and pronounced already established seller's market character. At least a part of price increase reported by the agency can be attributed to above-average mix of houses that temporary appeared on the market.

Graph 3. RGZ and 4zida housing prices (2019 QI = 100)



Conclusion

The paper investigates dynamics of residential housing market of City of Niš and the South and East Serbia. It analyzes how demand and supply forces mutually interacts, and how those interactions help to set the prices that would clear the market. The analyses are based on contributions from market microstructure theory. Here we assume that the housing market is segmented market that tend to consolidate. Data visualization techniques confirm that, in long-run, newly built houses may systematically differ in prices from existing housing stock. The differences are proved non-trivial and persistent, and could be attributed to the weak efficacy of forces that are supposed to consolidate market. Based on time precedence it seems that the secondary market rather than primary market leads in response of prices to demand shocks. Primary market follows the secondary market trend set ups and reversals with lags of up to four quarters. Moreover, the analysis of ask prices available from a real-estate agency indicates possibility of sellers' euphoria that has contributed to a year-lasting speculative bubble. In terms of desirable policy, the findings recommend activity that will stimulate residential construction and prevent shocks from the side of housing demand.

Acknowledgement:

The paper is a result of research based on the Agreement (number 451-03-65/2024-03) signed in 2024 by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia and the Faculty of Economics, University of Niš.

References

- Agencija za energetiku RS. <https://www.aers.rs/Index.asp?l=1&a=541&id=245> accessed 20.04.2024.
- DiPasquale, D. & Wheaton, W. C. (1994). Housing market dynamics and the future of housing prices. *Journal of Urban Economics*, 35 (1), 1–27. <https://doi.org/10.1006/juec.1994.1001>
- Harris, L. (2003). *Trading and exchanges*. New York: Oxford University Press.
- Marinković, S., Radojičić, J. & Jemović, M. (2023). Tržište stambenih nekretnina u Republici Srbiji iz perspektive regionalnog razvoja. In: *Regionalni razvoj i demografski tokovi zemalja Jugoistočne Evrope* (pp. 89–101). Niš: Ekonomski fakultet.
- Meen, G. (2002). The time-series behavior of house prices: A transatlantic divide? *Journal of Housing Economics*, 11 (1), 1–23. <https://doi.org/10.1006/jhec.2001.0307>
- Poterba, J. (1984). Tax subsidies to owner-occupied housing: An asset market approach. *Quarterly Journal of Economics*, 99 (4), 729–752. <https://doi.org/10.2307/1883123>
- Pravilnik o energetskej efikasnosti zgrada, *Službeni glasnik RS*, br. 61/2011.
- Pravilnik o uslovima i normativima za projektovanje stambenih zgrada i stanova, *Službeni glasnik RS*, br. 58/2012, 74/2015 i 82/2015.
- Pravilnik o uslovima, sadržini i načinu izdavanja sertifikata o energetskej svojstvima zgrada, *Službeni glasnik RS*, 69/2012.
- RGZ (2024). RGZ indeks cena stanova: Četvrto tromesečje 2023. Republički geodetski zavod, Beograd, Januar.
- Rustempašić, N. & Čaušević, A. (2014). *Rekonstrukcije zidanih objekata visokogradnje*. Sarajevo: Univerzitet u Sarajevu, Arhitektonski fakultet.
- RZS (2022). Opštine i regioni u Republici Srbiji, 2022. Beograd: Republički zavod za statistiku.
- Stefanini, F. (2006). *Investment strategies of hedge funds*. Chichester: John Wiley & Sons.
- Steiner, E. (2010). Estimating a stock-flow model for the Swiss housing market. *Swiss Journal of Economics and Statistics*, 146 (3), 601–627.
- Stoiljković, B. (2015). Primena koncepta individualizacije u stambenoj arhitekturi u kontekstu unapređenja kvaliteta višeporodičnog stanovanja u Srbiji. Univerzitet u Nišu, Građevinsko-arhitektonski fakultet, doktorska disertacija.
- Zbašnik-Senegačnik, M. (2010). Konstrukcija zidova pasivne kuće. *Građevinar*, 62 (5), 461–463.

KOLIKO SU ODRŽIVI TRENDOMI NA LOKALNOM TRŽIŠTU STANOVA?

Abstract: U radu istražujemo kretanje na tržištu stanova u gradu Nišu i regionu Južne i Istočne Srbije. Podaci potvrđuju da se cene novoizgrađenih stanova i postojećeg stambenog fonda mogu sistematski razlikovati. Ove razlike se mogu pripisati nedovoljnoj efikasnosti sila od kojih se očekuje da konsoliduju tržište. Izgleda da cene na sekundarnom tržištu stanova reaguju pre cena na primarnom na šokove sa strane tražnje. Primarno tržište sledi sekundarno tržište stanova kako u pogledu obrazovanja i zaokreta u trendu cena i to sa kašnjenjem do četiri kvartala.

Keywords: tržište stambenih nekretnina, model zaliha, cena stanova.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**FINANSIJSKA INTEGRACIJA I LIBERALIZACIJA KAPITALNOG
RAČUNA: ANALIZA EFEKATA NA EKONOMIJU REPUBLIKE SRBIJE**

Andrijana Đurđević *

Srđan Furtula •

***Apstrakt:** Proces finansijske integracije sve više privlači pažnju svih ekonomskih subjekata. Viši nivo finansijske integracije doprinosi jačanju nacionalnih ekonomija smanjenjem troškova kapitala i poboljšanjem alokacije finansijskih resursa. Republika Srbija, kao relativno mala ekonomija, prepoznaje značaj većeg uključivanja u svetsku i evropsku privredu, posebno nakon političkih promena iz 2000. godine koje su inicirale sistemsku liberalizaciju kapitalnog računa. Liberalizacija kapitalnih tokova predstavlja ključnu reformu koja olakšava investicione procese kroz prilive stranog kapitala. Najveći priliv stranih direktnih investicija (SDI) zabeležen je u 2006. godini, dok je nakon toga udeo SDI u bruto domaćem proizvodu (BDP) opadao, delom zbog svetske ekonomske krize iz 2008. godine. Liberalizacija kapitalnog računa, iako može povećati ranjivost zemlje na globalne ekonomske turbulencije, takođe može služiti kao indikator posvećenosti boljoj makroekonomskoj politici. Ovaj rad pruža teorijsku analizu finansijske integracije i finansijske liberalizacije, istražuje odnos između stranih direktnih investicija i tekućeg računa Republike Srbije, te analizira stepen otvorenosti ekonomije.*

***Ključne reči:** tekući račun, strane direktne investicije, deficit, Republika Srbija*

1. Uvod

U savremenom globalizovanom svetu, fenomeni globalizacije, liberalizacije i integracije značajno oblikuju dinamiku ekonomskih promena. Globalizacija se manifestuje kroz ukidanje barijera u svetskoj trgovinskoj razmeni i smanjenje prepreka u međunarodnoj

* Univerzitet u Kragujevcu - Ekonomski fakultet, Srbija, ORCID: 0000-0001-9381-0712,

✉ andrijana.djurdjjevic@ef.kg.ac.rs

• Univerzitet u Kragujevcu - Ekonomski fakultet, Srbija, ORCID: 0000-0002-0692-6539,

✉ furtulas@kg.ac.rs

UDK 330.142.23:330.3(497.11)

ekonomskoj interakciji, što vodi ka većoj ekonomskoj integraciji među zemljama. Integracija privreda zemalja Zapadnog Balkana, uključujući Republiku Srbiju, i njihovo aktivnije uključivanje u globalne lance vrednosti visoko je na agendi Evropske unije. Međutim, finansijska globalizacija nije bila bez rizika. Tokom 1980-ih i 1990-ih godina, brojne zemlje u razvoju suočile su se sa finansijskim krizama koje su zahvatile Latinsku Ameriku, Aziju i Afriku. Ove krize su često rezultirale kolapsima bankarskih sistema, recesijama i značajnim smanjenjem međunarodnih tokova kapitala. Kritičari, kao što su Bhagwati (1998), Rodrik (1998) i Stiglitz (2002), ističu da finansijska integracija može nositi velike rizike, posebno za zemlje sa srednjim nivoom dohotka. Stiglitz (2000) preporučuje da zemlje u razvoju uvedu ograničenja na priliv kapitala kako bi ublažile ekstremne fluktuacije na finansijskim tržištima. S druge strane, zagovornici globalizacije tvrde da poboljšana finansijska globalizacija može predstavljati važan korak za tržišta u nastajanju, koja teže stabilnosti i nivoima dohotka sličnim onima u razvijenim industrijskim ekonomijama (Fischer, 1998; Summers, 2000). Finansijska integracija može doprineti većoj efikasnosti nacionalnih ekonomija smanjenjem troškova kapitala i poboljšanjem alokacije finansijskih resursa, što može dovesti do stabilnijeg i neinflacionog rasta ekonomija. Takođe, doprinosi diversifikaciji aktivnosti i rizika finansijskih institucija, čime se povećava efikasnost i stabilnost finansijskih sistema. Mnogi ekonomisti naglašavaju prednosti liberalizacije i integracije. Finansijska liberalizacija povećava dostupnost finansijskih sredstava i omogućava diversifikaciju rizika među zemljama, čime poboljšava funkcionisanje finansijskih sistema (Stulz, 1999; Mishkin, 2001). Ova liberalizacija može promovisati transparentnost i odgovornost, smanjiti negativnu selekciju i moralni hazard, i unaprediti likvidnost na finansijskim tržištima. Strane direktne investicije (SDI) postaju sve važniji faktor za ekonomije domaćina, uključujući i zemlje u tranziciji poput Republike Srbije. Uvalić i Cvijanović (2018) beleže da su zemlje Zapadnog Balkana tokom prve decenije XXI veka zabeležile poboljšanje makroekonomskih performansi, uključujući rast bruto domaćeg proizvoda (BDP), opadanje inflacije i značajan priliv stranih direktnih investicija (SDI). Cilj ovog rada je da analizira uticaj finansijske integracije i liberalizacije kapitalnog računa na ekonomiju Republike Srbije, s posebnim fokusom na ulogu stranih direktnih investicija u finansiranju deficita tekućeg računa. Posebno će se razmotriti kako SDI utiču na tekući račun i kakva je njihova uloga u ekonomiji Srbije tokom različitih ekonomskih perioda, uključujući period krize izazvane pandemijom COVID-19. Takođe, biće analiziran stepen trgovinske otvorenosti srpske ekonomije. Rad je strukturiran u četiri komplementarna dela: prvi deo definiše pojam finansijske integracije i njegove karakteristike, kao i analizira finansijsku liberalizaciju kao ključnu komponentu globalizacije; drugi deo istražuje odnos SDI i tekućeg računa Srbije u periodu od 2005. do 2018. godine; treći deo fokusira se na uticaj SDI na deficit tekućeg računa tokom perioda krize izazvane pandemijom COVID-19; četvrti deo razmatra stepen trgovinske otvorenosti ekonomije Srbije.

2. Finansijska integracija i finansijska liberalizacija

Finansijska integracija označava lakoću i ugodnost trgovine finansijskim instrumentima unutar određenih regiona, između država i na globalnom nivou. Prema Hartmannu, Maddaloniju i Manganelliju (2003), finansijska integracija se ostvaruje kada unutar određenog ekonomskog područja ne postoje barijere koje diskriminišu ekonomske subjekte u pogledu privlačenja i plasiranja sredstava. To podrazumeva da finansijski instrumenti sa istim novčanim tokovima imaju istu cenu i da ne bi trebale postojati sistematske razlike u raspodeli portfolija i strukturi finansiranja.

Finansijska integracija i liberalizacija kapitalnog računa: Analiza efekata na ekonomiju Republike Srbije

Jappelli i Pagano (2008) naglašavaju da uklanjanje barijera finansijskoj integraciji može podstaći lokalni finansijski razvoj kroz povećanje konkurencije. Sofisticiranije i bolje organizovane inostrane finansijske institucije mogu pružiti povoljnije uslove i time doprineti rastu lokalnog finansijskog sistema. U integrisanim finansijskim prostorima, posebno u zemljama niskog finansijskog razvoja, može se očekivati značajan porast u pristupu i ponudi izvora finansiranja. Ukoliko strane institucije direktno nude svoje usluge, može doći do konsolidacije u finansijskom sektoru. S druge strane, ako lokalne institucije prihvate promene, integracija može dovesti do poboljšanja u poslovnim procesima, smanjenja troškova i boljih kreditnih uslova. Prednosti finansijske integracije uključuju veću mogućnost diverzifikacije portfolija, smanjenje operativnih troškova zahvaljujući ekonomiji obima i povećanje konkurencije koja dovodi do viših kamata za štediša i nižih kamata za kreditne korisnike. Međutim, finansijska integracija nosi i rizike, uključujući veću složenost, povećanu verovatnoću širenja finansijskih kriza, izazove u regulaciji i teškoće u oporezivanju finansijskih operacija. Različiti indikatori, kao što su *de jure* (zakonski) i *de facto* (stvarni) mere otvorenosti kapitalnog računa, pružaju različite uvide u stepen finansijske integracije.

Finansijska liberalizacija predstavlja ključnu komponentu globalizacije, koja se manifestuje kroz uklanjanje zvaničnih ograničenja kretanju kapitala između zemalja. Ovaj proces omogućava bolji pristup kapitalu i lakše investicije, posebno u zemljama u razvoju. Liberalizacija kapitalnog računa olakšava pristup međunarodnim finansijskim tržištima i poboljšava alokaciju ekonomskih resursa. Prema Mahmutoviću i Taloviću (2014), liberalizacija se intenzivirala od kasnih 60-ih i početka 70-ih godina, čime se omogućila veća mobilnost kapitala i ubrzani proces investiranja. Radošević (2010) ukazuje da potpuna liberalizacija kapitalnog računa zahteva usklađenost sa strategijama fleksibilnog režima deviznog kursa i jakom makroekonomskom politikom. MMF koristi različite indikatore za merenje finansijske otvorenosti, a liberalizacija može dovesti do pozitivnih i negativnih efekata.

Prednosti liberalizacije kapitalnog računa uključuju veću finansijsku efikasnost, specijalizaciju i inovativnost, poboljšanje uslova za investicije, optimizaciju agregatne štednje i mogućnost diverzifikacije portfolija. S druge strane, nedostaci uključuju rizik od smanjenja domaćih investicija, povećanu makroekonomsku nestabilnost, potencijal za valutne krize i mogućnost pojave finansijskih mehurica.

Finansijska liberalizacija je posebno značajna za zemlje u tranziciji, gde može značajno doprineti privlačenju stranog kapitala i ekonomskom razvoju, dok istovremeno predstavlja izazove u pogledu regulacije i stabilnosti finansijskog sistema.

3. Strane direktne investicije i tekuću račun Republike Srbije (2005-2018. godine)

Pre početka tranzicije, strane direktne investicije su bile veoma niske. Tokom tranzicije, vlade su počele da uklanjaju restriktivne propise i uvode podsticajne zakone za strana ulaganja. Zemlje su počele da se takmiče u privlačenju stranih investitora putem smanjenja poreza na dobit, poreskih olakšica i socijalnih pogodnosti.

Da bi mogla da finansira svoj razvoj u uslovima približavanja Evropskoj uniji, Srbija mora da smanji potrošnju i poveća izvoz, ali će i dalje imati deficit u bilansu tekućih transakcija. Taj deficit će finansirati prilivom stranih investicija, odnosno suficitom kapitalnog bilansa. Ako u cilju ograničenja potrošnje, priliv stranih investicija bude usmeravan u devizne rezerve, to će

dovesti do povećanja ponude deviza na deviznom tržištu što može da deluje u pravcu apresijacije kursa, a dobar način da se to izbegne je liberalizacija deviznog tržišta i kapitalnog računa. Povećan priliv stranih direktnih investicija u kratkoročnom periodu pokreće ekonomski rast koji doprinosi finansijskom razvoju i uključenosti u međunarodnu trgovinu što obezbeđuje održiv ekonomski rast (Pradhan et al., 2017).

Sistemska liberalizacija kapitalnog računa Srbije započinje sa političkim promenama 2000. godine. Srbija se odlučila za faznu liberalizaciju kapitalnih transakcija. Sa donošenjem novog Zakona o deviznom poslovanju u 2002. godini i potpunom liberalizacijom tekućih transakcija, statistika platnog bilansa je metodološki prilagođena međunarodnim statističkim standardima, shodno petom izdanju Priručnika o platnom bilansu Međunarodnog monetarnog fonda (NBS, 2006). Zakonom o deviznom poslovanju iz 2006. godine izvršena je dodatna liberalizacija, ali ne potpuna. Radi se o simetričnoj liberalizaciji, odnosno istovremenoj liberalizaciji kretanja kapitala u oba smera, kako za rezidente, tako i za nerezidente. Tokovi stranih direktnih investicija su u osnovi liberalizovani. Ovaj element kapitalnih tokova je najbrže liberalizovan u svim tranzicionim ekonomijama zbog ograničene domaće akumulacije.

Tokom 90-ih godina XX veka privrede regiona Centralne i Istočne Evrope i Zapadnog Balkana vodile su se kao "tržišta u nastajanju". Liberalizacijom finansijskih sektora, uklanjanjem barijera slobodnom protoku kapitala i uključivanjem u svetske trgovinske tokove, ovo područje postaje privlačno za strani kapital. Kao dopuna domaćoj akumulaciji, SDI postaju dominantan oblik ulaganja u ove zemlje (Maksimović, 2015).

Nakon slabog interesovanja stranih investitora za ekonomije Zapadnog Balkana 90-ih godina XX veka, tokom 2000-ih je došlo do rasta priliva SDI, podstaknutog tranzicijom, pre svega programima liberalizacije, privatizacije i restrukturiranja preduzeća i blagim poboljšanjem makroekonomskih performansi (Estrin & Uvalić, 2013).

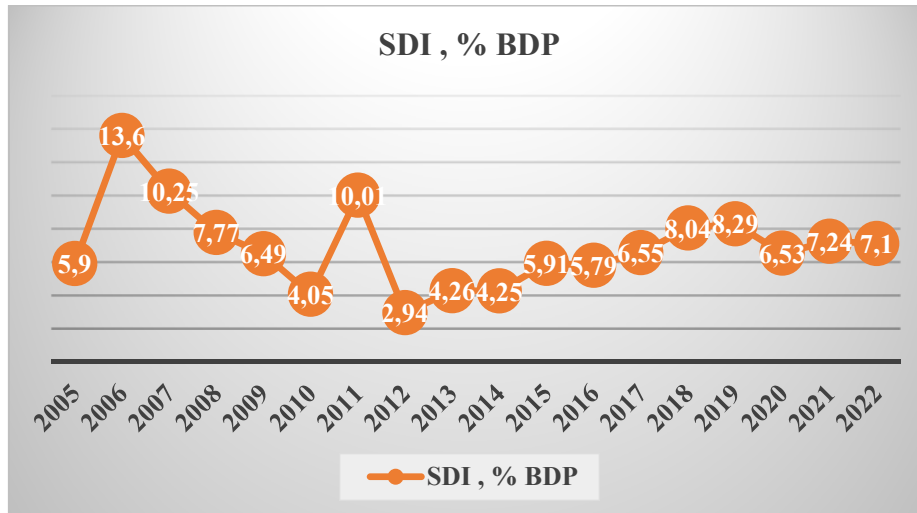
Na početku tranzicije, Srbija se suočavala sa značajnim makroekonomskim problemima kao što su inflacija, nezaposlenost, nedostatak domaće štednje i usporen ekonomski rast. Da bi rešila ove probleme, Srbija je nastojala da privuče strane direktne investicije (SDI) kako bi podstakla ekonomsku aktivnost. Liberalizacija trgovine i slobodan protok kapitala povećali su priliv SDI u manje razvijene tranzicione zemlje poput Srbije krajem XX i početkom XXI veka.

Strane direktne investicije (SDI) čine dominantan deo kapitalnog računa zemalja u razvoju. Globalne promene uticale su na tokove SDI, koje su postale glavna komponenta kapitalno-finansijskog računa, dok su portfolio investicije ostale ograničene. Srbija može privući dvostruko više SDI u poređenju sa sličnim zemljama, ali priliv je i dalje nedovoljan za potrebe domaće ekonomije. Učešće SDI u BDP-u Srbije za period 2005-2021. godine prikazano je u Tabeli 1.

Grafik 1 pokazuje da je priliv stranih direktnih investicija (SDI) u Srbiju bio neujednačen u odnosu na BDP. Najveći priliv SDI bio je 2006. godine, kada je prodat Mobtel Telenoru za 1,6 milijardi EUR, dok je nakon toga udeo SDI u BDP-u opadao. Svetska ekonomska kriza 2008. godine smanjila je SDI, a značajniji udeo zabeležen je još samo 2007. (10,2%) i 2011. (10,0%). Međutim, priliv SDI je ponovo porastao 2019. godine na 3,8 milijardi evra (8,3% BDP-a) i nastavio da raste tokom 2020. godine, zahvaljujući makroekonomskoj stabilnosti. Trend rasta se nastavlja i nakon pandemije.

**Finansijska integracija i liberalizacija kapitalnog računa:
Analiza efekata na ekonomiju Republike Srbije**

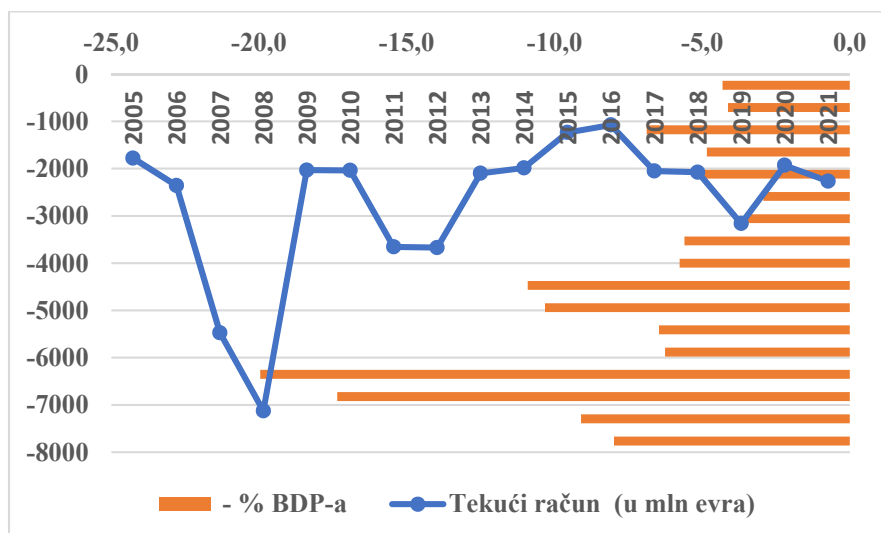
Grafik 1. Strane direktne investicije - % učešće u BDP-u (2005-2021. godine)



Izvor: Narodna banka Srbije, https://www.nbs.rs/sr_RS/indeks/

Granica na kojoj deficit tekućeg računa postaje problematičan nije jasno definisana, ali se smatra da je optimalan nivo do 5% BDP-a (Marčetić, 2017). U tranzicionim zemljama poput Srbije, liberalizacija tekućeg računa često dovodi do rasta deficita, koji se finansira kroz suficit na računu kapitala. Ovaj suficit nastaje zahvaljujući pozitivnim neto tokovima stranih direktnih investicija, portfolio investicija i drugih investicija.

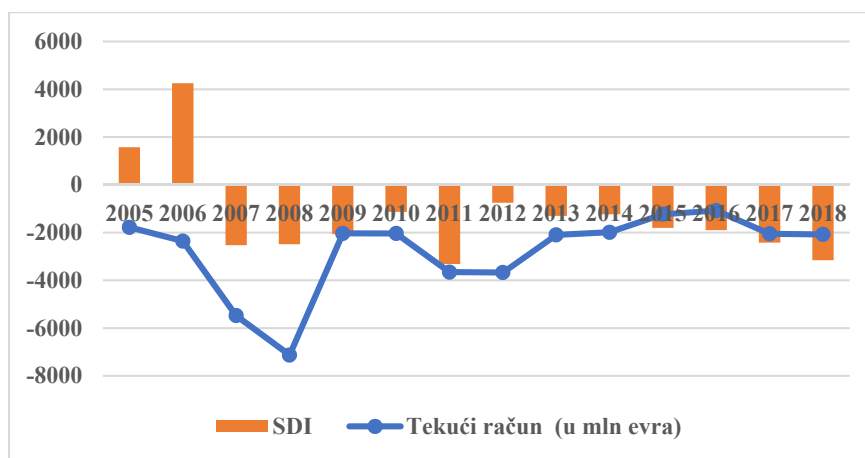
Grafik 2. Bilans tekućeg računa - % učešće u BDP-u (2005-2021. godine)



Izvor: NBS

Na Grafiku 2 prikazani su bilans tekućeg računa i njegovo učešće u BDP-u od 2005. do 2021. godine. Na početku perioda, deficit tekućeg računa u Srbiji pogoršan je zbog uticaja SDI, dostegnuvši rekordnih 20% BDP-a 2008. godine zbog visoke potrošnje i niske konkurentnosti izvoza. Globalna kriza 2008. godine smanjila je robni izvoz za 19,76% i robni uvoz za 30,18%, što je dovelo do smanjenja deficita tekućeg računa na 6,2% BDP-a u 2009. godini. Nakon toga, deficit se smanjivao, s izuzetkom 2011. i 2012. godine kada je prelazio 10% BDP-a. U 2021. godini, udeo deficita tekućeg računa u BDP-u bio je 4,4%, što je blago povećanje u odnosu na 2020. godinu (4,1%), uzrokovano većim deficitom robne razmene, ali podržano rastom izvoznih kapaciteta zahvaljujući prethodnim investicijama i većoj eksternoj tražnji.

Grafik 3. Odnos SDI i tekućeg računa Srbije (2005-2018. godine u mln evra)



Izvor: NBS

Odnos između stranih direktnih investicija (SDI) i tekućeg računa Srbije može se analizirati kroz tri perioda: pre ekonomske krize (2005-2008), nakon krize (2008-2018), i tokom krize COVID-19 (2019-2021).

Grafik 3 prikazuje period od 2005. do 2018. godine, obuhvatajući vreme pre i posle Svetske ekonomske krize 2008. godine. Pre devedesetih godina, SDI su se najčešće realizovale kroz zajednička ulaganja, prvenstveno u prerađivačku industriju, uz značajnu ulogu zemalja Evropske Unije. Tokom početnog perioda tranzicije, veliki deo SDI bio je povezan sa privatizacijom domaćih preduzeća. Nakon 2000. godine, priliv SDI bio je pretežno usmeren na privatizaciju, dok su nove investicije uglavnom usmerene u tercijarni sektor.

Tokom svetske ekonomske krize, deficit tekućeg računa je imao samokorigujući efekat, ali su se tokom vremena akumulirali problemi poput veće potrošnje od proizvodnje, rastućeg deficita, velike nezaposlenosti i neadekvatnog restrukturiranja preduzeća. Svetska ekonomska kriza je dovela do naglog pada stranih direktnih investicija (SDI) i stagnacije, jer su domaće stope štednje bile niske, a priliv kapitala bio nestabilan. Nakon 2006. godine, SDI su se smanjile ispod očekivanog nivoa.

Deficit tekućeg računa je u 2008. godini iznosio sedam miliona evra, dok je u 2009. pao na dva miliona evra. Od 2010. do 2012. godine, deficit je ponovo rastao i dostigao 3,7

Finansijska integracija i liberalizacija kapitalnog računa: Analiza efekata na ekonomiju Republike Srbije

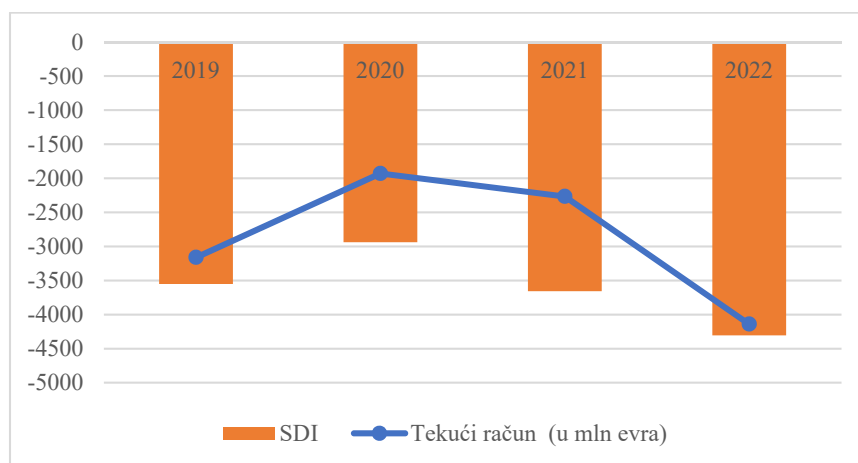
miliona evra. Nakon toga, od 2013. godine je ponovo opadao, dostigavši najniži nivo od 1,1 milion evra u 2016. godini. U 2018. godini deficit je bio 2,2 miliona evra. Od januara do juna 2018. godine, deficit tekućeg računa je bio stabilan, bez oscilacija.

Prema Bartlettu (2009), nizak priliv stranih direktnih investicija (SDI) bio je rezultat visokih ulaganja rizika, što je otežalo tehnološki napredak i smanjilo konkurentnost. Prihodi su bili niski, a mnoga domaćinstva su zavisila od doznaka iz inostranstva. Kriza krajem druge decenije tranzicije pogoršala je probleme smanjivanjem prihoda od izvoza, povlačenjem kapitala, usporavanjem rasta i povećanjem nezaposlenosti.

4. Strane direktne investicije i tekuću račun Republike Srbije (2019-2021. godine)

Period od 2019. do 2021. godine je obeležilo izbijanje krize izazvane pandemijom COVID-19, koja je uticala kako na svetsku, tako i na našu ekonomiju. Na Grafiku 4. je prikazan odnos SDI i deficita tekućeg računa u tom periodu.

Grafik 4. Odnos SDI i tekućeg računa Srbije (2019-2021. godine u mln evra)



Izvor: NBS

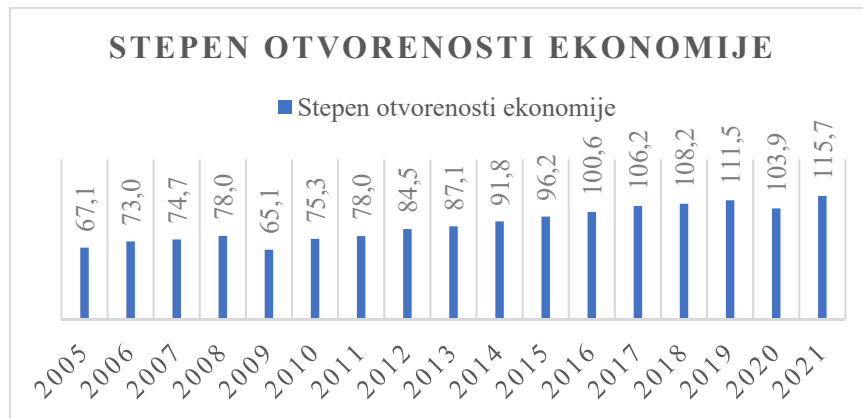
Pandemija COVID-19 nije značajno uticala na Srbiju zahvaljujući makroekonomskoj stabilnosti, prethodnim dinamikama rasta, fiskalnom prostoru i pravovremenim merama. Deficit tekućeg računa je bio pokriven rekordnim neto prilivom stranih direktnih investicija (SDI).

U 2019. godini, deficit tekućeg računa bio je 3,2 miliona evra. U 2020. godini, priliv SDI iznosio je 3.014,2 miliona evra, dok je neto priliv bio 2.902,3 miliona evra, što je pokrilo deficit (pokrivenost od 146,5%). U 2021. godini, deficit tekućeg računa bio je 2,3 miliona evra, uz povećan uvoz energenata i veći deficit na računu primarnog dohotka. Međutim, suficit u uslugama i sekundarnom dohotku poboljšao je tekući račun. Deficit je i dalje bio pokriven SDI, s rekordnim pokrićem od 154,7% na kraju 2021. godine. Neto priliv SDI u 2021. bio je 3,6 miliona evra, što je za 23,4% više nego prethodne godine. U 2022. godini, priliv SDI bio je 4,4 miliona evra, ili 7,1% BDP-a. Očekuje se da će deficit tekućeg računa u 2023. godini ostati na sličnom nivou kao u 2022. godini.

Integracija zemalja u svetsku trgovinu povezana je s ekonomskim rastom i razvojem. Istraživanja pokazuju da otvorenost privreda doprinosi rastu i boljoj raspodeli prihoda (Huchet et al., 2018). Za zemlje u razvoju, spoljna trgovina donosi prednosti kao što su ekonomija obima, veća iskorišćenost kapaciteta, privlačenje stranih investicija, povećanje zaposlenosti i tehnološka unapređenja. Za region zapadnog Balkana, spoljna trgovina je ključna za ekonomsku saradnju sa EU i drugim globalnim partnerima.

Održavanje deficita tekućeg računa, kao što je slučaj sa Srbijom, zavisi od stepena otvorenosti ekonomije. Veća otvorenost olakšava izmirivanje obaveza, dok smanjenje priliva stranog kapitala može zahtevati povećanje izvoza za obezbeđivanje strane valute. U međuvremenu, smanjenje uvoza može negativno uticati na industrijski sektor zavistan od uvoznih inputa, što je posebno problematično za zemlju poput Srbije koja je zavisna od uvoza.

Grafik 5. Stepen otvorenosti ekonomije Republike Srbije (2005-2021. godine)



Izvor: NBS

Grafik 5. prikazuje stepen otvorenosti ekonomije Srbije od 2005. do 2021. godine, koji se meri kao odnos zbira uvoza i izvoza prema BDP-u. Stepenn otvorenosti opao je 2009. zbog svetske ekonomske krize, ali je kasnije rastao. Kriza izazvana COVID-19 nije značajno uticala na smanjenje otvorenosti. Dok je 2005. bio 67,1%, 2021. je dostigao 115,7%, što pokazuje gotovo dupliranje. Iako je trgovinska otvorenost u Srbiji relativno mala, značajno je porasla u posmatranom periodu. Potrebno je dalje povećati stepen otvorenosti za bolju specijalizaciju, ekonomiju obima i pristup savremenim tehnologijama kroz strane direktne investicije.

5. Zaključak

Od druge polovine dvadesetog veka, procesi finansijske integracije, liberalizacije kapitala i globalizacije doveli su do povećanja stranih direktnih investicija (SDI), naročito u tranzicionim zemljama kao što je Srbija. Liberalizacija kapitalnog računa omogućila je priliv stranog kapitala ukidanjem barijera, što je pomoglo u pokrivanju deficita tekućeg računa. SDI igraju ključnu ulogu u razvoju zemalja i finansiranju deficita, jer suficit na kapitalnom računu omogućava pokrivanje deficita tekućeg računa. Takođe, reinvestirana dobit iz SDI može uticati na "prećenjenost" deficita tekućeg računa, jer se beleži kao priliv u finansijskom

Finansijska integracija i liberalizacija kapitalnog računa: Analiza efekata na ekonomiju Republike Srbije

računu, a kao odliv u računu dohotka, iako ne dolazi do stvarne konverzije valuta ili odlaska kapitala iz zemlje.

Strane direktne investicije (SDI) imaju negativan uticaj na tekući račun Srbije zbog rasta odliva kapitala kroz račun dohotka, s obzirom na povećanje dividendi. Dugoročno, ovaj rast odliva pogoršava platni bilans. Promene u prikazivanju računa dohotka dodatno otežavaju praćenje. SDI takođe negativno utiču na spoljnotrgovinski bilans Srbije zbog dominantnih investicija u tercijarnom sektoru (finansije, trgovina, nekretnine, saobraćaj, građevinarstvo). I pored toga, SDI su ključne za finansiranje deficita tekućeg računa jer ne stvaraju dugovanja i omogućavaju transfer znanja i tehnologije.

Istraživanje u ovom radu ima ograničenja, budući da je prevashodno kvalitativno i ne pruža empirijske dokaze o uticaju stranih direktnih investicija (SDI) na tekući račun. Buduća istraživanja trebalo bi da se fokusiraju na empirijske analize i na proučavanje drugih ključnih faktora koji utiču na održivost deficita tekućeg računa, pored SDI.

Reference

- Bartlett, W. (2009). Economic development in the European super-periphery: Evidence from the Western Balkans, *Economic Annals*, 54(181), 21-44.
- Bhagwati, J. (1998). The Capital Myth. The Difference between Trade in Widgets and Dollars. *Foreign Affairs*, 7(3), 7-12.
- Estrin, S. & Uvalić, M. (2013). Foreign Direct Investment in the Western Balkan: What role has it played during transition? *Comparative Economic Studies*, 58(3), 455-483.
- Fischer, Stanley. (1998). Capital Account Liberalization and the Role of the IMF, in *Should the IMF Pursue Capital-Account Convertibility?* Essays in International Finance 207 (Princeton, New Jersey, Princeton University)
- Hartmann, P., Maddaloni, A., & Manganelli, S. (2003). "The Euro Area Financial System: Structure, Integration, and Policy." *ECB Working Paper Series*, No. 204.
- Huchet, M., Chantal Le M., & Vijil, M. (2018). The relationship between trade openness and economic growth: Some new insights on the openness measurement Issue. *The World Economy*, 41, 59-76.
- Jappelli, T. & Pagano, M. (2008). Financial Market Integration under EMU. *European Economy*, Economic Papers.
- Mahmutović, H. & Talović, S. (2014). Liberalizacija ekonomskih tokova kao bitna determinanta savremene globalizacije: neki teoretski pogledi i argumenti. *Tranzicija*, 16 (33), 71-73
- Maksimović, Lj. & Radosavljević, G. (2015). The Impact of Foreign Direct Investments on the Economic Growth of Advanced Transition Countries. In book: Knowledge, Economy, Society (pp- 55-56), *Cracow University of Economics*.
- Marčetić, M. (2017). *Analiza eksterne neravnoteže Srbije*. Beograd, str. 33.
- Mishkin, F. (2001). Financial Policies and the Prevention of Financial Crises in Emerging Market Countries NBER Working Paper No. 8087 (Cambridge, Massachusetts: National Bureau of Economic Research)
- Narodna banka Srbije, https://www.nbs.rs/sr_RS/index/, pristupljeno 03.04.2022.

- Pradhan, R.P., Mak B.A., John H.H., & Mahendhiran N. (2017). Trade openness, foreign direct investment, and finance-growth nexus in the Eurozone countries. *The Journal of International Trade & Economic Development*, 26, 336–60.
- Pradhan, R.P., Mak B.A., John H.H., & Mahendhiran N. (2017). Trade openness, foreign direct investment, and finance-growth nexus in the Eurozone countries. *The Journal of International Trade & Economic Development*, 26, 336–60.
- Radošević, D. (2010). *Strategija liberalizacije kapitalnih tokova Hrvatske sa inostranstvom*, Hrvatsko društvo ekonomista, Zagreb.
- Rodrik, Dani. (1998). *Who Needs Capital-Account Convertibility?* in Essays in International Finance, Vol. 207 (Princeton, New Jersey, Princeton University).
- Stiglitz, J. (2000). Capital Market Liberalization, Economic Growth, and Instability. *World Development*, 28, (6), 1075–86.
- Stiglitz. (2002). *Globalization and Its Discontents* (New York, W.W. Norton and Company)
- Stulz, René. (1999). *International Portfolio Flows and Security Markets International Capital Flows*, NBER Conference Report Series, pp. 257–93 (Chicago and London: University of Chicago Press)
- Stulz, René. (1999). *International Portfolio Flows and Security Markets International Capital Flows*, NBER Conference Report Series, pp. 257–93 (Chicago and London: University of Chicago Press)
- Summers, Lawrence H. (2000). International Financial Crises: Causes, Prevention, and Cures. *American Economic Review*, 90, (2), 1–6.
- Uvalic, M. & Cvijanovic, V. (2018). Towards a Sustainable Economic Growth and Development in the Western Balkans. *Project: Economic development and growth in the Western Balkans*, Zagreb: Friedrich Ebert Stiftung.

FINANCIAL INTEGRATION AND LIBERALIZATION OF THE CAPITAL ACCOUNT: AN ANALYSIS OF THE EFFECTS ON THE ECONOMY OF THE REPUBLIC OF SERBIA

Abstract: *The process of financial integration is increasingly attracting the attention of all economic agents. A higher level of financial integration contributes to strengthening national economies by reducing capital costs and improving the allocation of financial resources. The Republic of Serbia, as a relatively small economy, recognizes the importance of greater engagement in the global and European economies, especially after the political changes of 2000 that initiated systemic liberalization of the capital account. Liberalization of capital flows is a key reform that facilitates investment processes through foreign capital inflows. The highest inflow of foreign direct investment (FDI) was recorded in 2006, after which the share of FDI in Gross Domestic Product (GDP) declined, partly due to the global economic crisis of 2008. While the liberalization of the capital account can increase a country's vulnerability to global economic turbulence, it can also serve as an indicator of commitment to better macroeconomic policies. This paper provides a theoretical analysis of financial integration and financial liberalization, explores the relationship between foreign direct investments and the current account of the Republic of Serbia, and analyzes the degree of openness of the economy.*

Keywords: *current account, foreign direct investment, deficit, Republic of Serbia*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**INTERACTION BETWEEN TAX REVENUES, TRADE OPENNESS
AND ECONOMIC GROWTH IN SERBIA: ARDL MODEL**

Branimir Kalaš, PhD*

Vera Mirović, PhD*

Jelena Andrašić, PhD*

Abstract: *The interaction between tax revenues, trade openness, and economic growth represents one of the most essential issues for every country. Tax revenues are a vital component of public finances, essential for funding government activities and promoting economic stability. Additionally, trade openness, reflecting a country's integration into the global market, can significantly influence the tax revenue collection, as well as economic growth. Analyzing data from 2006 to 2023, this study aims to identify their potential relationship in the Republic of Serbia. The empirical results of the ARDL model confirmed that trade openness and economic growth positively influence the tax revenues in the short-run and long-run.*

Keywords: *tax revenues, trade openness, economic growth, Serbia, ARDL model*

1. Introduction

The primary objective of fiscal strategies is to promote economic expansion, where the main financial tool employed to reach this objective is taxation (Gurdai et al. 2021). The evaluation of tax revenue performance pertains to the analysis of a government's effectiveness in tax collection and its ability to achieve revenue objectives.

* University of Novi Sad, Faculty of Economics in Subotica, Serbia,
ORCID 0000-0002-9141-7957, ✉ branimir.kalas@ef.uns.ac.rs

• University of Novi Sad, Faculty of Economics in Subotica, Serbia,
ORCID 0000-0002-1465-4692, ✉ vera.mirovic@ef.uns.ac.rs

• University of Novi Sad, Faculty of Economics in Subotica, Serbia,
ORCID 0000-0003-3941-1184, ✉ jelena.andrasic@ef.uns.ac.rs

UDC 336.2(497.11)

339.5.012(497.11)

330.35(497.11)

This matter is among the most critical concerns for policymakers globally. Recognizing and understanding the key factors in revenue collection undoubtedly poses significant challenges for any fiscal authority (Đurović Todorović et al. 2024). The issue of the relationship between tax revenues, economic openness, and economic growth is increasingly taking on a significant role in public finance strategies and policies. Namely, tax revenues are the most important sources of funding for public expenditures and meeting public needs. Accordingly, the tax structure must be designed in line with the economic environment and the economic structure of the country to achieve positive effects on the economy. Additionally, higher economic growth enables higher income and consumption, which can generate additional revenues in the form of indirect taxes such as VAT and excise duties. This is particularly relevant for countries where indirect taxes dominate the tax structure, which is the case with Serbia and countries in the region.

Understanding the effects of economic growth and trade openness on tax revenues is crucial for policymakers in designing effective tax policies that can support sustainable economic development. This paper aims to explore the relationship between economic growth, trade openness, and tax revenues, examining how changes in these variables can influence the fiscal capacity of a country and its ability to finance public expenditures. By analyzing empirical evidence and theoretical frameworks, we seek to shed light on the complex interplay between economic factors and tax revenue generation, providing insights that can inform policy decisions and enhance our understanding of the dynamics of taxation in a globalized economy.

The study is comprised of five segments. The first and second segments include an introduction and literature review where similar studies have investigated the relationship between tax revenues, trade openness and economic growth. The third segment is a methodology and data that defines variables and presents a model framework. The fourth segment is an empirical analysis of tax revenues, trade openness, and economic growth in Serbia from 2006 to 2023 using the ARDL model. The last segment indicates conclusions with the obtained findings with recommendations for further research direction.

2. Literature review

The relationship between tax revenues, trade openness and economic growth has been a subject of significant interest and debate among economists and policymakers. Economic growth is often seen as a key driver of tax revenues, as a growing economy typically generates higher levels of income and consumption, leading to increased tax collections. On the other hand, trade openness, which refers to the degree to which a country engages in international trade, can also have a significant impact on tax revenues through various channels such as import duties, export taxes, and value-added taxes on traded goods. When it comes to the theoretical background related to the nexus among these variables, it can be structured into two parts. Namely, many studies have mostly estimated the relationship between tax revenues and economic growth. Kalaš et al. (2017) found positive effects of taxes on economic growth in Serbia from 2006 to 2015. Also, Kalaš et al. (2020) confirmed that indirect tax revenues such as value-added and excises positively influenced the GDPpc in Serbia from 2005 to 2019. Loganathan et al. (2017) investigated the nexus between taxation and economic growth in China, India, Indonesia, Republic of Korea, Malaysia and Thailand from 1990 to 2014. Their results discover

Interaction between tax revenues, trade openness and economic growth in Serbia: ARDL model

bidirectional causality between economic growth and taxes. Additionally, many studies found positive, negative or neutral effects of trade openness and economic growth on tax revenues. For instance, Gaalya et al. (2016) confirmed that GDPpc and trade openness positively influence the tax revenues in East African countries (Burundi, Kenya, Rwanda, Tanzania, and Uganda) for the analyzed period 1994-2012. This is in line with the study of Gobachew et al. (2017) that has registered positive effects of these variables on tax revenues in Ethiopia from 1990 to 2016. Samimi (2020) identified the positive impact of trade openness on tax revenues in Iran for the period 1978-2018. Conversely, Tsauri (2021) found a negative influence of trade openness on tax revenues in upper-middle-income countries such as South Africa, Brazil, Argentina, Colombia, China, Mexico, Malaysia, Russia, Peru, Turkey and, Thailand for the period 2007-2017. Furthermore, Asghar and Mehmood (2017) identified an inverse relationship between trade openness and tax revenues in Pakistan using data from 1980 to 2015. Additionally, the study of Ihuarulam et al. (2021) confirmed that trade openness is not a significant predictor for tax revenue in ECOWAS countries from 2005 to 2019. In the study of twenty-nine developing countries, Ho et al. (2023) indicated that tax revenues have a positive effect on economic growth in general, where trade openness enhances their positive relationship. However, excessive trade openness negatively affects the relationship between tax revenues and economic growth for the period 2000-2020.

2.1. Hypotheses development

The main research question that should be answered whether there is a significant interaction between tax revenues, trade openness, and economic growth in the short-run and long-run. To answer this question, we developed two general hypotheses followed by auxiliary hypotheses:

H₁: There is a short-run relationship between tax revenues, trade openness and economic growth.

H_{1.1}: Trade openness positively influences tax revenues in the short-run.

H_{1.2}: GDP growth positively influences tax revenues in the short-run

H₂: There is a short-run relationship between tax revenues, trade openness and economic growth.

H_{2.1}: Trade openness positively influences tax revenues in the long-run.

H_{2.2}: GDP growth positively influences tax revenues in the long-run.

3. Methodology and data

In line with the objective of this research to assess the determinants influencing tax revenues, we utilized annual data sourced from the World Bank for the period 2006-2023. The chosen variables for analysis are detailed in Table 1.

Table 1. Variable selection

Variable	Symbol	Calculation
Tax revenues	TXR	% GDP
Trade openness	TRO	% GDP
Economic growth	GDP	annual growth rate

Source: Authors' illustration

Model framework can be presented as:

$$\text{TXR} = f(\text{TRO}, \text{GDP}) \quad (1)$$

The use of autoregressive distributed lag model has been reflected by Pesaran et al (1996) and upgraded by Shin et al. (2001). This model is favorable to determining the relationship between observed variables in the short-run and long-run.

4. Empirical results

Within this section, we provided descriptive analysis, unit root tests and autoregressive distributed lag stationarity model (ARDL) in order to analyze the short-run and long-run relationships between tax revenues, trade openness and economic growth. Descriptive analysis is presented in Table 2.

Table 2. Descriptive statistics

Variable	Mean	Std. dev.	Min.	Max.	Skew.	Kurt.
TXR	22.06	2.07	18.6	26	0.16	2.13
TRO	96.28	19.71	66	139	0.44	2.37
GDP	2.49	2.83	-2.73	7.55	-0.08	2.28

Source: Authors' calculation

Based on the results of descriptive statistics, we can notice that the mean share of tax revenues was 22.06 of GDP, where the highest value was identified in 2023 (26% of GDP). When it comes to trade openness, the average value was 96.28% of GDP with a maximum value of 139% of GDP in 2022. Finally, the mean GDP growth was 2.49% whereas economy of the Serbia reached the greatest value in 2021 (7.55%). Analyzing values of skewness and kurtosis, we can conclude that the distribution is slightly skewed to the right and leptokurtic, leading to a more peaked distribution than a normal distribution.

Table 3. Unit root tests

Tests	ADF test		PP test	
Level				
Variable	Intercept	Trend	Intercept	Trend
TXR	-1.06	-2.42	-0.88	-2.32
TRO	-0.59	-3.67**	-0.27	-3.77*
GDP	-4.12***	-4.38**	-4.15***	-4.04**

**Interaction between tax revenues, trade openness and economic growth in Serbia:
ARDL model**

First. Diff.				
TXR	-4.36**	-4.47***	-4.41***	-4.53***
TRO	-4.92***	-4.87***	-5.15***	-5.13***
GDP	-6.99***	-6.87***	-8.36***	-8.73***

Source: Authors' calculation

We applied ADF and PP tests to check potential unit roots. The results confirmed that tax revenues (TXR) and trade openness (TRO) are integrated at 1, while gross domestic product growth (GDP) is integrated at 0. However, after the first difference, all variables become stationary at the significance levels of 1%, 5% and 10%. Detailed results are presented in Table 3. Therefore, ARDL model is appropriate for evaluating the relationship between series with different orders of integration (Pesaran et al., 2001).

Table 4. ARDL model

Variables	Coefficient	P-value
Short-run		
TRO	0.439	0.000
GDP	2.711	0.021
ECT	-1.187	0.000
Long-run		
TRO	0.084	0.001
GDP	1.268	0.000
Diagnostic tests	F-stat	P-value
ARCH test	0.158	0.691
BPG test	2.569	0.109
Ramsey test	0.340	0.794

Source: Authors' calculation

The empirical results from Table 4 show that ECT coefficient is negative (-1.187), which means that there is a long-run convergence between observed variables. Analyzing the influence in the short-run, trade openness (TRO) and gross domestic product growth (GDP) have positive effects on tax revenues (TXR). Similarly, their influences are positive in long-run, but the intensity of their effects is lower compared to short-run. Specifically, an increase TRO and GDP by 1% enhances TXR by 0.44% and 2.71% in the short-run and 0.08% and 1.27% in the long-run.

5. Conclusion

We have analyzed the relationship between tax revenues, trade openness and economic growth in Serbia from 2006 to 2023. The results of ARDL model confirmed that trade openness (TRO) positively influences the tax revenues (TXR) in the short-run, which

implies that auxiliary hypothesis $H_{1.1}$ can be accepted. Additionally, gross domestic product growth (GDP) has positive impact on tax revenues (TXR) in the short-run. Thus, auxiliary hypothesis $H_{1.2}$ can be confirmed. Based on the aforementioned, the first general hypothesis H_1 can be accepted. When it comes to long-run relationship, we found that trade openness (TXR) and gross domestic product growth (GDP) positively affect the tax revenues (TXR). Therefore, auxiliary hypotheses $H_{2.1}$ and $H_{2.2}$ can be confirmed. It implies that the second general hypothesis H_2 can be accepted. We can highlight policy implications in the following steps. Firstly, policymakers should consider aligning tax policies with the positive influence of trade openness and GDP growth on tax revenues. This may involve revisiting tax structures to ensure that they are conducive to capturing the potential revenue gains from increased trade and economic activity. Secondly, the positive influence of trade openness and GDP growth on tax revenues highlights the importance of diversifying revenue sources. Namely, Diversification can help reduce reliance on a few sources of revenue and enhance the stability of tax collections in the face of economic fluctuations. Thirdly, effective tax administration is crucial for capturing the potential revenue gains from trade openness and GDP growth. Policymakers should invest in improving tax compliance mechanisms, enhancing tax collection efficiency, and combating tax evasion and avoidance. Finally, continuous monitoring and evaluation of the impact of trade openness and GDP growth on tax revenues are essential for informed decision-making. Policymakers should establish robust monitoring mechanisms to track changes in tax collections, analyze the drivers of revenue growth, and assess the effectiveness of tax policies. Future research will focus on West Balkan countries in order to provide new insights related to the potential implications of trade openness and economic growth to tax revenue level in the region.

References

- Asghar, F., & Mehmood, B. (2017). Effects Of Trade Liberalization On Tax Revenue In Pakistan: An Empirical Scrutiny Using Ardl Bound Testing. *Pakistan Economic and Social Review*, 55(1), 187–212. <https://www.jstor.org/stable/26730218>
- Đurović Todorović, J., Đorđević, M., Mirović, V., Kalaš, B., & Pavlović, N. (2024). Modeling Tax Revenue Determinants: The Case of Visegrad Group Countries. *Economies*, 12(6), 1-15. <https://doi.org/10.3390/economies12060131>
- Gaalya, M.S., Edward, B., & Eria, H. (2017). Trade Openness and Tax Revenues Performance in East African Countries. *Modern Economy* 8(5). 690-711. <https://doi.org/10.4236/me.2017.85049>
- Gobachew, N., Debela, K.L., & Shibiru, W. (2017). Determinants of Tax Revenues in Ethiopia. *Economics* 6(6), 58-64. <https://doi.org/10.11648/j.eco.20170606.11>
- Gurdal, T., Aydin, M. & Inal, V. The relationship between tax revenue, government expenditure, and economic growth in G7 countries: new evidence from time and frequency domain approaches. *Economic Change and Restructuring*, 54, 305–337. <https://doi.org/10.1007/s10644-020-09280-x>
- Ho, T. T., Tran, X. H., & Nguyen, Q. K. (2023). Tax revenue-economic growth relationship and the role of trade openness in developing countries. *Cogent Business & Management*, 10(2), 1-14.. <https://doi.org/10.1080/23311975.2023.2213959>

**Interaction between tax revenues, trade openness and economic growth in Serbia:
ARDL model**

- Ihuarulam, G.I., Sanusi, G.P., & Oderinde, L.O. (2021). Macroeconomic determinants of tax revenues in economic community of West African states. *The European Journal of Applied Economics* 18(2), 62-75. <https://doi.org/10.5937/EJAE18-30727>
- Kalaš, B., Milenković, I., Pjanić, M., Andrašić, J., & Milenković, N. (2017). The Impact of Tax Forms on Economic Growth – Evidence from Serbia. *Industry* 45(2), 113-125. <https://doi.org/10.5937/industrija45-12978>
- Kalaš, B., Mirović, V., & Andrašić, J. (2020). Cointegration analysis of indirect taxes and economic growth in the Republic of Serbia. *The Annals of the Faculty of Economics in Subotica* 56(44), 3-10. <https://doi.org/10.5937/AnEkSub2044003K>
- Loganathan, N., Taha, R., Ahmad, N., & Subramaniam, T. (2017). Taxation, growth and the stock traded nexus in emerging Asian countries: heterogeneous and semi-parametric panel estimates. *Economic Research-Ekonomska istraživanja*, 30(1), 566-580. <https://doi.org/10.1080/1331677x.2017.1305789>
- Pesaran, M.H., Shin, Y., & Smith, R.J. (1996). *Testing for the “Existence of a Long-run Relationship”*. Cambridge Working Papers in Economics. 9622.
- Pesaran, M.H., Smith, R.J., & Shin, Y. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16, 289-326. <https://doi.org/10.1002/jae.616>
- Samimi, A.J. (2020). Macroeconomic Variables and Tax Revenues in Iran’s Economy. *Journal of Iranian Economic Issues* 6(2), 255-285. <https://doi.org/10.30465/ce.2020.5421>
- Shin, Y., Smith, R.J., & Pesaran, M.H. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326. <https://www.jstor.org/stable/2678647>
- Tsaurai, K. (2021). Determinants of tax revenues in upper middle-income group of countries. *Journal of Accounting and Management* 11(2), 148-160. <https://www.dj.univ-danubius.ro/index.php/JAM/article/view/864>

**INTERAKCIJA IZMEĐU PORESKIH PRIHODA, TRGOVINSKE
OTVORENOSTI I EKONOMSKOG RASTA U SRBIJI: ARDL MODEL**

Abstract: Interakcija između poreskih prihoda, trgovinske otvorenosti privrede i ekonomskog rasta predstavlja jedno od najvažnijih pitanja za svaku zemlju. Poreski prihodi su ključna komponenta javnih finansija, neophodna za finansiranje vladinih aktivnosti i promovisanje ekonomske stabilnosti. Pored toga, trgovinska otvorenost, koja odražava integraciju zemlje u globalno tržište, može značajno uticati na naplatu poreskih prihoda, kao i na ekonomski rast. Analizom podataka od 2006. do 2023. godine, ova studija ima za cilj da identifikuje njihov potencijalni odnos u Republici Srbiji. Empirijski rezultati ARDL modela potvrdili su da trgovinska otvorenost i ekonomski rast pozitivno utiču na poreske prihode, kako u kratkom tako i u dugom roku.

Ključne reči: poreski prihodi, trgovinska otvorenost, ekonomski rast, Srbija, ARDL model



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**OPTIMIZING THE COORDINATION OF FISCAL AND
MONETARY POLICY FOR SUSTAINABLE ECONOMIC GROWTH
IN THE REPUBLIC OF SERBIA: AN EMPIRICAL STUDY**

Jadranka Đurović Todorović, PhD*

Marina Đorđević, PhD •

Milica Ristić Cakić, MSc •

Abstract: *This paper analyzes the relationship between fiscal and monetary policy and economic growth in the Republic of Serbia, using regression models to assess their impact on economic growth. The primary aim of this study is to determine the relative effectiveness of fiscal and monetary policy in fostering economic growth and to identify the key factors within these policies that significantly influence it. The analysis is based on quarterly data spanning from the first quarter of 2002 to the fourth quarter of 2022, obtained from the National Bank of Serbia and the Statistical Office of Serbia. The findings clearly suggest that fiscal policy is more effective than monetary policy in promoting economic growth in the Republic of Serbia, which can be partially explained by the inadequate coordination between fiscal and monetary policymakers. Given the results, it is essential to pay greater attention to optimizing fiscal policy to enhance its effectiveness and long-term impact on the economy.*

Keywords: *fiscal policy, monetary policy, linear regression*

* Faculty of Economics University of Niš, Serbia, ORCID 0000-0002-8910-2067,
✉ jadranka.djurovic@eknfak.ni.ac.rs

• Faculty of Economics University of Niš, Serbia, ORCID 0000-0002-9909-315X,
✉ marina.djordjevic@eknfak.ni.ac.rs

• Faculty of Economics University of Niš, Serbia, ORCID 0000-0003-3665-2361,
✉ milica.ristic@eknfak.ni.ac.rs

UDK 338.23:336.74(497.11)

336.02(497.11)

1. Introduction

The fiscal and monetary systems are essential pillars of the financial framework (Djurović Todorović, 2014; Rathnayaka, et al., 2024), making the efficacy of these policy instruments vital for fostering economic growth. In the Republic of Serbia, economic activity is significantly influenced by the effectiveness of fiscal policy, which operates in tandem with monetary policy, and vice versa.

The debate surrounding the effectiveness of fiscal and monetary policies has long been central to the discourse between Keynesian and monetarist economists, and this debate continues to resonate in academic circles today. While some theorists argue for the primacy of monetary policy, the prevailing view is that fiscal policy exerts a more substantial impact on economic development. Considerable disagreement exists among economists regarding the role of money in shaping economic processes (Mankiw & Taylor, 2007). This divergence stems from differing views on whether money actively controls economic processes or merely serves as a passive element within the system. According to the perspective of "inactive money," it is often assumed that the money supply adjusts to meet the real needs of economic development, rendering money a passive system component (Komazec & Ristić, 1992). Conversely, the idea that fiscal policy instruments can influence economic structure is well-established. Modern economies increasingly emphasize the importance of fiscal policy, particularly in its role in mobilizing resources for economic accumulation. Given the complexity of these interactions, it is clear that monetary policy cannot achieve its objectives in isolation from fiscal policy. An uncoordinated monetary policy is generally ineffective (Gali, 2008; Hoover, 2015). Therefore, the coordination of monetary and fiscal policies is crucial for economic stabilization and development. The interaction between monetary and fiscal policies has often been modeled as a "non-cooperative game," with the central bank and government each pursuing distinct priorities. Over the past three decades, academic focus has increasingly emphasized fiscal policy, which is perceived to have a more profound influence on price stability. This shift has heightened the importance of understanding the interplay between monetary and fiscal policies, leading to the question: what kind of coordination between these policies is most desirable? (Canzoneri et al., 2010).

The focus of this research is the fiscal and monetary policies of the Republic of Serbia. The primary objective of this research is to evaluate the impact of fiscal and monetary policies on economic growth in the Republic of Serbia. The research is structured into four sections. The second section reviews existing literature on the topic. The third section presents the research findings, based on quarterly data from 2002 to 2022 and relevant statistical methods. The final section offers recommendations for policymakers and suggests ways to enhance the effectiveness of fiscal and monetary instruments.

2. Literature Review

In the field of economics, one of the most extensively debated and contentious topics is the impact of fiscal and monetary policies on economic growth. Despite a substantial body of empirical research that examines the relative efficacy of these policies across both advanced and emerging economies, the results remain inconclusive.

Optimizing the coordination of monetary and fiscal policy for sustainable economic growth in the Republic of Serbia: An empirical study

Andersen and Jordan (1968) conducted an empirical analysis of the relationship between fiscal and monetary interventions and aggregate expenditure in the United States using regression analysis on quarterly data. They employed GDP as the primary indicator of economic activity, while money stock and monetary base served as indicators of monetary actions, and high-employment budget surplus, expenditure, and receipts were used as indicators of fiscal actions. Their findings suggested that monetary interventions should be accorded greater significance than fiscal interventions.

During the late 1960s to the early 1980s, Batten and Hafer (1983) analyzed the relative impact of monetary and fiscal policies in the United Kingdom, the United States, Canada, Japan, and France. Their results indicated that monetary policy exerted a greater influence than fiscal policy across these nations. Similarly, Ajisafe and Folorunso (2002) examined annual data in the period 1970-1998 and concluded that monetary policy had a more pronounced effect on economic activity in Nigeria compared to fiscal policy.

The discourse among economists regarding the influence of fiscal and monetary policies on economic growth remains ongoing (Jawaid et al., 2010; Jawaid et al., 2011). However, the prevailing consensus among contemporary economists is that both policies exert a significant impact on the economy's stability. Kasasbeh (2023) provides a comprehensive literature review on the nexus between fiscal policies and economic growth, noting that fiscal policy employs three primary instruments: government expenditures, taxation, and debt. Recent research underscores the complex and inconsistent relationship between fiscal policy and economic development. While a positive correlation is sometimes observed, there are instances where a negative correlation exists.

Baum and Koester (2011) analyzed quarterly German data in the period 1976-2009 using a threshold SVAR model, introducing new insights into the effects of fiscal shocks on economic stability. Noman and Khudri (2015) explored the impact of fiscal and monetary policy changes on Bangladesh's economic development using annual data from 1979-1980 to 2012-2013. Their study employed line diagrams, correlation matrices, and multiple linear regression models to assess the effects of policy variables on economic expansion. The results indicated a positive correlation between R and variables such as narrow money, broad money, exchange rates, government revenue, and expenditure, while inflation and deposit interest rates were found to negatively affect.

According to Wu, Xu, and Yan (2022), the coordination of fiscal and monetary policies has the potential to enhance market confidence, attenuate economic volatility in the short term, and lay the foundation for structural adjustments in the medium to long term. A breakdown in coordination, however, can lead to compounded adverse effects, either by stalling progress through excessive regulation or by fostering disorder through excessive decentralization. Both fiscal and monetary policies, which are essential tools for short-term demand-side stabilization, share similarities and divergences in their policy objectives. In periods of economic slack, fiscal measures aimed at stimulating output may lead to increased debt, while expansionary monetary policies may heighten inflationary pressures.

The complexity is further amplified in developing economies, which must harmonize fiscal and monetary policies in the aftermath of the COVID-19 crisis to mitigate its adverse consequences. Karaman (2022) utilizes daily data to examine the effects of the COVID-19 pandemic and the monetary policy measures implemented by the European Central Bank. The findings suggest that the pandemic significantly elevated sovereign risk

in the peripheral countries of the European Monetary Union, but monetary policy interventions were effective in alleviating financial conditions.

Fiscal and monetary policies are critical for economic recovery. From the reviewed empirical studies, it is evident that a variety of methodologies and variables are employed to evaluate the impact of fiscal and monetary policies on economic activities. Following the above discussion, we hypothesize that:

Hypothesis 1 (H1)	<i>Variables related to fiscal policy have a substantial impact on economic growth.</i>
Hypothesis 2 (H2)	<i>Variables related to monetary policy have a substantial impact on economic growth.</i>

3. Analysis of Factors and Evaluation of Impact on Economic Growth

From the empirical studies reviewed so far, it is evident that a range of methods and variables are employed to evaluate the impact of fiscal and monetary policies on economic activity. The key factors include:

- *interest rate,*
- *inflation rate,*
- *exchange rate,*
- *money supply,*
- *public revenues,*
- *public expenditures,*
- *government investments and*
- *budget deficit.*

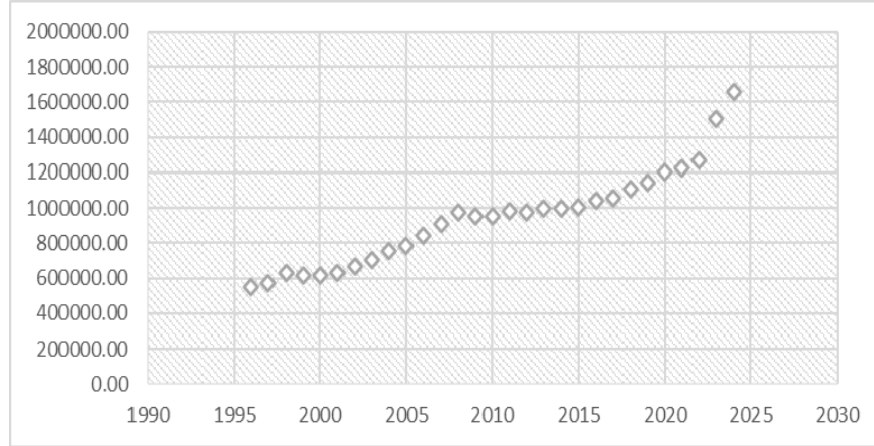
Our analysis will focus on assessing the relative impact of fiscal and monetary policies on economic activity in the Republic of Serbia, using selected variables and appropriate methodologies.

Over the past 25 years, the trend of economic growth in the Republic of Serbia has exhibited a marked cyclicalities. Graph 1 illustrates the economic growth trend from 1996 to 2024. This cyclicalities can be attributed to inadequately managed economic policies and a lack of alignment between fiscal and monetary policy instruments. While these issues contribute to the observed cyclicalities, economic and political conditions at specific times also play a crucial role.

Analyzing economic growth as the dependent variable, it is clear that the highest growth was recorded in 2021, marking the peak gross domestic product (GDP) percentage during this period. It is important to note that various fiscal and monetary measures were implemented in 2020 in response to the crisis triggered by the COVID-19 pandemic. Consequently, the economic growth observed in 2021 can be seen as a direct outcome of these measures.

Optimizing the coordination of monetary and fiscal policy for sustainable economic growth in the Republic of Serbia: An empirical study

Graph 1. GDP trends in the Republic of Serbia (in millions of dinars), 1996–2024.



Note: The amount of GDP is given in millions of dinars at constant prices from the previous year, the reference year 2015.

Source: The authors based their analysis on data from the Bulletin of Public Finances of the Republic of Serbia.

We analyzed the indicators of fiscal and monetary policy. For measuring the impact of fiscal policy, we examined government revenue (GR) and government expenditures (GE). To assess the effect of monetary policy on economic growth, we utilized narrow money (M1), liquid assets (M2), broad money (M3), and the repo rate (R). The data for this study were sourced from the official websites of the National Bank of Serbia and the Statistical Office of Serbia. The resulting dataset encompasses quarterly data spanning from the first quarter of 2002 to the fourth quarter of 2022.

To investigate the impact of fiscal and monetary determinants on economic growth (Y), we employed regression analysis. To model the dependence of economic growth on fiscal determinants by the following regression we use the equation:

$$\ln(Y) = B_0 + B_1 \ln(GR) + B_2 \ln(GE) \quad (1)$$

or equivalently

$$Y = e^{B_0 + B_1 \ln(GR) + B_2 \ln(GE)} \quad (2)$$

where, Y is gross domestic product (in constant prices where 2015 is the reference year), GR is government revenues, and GE is government expenditures.

The secondary objective was to model the relationship between economic growth and monetary determinants using the following regression equation:

$$\ln(Y) = B_0 + B_1 \ln(M_1) + B_2 \ln(M_2) + B_3 \ln(M_3) + B_4(R) \quad (3)$$

or equivalently

$$Y = e^{B_0 + B_1 \ln(M_1) + B_2 \ln(M_2) + B_3 \ln(M_3) + B_4 (R)} \quad (4)$$

where, Y is gross domestic product (in constant prices where 2015 is the reference year), M_1 is narrow money, M_2 is liquid assets (M_2), M_3 is broad money (M_3) and R is repo rate.

First, we assessed the individual impact on gross domestic product using simple regression models:

$$\ln(Y) = B_0 + B_1 \ln(X) \quad (5)$$

Table 1. Regression analysis results

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.	<i>R</i> ²	<i>F</i>	sig
	B	Std. Error	Beta					
(Constant)	11.544	0.105	0.000	109.988	0.000	.856	488.278	.000
lnM1	0.183	0.008	0.925	22.097	0.000			
(Constant)	11.421	0.093	0.000	123.260	0.000	.894	694.546	.000
lnM2	0.188	0.007	0.946	26.354	0.000			
(Constant)	11.507	0.101	0.000	114.076	0.000	.869	545.289	.000
lnM3	0.169	0.007	0.932	23.351	0.000			
(Constant)	14.035	0.016	0.000	870.114	0.000	.526	69.859	.000
Repo rate	-0.015	0.002	-0.725	-8.358	0.000			
(Constant)	10.445	0.152	0.000	68.778	0.000	.881	519.640	.000
lnGR	0.294	0.013	0.939	22.796	0.000			
(Constant)	10.447	0.171	0.000	61.269	0.000	.855	411.913	.000
lnGE	0.294	0.014	0.925	20.296	0.000			

Source: Own calculations.

Each determinant demonstrates a significant impact on gross domestic product, with each explaining a substantial portion of the variance in the dependent variable (over 85%, except for the repo rate, which accounts for 52.6%). However, due to correlations between the determinants, models (1) and (4) exhibited suboptimal performance. To enhance the suggested models, a stepwise optimization algorithm was applied, yielding the following results.

Table 2. Regression analysis results of Model 1

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.	<i>R</i> ²	<i>F</i>	sig
	B	Std. Error	Beta					
(Constant)	11.733	0.151	0.000	77.866	0.000	.770	211.179	.000b
lnM2	0.164	0.011	0.878	14.532	0.000			

Source: Own calculations.

Optimizing the coordination of monetary and fiscal policy for sustainable economic growth in the Republic of Serbia: An empirical study

Table 3. Regression analysis results of Model 2

	Unstandardized Coefficients		Standardized Coefficients	<i>t</i>	Sig.	<i>R</i> ²	<i>F</i>	<i>sig</i>
	B	Std. Error	Beta					
(Constant)	10.445	0.152	0.000	68.778	0.000	.881	519.640	.000b
<i>lnGR</i>	0.294	0.013	0.939	22.796	0.000			

Source: Own calculations.

After optimization, only the variable *lnM2* remained in the predictive model as the most influential factor, while *lnM1*, *lnM3*, and the repo rate were excluded due to their insufficient individual predictive potential. In the second model, post-optimization, only the variable *lnGR* was retained as the most significant factor, with *lnGE* being excluded for similar reasons. Tables 2 and 3 present the regression analysis results for the calculated regression models. The first model examines the impact of liquid assets on economic growth, with the underlying assumption that the regression coefficient would be positive. The data in Table 3 confirm this assumption, as the regression coefficient indicates a positive relationship.

Specifically, a 1% increase in liquid assets is associated with a 0.16% increase in gross domestic product. This model suggests a positive correlation between monetary policy and economic development, explaining 77% of the variance in economic growth. The second model evaluates the effect of government income on economic growth, also assuming a positive regression coefficient. The positive and statistically significant coefficient for government revenues indicates that a 1% increase in government revenues would result in a 0.294% increase in *Y*. This model's variables account for 88% of the variance in economic growth.

4. Conclusion

The study provides evidence of a significant long-term relationship between fiscal and monetary policies and economic growth in the Republic of Serbia. Through regression analysis, it was found that while both fiscal and monetary policies contribute positively to economic growth, fiscal policy—specifically government revenue—exerts a more pronounced influence compared to monetary policy. The impact of the *M2* variable, representing liquid assets, confirms the importance of monetary policy in promoting economic activity, yet its influence is less significant than that of fiscal policy.

The findings highlight a critical issue: the suboptimal coordination between fiscal and monetary policymakers, which may be constraining the overall effectiveness of these policies. This lack of synergy could be preventing Serbia from fully realizing the potential benefits of a well-coordinated economic strategy, where both fiscal and monetary tools work in tandem to drive economic growth. The disparity in their effectiveness underscores the need for a more integrated approach to economic policymaking. In the broader context of digital transformation, globalization, and the lingering effects of the COVID-19 pandemic, the challenges facing fiscal and monetary policymakers have become

increasingly complex. These challenges necessitate a more sophisticated and harmonized policy response to ensure macroeconomic stability and sustained economic growth. The pandemic has not only introduced new economic uncertainties but has also highlighted the vulnerabilities in current policy frameworks, making the need for refinement and better coordination even more pressing. Given these findings, there is a strong case for placing greater emphasis on refining fiscal policy to enhance its effectiveness. This includes optimizing government revenue and expenditure strategies to better support economic growth. Moreover, improving the coordination between fiscal and monetary policies is essential to amplify their collective impact. A more synchronized approach would ensure that both policy areas complement each other, creating a more conducive environment for sustainable economic development.

The authors further emphasize the need for additional research into the determinants that affect the coordination between fiscal and monetary policies. Identifying these factors is crucial for understanding how these two policies can better cooperate to achieve maximum efficiency in promoting economic growth. Potential factors that may influence coordination include institutional arrangements, political priorities, the levels of autonomy of key economic institutions, as well as communication mechanisms between policymakers.

The authors suggest that future research should include a deeper analysis of both internal and external factors that may either hinder or support the alignment of fiscal and monetary measures. For instance, political cycles, public pressures, and international obligations should be further explored to understand how they impact the state's ability to integrate these two key policy areas. By expanding research in this direction, the authors believe that specific strategies for improving coordination could be identified, allowing for more efficient use of resources and a stronger contribution to economic development. In light of global changes and increasing economic challenges, this research could provide the foundation for developing innovative approaches that enable better synergistic action between fiscal and monetary policies. The authors conclude that, in addition to strengthening coordination, it is necessary to continuously monitor and adjust these policies in response to changes in the economic environment. In this context, the importance of further research into the determinants of coordination becomes even more pronounced, as it would allow Serbia to become more resilient to external shocks and consistently achieve the goals of sustainable economic growth.

Acknowledgement:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

References

- Ajisafe, R.A., & Folorunso, B.A. (2002). The Relative Effectiveness of Fiscal and Monetary Policy in Macroeconomic Management in Nigeria. *The African Economic and Business Review*, 3(1), 23-40.

Optimizing the coordination of monetary and fiscal policy for sustainable economic growth in the Republic of Serbia: An empirical study

- Al-Kasasbeh, O. (2023). The Impact Of Fiscal Policy On Economic Growth. *Historical: Journal of History and Social Sciences*, 2(1), 16-24.
- Al-Kasasbeh, O., Alzghoul, A., & Alghraibeh, K. (2022). Global FDI inflows and outflows in emerging economies Post-COVID-19 era. *Future Business Journal*, 8(1), 1-9.
- Andersen, L. C., & Jordan, J. L. (1968). Monetary and fiscal actions: A test of their relative importance in economic stabilization. *Review*.
- Batten, D. S., & Hafer, R. W. (1983). The relative impact of monetary and fiscal actions on economic activity: A cross-country comparison. *Federal Reserve Bank of St. Louis Review*, 65(1), 5-12.
- Baum, A., & Koester, G. (2011). The impact of fiscal policy on economic activity over the business cycle-evidence from a threshold VAR analysis.
- Canzoneri, M., Cumby, R., & Diba, B. (2010). The interaction between monetary and fiscal policy. *Handbook of monetary economics*, 3, 935-999.
- Chugunov, I., Pasichnyi, M., Koroviy, V., Kaneva, T., & Nikitishin, A. (2021). Fiscal and monetary policy of economic development. *European Journal of Sustainable Development*, 10(1), 42-42.
- Đorđević, M., Đurović Todorović, J., Ristić Cakić, M. (2020). The Importance of using QE and “Helicopter money” in starting economic activity after the crisis caused by COVID 19 virus. *Finansije*, 7-27.
- Đorđević, M., Todorović, J. Đ., & Cakić, M. R. (2020). Application of unconventional monetary policy instruments in mitigation of the economic consequences of the COVID 19 virus pandemic. *Facta Universitatis, Series: Economics and Organization*, 231-248.
- Đurović Todorović, J. (2014). *Monetarna ekonomija*. Niš: Ekonomski fakultet.
- Engen, E. M., & Skinner, J. S. (1992). *Fiscal policy and economic growth*.
- Gali, J. (2008). *Monetary policy, inflation and business cycle: An introduction to the New Keynesian Framework*. Oxfordshire: Princeton University Press.
- Hoover, H. (2015). *The Memoirs of Herbert Hoover-The Great Depression, 1929-1941*. Read Books Ltd.
- Jawaid, S. T., Qadri, F. S., & Ali, N. (2011). Monetary-fiscal-trade policy and economic growth in Pakistan: Time series empirical investigation. *International Journal of Economics and Financial Issues*, 1(3), 133-138.
- Jawaid, S.T., Arif, I., & Naeemullah, S.M. (2010). Comparative Analysis of Monetary and Fiscal Policy: A Case Study of Pakistan. *NICE Research Journal*, 3, 58-67.
- Mertens, K., & Ravn, M. (2010). Measuring the impact of fiscal policy in the face of anticipation: a structural VAR approach. *The Economic Journal*, 120, 393-413.
- Karaman, S. Y. (2022). Covid-19, sovereign risk and monetary policy: Evidence from the European Monetary Union. *Central Bank Review*, 22(3), 99-107.
- Komazec, S., Ristić, Ž. (1992). *Monetarna I fiskalna politika*. Beograd: ABC-“Glas”.
- Mankiw, G.N. and Taylor, M.P. (2007). *Macroeconomics*. (European Editioned.) Basingstoke: Palgrave Macmillan.
- Noman, S. M. S., & Khudri, M. M. (2015). The effects of monetary and fiscal policies on economic growth in Bangladesh. *ELK Asia Pacific Journal of Finance and Risk Management*, 6(3), 21-34.
- Parker, J. (2011). On measuring the effects of fiscal policy in recessions. *Journal of Economic Literature*, 49, 703-718.
- Ramey, V., & Zubairi, S. (2018). Government spending multipliers in good times and in bad: evidence from US historical data. *Journal of Political Economics*, 126, 850-901.

- Rathnayaka, I. W., Khanam, R., & Rahman, M. M. (2024). Examining Monetary Policy Measures and Their Impacts During and After the COVID Era: OECD Perspectives. *Economies*, 12(6), 154.
- Wu, H., Xu, Z., & Yan, P. (2022). Financial repression, SOE reform and fiscal-monetary policy coordination. *China Economic Quarterly International*, 2(2), 151-163.

OPTIMIZACIJA KOORDINACIJE MONETARNE I FISKALNE POLITIKE ZA ODRŽIVI EKONOMSKI RAST U REPUBLICI SRBIJI: EMPIRIJSKO ISTRAŽIVANJE

Abstract: *Ovaj rad analizira odnos između fiskalne i monetarne politike i ekonomskog rasta u Republici Srbiji, koristeći regresione modele za procenu njihovog uticaja na ekonomski rast. Primarni cilj ovog istraživanja je da se utvrdi relativna efikasnost fiskalne i monetarne politike u podsticanju ekonomskog rasta i identifikuju ključni faktori unutar ovih politika koji značajno utiču na njega. Analiza se zasniva na kvartalnim podacima koji obuhvataju period od prvog kvartala 2002. godine do četvrtog kvartala 2022. godine, prikupljenim od Narodne banke Srbije i Republičkog zavoda za statistiku. Nalazi jasno ukazuju na to da je fiskalna politika efikasnija od monetarne politike u podsticanju ekonomskog rasta u Srbiji, što se delimično može objasniti nedovoljnom koordinacijom između kreatora fiskalne i monetarne politike. S obzirom na rezultate, neophodno je posvetiti veću pažnju optimizaciji fiskalne politike kako bi se poboljšala njena efikasnost i dugoročni učinak na privredu.*

Keywords: *fiskalna politika, monetarna politika, linearna regresija*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**IZAZOVI I PERSPEKTIVE FINANSIRANJA LOKALNIH
SAMOUPRAVA PUTEM BANAKA**

Marija Đurković, MSc*

Jelena Radojičić, PhD*

Rezime: Finansiranje lokalnih samouprava predstavlja kompleksan proces, kome je neophodno pažljivo pristupiti. Donošenje odluke o načinu zaduživanja je jedan od svojevrsnih problema sa kojima se JLS suočavaju, kako u Srbiji, tako i širom sveta. Postoje brojna rešenja pomenutog problema, a jedno od njih je upravo zaduživanje putem banaka. Banke, kao stabilne finansijske institucije, mogu biti direktni učesnici u finansiranju jedinica lokalne samouprave, ali i indirektni posrednici u njihovom rastu i razvoju. Ipak, postoje određeni kriterijumi i uslovi koje je neophodno ispuniti, kako bi pomenuti način finansiranja bio odobren. Takođe, brojni su izazovi i rizici sa kojima se bankarski sektor susreće kada je u pitanju saradnja sa lokalnim samoupravama, stoga oni moraju biti pažljivo istraženi.

Ključne reči: bankarski sektor, finansiranje lokalnih samouprava, krediti i zaduživanje

1. Uvod

Dugogodišnji problem postojanja nedovoljne fiskalne autonomije lokalnih samouprava, doveo je do toga da one neretko zavise od transfera sa viših nivoa vlasti, a povećane su i potrebe za zaduživanjem. Ograničene mogućnosti za pristup alternativnim izvorima finansiranja i oskudni prihodi sa jedne strane, i rastuće potrebe za različitim infrastrukturnim projektima i pružanjem osnovnih usluga sa druge strane, iziskuju potrebu za pronalaženjem rešenja. Lokalne samouprave rešenje najčešće pronalaze u bankarskim kreditima, što za bankarski sektor predstavlja posebnu vrstu izazova. Cilj istraživanja u ovom radu biće ukazivanje na zastupljenost pomenutog načina finansiranja, kao i na rizike

* Stipendista Ministarstva nauke, tehnološkog razvoja i inovacija – doktorand, Univerzitet u Nišu, Ekonomski fakultet, ORCID 0009-0008-4088-9680,

✉ marijadjurkovic444@gmail.com

* Univerzitet u Nišu, Ekonomski fakultet, ORCID 0000-0003-3444-0138,

✉ jelena.radojicic@eknfak.ni.ac.rs

UDK 352:658.14/.17]:336.71

sa kojima se mogu susresti obe strane. Rad je podeljen u tri dela. U prvom delu ćemo teorijski istražiti i objasniti načine finansiranja jedinica lokalne samouprave. Drugi deo rada posvetićemo bankama i njihovoj ulozi u zaduživanju lokalne vlasti, pri čemu ćemo detaljno analizirati kreditno zaduženje JLS u Republici Srbiji. Tema poslednjeg poglavlja biće analiza kreditnog zaduženja lokalnih samouprava u odabranim zemljama.

2. Finansiranje jedinica lokalne samouprave

Da bi jedinice lokalne samouprave efikasno funkcionisale, potrebno je odabrati odgovarajući način finansiranja, naročito u uslovima kada je problem nedostajućih sredstava izražen. Shodno članu 5 Zakona o finansiranju lokalne samouprave ("Sl. glasnik RS", br. 62/2006, 47/2011, 93/2012, 99/2013, 125/2014, 95/2015., 83/2016, 91/2016, 104/2016, 96/2017, 89/2018, 95/2018, 86/2019, 126/2020, 99/2021, 111/2021, 124/2022 i 97/2023) sredstva budžeta jedinice lokalne samouprave obezbeđuju se iz:

- izvornih i ustupljenih prihoda,
- transfera,
- primanja po osnovu zaduživanja i
- drugih prihoda i primanja utvrđenih zakonom.

U izvorne prihode najčešće možemo ubrojati porez na imovinu, razne vrste taksi (administrativnih, komunalnih, boravišnih), kao i mnogi drugi koji su preciznije navedeni i objašnjeni u gore navedenom zakonu. Dakle, o visini ovih prihoda, odnosno stopi i načinima utvrđivanja, odlučuje jedinica lokalne samouprave, pri čemu se zakonom ona može ograničiti. To je ujedno i osnovna razlika u odnosu na ustupljene prihode, čija se poreska stopa, ali i postupci izračunavanja iste, utvrđuju zakonom, dok prihod ostvaren na teritoriji određene JLS biti ustupljen toj lokalnoj samoupravi delimično ili u potpunosti. Tu možemo navesti prihode od ustupljenih poreza i prihode od ustupljenih naknada. Još jedan, veoma značajan izvor sredstava, predstavljaju i transferi, koji se mogu koristiti se za finansiranje tačno određenih funkcija (tzv. namenski transferi), kao i nenamenski, koji u ukupnom iznosu čine kompenzacioni transfer, transfer za ujednačavanje, opšti transfer i transfer solidarnosti. Kako će se u fokusu ovog rada naći zaduživanje kao izvor finansiranja lokalnih samouprava, najviše pažnje ćemo upravo i posvetiti primanjima po osnovu zaduživanja. Zaduzivanje se definiše kao uzimanje kredita, odnosno zajmova i emitovanje državnih hartija od vrednosti za finansiranje budžetskog deficita i deficita tekuće likvidnosti, za refinansiranje obaveza po osnovu javnog duga i za finansiranje investicionih i programskih projekata, kao i davanje garancija (Zakon o javnom dugu, („Sl. glasnik RS“, br. 61/2005, 107/2009, 78/2011, 68/2015, 95/2018, 91/2019 i 49/2020), član 2). Proces donošenja odluke o zaduživanju lokalne vlasti nije jednostavan. On podrazumeva sprovođenje odgovarajućih procedura propisanih zakonom, procenu od strane regulatornih organa, kao i ocenu o ispunjenosti uslova i kriterijuma za zaduživanje. Takođe, napominjemo da postoje limiti i ograničenja u pogledu zaduživanja JLS, a koji su precizno objašnjeni u Zakonu o javnom dugu. Zbog kompleksnosti pomenutog procesa, potrudimo se da u narednom tabelarnom prikazu kroz pitanja i odgovore predstavimo način zaduživanja lokalne vlasti na pojednostavljeni način. Sve odluke koje se tiču zaduženja, moraju se donositi u skladu sa budžetom jedinice lokalne samouprave.

Tabela 1. Pojednostavljeni prikaz zaduživanja lokalne vlasti

Pitanje	Odgovor
Ko donosi odluku o zaduživanju lokalne vlasti?	Odluku o zaduživanju donosi nadležni organ lokalne vlasti. Skupština grada donosi akt o javnom zaduživanju grada, odnosno JLS.
Čija je saglasnost neophodna?	Neophodna je saglasnost Ministarstva finansija, kome se prethodno podnosi zahtev za davanje saglasnosti o zaduživanju.
Gde se mogu zadužiti lokalne vlasti?	Lokalne vlasti se mogu zadužiti na domaćem i inostranom tržištu.
U kojoj valuti se mogu zadužiti lokalne vlasti?	Shodno odgovoru na prethodno pitanje, mogu se zadužiti u domaćoj ili stranoj valuti.
Da li se lokalne vlasti mogu dugoročno zadužiti ili se kao opcija pojavljuje isključivo kratkoročno zaduživanje?	Lokalne vlasti se mogu dugoročno zadužiti jedino u slučaju finansiranja kapitalnih projekata koji su predviđeni budžetom. U slučaju kratkoročnog zaduživanja (do 3 godine), sredstva se najčešće koriste za finansiranje tekuće likvidnosti budžeta.
Koji je glavni uslov koji mora biti ispunjen za dugoročno zaduživanje lokalne vlasti?	Iznos neizmirenog dugoročnog zaduženja za kapitalne investicione rashode ne može biti veći od 50% ukupno ostvarenih tekućih prihoda budžeta lokalne vlasti u prethodnoj godini.

Izvor: Obrada autora na osnovu Zakona o lokalnoj samoupravi ("Sl. glasnik RS", br. 129/2007, 83/2014 - dr. zakon, 101/2016 - dr. zakon, 47/2018 i 111/2021 - dr. zakon), član 32 i Zakona o javnom dugu ("Sl. glasnik RS", br. 61/2005, 107/2009, 78/2011, 68/2015, 95/2018, 91/2019 i 49/2020), član 36

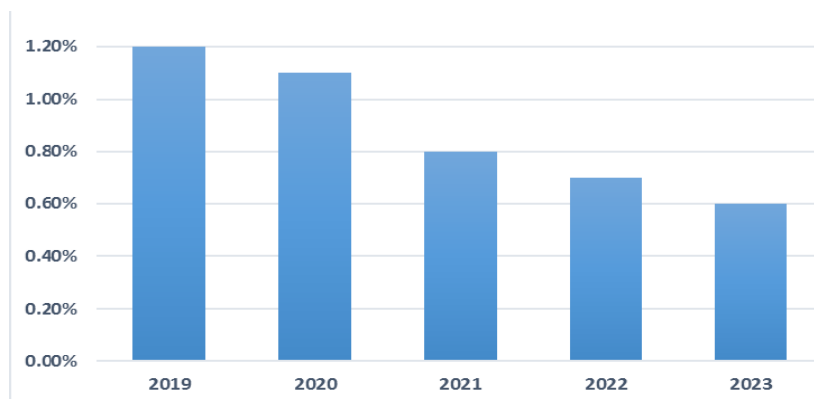
Brojne jedinice lokalne samouprave u Srbiji imaju relativno visok kreditni potencijal, što znači da postoji prostor za eventualno novo zaduživanje (Fiskalni savet Republike Srbije, 2017, p.28). Zaduživanje jeste vid pomoći koji lokalnim samoupravama, bilo da su u pitanju opštine ili gradovi, može biti od velikog značaja kada je reč o finansiranju kapitalnih investicija, a koje doprinose unapređenju i razvoju lokalne sredine. Ipak, ovakav način finansiranja nosi i određene rizike, naročito kada je u pitanju upravljanje dugom. Zbog toga je jedno od najvažnijih pitanja i odabir banke kod koje će se jedinice lokalne samouprave zadužiti, odnosno, sa kojom će bankom ovlašćeno lice (gradonačelnik, predsednik opštine) sklopiti ugovor o kreditu. Na donošenje odluke o izboru banke, utiče i povoljnost uslova koje ove stabilne finansijske institucije nude.

3. Uloga banaka u zaduživanju lokalne vlasti

Veoma značajnu ulogu u stvaranju i očuvanju stabilnih lokalnih javnih finansija imaju banke. Njihov doprinos u realizaciji važnih investicionih projekata je nezaobilazan, jer većina investicija dobrim delom biva finansirana putem banaka. Banke mogu učestvovati u finansiranju jedinica lokalne samouprave na dva načina: emisijom municipalnih obveznica ili sklapanjem ugovora o kreditu. Emitovanje municipalnih obveznica predstavlja novinu na tržištu kredita lokalnih samouprava u Srbiji (Jakšić, 2022

p.91). Naime, one predstavljaju specifičan finansijski instrument koji se najčešće koristi za dugoročno finansiranje infrastrukturnih projekata. Neoporezivi prihodi od kamata na dužničke hartije od vrednosti izdate od strane Republike, NBS ili JLS za banke predstavljaju značajnu uštedu (poreski efekat). Ipak, kako kod nas tržište municipalnih obveznica nije razvijeno, u Srbiji svega 5 jedinica lokalnih samouprava koristi ovaj izvor finansiranja, među kojima je prvi Novi Sad, a potom slede Šabac, Pančevo, Stara Pazova i Knjaževac. Napomenuli smo da je uzimanje zajmova, odnosno kredita, jedan od najčešćih načina finansiranja lokalnih samouprava, stoga ćemo se fokusirati na bankarske kredite i ulogu banaka u zaduživanju lokalne vlasti. Kao potencijalne prednosti bankarskih kredita u odnosu na prethodno pomenute municipalne obveznice mogu se navesti jednostavniji proces izvršenja, ali i niži troškovi. Takođe, ugovori o kreditu mogu biti sačinjeni na način koji više odgovara konkretnim projektima i planovima otplate, nego što je to slučaj sa emitovanjem municipalnih obveznica (Nguyen et al., 2017). U izveštajima Narodne banke Srbije, jedinice lokalne samouprave svrstavaju se u nefinansijski sektor, čiji je ukupan iznos kredita kod komercijalnih banaka u Srbiji, u periodu od 2019. do 2023. godine rastao. U dostupnim podacima (Republički zavod za statistiku, 2024, p.73), primećuje se primat dinarskih nad deviznim kreditima sve do 2022. godine, kada je situacija naglo promenjena, pa je tako učešće deviznih kredita nefinansijskog sektora u toj godini iznosilo čak 65,12%. U godini koja je usledila, to učešće je povećano, te je iznosilo 66,24%. Shodno trenutnoj situaciji, taj trend će se nastaviti i u tekućoj godini. Razlozi preokreta u valutnoj strukturi su brojni. Rast inflacije u 2022. godini, a potom i podizanje referentne kamatne stope kao odgovor na inflaciju, uticali su na povećanje kamatnih stopa na dinarske kredite, istovremeno motivišući zaduživanje u devizama. Posmatrano po nameni, najviše se duguje po osnovu investicionih kredita, u čemu jedinice lokalne samouprave i te kako uzimaju značajno učešće. Učešće duga JLS Republike Srbije u bruto domaćem proizvodu, predstavljeno je na sledećem grafiku:

Grafik 1. Učešće duga JLS Republike Srbije u BDP-u (%)



Izvor: Obrada autora na osnovu mesečnog izveštaja Uprave za javni dug pri Ministarstvu finansija (Uprava za javni dug, 2024. p.12)

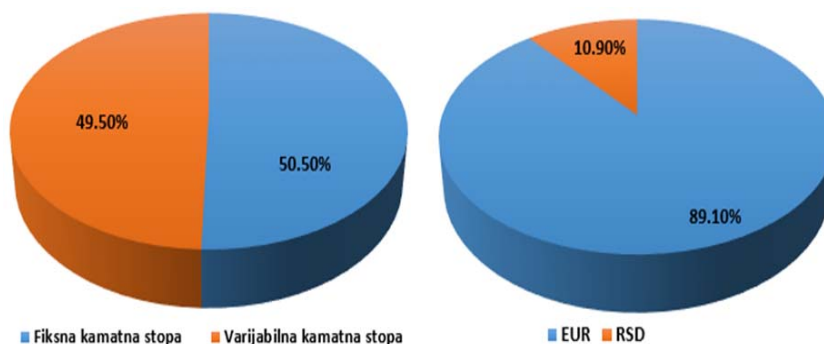
Zapažamo opadajući trend učešća duga lokalnih samouprava u bruto domaćem proizvodu Republike Srbije, u periodu od 2019. do 2023. godine. Kao uzroci ovakve dinamike analiziranog pokazatelja mogu se navesti, pre svega, fiskalna disciplina koja se

Izazovi i perspektive finansiranja lokalnih samouprava putem banaka

ogleda kroz uvođenje strožih fiskalnih mera, a u cilju stabilizacije lokalnih javnih finansija. Fiskalnom konsolidacijom, koja podrazumeva kontrolu zaduživanja i smanjenje deficita u budžetu, značajno se uticalo na smanjenje učešća duga JLS u BDP-u Republike Srbije. Takođe, ovakva slika može biti i rezultat rasta bruto domaćeg proizvoda, jer se u tom slučaju relativno učešće duga JLS u istom smanjuje, pa čak i u situaciji da je nominalni iznos duga JLS ostao nepromenjen. Treba pomenuti i to da su mnoge lokalne samouprave ipak uspele da smanje svoj dug, bilo kroz otplatu obaveza koje su postojale, ili pak njegovim refinansiranjem. Pet najzaduženijih JLS u Srbiji (Beograd, Novi Sad, AP Vojvodina, Kragujevac i Vranje) u ukupnom dugu učestvuju sa čak 84,1%, od čega samo Beograd 66,7%. Ovaj podatak ukazuje na značajnu koncentraciju duga u glavnom gradu, što može predstavljati rizik po fiskalnu stabilnost. U svakom slučaju, država treba da nastavi sa postavljanjem strogih kriterijuma za kreditno zaduživanje lokalnih samouprava.

Kada je reč o valutnoj strukturi i strukturi kamatnih stopa kreditnog zaduženja jedinica lokalne samouprave u Republici Srbiji, one su prikazane na narednom grafikonu:

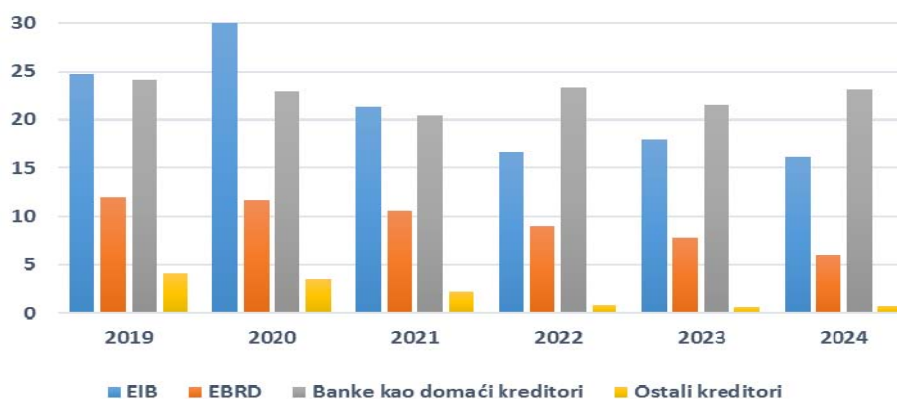
Grafik 2. Valutna struktura i struktura kamatnih stopa duga JLS Republike Srbije na dan 30.06.2024



Izvor: Obrada autora na osnovu mesečnog izveštaja Uprave za javni dug pri Ministarstvu finansija (Uprava za javni dug, 2024, p.12)

Primećujemo da izloženost duga jedinica lokalne samouprave Republike Srbije valutnom riziku iznosi 89,1%, što ukazuje na to da je skoro 90% duga lokalnih samouprava denominovano u stranoj valuti. Ovako visok nivo izloženosti valutnom riziku zahteva veoma pažljivo upravljanje, ali i pokušaje refinansiranja duga u domaćoj valuti u cilju njegovog smanjenja. Sa druge strane, izloženost riziku promene kamatnih stopa od 49,5% oslikava stanje da je skoro polovina duga JLS u Republici Srbiji podložna promenama kamatnih stopa, koje često nisu predvidljive. Grafik 3. nam pokazuje kretanje duga JLS po kreditorima, a iz koga možemo videti značajno učešće banaka kao domaćih kreditora. Prosečno učešće banaka kao domaćih kreditora u dugu JLS je u analiziranom periodu iznosilo 22,6%.

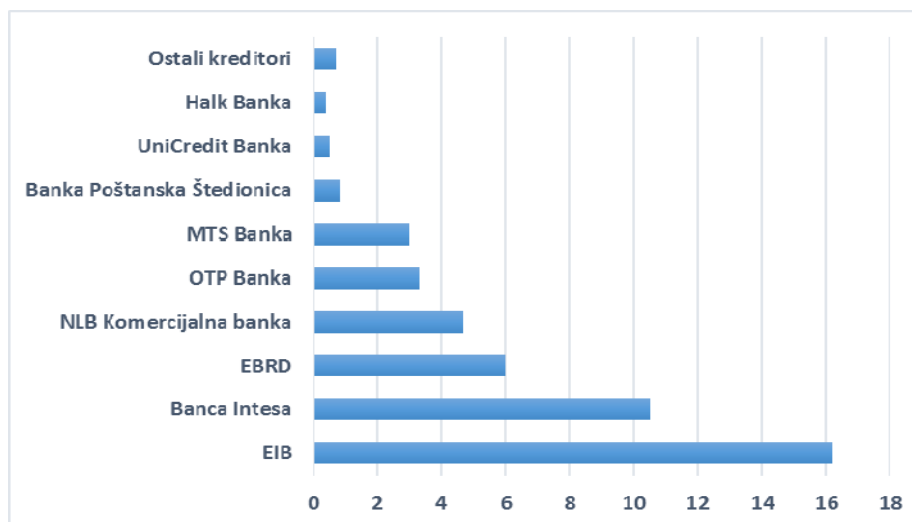
Grafik 3. Kretanje duga JLS po kreditorima, po srednjem kursu na dan 30.06. u periodu od 2019. do 2024. godine (u milijardama RSD)



Izvor: Obrada autora na osnovu mesečnih izveštaja Uprave za javni dug (2019-2024)

Ako analiziramo stanje u tekućoj godini, na grafiku broj 4 možemo videti i pojedinačno učešće domaćih kreditora u dugu jedinica lokalne samouprave. Učešće domaćih kreditora u ukupnom dugu, u prvoj polovini tekuće godine, iznosi 51,9%.

Grafik 4. Stanje duga JLS po kreditorima, po srednjem kursu na dan 30.06.2024 (u milijardama RSD)



Izvor: Obrada autora na osnovu mesečnog izveštaja Uprave za javni dug (2024, p.12) Napomena: MTS banka je 2021. godine pripojena Poštanskoj Štedionici, ali su u mesečnom izveštaju Uprave za javni dug za jun 2024. g. ti podaci ipak pojedinačno predstavljeni.

Izazovi i perspektive finansiranja lokalnih samouprava putem banaka

Dug jedinica lokalne samouprave prema bankarskom sektoru Republike Srbije je iznosi 23,2 milijarde dinara (po srednjem krusu NBS na dan 30.06.2024. godine) što je 50,32% ukupnog duga. Od toga samo dug prema banci Banca Intesa od 10,5 milijardi, čini što čini 45,25% duga JLS prema bankarskom sektoru, odnosno 22,77% ukupnog duga JLS. Po veličini duga, ispred banke Banca Intesa nalazi se finansiranje samouprave sredstvima EIB-a u iznosu od 16.2 milijarde dinara. Naredna tabela služiće nam za analizu plasmana banaka lokalnim samoupravama. Kako izloženost kreditnom riziku oslikava kreditne plasmane, iskoristili smo ove podatke da izračunamo učešće plasmana JLS u kreditnom portfoliju i ukupnoj aktivni odabranih banaka. Ove dve vrste učešća pružaju uvid u to koliko svojih resursa banke izlažu kreditnom riziku, odnosno, koliki deo ukupnih sredstava drže u plasmanima. Prikazani podaci pokazuju relativno nisko učešće plasmana lokalnim samoupravama, a što ukazuje na strategiju banaka da minimiziraju izloženost kreditnom riziku. Banka Poštanska Štedionica je u poslednjih godinu dana pokazala veću spremnost da svoja sredstva koristi za kreditiranje, a što ukazuje na spremnost za vođenjem aktivnije kreditne politike i preuzimanjem umerenog nivoa rizika. U svakom slučaju, možemo reći da navedene banke prepoznaju važnost kreditiranja lokalnih samouprava, ali da istovremeno vode računa o likvidnosti i potencijalnim rizicima.

Tabela 2. Prikaz učešća plasmana lokalnim samoupravama u ukupnom kreditnom portfoliju i aktivni banaka

	2022. g.		2023. g.	
	Učešće u kreditnom portfoliju	Učešće u ukupnoj aktivni banke	Učešće u kreditnom portfoliju	Učešće u ukupnoj aktivni banke
Banca Intesa	1,23%	1,36%	1%	1,09%
OTP Banka	0,54%	0,56%	0,46%	0,44%
Banka Poštanska Štedionica	1,16%	1,4%	4,07%	4,86%
NLB Komercijalna Banka	0,57%	1,22%	0,46%	1,06%
UniCredit Banka	0,21%	0,21%	0,1%	0,1%

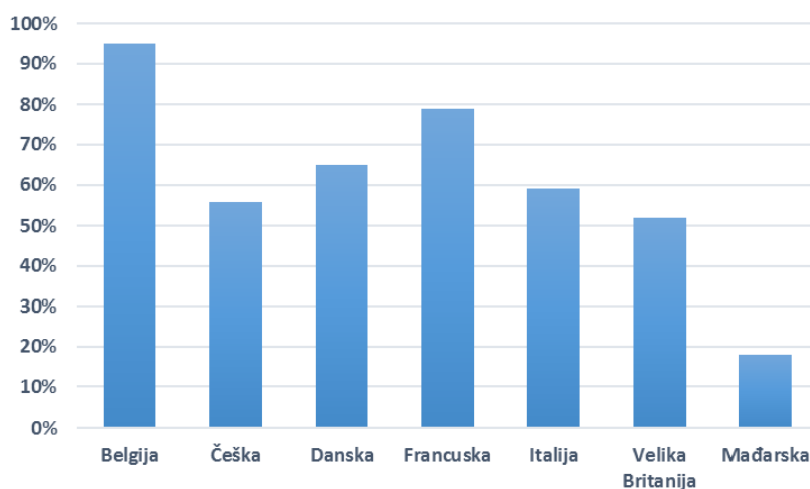
Izvor: Obrada autora na osnovu godišnjih izveštaja banaka za 2022. i 2023 godinu (Banka Intesa, 2024; OTP Banka, 2023; OTP Banka, 2024; Banka poštanska štedionica 2023, Banka poštanska štedionica, 2024; NLB Komercijalna Banka, 2024; Unikredit banka, 2023; Unikredit banka, 2024).

4. Analiza kreditnog zaduženja lokalnih samouprava u odabranim zemljama

Prema zvaničnim podacima, ukupan dug lokalnih samouprava u Evropskoj uniji je iznosio u 2017. godini 847,4 milijardi evra, što je činilo 6,7% ukupnog duga (Vertesy, 2019, p.1). Za zemlje koje su članice Evropske unije, pomenuti problem je od ključnog značaja sa ekonomske tačke gledišta. I u Evropskim zemljama je, kao što se može primetiti na narednom grafičkom prikazu, prisutno zaduživanje putem banaka kao izvor finansiranja. Belgija se ističe po tome što su bankarski krediti ove države činili čak 97,9% duga lokalnih samouprava u periodu od 2006. do 2016. godine (LPF-Country Reports, 2017, p.22). Izuzetak je Mađarska, čija je Vlada u proteklom periodu preuzela deo duga lokalnih

samouprava na sebe, smanjujući tako potrebu lokalnih samouprava za zaduživanjem. Nedostatak poverenja u municipalne obveznice ne izostaje ni u prikazanim zemljama, mada se kao izuzetak opet može navesti Mađarska, čije su JLS od 2010. godine počele intenzivno da koriste ovaj način finansiranja. Ono što je novina, jeste da lokalne samouprave u pojedinim zemljama osnivaju posebne fondove i agencije za potrebe finansiranja.

Grafik 4. Učešće bankarskih kredita u dugu lokalnih samouprava u odabranim zemljama



Izvor: Obrada autora na osnovu podataka OECD (2024).

5. Zaključak

Na osnovu prethodno izvršenih analiza, jasno je da finansiranje lokalnih samouprava nije nimalo jednostavan proces. Štaviše, on zavisi od mnoštva faktora i politika koje se sprovode na centralnom nivou vlasti. Kada je reč o izvorima finansiranja lokalnih samouprava, zaduživanje putem banaka je dominantno, kako u Srbiji, tako i u razvijenim zemljama Evrope. Naravno, izuzetaka uvek ima, a upravo u tim izuzecima, kriju se i potencijalne perspektive, odnosno novi načini finansiranja lokalnih samouprava. Ipak, gledano iz sadašnje perspektive, malo je verovatno da će oni uskoro zaživeti. Promene na svetskom tržištu, ali i na nacionalnim nivoima, odrazile su se i na kreditno zaduženje lokalnih samouprava, te su tako do skoro dominirali krediti u domaćoj valuti, dok u poslednje vreme prednost uglavnom imaju devizni krediti. Valutni rizik usled zaduživanja u stranoj valuti čini neizvesnim povraćaj sredstava. Sa druge strane, varijabilne kamatne stope potencijalno mogu dovesti do povećanja troškova zaduživanja, a što u krajnjem može da se odrazi i na likvidnost banaka. Ono što je sigurno, jeste da će lokalne samouprave u bliskoj budućnosti ipak morati da balansiraju između zaduživanja putem banaka i drugih izvora finansiranja, kako bi osigurale fiskalnu stabilnost. Banke će, sa druge strane, morati pažljivije da procenjuju rizike, kako bi se zaštitile od neizvesnosti koju saradnja sa lokalnim samoupravama može doneti.

Literatura

- Jakšić, P. (2022). Municipalne obveznice kao instrument finansiranja lokalnih samouprava. *Oditor*, 8(1), 83-108.
- Nguyen, B. & Sylesh, V. & Wong, A. (2017). Risky Bussiness: Bank Loans to Local Governments. *Policy Brief* (1-5). Stanford: Stanford Institute for Economic Policy Research.
- Vertesy, L. (2019). *Local Government Debts in the EU Countries*, preuzeto sa: https://www.nispa.org/files/conferences/2019/e-proceedings/system_files/papers/local-government-debts-vertesy.pdf, pristupljeno 09. Avgusta 2024.
- Zakon o finansiranju lokalne samouprave ("Sl. glasnik RS", br. 62/2006, 47/2011, 93/2012, 99/2013, 125/2014, 95/2015., 83/2016, 91/2016, 104/2016, 96/2017, 89/2018, 95/2018, 86/2019, 126/2020, 99/2021, 111/2021, 124/2022 i 97/2023). Preuzeto sa https://www.paragraf.rs/propisi/zakon_o_finansiranju_lokalne_samouprave.html, pristupljeno 28. Jul 2024.
- Zakon o javnom dugu ("Sl. glasnik RS", br. 61/2005, 107/2009, 78/2011, 68/2015, 95/2018, 91/2019 i 49/2020). Preuzeto sa https://www.paragraf.rs/propisi/zakon_o_javnom_dugu.html, pristupljeno 28. Jul 2024.
- Zakon o lokalnoj samoupravi ("Sl. glasnik RS", br. 129/2007, 83/2014 - dr. zakon, 101/2016 - dr. zakon, 47/2018 i 111/2021 - dr. zakon). Preuzeto sa https://www.paragraf.rs/propisi/zakon_o_lokalnoj_samoupravi.html, pristupljeno 29. Jul 2024.
- Fiskalni savet Republike Srbije (2017). Preuzeto sa [https://www.fiskalnisavet.rs/doc/analize-stavovi-predlozi/Lokalne%20javne%20finansije_%20Problemi,%20rizici%20i%20preporuke%20\(2017\).pdf](https://www.fiskalnisavet.rs/doc/analize-stavovi-predlozi/Lokalne%20javne%20finansije_%20Problemi,%20rizici%20i%20preporuke%20(2017).pdf), pristupljeno 31. Jul 2024.
- Republički zavod za statistiku (2024). Mesečni statistički bilten 01/2024. Preuzeto sa <https://publikacije.stat.gov.rs/G2024/PdfE/G20243004.pdf>, pristupljeno 02. Avgusta 2024.
- Uprava za javni dug (2024). Mesečni izveštaj 06/2024. Preuzeto sa <https://javnidug.gov.rs/static/uploads/Mesecni%20izvestaj%20Uprave%20za%20javni%20dug%20-%20CIR%20Jun%202024.pdf>, pristupljeno 04. Avgusta 2024.
- OECD (2024). Regionalni razvoj. Preuzeto sa <https://www.oecd.org/en/topics/regional-development.html>, pristupljeno 09. Avgusta 2024.
- LPF - Country Reports (2017). Local Public Finance in Europe. Preuzeto sa https://www.bertelsmann-stiftung.de/fileadmin/files/Projekte/79_Nachhaltige_Finzen/LPF-Country-Reports.pdf, pristupljeno 09. Avgusta 2024.
- Uprava za javni dug (2024). Mesečni izveštaji (2019-2024) Preuzeto sa <https://javnidug.gov.rs/rsc/%D0%BC%D0%B5%D1%81%D0%B5%D1%87%D0%BD%D0%B8%D0%B8%D0%B7%D0%B2%D0%B5%D1%88%D1%82%D0%B0%D1%98>, pristupljeno 15. Avgusta 2024.
- Banca Intesa (2024). Godišnji izveštaj 2023. Preuzeto sa https://www.bancaintesa.rs/document/publications/BIB/Godi%C5%A1nji-izve%C5%A1taji/Godisnji_izvestaj_2023/Godisnji_izvestaj_2023.pdf, pristupljeno 16. Avgusta 2024.

- NLB Komercijalna banka (2024). Godišnji izveštaj 2023. Preuzeto sa https://www.nlbkb.rs/upload/pdf/Izvestaj_opi_banke_31_12_2023%20NLB%20Komercijalna%20Banka%20AD.pdf, pristupljeno 16. Avgusta 2024.
- Banka Poštanska Štedionica (2024). Godišnji izveštaj 2023. Preuzeto sa <https://www.posted.co.rs/o-nama/doc/bazel/Godisnja-objava-Banke-31.12.2023.pdf>, pristupljeno 16. Avgusta 2024.
- Banka Poštanska Štedionica (2023). Godišnji izveštaj 2022. Preuzeto sa <https://www.posted.co.rs/o-nama/doc/bazel/Godisnja-objava-podataka-i-informacija-Banke-sa-stanjem-na-dan-31.12.2022.pdf>, pristupljeno 16. Avgusta 2024.
- OTP Banka (2024). Godišnji izveštaj 2023. Preuzeto sa <https://www.otpbanka.rs/wp-content/uploads/2024/03/godisnji-izvestaj-o-poslovanju-2023.pdf>, pristupljeno 16. Avgusta 2024.
- OTP Banka (2023). Godišnji izveštaj 2022. Preuzeto sa <https://www.otpbanka.rs/wp-content/uploads/2023/05/objavljivanje-podataka-i-informacija-31-12-2022-srb.pdf>, pristupljeno 16. Avgusta 2024.
- UniCredit Banka (2023). Godišnji izveštaj 2022. Preuzeto sa https://www.unicreditbank.rs/content/dam/cee2020-pws-rs/Retail%20documents/Odluka_podaci/IZVE%C5%A0TAJ%20SA%20STANJEM%20NA%20DAN%2031.12.2022.GODINE.pdf, pristupljeno 16. Avgusta 2024.
- UniCredit Banka (2024). Godišnji izveštaj 2023. Preuzeto sa https://www.unicreditbank.rs/content/dam/cee2020-pws-rs/DocumentePDF/Retail_documents/izvestaji/IZVESTAJ%20SA%20STANJEM%20NA%20DAN%2031.12.2023..pdf, pristupljeno 16. Avgusta 2024.

CHALLENGES AND PERSPECTIVES OF FINANCING LOCAL GOVERNMENTS THROUGH BANKS

Abstract: *Financing of local self-governments is a complex process, which must be approached carefully. Making a decision on the method of borrowing is one of the specific problems for LGUs in Serbia and around the world. There are numerous solutions to the mentioned problem, and one of them is borrowing through banks. Banks, as stable financial institutions, can be direct participants in the financing of local self-government units, but also indirect intermediaries in their growth and development. However, there are certain criteria and conditions that must be met, in order for the mentioned method of financing to be approved. Also, there are numerous challenges and risks that the banking sector faces when it comes to cooperation with local self-governments, therefore they must be carefully investigated.*

Keywords: *banking sector, financing of local governments, loans and borrowing*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**THE ROLE OF CORPORATE FINANCIAL REPORTING IN THE
FINANCIAL OPERATIONS OF BANKS IN THE REPUBLIC OF
NORTH MACEDONIA**

Filip Taskovski, MSc*

Olivera Gjorgieva – Trajkovska, PhD*

***Abstract:** According to a large number of researches, it can be concluded that the quality of corporate financial reporting is one of the determinants for maintaining the financial stability of the banking sector. The subject of this research is the role of corporate financial reporting in the financial operations of banks in the Republic of North Macedonia, and the purpose is to examine the influence of a group of financial indicators on the financial performance of banks listed on AD Macedonian Stock Exchange. Based on the results, it can be concluded that there is a significant correlation between ROA and ROE and the independent variables, and net profit per share and accounting value of shares had a significant impact on ROA and ROE.*

***Keywords:** Banks, financial reporting, financial performances, ROA, ROE.*

1. Introduction

Corporate financial reporting, which is increasingly asserting itself as one of the key factors in the business operations of companies and banks, has great influence on the flows of financial operations, namely corporate financial reporting has a significant role in the domain of access of business entities and banks of the stock exchanges where capital is primarily mobilized. A large number of research points to the importance of corporate financial reporting and the disclosure process of financial statements in maintaining the stability of the banking sector as a whole. Namely, the same is very important in order to maintain the high level of trust of customers and stakeholders towards the banks, and analogously to the maintenance of the financial stability of banking financial institutions.

* Faculty of Economics, Goce Delcev University, Stip, North Macedonia, ORCID 0009-0002-6440-3944, ✉ filip.30825@student.ugd.edu.mk

* Faculty of Economics, Goce Delcev University, Stip, North Macedonia, ORCID 0009-0002-9888-1741, ✉ Olivera.trajkovska@ugd.edu.mk
UDC 005:657]:336.71 (497.7)

Banks that are listed on AD Macedonian Stock Exchange must regularly disclose their financial statements precisely because of the process of stock exchange transactions and maintenance of liquidity, but above all financial stability, which is one of the prerequisites for trading on the stock exchange. What is characteristic of the Macedonian banking sector, is that in the past period, despite frequent economic and financial problems and market distortions that were of an international nature, managed to maintain financial stability, which, according to a large number of studies, played a major role in dealing with the economic crisis in the country and softening the consequences.

The subject of this research is the role of corporate financial reporting in the financial operations of banks in the Republic of North Macedonia, and the purpose is to examine the influence of a group of financial indicators on the financial performance of banks presented through the indicator of return on bank assets and the indicator of return on capital of the banks listed on AD Macedonian Stock Exchange.

The research is based on secondary data and it is composed of descriptive statistics, comparative analysis and correlation analysis and regression analyses. Namely, the research incorporates two regression analysis, in the first regression analysis, the return on assets (ROA) indicator is taken as the dependent variable, and in the second regression analysis, the return on equity (ROE) indicator is taken.

The main hypothesis from which the research starts is that the basic financial indicators have significant influence on the ROA and ROE of banks that are listed on the AD Macedonian Stock Exchange.

According to the results of the research, it can be concluded that both models of regression analysis are statistically significant, which indicates that the results are relevant, and the net profit per share and the book value per share statistically have a significant influence on the value of the indicators of the return on assets and return on capital, while the rest of the variables incorporated in the model, according to the regression analysis, do not have a statistically significant impact on ROA and ROE.

2. Literature review

According to economic theory, the value of business entities, including banks, reflect their value through the results of financial operations. Namely, the financial performance presented in the financial statements reflects the position in which business entities including banks before the stakeholders (Ogundajo, Adegbe, Oyegoke, Akande, & Ajayi-Owoeye, 2023). A large number of authors including Zabri, Ahmad & Wah (2016) claim that quality corporate financial reporting is crucial because users of accounting information expect relevant, reliable and accurate information in order to make business decisions (Zabri, Ahmad, & Wah, 2016). Also, quality corporate reporting conditions the preservation of the interests of stakeholders, that is, partners of banks in the domain of financial transactions (Zaharia & Zaharia, 2012). It is characteristic of the banking sector that in a large number of countries it is strictly regulated by the authorities, that is, by the Central Banks, whereby corporate financial reporting plays a significant role in harmonizing the financial operations of banks with the set regulation and fulfilling the requirements in the domain of the amount of capital, and other indicators for maintaining financial stability (Sorensen & Miller, 2017). In addition to the fact that quality information

The Role of Corporate Financial Reporting in the Financial Operations of Banks in the Republic of North Macedonia

is a condition for quality cooperation with the business environment of banks, which are of great importance for the scope of work of bank managers, precisely because they make business decisions, especially in the field of financial operations of banks according to data from financial reports (Nygaard, Silkoset, & Kidwell, 2016). Also, the quality of financial reports has a high degree of contribution when comparing the external audit process of banks, in order to perform a quality and accurate audit with an appropriate audit opinion (Nygaard, Silkoset, & Kidwell, 2016).

Banks in developing countries such as the Republic of North Macedonia have a significant role in the financial system, due to the fact that financial markets have failed to establish competitiveness in the domain of financial services (Andries & Capraru, 2013). Namely, the banking sector in order to maintain its market share in an increasingly dynamic economic environment must maintain financial stability, and thus the quality of the overall financial management (Haselmann & Wachtel, 2016). Based on previous research, it can be concluded that the quality of financial operations of banks is influenced by several factors (Diaconu & Oanea, 2014). The researches related to the research of the financial operations of the banks in the countries of Southeast Europe as factors affecting the quality of financial operations of banks and the banking sector as a whole take into account the specific indicators in the financial operations of the banks and key macroeconomic variables (Antoun, Coskun, & Gerogievski, 2018). As variables that are taken into account at the bank level, most authors analyzed indicators return on assets and return on capital (Antoun, Coskun, & Gerogievski, 2018).

According to the reports on the financial stability of RNM, it can be concluded that the economy of RNM in the past few years faced more risks due to the emergence of the Corona crisis in 2020 and the beginning of the Russian-Ukrainian conflict, which has not yet been stabilized. According to this report, the banking sector in RNM showed a high degree of resistance to the unstable environment and macroeconomic pressures, while it is relatively stable.

According to the researches of National Bank of the Republic of North Macedonia in the field of financial operations of banks in RNM, it can be concluded that higher indicators of solvency and capitalization were observed, while other financial indicators recorded a relative decrease. It was established that the banking sector as a whole has a satisfactory level of liquidity and financial stability (HBPCM, 2023).

3. Methodology of research

The research was done using secondary data. In order to increase the relevance of the research results when choosing the data source, several criteria are taken into account, namely: 1) the relevance of the institution that publishes them, 2) the date of publication and 3) the degree of scientific contribution of the data to the relevance of the research.

The research is composed of: 1) descriptive statistics, 2) correlation analysis and regression analysis (OLS method). The research concerns seven banks in the Republic of North Macedonia that are listed on the AD Macedonian Stock Exchange.

Table 1. Banks in the research and type of listing

Bank	Listing type
Komercijalna bank AD Skopje	Super listing
Stopanska bank AD Skopje	Exchange listing
TTK bank AD Skopje	Exchange listing
HLB bank AD Skopje	Mandatory listing
Stopanska bank AD Skopje	Mandatory listing
UNI bank AD Skopje	Mandatory listing
Centralna kooperativna banka AD Skopje	Mandatory listing

Regression equation:

$$Y_{it} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon_{it} \quad (1)$$

Y_{it} – Value of the dependent variable

β_0 – Constant

$\beta_1, \beta_2, \beta_3, \beta_4$ – Regression coefficients

X_1, X_2, X_3, X_4 – Value of the independent variables

ε_{it} – Residuals in regression

t – Research period (2021, 2022, 2023); 1-3;

Table 2. Variables in the research

Variables	Abbreviation	Type	Expected effect
Return of funds	ROA	Dependent	/
Return of capital	ROE	Dependent	/
Net earnings per share	EPS	Independent	Positive
Price/earnings per share ratio	CPP	Independent	Negative
Book value per share	AVS	Independent	Negative
Ratio price / book value per share	CPA	Independent	Positive
Data source:	Audited financial statements of the banks and AD Macedonian Stock Exchange		

Regression equation (ROA is the dependent variable):

$$ROA_t = \beta_0 + \beta_1 EPS_t + \beta_2 CPP_t + \beta_3 AVS_t + \beta_4 CPA_t + \varepsilon_{it} \quad (2)$$

Regression equation (ROE is the dependent variable):

$$ROE_t = \beta_0 + \beta_1 EPS_t + \beta_2 CPP_t + \beta_3 AVS_t + \beta_4 CPA_t + \varepsilon_{it} \quad (3)$$

Research hypotheses:

- H1: Basic financial indicators have a significant impact on ROA and ROE of banks listed on AD Macedonian Stock Exchange.

The Role of Corporate Financial Reporting in the Financial Operations of Banks in the Republic of North Macedonia

- o H1.1: Net profit per share has a significant impact on the ROA and ROE of banks listed on AD Macedonian Stock Exchange.
- o H1.2: Price/earnings per share ratio has a significant impact on ROA and ROE of banks listed on AD Macedonian Stock Exchange.
- o H1.3: Book value per share has a significant impact on the ROA and ROE of the banks listed on AD Macedonian Stock Exchange.
- o H1.4: The price/book value per share ratio has a significant impact on the ROA and ROE of banks listed on the Macedonian Stock Exchange.

4. Research results

4.1. Descriptive statistics

Based on the results of the descriptive statistics, it can be concluded that the average value of ROA is 9.65. This coefficient, according to established accounting and financial standards, is relatively high, that is, it reflects a relatively high stability. The average value of ROE is 1.31 which is relatively low for the banking sector average. The average value of net profit per share is 764 denars. Descriptive statistics indicate that the average price/earnings ratio per share is 10.58, the average book value per share is 5861 denars, and the average coefficient price/book value per share is 0.99.

According to descriptive statistics, the distribution of data for all variables except for the coefficient price/book value ratio per share is more convex than normal, that is, it has a leptokurtic shape, as for the coefficient price/book value ratio, it is flatter than normal, that is, it is platykurtic.

The distribution of frequencies for ROA and ROE has a negative symmetry to the left, and for the rest of the variables the distribution of frequencies has a positive symmetry to the right. The results of the descriptive statistics have a probability of the entire statistical mass of 95%.

Table 3. Descriptive statistics

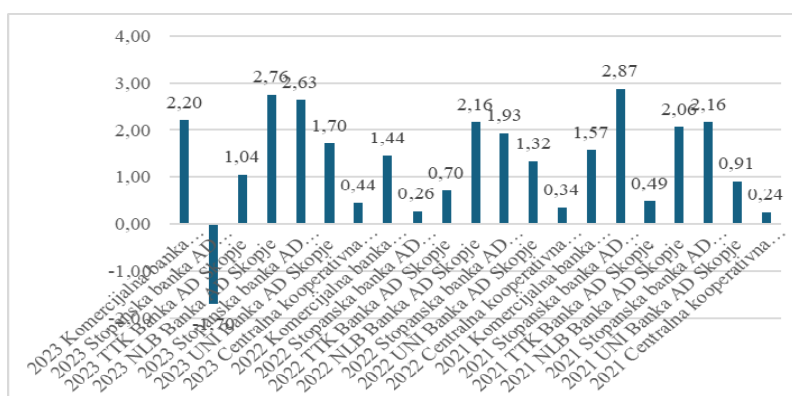
	ROE	ROA	EPS	CPP	AVS	CPA
Mean	9,645238095	1,31047619	764,7409524	10,58190476	5861,271429	0,989047619
Standard Error	1,636562399	0,238955541	237,4197674	1,795644018	1225,736553	0,116035513
Median	10,7	1,44	198,78	9	4714,02	1,06
Mode	#N/A	2,16	#N/A	#N/A	#N/A	1,79
Standard Deviation	7,499671072	1,095031854	1087,994056	8,228674631	5617,030535	0,531741523
Sample Variance	56,24506619	1,199094762	1183731,065	67,71108619	31551032,03	0,282749048
Kurtosis	1,442764379	1,29561266	2,098292759	2,495104311	1,592453982	-1,122956254
Skewness	-0,94852469	-0,85452864	1,624482556	1,112142847	1,555857288	0,090516926
Range	31,12	4,57	4252,05	37,69	18493,16	1,65
Minimum	-11,22	-1,7	-485,5	-5,96	1133,57	0,14
Maximum	19,9	2,87	3766,55	31,73	19626,73	1,79
Sum	202,55	27,52	16059,56	222,22	123086,7	20,77
Count	21	21	21	21	21	21
Largest (1)	19,9	2,87	3766,55	31,73	19626,73	1,79
Smallest (1)	-11,22	-1,7	-485,5	-5,96	1133,57	0,14
Confidence Level (95,0%)	3,413809343	0,498452524	495,2489564	3,745647785	2556,841645	0,242045839

Source: Authors' calculation

4.2. Comparative analysis of ROA and ROE of banks included in the research

According to the table, it can be concluded that Stopanska banka AD Bitola recorded the highest amount of ROA during the entire research period. It can also be concluded that in 2022 banks have a relatively lower ROA compared to the other two years. It is characteristic that the Central Cooperative Bank has the lowest ROA compared to other banks throughout all analysed years. It is also characteristic that NLB Banka and Stopanska banka AD Skopje have a relatively high and stable ROA during the entire period of time.

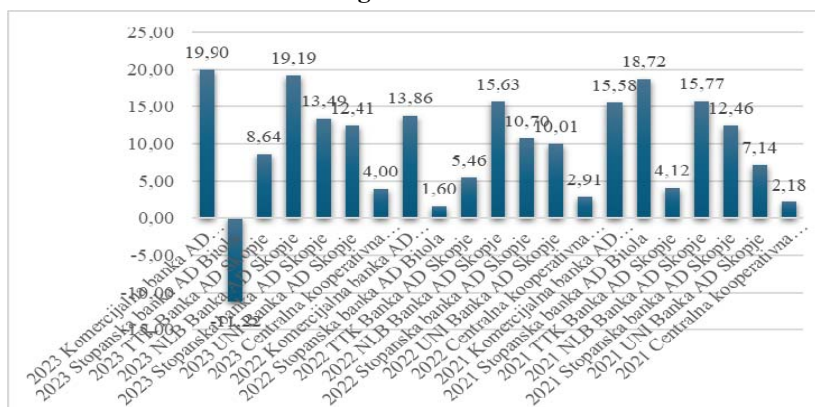
Figure 1: ROA



Source: AD Macedonian Stock Exchange and bank financial reports

According to the chart, it can be concluded that Komercijalna banka AD Skopje recorded the highest amount of ROE during the entire research period. It can also be concluded that in 2022 banks have a relatively lower ROE compared to the other two years. It is characteristic that Stopanska banka AD Bitola recorded the lowest ROE compared to other banks in all analysed years, that is in 2021 negative and in 2022 1.60. It is also characteristic that NLB Bank has a relatively high and stable ROE during the entire time period.

Figure 2: ROE



Source: AD Macedonian Stock Exchange and bank financial reports

The Role of Corporate Financial Reporting in the Financial Operations of Banks in the Republic of North Macedonia

4.3. Correlation analysis

According to the correlation analysis, it can be concluded that ROE has a positive correlation with all variables except the price/earnings per share ratio where a negative correlation was observed, the results indicate that the correlation of ROE with ROA is the most significant in relation to the rest (0.96), and with the Price/Profit Coefficient is insignificant (-0.04). In addition, it can be concluded that the correlation of ROE with Net profit per share and Price/book value per share ratio has a high degree of correlation.

Correlation analysis indicates that ROA, similarly to ROE, has a positive significant correlation with all variables except the Price/Earnings ratio, where an insignificant negative correlation is observed.

Table 4. Correlation analysis

	ROE	ROA	EPS	CPP	AVS	CPA
ROE	1					
ROA	0,956724921	1				
EPS	0,696249095	0,617596734	1			
CPP	-0,043688181	-0,064758397	-0,107468513	1		
AVS	0,496883442	0,410764271	0,953068031	-0,160105537	1	
CPA	0,651965703	0,524925594	0,59053491	0,165894701	0,477207875	1

Source: Authors' calculation

4.4. Regression analysis (ROA – dependent variable)

According to the regression statistics, it can be concluded that 67.46% of the variability of ROA is explained by the variability of the independent variables in the model, and the remaining 32.54% are explained by the variability of variables that are not included in the regression model.

Table 5. Regression statistics (ROA)

<i>Regression Statistics</i>	
Multiple R	0,860035816
R Square	0,739661604
Adjusted R Square	0,674577005
Standard Error	0,62467032
Observations	21

Source: Authors' calculation

According to the F test, it can be concluded that the model is statistically significant (F=0.00, F<0.05). Accordingly, the relevance of the model and the regression results can be confirmed.

Table 6. ANNOVA (ROA)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	17,7384871	4,434621776	11,36461799	0,000145963
Residual	16	6,243408133	0,390213008		
Total	20	23,98189524			

Source: Authors' calculation

According to the results of the regression analysis, it can be concluded that the variables: 1) Net profit per share (EPS) and 2) Book value per share have a statistically significant influence on the value of ROA.

Namely, the regression indicates that the growth of the Net profit per share causes an increase of the return on assets, and the growth of the Book Value per share causes the decrease of the return on assets.

Table 7. Regression results (ROA)

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1,787411361	0,437686417	4,083771607	0,000865523	0,859557607	2,715265115
EPS	0,002502696	0,000493049	5,075959393	0,000112316	0,001457479	0,003547913
CPP	-0,016072831	0,017910479	-0,897398124	0,382811524	-0,054041351	0,02189569
AVS	-0,000388194	8,81553E-05	-4,403519575	0,000443985	-0,000575074	-0,000201313
CPA	0,055143001	0,357812368	0,154111502	0,879448953	-0,703385335	0,813671337

Source: Authors' calculation

4.5. Regression analysis (ROE – dependent variable)

According to the regression statistics, it can be concluded that 76.46% of the variability of ROE is explained by the variability of the independent variables in the model, and the remaining 23.54% are explained by the variability of variables that are not included in the regression model.

Table 8. Regression statistics (ROE)

<i>Regression Statistics</i>	
<i>Multiple R</i>	0,900936048
<i>R Square</i>	0,811685762
<i>Adjusted R Square</i>	0,764607203
<i>Standard Error</i>	3,638637582
<i>Observations</i>	21

Source: Authors' calculation

According to the F test in ANOVA, it can be concluded that the model is statistically significant (Significance F=0.00, F<0.05). Similarly, the relevance of the model as a whole and the results of the regression analysis can be confirmed.

The Role of Corporate Financial Reporting in the Financial Operations of Banks in the Republic of North Macedonia

Table 9. ANNOVA (ROE)

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	913,0663885	228,2665971	17,24109175	1,18508E-05
Residual	16	211,8349353	13,23968345		
Total	20	1124,901324			

Source: Authors' calculation

According to the results of the regression analysis, it can be concluded that identically as in the case of ROA as a dependent variable, Net profit per share and Book value per share have a statistically significant influence on the value of ROE.

It is characteristic that in this case as well, the growth of the Net profit per share causes an increase of ROE, and the growth of the Book value per share, according to this model, causes a decrease in the capital return.

Table 10. Regression results (ROE)

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	9,937780692	2,549476411	3,897969265	0,001279233	4,533132138	15,34242925
EPS	0,01525444	0,002871957	5,311513598	7,02166E-05	0,009166162	0,021342717
CPP	-0,101366062	0,104326621	-0,971622213	0,345699094	-0,322528618	0,119796494
AVS	-0,002293095	0,000513495	-4,465660624	0,000390313	-0,003381655	-0,001204534
CPA	2,583150422	2,084218651	1,239385522	0,233075156	-1,835195742	7,001496585

Source: Authors' calculation

5. Discussion

Based on the results of the research, it can be concluded that the return on assets of banks is relatively high, which points to the relative stability of banks in terms of this indicator, on the other hand, the average value of the return on capital indicator is relatively low, which points to low return on capital. The comparative analysis shows that Stopanska banka AD Bitola recorded the highest rate of return on assets (ROA) during the analysed period, and the highest rate of return on capital (ROE) was recorded by Komercijalna banka AD Skopje.

The correlation analysis indicates that ROA and ROE have a positive correlation with almost all variables incorporated in the model, and the strongest correlation is noted with the net profit share.

The results of the F test indicate the statistical significance of the regression models, where the results are relevant, and indicate that the net profit per share and the book value per share have a significant impact on the value of ROA and ROE. Namely, the growth of net profit per share causes the increase of ROA and ROE, and the growth of book value per share causes the decrease of ROA and ROE. Consequently, hypotheses H1.1 and H1.3 are completely accepted.

6. Conclusion

Corporate financial reporting is one of the crucial conditions for maintaining the financial stability of business entities. The banking sector, which is largely different from classic companies, primarily because it is a financial sector that is quite sensitive to the changes that occur in the business environment and the information that is presented to customers on one hand and stakeholders on the other, must be based on strong financial transparency and regular disclosure of financial reports from which the environment can draw data and make conclusions about future business ventures which are a key determinants for maintaining the financial stability of banks.

Namely, the research that refers to the role of corporate financial reporting in the financial operations of banks indicates that the availability of data from financial reports is of particular importance for the preparation of analysis in the domain of financial operations of banks. The results of the research show that the return on assets and the return on capital of banks in the Republic of North Macedonia that are listed on AD Macedonian Stock Exchange are significantly influenced by the net profit per share. If we take into account the fact that in order for banks to carry out the basic banking activities (lending and collecting deposits) and to list their shares on the stock exchange, which are a prerequisite for profitability, and thus the growth of the net dividend per share, must regularly disclose the unaudited and audited financial statements that are decisive in the decision-making by customers for choosing a bank and banking services, then it comes to the conclusion that corporate financial reporting is decisive for the financial stability of banks and has a great role in the financial operations of the banking sector.

Accordingly, banks in the Republic of North Macedonia should strive to achieve complete transparency of their operations, full disclosure of financial reports and quality channeling of information arising from financial reports to the environment and interested parties.

References

- Andries, A. M., & Capraru, B. (2013). Impact of Financial Liberalization on Banking Sectors Performance from Central and Eastern European Countries. *PLoS ONE* 8(3): e59686. doi:10.1371/journal.pone.0059686.
- Antoun, R., Coskun, A., & Gerogievski, B. (2018). Determinants of financial performance of banks in Central and Eastern Europe. *BEH - Business and Economic Horizons* Vol(14) 3, 513-529.
- Diaconu, R.-I., & Oanea, D.-C. (2014). The Main Determinants of Bank's Stability. Evidence from Romanian Banking Sector. *Procedia Economics and Finance* Vol(16), 329-335.
- Haselmann, R., & Wachtel, P. &. (2016). Credit Institutions, Ownership and Bank Lending in Transition Economies. In: Beck, T., Casu, B. (eds). Bo R. Haselmann, & P. &. Wachtel, *The Palgrave Handbook of European Banking* (срп. 623-643). London: Macmillan.
- Mahboub, R. (2017). Main Determinants of Financial Reporting Quality in the Lebanese Banking Sector. *European Research Studies Journal* Volume XX, Issue 4B, 706-727.
- Nygaard, A., Silkoset, R., & Kidwell, R. E. (2016). Differential effects of plural ownership and governance mechanisms in limiting shirkers and free riders. *Corporate Ownership and Control* 13(2), 113-132.

The Role of Corporate Financial Reporting in the Financial Operations of Banks in the Republic of North Macedonia

- Ogundajo, G. O., Adegbe, F. F., Oyegoke, S. K., Akande, F., & Ajayi-Owoeye, E. A. (2023). Examining the impact of corporate governance and corporate financial reporting on firmvalue: A study of selected banks in Nigeria. *International Journal of Applied Economics, Finance and Accounting* ISSN 2577-767X Vol. 16, No. 2, 106-117.
- Sorensen, D. P., & Miller, S. E. (2017). Financial accounting scandals and the reform of corporate governance in the United States and in Italy. *Corporate Governance* 17(1), 77-88.
- Zabri, S. M., Ahmad, K., & Wah, K. K. (2016). Corporate governance practices and firm performance: Evidence from top 100 public listed companies in Malaysia. . *Procedia Economics and Finance* Volume 35, 287-296.
- Zaharia, I., & Zaharia, C. (2012). CORPORATE GOVERNANCE AND THE MARKET VALUE OF FIRMS. *Economics, Management, and Financial Markets* Vol(7), 227-232.
- НБРСМ. (2023). ИЗВЕШТАЈ ЗА ФИНАНСИСКАТА СТАБИЛНОСТ ВО РЕПУБЛИКА СЕВЕРНА МАКЕДОНИЈА ВО 2022 ГОДИНА. Скопје: НБРСМ.

ULOGA KORPORATIVNOG FINANSIJSKOG IZVEŠTAVANJA U FINANSIJSKOM POSLOVANJU BANAKA U REPUBLICI SEVERNA MAKEDONIJA

Apstrakt: Prema velikom broju istraživanja, može se zaključiti da je kvalitet finansijskog izveštavanja preduzeća jedna od determinanti održavanja finansijske stabilnosti bankarskog sektora. Predmet ovog istraživanja je uloga korporativnog finansijskog izveštavanja u finansijskom poslovanju banaka u Republici Severnoj Makedoniji, a svrha je da se ispita uticaj grupe finansijskih indikatora na finansijsko poslovanje banaka koje kotiraju na AD Makedonskoj berzi. Razmena. Na osnovu rezultata može se zaključiti da postoji značajna korelacija između ROA i ROE i nezavisnih varijabli, a neto dobit po akciji i knjigovodstvena vrednost akcija su imali značajan uticaj na ROA i ROE.

Ključne reči: Banke, finansijsko izveštavanje, finansijske performanse, ROA, ROE



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**IZVEŠTAVANJE O EKOLOŠKOJ ODRŽIVOSTI U KONTEKSTU
AGENDE 2030**

MSc Jovana Milenović *

Dr Ljiljana Bonić •

Abstract: Izveštaj Ujedinjenih nacija (UN) iz 2015. godine ukazuje da Milenijumski razvojni ciljevi nisu u potpunosti ostvareni kod svih zemalja potpisnica (United Nations, 2015). Po isteku ovih ciljeva, na snagu su stupili Ciljevi održivog razvoja (COR) za period od 2015. do 2030. godine. Novi COR, inicirani od strane UN, osmišljeni su sa idejom da se globalni razvoj može ostvariti samo ako COR budu prihvaćeni od strane šire populacije. Ovaj proces je otvorio pitanje izveštavanja o napretku u ostvarivanju COR, a posebno o izveštavanju o ekološkim COR kao najznačajnijom grupom COR. Generalno izveštavanje o ekološkim COR se u globalnim okvirima odvija na nivou: a) kompanija preko izveštaja o održivom razvoju i b) na nivou pojedinih država članica UN putem dobrovoljnog izveštavanja o ostvarivanju napretka ekoloških i drugih COR. Istraživanje je pokazalo da su velike kompanije u globalnim okvirima prihvatile izveštavanje o održivom razvoju, sa tendencijom da se ono postane obavezno i za srednja i mala preduzeća, za sada uglavnom u skladu sa smernicama GRI. Takođe, što se tiče izveštavanja zemalja članica UN zaživelo je dobrovoljno izveštavanje o ekološkim indikatorima u skladu sa Agendom 2030, s tim što nisu sve članice UN još uvek formulisale svoje ekološke nacionalne indikatore, među kojima je i Srbija.

Keywords: izveštavanje, Agenda 2030, ekološka održivost, COR, ekološki nacionalni indikatori.

1. Uvod

Poslednjih nekoliko decenija poslovno okruženje karakteriše visoki stepen konkurencije, složeni zahtevi kupaca i povećanje svesti o značaju ekološkog i društvenog

* Ekonomski fakultet Univerziteta u Nišu, Srbija, ORCID 0000-0001-9718-0383,

✉ jovana.milenovic@eknfak.ni.ac.rs

• Ekonomski fakultet Univerziteta u Nišu, Srbija, ORCID 0000-0003-3877-8400,

✉ ljiljana.bonic@eknfak.ni.ac.rs

UDK 502.131.1:657

okruženja. Kako bi pristup razvoju bio održiv, rast mora da bude inkluzivan. Može se ostvariti rešavanjem pitanja socijalne isključenosti, nejednakosti i sprovođenjem politika u oblasti ljudskih prava i zaštite životne sredine.

Usvajanjem Agende 2030, zemlje članice Ujedinjenih nacija su se obavezale na postizanje Ciljeva održivog razvoja. Agenda 2030 uključuje 17 Ciljeva održivog razvoja koji se odnose na siromaštvo, poboljšanje zdravlja i borbu protiv klimatskih promena. S tim u vezi, kompanije moraju efikasnije da koriste svoje resurse i razvijaju nove kompetencije. Dakle, pažnja se posvećuje tome da li entiteti integrišu informacije o ekonomskoj i socijalnoj dimenziji kao i o zaštiti životne sredine u svoje strategije i aktivnosti.

Prethodno navedeno upućuje na zaključak da tradicionalni finansijski izveštaji iako su primarni i neizostavni, nisu više dovoljan izvor informacija za donosiocima odluka, te raste interesovanje investitora, menadžmenta, države, profesionalnih i regulatornih tela, ali i drugih stejkholdera za unapređenje korporativnog finansijskog izveštavanja. Nefinansijsko izveštavanje intenzivno se razvija poslednjih nekoliko decenija, uglavnom na dobrovoljnoj bazi. U tom periodu su razvijeni različiti okviri nefinansijskog izveštavanja koji imaju za cilj da zadovolje potrebe za informacijama različitih stejkholdera.

Rad je strukturiran tako da sadrži tri dela. Prvi deo se bavi izveštavanjem o ekološkoj održivosti u kompanijama preko izveštaja o održivom razvoju koji postaje obavezan pratilac finansijskih izveštaja velikih kompanija, sa tendencijom da se obaveznost izveštavanja tokom vremena prenese na srednja i mala preduzeća. U drugom delu je izvršena komparativna analiza implementiranih ekoloških indikatora Srbije, zemalja EU-27 i zemalja u regionu. Konačno, poslednji treći deo rada se bavi nacionalnim indikatorima o ekološkoj održivosti o kojima treba da izveštavaju u dobrovoljnim izveštajima zemlje članice UN u cilju izveštavanja o ostvarenom napretku ekoloških COR Agende 2030.

2. Izveštavanje o ekološkoj održivosti kompanija – izveštaj o održivom razvoju

U poslednjoj deceniji, korporativno izveštavanje karakteriše evolutivni proces odnosno brojni korporativni skandali, finansijske krize, klimatske promene, smanjenje siromaštva i sl. Promena uslova poslovanja je uslovlila da se fokus sa finansijske vrednosti usmeri na koncept zajedničke vrednosti. Imajući u vidu da finansijske informacije nisu dovoljne, jer prikazuju samo deo ukupne vrednosti imovine, došlo je do razvijanja novih modela korporativnog izveštavanja. Evolucija je započela od uvođenja izveštaja o vrednosti, preko izveštaja o održivom razvoju, a kruna tog procesa je integrisano izveštavanje.

Izveštavanje o održivom razvoju, kao savremeni koncept, ima korene još u drugoj polovini 19. veka. U vreme industrijske revolucije u SAD Džordž Perkins, izvršni direktor kompanije US Steel, uveo je plan kontribucionih primanja zaposlenih, promovišući socijalne namere sa ciljem stvaranja „stabilnih, efikasnih i zadovoljnih zaposlenih” (Heald, 2005). Perkins je bio usmeren samo na socijalnu dimenziju, dok koncept održivog razvoja počiva na tri stuba: ekonomskom prosperitetu (ekonomska dimenzija), kvalitetu životne sredine (ekološka dimenzija) i socijalnoj pravdi (socijalna dimenzija). Ekonomska dimenzija održivog razvoja se odnosi na uticaj koji organizacija ima na ekonomsko stanje svojih stejkholdera, kao i na ekonomski sistem u širem kontekstu - lokalnom, nacionalnom i globalnom. Često se ova dimenzija pogrešno poistovećuje isključivo sa finansijskim performansama prikazanim u finansijskim izveštajima, što dovodi do zanemarivanja njene

Izveštavanje o ekološkoj održivosti u kontekstu Agende 2030

pune važnosti (Lin, 2014). Ekološka dimenzija se fokusira na uticaj organizacije na prirodne resurse, uključujući ekosisteme, zemlju, vazduh i vodu. Pitanja zaštite životne sredine dobila su na značaju nakon serije ekoloških katastrofa tokom sedamdesetih i osamdesetih godina 20. veka. Socijalna dimenzija je takođe ključna za stvaranje okruženja u kojem se znanje o održivosti može usvojiti i unapređivati. Uzimajući u obzir buduće rastuće potrebe za hranom, obrazovanjem i zdravstvenom zaštitom, društvena dimenzija održivosti postaje sve značajnija.

Važno je napomenuti da se ovaj koncept ne odnosi samo na privatna, već i na preduzeća u državnom vlasništvu (Stošić et al., 2012). Zaštita životne sredine i upravljanje održivim razvojem postali su ključni faktori za izgradnju pozitivnog imidža kompanije u savremenom poslovnom okruženju (Stevanović & Petrović-Randelović, 2012). Pored toga što postoje brojni razlozi koji opravdavaju izveštavanje o održivom razvoju, kompanije uglavnom izveštaje sastavljaju na dobrovoljnoj osnovi. U Evropi u pojedinim zemljama, poput Švedske, Norveške, Finske, Danske, Nemačke, Francuske, Velike Britanije i Švajcarske, postoje propisi koji se odnose na obelodanjivanje informacija o društveno odgovornom poslovanju kompanija (Bonsón, & Bednárová, 2015). Iako je objavljivanje ovih izveštaja u većini zemalja dobrovoljno, za sve veći broj svetskih kompanija praksa objavljivanja izveštaja o održivom razvoju postala je pravilo, a ne izuzetak (KPMG, 2011). Izveštavanjem o održivom razvoju može se smanjiti informaciona asimetrija (Healy & Palepu, 2001). Kolk (2010) navodi razloge kompanija za i protiv izveštavanja o održivom razvoju (Tabela 1).

Tabela 1. Razlozi za i protiv izveštavanja kompanija o ekološkim performansama u kontekstu izveštavanja o održivom razvoju

Za izveštavanje o održivom razvoju	Protiv izveštavanja o održivom razvoju
Poboljšana sposobnost praćenja napretka u odnosu na određene ciljeve	Sumnje o prednostima koje bi ona donela organizaciji
Olakšavanje implementacije strategije zaštite životne sredine	Konkurenti ne objavljuju izveštaje
Veća svest o pitanjima zaštite životne sredine u celoj organizaciji	Kupci nisu zainteresovani za to, neće povećati prodaju
Sposobnost prenošenja korporativne poruke unutar i spolja	Kompanija već ima dobru reputaciju za svoje ekološke performanse
Veća transparentnost doprinosi poboljšanom sveobuhvatnom kredibilitetu	Postoji mnogo drugih načina komuniciranja o pitanjima životne sredine
Sposobnost prenošenja napora kompanije ka održivosti	Preskupo je
Osiguranje licence za rad i bolja kampanja	Teško je prikupiti dosledne podatke iz svih operacija i odabrati tačne indikatore
Korišćenje reputacije, identifikovanje uštede troškova, povećanje efikasnosti, poboljšanje mogućnosti za razvoj poslovanja i poboljšanje morala zaposlenih	Moglo bi oštetiti reputaciju kompanije ili imati pravne implikacije

Izvor: Prilagođeno prema: Kolk, A. (2010). Trajectories of sustainable reporting by MNCs. *Journal of World Business*, 45, p. 368.

Na osnovu Tabele 1 može se zaključiti da su razlozi za objavljivanje izveštaja o održivom razvoju značajniji od razloga koje kompanije navode protiv sastavljanja i objavljivanja ovih izveštaja.

Kompanije u izveštaju o održivom razvoju obelodanjuju informacije koje se odnose na ključne aspekte zaštite životne sredine. Tako se mogu pronaći podaci o emisijama gasova sa efektom staklene bašte, podaci o potrošnji energije, upravljanju otpadom, uticaju na biodiverzitet. Kompanije izveštavaju o zagađenju i kontroli emisija opasnih supstanci, ali i o ekološkom dizajnu i održivim proizvodima. Takođe, u njihovim izveštajima mogu se pronaći informacije o usklađenosti sa zakonodavstvom o zaštiti životne sredine, uključujući kazne ili sankcije za kršenje propisa. Obelodanjivanje prethodno navedenih informacija, omogućava procenu ekološkog otiska kompanije, izračunavanje različitih indeksa kojima se može proceniti koliko kompanija doprinosi održivom razvoju. Imajući ovo u vidu, mnoge međunarodne organizacije su predložile različite načine kompanijama za inkorporiranje informacija o održivosti. Glavni kreatori smernica za izveštavanje su: Globalna inicijativa za izveštavanje (*Global Reporting Initiative* – GRI), Radna grupa za finansijska obelodanjivanja u vezi sa klimom (*Task Force on Climate-related Financial Disclosures* – TCFD), Odbor za računovodstvene standarde održivosti (*Sustainability Accounting Standards Board* – SASB), Odbor za standarde za obelodnjivanja u vezi sa klimom (*Climate Disclosure Standards Board* – CDSB) Svetskog ekonomskog foruma (WEF), Američka komisija za hartije od vrednosti (*Securities and Exchange Commission* – SEC), Evropska komisija (*European Commission* – EC) i drugi. Navedeni akteri samostalno ili u saradnji su ustanovili određena pravila nefinansijskog izveštavanja o održivosti, uz naglašavanje zahteva za obelodanjivanjima u vezi sa klimom. Novembra 2021. godine Fondacija IFRS – krovna organizacija Međunarodnog odbora za računovodstvene standarde (*International Accounting Standards Board* – IASB) koji izdaje Međunarodne standarde finansijskog izveštavanja (*International Financial Reporting Standards* – IFRS) se takođe uključila u ovaj proces kroz osnivanje Međunarodnog odbora za standarde održivosti (*International Sustainability Standards Board* – ISSB).

Odbor ISSB je tokom 2022. godine objavio nacрте dva standarda, jedan koji se bavi obelodanjivanjima o održivosti (ED IFRS S1) i drugi koji za predmet ima obelodanjivanja u vezi sa klimom (ED IFRS S2). Nacrti standarda su usvojeni i na snazi su od 1. januara 2024. godine. Evropska komisija je 31.7.2023. godine usvojila Evropske standarde izveštavanja o održivosti (*European Sustainability Reporting Standards* – ESRS) koji se odnose na 50.000 kompanija u odnosu na dosadašnjih 12.000. Objavljeno je 12 ESRS standarda koji obuhvataju principe i zahteve za izveštavanjem na sledeće teme: *opšti zahtevi; opšta obelodanjivanja; klima; zagađenje; voda i morski resursi; biodiverzitet i ekosistemi; upotreba resursa i cirkularna ekonomija; zaposleni u kompaniji; zaposleni u lancu vrednosti; zajednice pod uticajem; potrošači i korisnici i upravljanje*. Cilj uvođenja ovih standarda bio je da se standardizuje način na koji kompanije izveštavaju o održivosti. Nastali su kao odgovor na rastuću potrebu za sveobuhvatnim izveštavanjem o uticaju poslovanja na društvo i životnu sredinu i kako bi se postavio temelj za standarde izveštavanja o održivosti na globalnom nivou. Novim standardima je specifičan koncept „dvostruke materijalnosti“ koji kompanijama pored obaveze da izveštavaju o načinu na koji ESG pitanja kreiraju rizike za kompanije, nameće i obavezu izveštavanja o načinu na koji kompanije svojim poslovanjem utiču na okruženje i ljude. Izveštavanje o određenim pitanjima, poput klime biće dobrovoljno umesto obavezno, tako da će kompanija sama donositi procenu da li određeni indikator utiče na njeno poslovanje pre nego što podatke obelodani. Od prvog januara 2024. godine, deo velikih kompanija sa sedištem u EU započinje izveštavanje u skladu sa novim Evropskim standardima. ESRS standardi obavezuju preduzeća koja su kotirana na berzi sa preko 500 zaposlenih da 2025. godine

Izveštavanje o ekološkoj održivosti u kontekstu Agende 2030

dostave izveštaj za 2024. godinu. Od 2025. godine, obaveza primene standarda važiće za ostala velika preduzeća, a od 2026. godine za mala i srednja preduzeća.

Društveno odgovorno poslovanje omogućava obezbeđenje konkurentske prednosti, a izveštavanje o održivom razvoju logičan postupak društveno odgovornih kompanija. U Republici Srbiji izveštavanje o održivom razvoju počinje nakon 2000. godine i u vezi je sa razvojem koncepta društvenog odgovornog poslovanja. Prvi izveštaj o održivom razvoju je objavljen 2008. godine na dobrovoljnoj osnovi, sastavljen po metodologiji GRI. Usvajanjem Zakona o računovodstvu 2019. godine koji je na snagu stupio 1. januara 2020. godine i koji je usklađen sa Direktivom 2014/95/EU (član 37 – nefinansijsko izveštavanje na nivou pojedinačnih izveštajnih entiteta i član 38 – konsolidovano finansijsko izveštavanje) entiteti imaju obavezu da obelodane nefinansijske informacije kao dopunu tradicionalnim finansijskim izveštajima („Sl. Glasnik RS“, br. 73/2019 i 44/2021). Dakle, definisano članom 37, obveznici nefinansijskog izveštavanja su velika pravna lica koja su društva od javnog interesa i koja na datum bilansa prelaze kriterijum broja 500 zaposlenih tokom poslovne godine. Izuzetak od neobeleđivanja nefinansijskih informacija je pravno lice koje ima karakter zavisnog pravnog lica i koje je uključeno u konsolidovani godišnji izveštaj. Takođe, novom Direktivom iz 2022. godine se zahteva da sva velika preduzeća, čije su hartije od vrednosti kotirane na regulisanom tržištu izveštavaju o održivosti i koji su subjekti od javnog interesa treba da bude dozvoljeno da izveštavaju u skladu sa standardima izveštavanja o održivosti za mala i srednja preduzeća. Sve matične kompanije treba da pripremaju izveštaje o održivosti na nivou grupe.

3. Dobrovoljno izveštavanje članica UN o ekološkoj održivosti u kontekstu ostvarivanja COR u skladu sa Agendom 2030 – slučaj Srbije u poređenju sa EU-27 i zemljama u regionu

Kako bi se izvršila analiza napretka u ostvarivanju COR, potrebno je rezimirati Agendu 2030 za održivi razvoj. Agenda 2030 predstavlja plan delovanja za dobrobit ljudi, planete i prosperiteta, s ciljem učvršćivanja univerzalnog mira u uslovima veće slobode. Iskorenjivanje siromaštva u svim njegovim oblicima, uključujući ekstremno siromaštvo, prepoznato je kao najveći globalni izazov i ključni uslov za održivi razvoj. Agendom je postavljeno 17 COR i 169 potciljeva koji su integrisani, nerazdvojni i ravnomerno obuhvataju tri prethodno pomenute dimenzije održivog razvoja. Ostvarivanje COR prati se putem indikatora – opštih i nacionalnih. Postoji potreba za kvalitetnim, dostupnim, pravovremenim i pouzdanim podacima kako bi se merio napredak i kako bi se obezbedilo da niko ne bude izostavljen. Globalni okvir indikatora za praćenje COR je dizajniran tako da meri napredak ostvarenja COR na globalnom nivou i koristi globalnu listu indikatora Međuagencijske ekspertske grupe za COR indikatore. Globalna lista obuhvata 231 indikator, da bi se početkom 2022. godine, broj predloženih indikatora povećao na 248 (Mapa puta za statistiku za COR, 2022). U skladu sa Okvirom za saradnju UN sa RS izvršeno je mapiranje nacionalnih strategija i javnih politika Srbije u oblasti COR, koje se zasniva na četiri oblasti koje čine “pet slova P”: Narod, Planeta, Prosperitet, Mir i Partnerstva (engl. People, Planet, Prosperity, Peace, Partnerships). Četiri oblasti za grupisanje COR u strategijama i javnim politikama u Srbiji prikazane su u Tabeli 2.

Prema Izveštaju o Ciljevima održivog razvoja za 2024. godinu (The Sustainable Development Goals Report 2024, 2024, <https://s3.amazonaws.com/sustainabledevelopment.report/2024/sustainable-development-report-2024.pdf>), Srbija se u

2024. godini nalazila na 35. mestu od ukupno 193 zemlje članice UN (od kojih je samo 167 zemalja započelo implementaciju Agende 2030). Zemlje su rangirane na osnovu ukupne ocene koja meri napredak u ostvarivanju svih 17 Ciljeva održivog razvoja. Ova ocena može se tumačiti kao procenat postignuća COR. Ocena 100 ukazuje da su svi ciljevi ostvareni, dok je ukupna ocena za Srbiju iznosila 77,00/100. U Tabeli 3 prikazane su prvih 36 rangiranih zemalja članica UN na osnovu rezultata u implementaciji COR.

Tabela 2. Grupisanje COR u četiri oblasti koje je vlada Srbije usvojila za implementaciju Agende 2030

NAROD	PLANETA
Razvoj ljudskih resursa (COR 1, 2, 3, 4, 5 i 10)	Životna sredina i klima (COR 6, 7, 11, 12, 13, 14 i 15)
PROSPERITET	MIR I PARTNERSTVO
Ekonomski rast (COR 8 i 9)	Institucije, finansije i saradnja (COR 16 i 17)

Izvor: Okvir saradnje UN za održivi razvoj sa Republikom Srbijom: 2021–2025., 2020, str. 11
<https://serbia.un.org/sites/default/files/2022-02/okvir-saradnje-un-za-odrzivi-razvoj-srbija-2021-2022.pdf>

Tabela 3. Rangiranje članica UN na osnovu rezultata u implementaciji COR za 2024. godinu

Zemlja	Ocena	Zemlja	Ocena	Zemlja	Ocena
1. Finska	86,40	13. Letonija	81,00	25. Kanada	78,80
2. Švedska	85,70	14. Španija	80,70	26. Novi Zeland	78,80
3. Danska	85,00	15. Estonija	80,50	27. Moldavija	78,80
4. Nemačka	83,40	16. Portugal	80,20	28. Irska	78,70
5. Francuska	82,80	17. Belgija	80,00	29. Grčka	78,70
6. Austrija	82,50	18. Japan	79,90	30. Belorusija	78,60
7. Norveška	82,20	19. Island	79,50	31. Litvanija	78,10
8. Hrvatska	82,20	20. Mađarska	79,50	32. Čile	77,80
9. Velika Britanija	82,20	21. Slovačka Republika	79,40	33. Republika Koreja	77,30
10. Poljska	81,70	22. Švajcarska	79,30	34. Urugvaj	77,10
11. Slovenija	81,30	23. Italija	79,30	35. Srbija	77,00
12. Češka	81,30	24. Holandija	79,20	36. Malta	77,00

Izvor: UN:Rankings the overall performance of all 193 UN Member States (2024) Dostupno na:
<https://dashboards.sdindex.org/rankings>

Napredak u ostvarivanju ekoloških COR može se pratiti kroz komparativnu analizu sa zemljama EU-27, kojoj Srbija teži da se priključi i sa čijim normativnim okvirom i razvojnim standardima treba da se uskladi. U Tabeli 4 je shodno dostupnosti podacima iz Evrostatove baze za 2022. godinu izvršena komparativna analiza sa zemljama EU-27 kao i zemljama u regionu koje su kandidati za članstvo u EU: Albanijom, Crnom Gorom i Severnom Makedonijom.

Pristup bezbednoj i priuštivoj pijaćoj vodi, sanitaciji i higijeni, deo je osnovnih potreba i ključnih prava stanovništva. U EU se ovaj aspekt održivog razvoja smatra pitanjem javnog zdravlja i zdrave životne sredine. Za sada je moguće porediti napredak u ostvarivanju ovog cilja između Srbije i EU-27 prema indikatoru kojim se meri udeo stanovništva koje nema

Izveštavanje o ekološkoj održivosti u kontekstu Agende 2030

kadu ili tuš kao ni toalet u svom domaćinstvu. Prema ovom indikatoru, kada se posmatra za ukupno stanovništvo, Republika Srbija pokazuje sličnosti sa zemljama u regionu u pogledu udela stanovništva koje nema adekvatan pristup sanitaciji (nema kadu ili tuš, kao ni toalet u svom domaćinstvu). Razlike između Srbije i drugih država u regionu nisu velike, jer dok u Srbiji 1,6% ukupnog stanovništva nema pristup adekvatnoj sanitaciji, u Severnoj Makedoniji takođe 1,6 stanovništva, u Albaniji 2,9%, a u Crnoj Gori je stanje nešto bolje jer se radi o 0,9% stanovništva. U Srbiji i zemljama regiona je znatno niži procenat stanovništva koje je priključeno na tretman otpadnih voda sa najmanje sekundarnim tretmanom nego u Evropskoj uniji (15,6% prema 80,88%), ali i u odnosu na Albaniju.

Tabela 4. Komparativna analiza napretka u ostvarivanju ekoloških COR – slučaj Srbije u odnosu na zemlje EU-27 i zemlje u regionu

EU SDG Indikatori	Srbija	EU-27	Albanija	Crna Gora	Severna Makedonija
<i>COR 6 – Obezbediti dostupnost i održivo upravljanje vodom i sanitacijama za sve</i>					
Stanovništvo koje nema kadu ili tuš, kao ni toalet u svom domaćinstvu, prema statusu siromaštva (u %)	1,6*	1,5*	2,9*	0,9*	1,6*
Stanovništvo priključeno na tretman otpadnih voda sa najmanje sekundarnim tretmanom (u %)	15,6	80,88	22,91	-	-
<i>COR 7 - Osigurati pristup dostupnoj, pouzdanoj, održivoj i modernoj energiji za sve</i>					
Finalna potrošnja energije u domaćinstvima po glavi stanovnika (kilogram ekvivalenata nafte – KGOE)	510	542	189	403	269
Udeo obnovljive energije u bruto finalnoj potrošnji energije (u %)	24,670	23,036	19,940	39,944	18,682
Zavisnost od uvoza energije prema proizvodima (u %)	44,902	62,502	31,467	29,089	63,022
Nemogućnost domaćinstva da priušti adekvatno zagrevanje stana (u %)	9,5	9,3	-	-	13,9
<i>COR 11 – Učiniti gradove i ljudska naselja inkluzivnim, bezbednim, otpornim i održivim</i>					
Stanovništvo koje smatra da njihovo domaćinstvo trpi buku, prema statusu siromaštva (u %)	9,8*	17,6*	3,0*	8,5*	7,5*
Stopa recikliranja komunalnog otpada (u %)	17,6	48,6	18,9	4,2	0
<i>COR 12 – Obezbediti održive obrasce potrošnje i proizvodnje</i>					
Generisani otpad iz koga je isključen glavni mineralni otpad prema opasnosti (kg)	1.763	1.735*	-*	1.152	437

*Napomena: Podaci obeleženi * su iz 2020. godine. Ostali podaci prikazani u tabeli su iz 2022. godine.*
Izvor: https://ec.europa.eu/eurostat/databrowser/explore/all/tb_eu?lang=en&subtheme=sdg.sd_g_11&display=list&sort=category&extractionId=sdg_11_60

Energija omogućava nesmetano funkcionisanje svih privrednih sektora, ali i svakodnevnog života stanovništva. U svojoj agendi za održivi razvoj, EU ističe da se i dalje u velikoj meri oslanja na fosilna goriva u obezbeđivanju energije, te da se suočava sa brojnim izazovima da obezbedi pristupačne, pouzdane i održive zalihe energije (Babović &

Janković, 2022). Smanjenje ukupne potrošnje energije i korišćenje obnovljivih izvora energije, obezbeđivanje sigurnosti snabdevanja, i omogućavanje pristupa pristupačnoj energiji za sve svoje građane, važni su aspekti COR 7 u EU. U poređenju sa državama Zapadnog Balkana koje su kandidati za članstvo, a posebno u odnosu na Albaniju i Severnu Makedoniju, EU ima veću finalnu potrošnju energije u domaćinstvima. Republika Srbija koja je donedavno bila u potrošnji energije najbližija Crnoj Gori, sada se približava proseku potrošnje EU-27. Prema udelu energije iz obnovljivih izvora u ukupnoj bruto finalnoj potrošnji energije u domaćinstvima Srbija se nalazi u sredini, između EU-27, Albanije i Severne Makedonije koje beleže niži udeo energije iz obnovljivih izvora i Crne Gore koja beleži znatno viši udeo energije iz obnovljivih izvora. U pogledu zavisnosti od uvoza energije prema proizvodima, Republika Srbija pokazuje bolje performanse od Crne Gore i Albanije, ali ne i od proseka za EU-27 i Severne Makedonije. U pogledu udela stanovništva koje je u riziku od siromaštva i ne može adekvatno da zagreje stambeni prostor Srbija ima bolji rezultat od država u regionu.

Stanovništvo EU-27 u većem procentu se suočava sa problemima buke u svom životnom okruženju, a sa ovim problemom se češće suočavaju osobe u riziku od siromaštva. U Srbiji i zemljama regiona, manji je procenat stanovništva koji se žali na buku u svojoj životnoj sredini, a i osobe koje su u riziku od siromaštva u manjem procentu prijavljuju ovaj problem nego osobe koje nisu u riziku od siromaštva što može ukazivati da one češće žive u manje urbanim sredinama. Nastojanja da se recikliranjem komunalnog otpada smanji štetni uticaj gradova na životnu sredinu izuzetno je slab u Srbiji i u tom pogledu ona se nalazi daleko iza proseka za EU-27 (48,6%), ali i Albanije. U pogledu količine generisanog otpada, Srbija pokazuje kontinuiran porast i približava se EU-27, i generiše znatno veće količine nego druge zemlje u regionu.

Na osnovu analiziranih indikatora kojima se ocenjuje napredak u ostvarivanju COR u oblasti planeta (COR 6, 7, 11 i 12), može se primetiti da u poređenju sa zemljama EU-27, Republika Srbija pokazuje niža postignuća u ostvarivanju ciljeva održivog razvoja. Republika Srbija beleži bolje rezultate od EU-27 samo kod dva indikatora: prvi - *Nemogućnost domaćinstva da priušti adekvatno zagrevanje stana u %* 9,5% prema 9,3%), dok drugi indikator kod COR 7 pokazuje da Republika Srbija u većoj meri troši energiju iz obnovljivih izvora (verovatno zahvaljujući većem udelu ruralnog stanovništva koje se greje na drva, pelet i sl.) u odnosu na proseku EU-27. U poređenju sa državama regiona, Republika Srbija pokazuje brojne sličnosti, ali i kod pojedinih indikatora beleži i bolje rezultate.

4. Praksa razvijenih zemalja UN koje su uspešno implementirale ekološke nacionalne indikatore

Kako bi se efikasnije pratio napredak u implementaciji Agende 2030, neophodno je pored opštih indikatora uspostaviti nacionalne indikatore koji odražavaju specifične razvojne potrebe i prioritete specifične za zemlje. Nacionalni indikatori dopunjuju globalne indikatore i omogućavaju različitim akterima, poput vlade, akademske zajednice, privatnog sektora, nevladinih organizacija i civilnog društva, da precizno identifikuju gde i kako mogu da doprinesu ostvarenju Ciljeva održivog razvoja. Od 56 članica Ekonomske komisije UN za Evropu, 43 države već su utvrdile ovu vrstu indikatora (<https://www.dri.rs/storage/newaudits/2023-2-Ciljevi%20odrzivog%20razvoja.pdf>), što im omogućava da prilagode globalne ciljeve svojim nacionalnim prioritetima i izazovima. Uspostavljanje takvih indikatora u Srbiji bi značajno poboljšalo praćenje napretka i

Izveštavanje o ekološkoj održivosti u kontekstu Agende 2030

implementaciju Agende 2030 u skladu sa nacionalnim potrebama, ali se postiže i veće međuresorno učešće i jača saradnja u oblasti COR (Mapa puta za statistiku za COR, 2022).

Prema listi regionalnog napretka u primeni ključnih preporuka Mape puta za statistiku (United Nations Economic Commission for Europe – UNECE), zemlje koje su usvojile nacionalne indikatore su: *Jermenija, Austrija, Azerbejdžan, Belorusija, Belgija, Bosna i Hercegovina, Kanada, Kolumbija, Češka, Danska, Estonija, Finska, Francuska, Gruzija, Nemačka, Grčka, Mađarska, Irska, Izrael, Italija, Kazahstan, Kirgistan, Letonija, Lihtenštajn, Litvanija, Luksemburg, Meksiko, Monako, Crna Gora, Poljska, Moldavija, Rumunija, Rusija, Slovačka, Slovenija, Južna Afrika, Španija, Švedska, Švajcarska, Tadžikistan, Turska, Ukrajina, Uzbekistan.*

Republika Srbija nije ustanovila nacionalne indikatore do početka 2023. godine. Usvajanjem bi se potvrdila posvećenost Republike Srbije COR i dao bi se veći značaj radu Republičkog zavoda za statistiku (RZS) na obezbeđivanju raspoloživih i kvalitetnih podataka za COR. Zadatak koji je bio predviđen Dobrovoljnim nacionalnim izveštajem 2019. godine obuhvatao je rad na nacionalnim indikatorima za praćenje dostizanja COR. Proces identifikacije nacionalnih indikatora podrazumeva identifikaciju institucija koje će raditi na izradi okvira za nacionalne pokazatelje. Ovo uključuje saradnju sa državnim i lokalnim vlastima, akademskim institucijama, firmama iz javnog i privatnog sektora, kao i organizacijama civilnog društva. U Tabeli 5 dat je pregled broja nacionalnih indikatora kojim se prati ekološka održivost koje su uvele 43 članice UN.

Tabela 5. Pregled zemalja koje su usvojile ekološke nacionalne indikatore za praćenje ekoloških COR

Zemlja	Broj NI	Broj ekoloških ind.	Zemlja	Broj NI	Broj ekoloških ind.
1. Bosna i Hercegovina	152	13	20. Litvanija	84	16
2. Kanda	231	12	21. Luksemburg	130	-
3. Kolumbija	156	-	22. Meksiko	-	-
4. Češka	97	42	23. Monako	-	-
5. Danska	37	-	24. Crna Gora	252	38
6. Estonija	32	30	25. Poljska	70	26
7. Finska	50	31	26. Moldavija	-	-
8. Francuska	109	-	27. Rumunija	-	-
9. Gruzija	200	-	28. Rusija	183	39
10. Nemačka	75	30	29. Slovačka	42	21
11. Grčka	70	10	30. Slovenija	-	-
12. Mađarska	130	-	31. Južna Afrika	-	-
13. Irska	-	-	32. Španija	234	37
14. Izrael	-	-	33. Švedska	60	10
15. Italija	-	-	34. Švajcarska	85	26
16. Kazahstan	87	11	35. Tadžikistan	217	9
17. Kirgistan	57	17	36. Turska	-	-
18. Letonija	-	-	37. Ukrajina	-	-
19. Lihtenštajn	55	-	38. Uzbekistan	206	12

Napomena: NI- nacionalni indikatori; Za pojedine zemlje nema dostupnih podataka, jer nisu eksplicitno objavile tačan broj usvojenih nacionalnih indikatora za praćenje COR, već je samo kvalitativno opisano ostvarenje COR.

Izvor: <https://sustainabledevelopment.un.org/index.php?page=view&type=30022&nr=378&menu=3170>

Prikazan broj nacionalnih indikatora pruža značajan uvid u napredak sprovođenja Agende 2030 i definisanih COR. Analizirani primeri i prakse iz razvijenih zemalja pružaju vredne uvide u efikasne strategije za implementaciju nacionalnih indikatora u skladu sa Agendom 2030. Njihova iskustva ukazuju na značaj prilagođavanja globalnih ciljeva lokalnim kontekstima, jačanje institucionalnih kapaciteta i kontinuirano praćenje napretka kako bi se postigli održivi rezultati. Usvajanje ekoloških nacionalnih indikatora za praćenje ekoloških COR (broj) može se oceniti kao pozitivan iskorak ka održivom razvoju. Na ovaj način zemlje mogu bolje da prate i ocenjuju svoje ekološke performanse. Usvojeni indikatori omogućavaju praćenje ključnih aspekata životne sredine poput emisije gasova sa efektom staklene bašte, kvalitet vazduha, vode, biodiverziteta. Na taj način zemlje mogu da identifikuju oblasti gde će prilagoditi svoje politike kako bi ostvarili održivost. Takođe, zemlje koje su usvojile nacionalne indikatore, a posebno ekološke nacionalne indikatore pokazuju transparentnost prema međunarodnoj zajednici, ali i stanovništvu i na taj način doprinose poverenju i boljoj saradnji prilikom sprovođenja ekoloških inicijativa. Analizirajući nacionalne dobrovoljne izveštaje pojedinih zemalja koje su usvojile nacionalne indikatore, primećeno je da nije kod svih zemalja eksplicitno dat broj ekoloških nacionalnih indikatora, ali da bez obzira na to sve zemlje naglašavaju planove za budućnost u okviru COR, što ukazuje na to da su zemlje posvećene upravljanju ekološkim izazovima i zaštitom životne sredine i da će u budućnosti moći da prezentuju tačan broj usvojenih ekoloških nacionalnih indikatora.

5. Zaključak

Usklađenost sa zahtevima održivog razvoja predstavlja jedan od prioriteta za kompanije. Agenda 2030 i njenih 17 ciljeva održivog razvoja su novi izazovi za kompanije koje bi trebalo da prilagode svoje poslovanje i strategije sa zahtevima COR. U tom smislu rad je imao za cilj da ukaže na izveštavanje o ekološkim COR koje se odvija na nivou kompanija preko izveštaja o održivom razvoju i na nivou pojedinih država članica UN putem dobrovoljnog izveštavanja.

Istraživanje u ovom radu je pokazalo da je proces izveštavanja o održivom razvoju kompanija zaživeo u praksi. Izveštavanje kompanija o održivosti je za sada postalo obaveza velikih kompanija, sa tendencijom da se u ovaj proces uključe i srednja i mala preduzeća. Imajući u vidu da su mnoge međunarodne i profesionalne organizacije (GRI, IFAC, Evropska komisija) uključene u proces definisanja okvira za izveštavanje o održivom razvoju, pa i ekološkoj održivosti, ostaje nejasno na koji način će se pojedine zemlje opredeljavati za polazne osnove u izveštavanju o održivom razvoju. Za sada se izveštaji o održivom razvoju kompanija u globalnim okvirima uglavnom sastavljaju u skladu sa GRI standardima.

Kada govorimo o dobrovoljnom izveštavanju zemalja članica UN, može se zaključiti da je izveštavanje sve prisutnije, ali da varira u zavisnosti od prioriteta zemalja. Iako je uočeno u dobrovoljnim izveštajima broj ekoloških indikatora, ipak postoje one koje nisu u potpunosti formulisale ili uskladile svoje indikatore sa COR. Objavljivanje informacija koje obuhvataju tri dimenzije održivog razvoja (ekonomska, ekološka i socijalna) mogu da poboljšaju odnos između kompanije i zainteresovanih stejkholdera (Nikolaou & Evangelinos, 2010; Sotorrio & Sánchez, 2010).

Izveštavanje o ekološkoj održivosti u kontekstu Agende 2030

Izveštavanje o održivom razvoju omogućava praćenje i unapređenje globalnih napora ka održivosti. Praćenje napretka u ostvarivanju COR pomoću opštih indikatora koje su propisale UN može se obezbediti uporedivost i praćenje napretka na globalnom nivou, ali i omogućavaju fleksibilnost za prilagođavanje specifičnim nacionalnim okolnostima. Na osnovu analiziranih indikatora kojima se ocenjuje napredak u ostvarivanju COR u oblasti planeta (COR 6, 7, 11 i 12), može se primetiti da u poređenju sa zemljama EU-27, Republika Srbija pokazuje niža postignuća u ostvarivanju ciljeva održivog razvoja.

U radu su analizirani primeri zemalja koje su uspešno implementirane nacionalne indikatore za praćenje ekoloških COR u skladu sa Agendom 2030. Primeri pokazuju da iako opšti indikatori predstavljaju solidnu osnovu, uspešna implementacija Agende 2030 zavisi i od sposobnosti zemlje da ove indikatore prilagodi svojim specifičnostima, ali i da ih uspešno integriše u svoje nacionalne strategije. Usvojeni ekološki nacionalni indikatori mogu poslužiti kao model odnosno smernice za efikasnu primenu održivih praksi. Srbija je u procesu prepoznavanja nacionalnih indikatora kojima se može pratiti ostvarivanje ekološke održivosti. Proces podrazumeva razvoj metodologije, prikupljanje podataka i definisanje politika koje će omogućiti i olakšati praćenje. Ono što se možda može navesti kao izazov u procesu identifikovanja nacionalnih indikatora je nedostatak tehničkih kapaciteta. Ključno ograničenje u istraživanju nacionalnih ekoloških indikatora pojedinih zemalja članica UN je bio pristup podacima u dobrovoljnim izveštajima pojedinih zemalja (nemogućnost pristupa dobrovoljnom izveštaju, različite godine podnošenja dobrovoljnih izveštaja, različiti pristupi u prezentiranju ekoloških nacionalnih indikatora). Ovo je uslovalo nekompletnost sprovedene komparativne analize nacionalnih ekoloških indikatora za posmatrane zemlje. Ipak, na osnovu istraživanja se može zaključiti da je za ostvarivanje ekoloških i drugih COR neophodno redovnije i transparentnije dobrovoljno izveštavanje članica UN radi ostvarivanja pozitivnog ishoda na globalnom nivou. Ovo ujedno ukazuje na obavezu svih članica UN, koje nisu definisale nacionalne indikatore za praćenje ekoloških i drugih COR, da što pre to učine.

Literatura

- Babović, M & Janković, V. (2022). Report on Progress in achieving Sustainable Development Goals until 2030 in the Republic of Serbia compared to EU-27 and the countries in the region. Dostupno na: <https://sdgs4all.rs/en/documents/report-on-progress-in-achieving-sustainable-development-goals-until-2030-in-the-republic-of-serbia-compared-to-eu-27-and-the-countries-in-the-region/>
- Bonsón, E. & Bednárová, M. (2015). CSR reporting practices of Eurozone companies. *Revista de Contabilidad – Spanish Accounting Review*, 18(2), 182–193.
- Državna revizorska institucija (2023). Izveštaj o reviziji svrsishodnosti poslovanja – Ciljevi održivog razvoja: Spremnost Republike Srbije za implementaciju Agende 2030. Dostupno na: <https://www.dri.rs/storage/newaudits/2023-2-Ciljevi%20odrzivog%20razvoja.pdf>
- Eurostat Data Browser. Dostupno na: https://ec.europa.eu/eurostat/databrowser/explore/all/tb_eu?lang=en&subtheme=sdg.sdg_11&display=list&sort=category&extractionId=sdg_11_60
- Heald, M. (2005). The Social Responsibilities of business. Transaction publishers, New Jersey.
- Healy, P., & Palepu, K. (2001). A review of the empirical disclosure literature. *Journal of Accounting & Economic*, 31(3), 441–456.
- Kolk, A. (2010). Trajectories of sustainability reporting by MNCs. *Journal of world business*, 45(4), 367-374.
- KPMG. (2011). KPMG International Survey of Corporate Responsibility Reporting 2011.

- Lin, I. (2014). Importance of sustainability performance indicators as perceived by the users and preparers. *J. Mgmt. & Sustainability*, 4, 29.
- Nikolaou, I. E., & Evangelinos, K. I. (2010). Classifying current social responsibility accounting methods for assisting a dialogue between business and society. *Social Responsibility Journal*, 6(4), 562-580.
- Okvir saradnje UN za održivi razvoj sa Republikom Srbijom: 2021–2025., 2020, str. 11 <https://serbia.un.org/sites/default/files/2022-02/okvir-saradnje-un-za-odrzivi-razvoj-srbija-2021-2022.pdf>
- Sotorrió, L. L., & Sánchez, J. L. F. (2010). Corporate social reporting for different audiences: The case of multinational corporations in Spain. *Corporate Social Responsibility and Environmental Management*, 17(5), 272-283.
- Stevanović, T., Petrović Randelović, M. (2012). Balanced Scorecard održivosti i analiza eko-efikasnosti, *Facta universitatis – series: Economics and Organization*, 9(2), 257–270
- Stošić, I., Erić, D., Redžepagić, S. (2012). Unapređenje korporativnog upravljanja u preduzećima u državnom vlasništvu radi podizanja efikasnosti i efektivnosti poslovanja Srbije. *Poslovna ekonomija*, 6(2), 33–48
- The Sustainable Development Goals Report 2024, 2024, <https://s3.amazonaws.com/sustainabledevelopment.report/2024/sustainable-development-report-2024.pdf>
- Sustainable Development Goals. Knowledge platform. Dostupno na: <https://sustainabledevelopment.un.org/index.php?page=view&type=30022&nr=378&menu=3170>
- Ujedinjene nacije (2022). Mapa puta za statistiku za COR. Dostupno na: <https://sdg.indikatori.rs/media/1609/mapa-puta.pdf>
- United Nations. (2015). The Millennium Development Goals Report 2015, New York, Dostupno na: [http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%2015%20rev%20\(July%201\).pdf](http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%2015%20rev%20(July%201).pdf)
- UN:Rankings the overall performance of all 193 UN Member States (2024) Dostupno na: <https://dashboards.sdgindex.org/rankings>
- Zakon o računovodstvu, „Službeni glasnik RS, br. 73/2019 i 44/2021

REPORTING ON ENVIRONMENTAL SUSTAINABILITY IN THE CONTEXT OF THE AGENDA 2030

Abstract: *The 2015 United Nation (UN) report indicates that the Millennium Development Goals were not fully achieved by all signatory countries (United Nations, 2015). Upon the expiration of these goals, the Sustainable Development Goals (SDGs) for the period from 2015 to 2030 came into effect. The new SDGs, initiated by UN, were designed with the idea that global development can only be achieved if the SDGs are accepted by a broader population. This process has raised the issue of reporting on the progress in achieving the SDF, particularly regarding environmental SDGs as the most significant group of goals. In general, reporting on environmental SDG on a global level in two main ways: a) at the company level through sustainability reports and b) at the level of individual UN member states through voluntary reporting on the progress in achieving environmental and other SDGs. Research has shown that large companies globally have embraces sustainability reporting, with a tendency for it to become mandatory for small and medium-sized enterprises as well, for now, mainly in accordance with GRI guidelines. Additionally, as for the reporting by UN member states, voluntary reporting on environmental indicators in accordance with the Agenda 2030 has gained traction, although not all UN member states, including Serbia, have yet formulated their national environmental indicators.*

Keywords: *reporting, Agenda 2030, environmental sustainability, SDGs, environmental national indicators*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**ZELENO RAČUNOVODSTVO U FUNKCIJI NOVE AGRARNE
POLITIKE EVROPSKE UNIJE**

Dr Aleksandra Arsenijević*

Dr Ljilja Antić•

Dr Sonja Jovanović°

Rezime: Zajednička agrarna politika EU predstavlja složenu dugoročnu politiku upravljanja poljoprivredom i ruralnim razvojem. Nakon brojnih reformi koje nisu uspele da održe kvalitet prirodnog kapitala, Evropska komisija odlučila se na radikalno rešenje u vidu nove koncepcije "zelene" agrarne politike. Zeleno računovodstvo, kao mlada računovodstvena disciplina, predstavlja pouzdanu informacionu osnovu za realizaciju nove reforme "zelene" agrarne politike EU, što su pokazali i rezultati prvih istraživanja sprovedenih na temu doprinosa zelenog računovodstva očuvanju prirodnog kapitala. U uslovima primene novih mera agrarne politike koje treba da spreče devastaciju prirodnog kapitala, zeleno računovodstvo ima potencijal da pruži značajan doprinos realizaciji nove "zelene" reforme agrarne politike EU.

Ključne reči: zeleno računovodstvo, prirodni kapital, "ozelenjavanje" Zajedničke agrarne politike EU

1. Uvod

Promena klimatskih faktora, u vidu pojave velikih suša ili poplava, nestanak pojedinih biljnih i životinjskih vrsta, kao i mnogi drugi klimatski problemi uslovili su potrebu za drugačijim tretmanom prirodne sredine od strane zakonodavaca. Pored toga, neracionalna potrošnja vode, isušivanje zemljišta, krčenje šuma i slične aktivnosti u cilju

* Univerzitet u Nišu, Republika Srbija, ORCID 0000-0001-9416-6914,

✉ arsenijevicva@yahoo.com

• Univerzitet u Nišu, Ekonomski fakultet, Republika Srbija, ORCID 0000-0001-8796-4619,

✉ ljilja.antic@eknfak.ni.ac.rs

° Univerzitet u Nišu, Ekonomski fakultet, Republika Srbija, ORCID 0000-0003-0937-9195,

✉ sonja.jovanovic@eknfak.ni.ac.rs

UDK 502.1:657]:338.43.02(4-672EU)

ispunjavanja poljoprivrednih ciljeva doveli su do opadanja kvantiteta i kvaliteta prirodnog kapitala. U savremenim, vrlo dinamičnim, uslovima poslovanja preduzeće mora biti svesno svog uticaja na ovu bitnu komponentu poslovanja, ali i njene globalne važnosti.

Zemlje članice Evropske unije vode Zajedničku agrarnu politiku (ZAP) kao jedan od osnovnih vidova njihove međusobne povezanosti. Zajednička agrarna politika EU je složena i dugoročna politika upravljanja poljoprivredom i ruralnim razvojem. U prvom delu rada biće predstavljeni pravci promena Zajedničke agrarne politike EU za period od 2021. do 2027. godine. Naime, nakon brojnih reformi i različitih programskih rešenja koja nisu uspeła da održe kvalitet prirodnog kapitala, Evropska komisija odlučila se na radikalno rešenje u vidu nove koncepcije "zelenog" ZAP-a. Drugim rečima, biće sagledani ciljevi nove reforme u sedmogodišnjem periodu, sa posebnim osvrtom na „ozelenjavanje“ ZAP-a. Insistiranje na ekološki održivom razvoju poljoprivrede, uz veće institucionalne nadležnosti zemalja članica, su ključne ideje agrarne politike u tekućem programskom periodu.

U drugom delu rada, biće reči o zelenom računovodstvu koje se smatra važnim alatom za razumevanje svih aspekata uticaja prirodnog okruženja na ekonomiju, odnosno njihovog intermedijalnog odnosa. Informacije koje proizvodi zeleno računovodstvo pokazuju relacije između komponenti prirodnih resursa, njihov doprinos ekonomskom razvoju i troškove koji nastaju zbog njihove degradacije. Od značaja je prikaz različitih studija sprovedenih radi utvrđivanja uticaja poslovnih odluka u agrosektoru u okviru Zajedničke agrarne politike EU na prirodnu sredinu.

Usmeravanje pažnje na zaštitu životne sredine i održivi razvoj uslovalo je nastanak fleksibilnijeg upravljačkog instrumenta, tzv. zelenog računovodstva koji pruža preciznije informacije za donošenje poslovnih odluka u odnosu na tradicionalno upravljačko računovodstvo. Takođe, bez obzira na dalekosežne posledice sprovedenih reformi agrarne politike EU, u ovom radu fokus će biti na njenu poslednju reformu. Naime, reperkusije poslednje reforme agrarne politike EU u sadašnjem trenutku imaju bitan uticaj na potencijale korišćenja zelenog računovodstva.

2. Nova reforma agrarne politike Evropske unije

Zajednička agrarna politika EU postoji već više od šest decenija. Različiti unutrašnji (na primer, heterogenost zajedničkog tržišta EU) i spoljašnji faktori (kao što su uslovi Svetske trgovinske organizacije o smanjenju protekcionizma) usloveli su njene brojne reforme. Poslednja u nizu, odnosno Sporazum o reformi Zajedničke agrarne politike zvanično je usvojen 2. decembra 2021. godine. Međutim, usled brojnih ograničenja izazvanih, pre svega, krizom prouzrokovanom kovid pandemijom, početak njene primene je odložen za 2023. godinu.

Značajne promene u klimatskim uslovima na planeti Zemlji i potreba da se zaštiti životna sredina predstavljaju osnovne razloge sprovođenja nove reforme ZAP-a. Problemi klimatskih promena vremenski su se poklopili sa problemom globalne kovid pandemije i političkim promenama u EU (izlazak Ujedinjenog kraljevstva Velike Britanije i Severne Irske iz EU, tzv. Bregzit). Upravo razumevanje načina na koji će klimatske promene uticati na svetsko tržište hrane smatra se presudnim uslovom za rešavanje budućih izazova u oblasti prehrambene bezbednosti (Blanco et al., 2017). Ideja vodilja nove reforme ZAP-a je "ozelenjavanje" agrarne politike EU, odnosno radikalni zaokret ka ekološkim ciljevima.

Zeleno računovodstvo u funkciji nove agrarne politike Evropske unije

Svaka reforma agrarne politike EU imala je značajan upliv na druge oblasti zajedničkog delovanja država u okviru EU. Međutim, čini se da ni jedna od njih nije ostvarila pomak u ideološkom i materijalnom domenu kao reforma za period 2023-2027. godine. S jedne strane, krajem druge decenije 21. veka predstavljena je strategija „Evropski zeleni dogovor“ (*European Green Deal*) koja ima za cilj redizajniranje evropskog sistema poljoprivredne proizvodnje. Ova strategija naslanja se na Pariski sporazum o klimatskim promenama iz 2015. godine. Naime, Evropski sistem proizvodnje hrane ima značajne reperkusije na globalne klimatske promene i to, pre svega, zbog korišćenja ogromne količine prirodnih resursa u svrhe poljoprivredne proizvodnje. Ovo rezultira opadanjem kvantiteta i kvaliteta tih resursa i gubitkom biodiverziteta. Štaviše, procena je da skoro jedna trećina globalne emisije gasova sa efektom staklene bašte proizilazi iz poljoprivredno-prehrambenih sistema. Drugim rečima, potrebno je obezbediti proizvodnju kvalitetne hrane uz ostvarenje prehrambene bezbednosti i načela zdravlja sa istovremenim poštovanjem ambicija ekološke i zdravstvene prirode (Jović et al., 2022, 263-266). S druge strane, prvi put u svojoj istoriji, Zajednička agrarna politika smanjila je svoje učešće u ukupnom budžetu EU na ispod 30%, dok se u odnosu na prethodni programski period (2014-2020.) ukupna sredstva podrške poljoprivredi smanjuju za 15% (Đurić et al., 2020, 38-39).

Zajednička agrarna politika EU za period od 2021. do 2027. godine se zasniva na deset specifičnih ciljeva, kao što je prikazano na slici 1. Specifični ciljevi su: obezbeđivanje adekvatnog dohotka poljoprivrednicima, povećanje konkurentnosti, poboljšanje pozicije poljoprivrednika u lancu snabdevanja hranom, borba protiv klimatskih promena, zaštita životne sredine, očuvanje predela i biodiverziteta, opstanak mladih na poljoprivrednim gazdinstvima, oživljavanje ruralnih područja, proizvodnja zdrave i bezbedne hrane, podsticanje inovacija i edukacija (European Commission, 2022; Jović et al., 2022, 265).

Slika 1: Osnovni ciljevi ZAP za period 2021-2027. godine



Izvor: European Commission, 2022; Jović et al., 2022, 265

Ovu reformu karakteriše minimalna izmena u domenu mera (ekonomskih, ekoloških i socijalnih mera) i instrumenata agrarne politike koji služe realizovanju specifičnih ciljeva agrarne politike. Ključne promene odnose se na način sprovođenja agrarne politike,

odnosno na obezbeđivanje veće nadležnosti zemljama članicama EU u upravljanju agrarnom politikom u cilju povećanja efikasnosti (Wieliczko, 2019). Finansiranje mera zavisi od stepena prioriteta i oblasti delovanja i može biti iz fondova Evropske unije i/ili budžeta zemalja članica. S jedne strane, iz fondova EU finansiraće se mere za ostvarivanje ciljeva ekonomske održivosti poljoprivrednih gazdinstava, zatim prilagođavanje poljoprivrede klimatskim promenama, kao i obezbeđenje smene generacija poljoprivrednika. S druge strane, mere koje se odnose na proizvodnju zdravstveno bezbedne hrane, dobrobit domaćih životinja ili očuvanje biodiverziteta, biće finansirane iz nacionalnih budžeta. Treća mogućnost je kofinansiranje između EU i njenih članica i to mera koje se odnose na rast konkurentnosti agrarnog sektora, održivo upravljanje prirodnim resursima i zaposlenost (Đurić et al., 2020, 37).

I pored toga što je ova reforma, kao uostalom i prethodne, skoncentrisana na rast konkurentnosti pored proklamovanja "ozelenjavanja", odnosno ekološke dimenzije, i veće pravednosti, odnosno socijalne dimenzije agrarne politike, dolazi do nezahvalne *trade-off* situacije između ciljeva ekonomske, socijalne i ekološke prirode (Coderoni et al., 2021). Posledično, to može usloviti pojavu teškoća u zadovoljavanju potreba za stabilnim prinosima i ostvarenju prehrambene sigurnosti u kriznim i turbulentnim periodima (Dobbs et al., 2021). S tim u vezi, brojne su prepreke sa kojima se suočava nova reforma. Na primer, rezultati "klimatskih investicija" drugačije su prirode u odnosu na profitnu prirodu investicionih ciljeva (Long & Blok, 2021). Novim poljoprivrednim praksama najviše je ugrožena stočarska proizvodnja, jer se ističe neophodnost povećanja poljoprivrednih površina pod organskom proizvodnjom, što dovodi do smanjenja neto dohodaka utvrđenih kroz izvršenu analizu osetljivosti na primenu mera ekološki i klimatski orijentisane proizvodnje u stočarstvu (Jongeneel et al., 2021). Na osnovu različitih analiza utvrđena je mogućnost smanjenja proizvodnje i prinosa čak do 30% za pojedine poljoprivredne kulture, dok bi prosek smanjenja svih useva prema proračunima mogao iznositi 10-20% (Bremmer et al. 2021). Dalje, smanjivanje sredstava namenjenih poljoprivrednom sektoru može se negativno odraziti na evropsku poljoprivredu. Pri tome, sredstva namenjena direktnoj podršci smanjena su u odnosu na prethodni programski period za 11%, dok su sredstva za finansiranje mera ruralnog razvoja smanjena za 28% (Wieliczko, 2019). I pored toga, ZAP ostaje druga po redu zajednička politika EU, kada je u pitanju obim njenog finansiranja (Đurić et al., 2020, 38-39).

3. Zeleno računovodstvo

Često se održivi razvoj definiše kao razvoj koji zadovoljava potrebe sadašnje generacije bez ugrožavanja sposobnosti budućih generacija da zadovolje svoje potrebe. Ovakav razvoj podrazumeva smanjenje siromaštva, unapređenje kvaliteta života i smanjenje nivoa zagađenosti. Drugim rečima, održivi razvoj čini ekonomska, ekološka i socijalna održivost. Ciljevi održivog razvoja preduzeća odnose se na uspostavljanje sistema kojim će se izbalansirati ekonomski razvoj sa odgovornom potrošnjom resursa i boljom zaštitom životne sredine (Sekerez, 2016).

"Širenje svesti o kvalitetu životne sredine ne treba tražiti samo u primeni ekotehnologija već i u ekološkoj etici, jer bez nje nema opstanka čoveka i očuvanja životne sredine" (Antić et al., 2021, 53). S tim u vezi može se reći da zeleno računovodstvo predstavlja analitičko sredstvo ekološke etike. Zeleno računovodstvo, odnosno ekološko upravljačko računovodstvo nastaje kada tradicionalnim metodama upravljačkog

Zeleno računovodstvo u funkciji nove agrarne politike Evropske unije

računovodstva dodamo ekološku dimenziju poslovanja preduzeća. U savremenim uslovima kada se kao bitan cilj poslovanja nameće isticanje odgovornog poslovanja preduzeća, "menadžment donosi određene odluke po pitanju konfiguracije računovodstvenog sistema koji proizvodi informacije neophodne za utvrđivanje rezultata preduzeća i stepena ostvarivanja cilja" (Arsenijević et al., 2023, 401).

3.1. Potreba za zelenim računovodstvom

U literaturi domaćih autora za mladu računovodstvenu disciplinu, koja se bavi izučavanjem brojnih ekoloških troškova i njihovim uticajem na poslovanje preduzeća i životnu sredinu, javljaju se različiti termini - ekološko računovodstvo, računovodstvo zaštite životne sredine, zeleno računovodstvo ili računovodstvo okruženja. U ovom radu će biti korišćen termin *zeleno računovodstvo* kako bi se istakla njegova povezanost sa "zelenom" reformom agrarne politike o čemu će biti reči u nastavku rada. Treba istaći da ne postoji opšteprihvaćena i univerzalna definicija zelenog računovodstva. Međunarodna federacija računovođa definiše zeleno računovodstvo kao "upravljanje ekološkim i ekonomskim performansama posredstvom razvoja i primene odgovarajućih računovodstvenih sistema i praksi povezanih sa zaštitom životne sredine" (IFAC, 2005, 16).

Pojava zelenog računovodstva vezuje se za kraj 20. veka i konsekvence negativnih uticaja poslovanja preduzeća na prirodnu sredinu. Kako bi se smanjili negativni uticaji poslovanja preduzeća na prirodnu sredinu, potrebno je da se identifikuju. U procesu upravljanja zaštitom životne sredine od izuzetnog značaja su informacije koje pruža zeleno računovodstvo. Ekološka dimenzija zelenog računovodstva doprinela je da upravljačko računovodstvo dobije značajnu ulogu u upravljanju resursima i njihovom efikasnijem korišćenju, kako sa finansijskog tako i sa ekološkog stanovišta (Radukić & Stevanović, 2011).

Zeleno računovodstvo omogućava preduzećima da lakše identifikuju ekološke troškove svog poslovanja, da njima upravljaju, kao i da izveštavaju o uticaju svog poslovanja na životnu sredinu. Međutim, ekološki troškovi vrlo često su skriveni u preduzeću i teško se prepoznaju. Drugim rečima, u cilju obezbeđivanja adekvatnih informacija o ekološkim troškovima, preduzeće mora imati odgovarajući sistem obračuna troškova. Na primer, kako ekološki troškovi pripadaju opštim troškovima, obračun troškova zasnovan na aktivnostima omogućava praćenje ekoloških troškova po proizvodima i aktivnostima pomoću relevantnih uzročnika koji izazivaju te troškove. Važan korak u primeni metode je identifikovanje uzročnika potrošnje resursa kako bi se alocirali troškovi resursa na svaku aktivnost, kao i uzročnika aktivnosti kako bi se troškovi sa aktivnosti alocirali na objekte troškova. Zeleno računovodstvo obezbeđuje informacije finansijskog i nefinansijskog karaktera. Nefinansijske informacije odnose se na fizičke jedinice mere, dok se informacije finansijskog karaktera odnose na novčano izražene vrednosti tokova i koristi. Ove informacije su od primarnog značaja prilikom upravljanja troškovima i smanjenja negativnih uticaja preduzeća na životnu sredinu (Antić et al., 2021, 58-60).

3.2. Zeleno računovodstvo i Zajednička agrarna politika Evropske unije

Zajednička agrarna politika EU je od svog osnivanja do danas prošla kroz značajne reforme. Decenijama se smenjuju instrumenti kojima ZAP teži da ostvari postavljene ciljeve. U ovom delu rada biće razmatran uticaj brojnih mera ZAP-a na stanje životne sredine u EU. Konkretno, biće analizirane različite studije koje su sprovedene sa ciljem da

se ukaže na uticaj agrarnog sektora na prirodnu sredinu. Ova istraživanja odnose se na tadašnju državu članicu EU i neto davaoca sredstava, Ujedinjeno kraljevstvo Velike Britanije i Severne Irske. Naime, efekti raznih mera mogu pokazati svoj pravi karakter godinama nakon njihovog sprovođenja i zato se "debate koje okružuju ZAP više od dve decenije mogu tumačiti kao različiti stavovi o veličini određenih tržišnih pokazatelja, posebno tržišnih otkaza (Buckwell, 2005, 187)."

U studiji *Green Accounting for Agriculture* (Buckwell, 2005) vrši se poređenje rezultata istraživanja pet različitih studija i izvode zaključci o uticaju poljoprivrede na životnu sredinu. Teoretičari Adger i Vitbi (Adger & Whitby, 1993) postavili su osnove u primeni zelenog računovodstva u agrosektoru u Ujedinjenom kraljevstvu svojim radom "Računovodstvo prirodnih resursa u poljoprivrednom sektoru: teorija i praksa (*Natural Resource Accounting in the Land Use Sector: Theory and Practice*). Oni su izvršili procenu eksternih efekata agrosektora na prirodnu sredinu. Sledeću ovakvu procenu izvršila je grupa autora na čelu sa Pritijem (Pretty et al., 2000) u radu "Procena ukupnih eksternih troškova agrarnog sektora Ujedinjenog kraljevstva" (*An Assessment of the Total External Costs of UK Agriculture*). Zatim su Hartridž i Pirs (Hartridge & Pearce, 2001) objavili rad "Da li postoji održivost agrarnog sektora Ujedinjenog kraljevstva? Računovodstveni podaci obogaćeni ekološkim procenama" (*Is UK Agriculture Sustainable? Environmentally Adjusted Economic Accounts for UK Agriculture*). Ubrzo je objavljena velika studija na temu "Poljoprivredni i prirodni resursi: benefiti, troškovi i potencijalna rešenja" (*Agriculture and Natural Resources: Benefits, Costs and Potential Solutions*) od strane Agencije za zaštitu životne sredine (Environment Agency, 2002). Poslednja u ovom nizu studija koja će biti sagledana je "Okvir za razvoj ekoloških pokazatelja u agrarnom sektoru" (*Framework for Environmental Accounts for Agriculture*) Instituta za Evropsku politiku zaštite životne sredine (EFTEC/IEEP, 2004).

U Tabeli 1. prikazan je uticaj agrosektora na vodu, vazduh, zemljište, pejzaže, životna staništa i prirodne vrste, zatim na količinu otpada. Takođe, sagledava se i uticaj na potencijalna ograničenja u daljem obnavljanju i razvijanju prirodnih resursa. Svi podaci izraženi su u milionima funti prema procenama gore pomenutih teoretičara.

Tabela 1: Kalkulacije efekata agrosektora na prirodnu sredinu (u 000000 funti)

	Whitby and Adger	Pretty et al.	Hartridge and Pearce	Agencija za zaštitu životne sredine	EFTEC/IEEP
Smanjenje prirodnog kapitala					
Voda	12	231	428	203	470
Vazduh	Nema procene	1113	585	760	956
Zemljište	Nema procene	96	21	264	9
Pejzaž	Nema procene	99	Nema procene	Nema procene	Nema procene
Staništa i vrste	66	27	38	Nema procene	Nema procene
Otpad	Nema procene	Nema procene	Nema procene	Nema procene	15
Ugrožavanje razvoja prirodnih resursa	Nema procene	Nema procene	Nema procene	Nema procene	Nema procene
Ukupno	78	1556	1072	1227	1450
Povećanje prirodnog kapitala					
Voda	Nema procene	Nema procene	Nema procene	Nema procene	Nema procene
Vazduh	150	Nema procene	Nema procene	Nema procene	Nema procene
Zemljište	Nema procene	Nema procene	Nema procene	Nema procene	Nema procene

Zeleno računovodstvo u funkciji nove agrarne politike Evropske unije

Pejzaž	1008	Nema procene	225	Nema procene	488
Staništa i vrste	Nema procene	Nema procene	370	Nema procene	740
Otpad	Nema procene	Nema procene	Nema procene	Nema procene	Nema procene
Ugrožavanje razvoja prirodnih resursa	Nema procene	Nema procene	Nema procene	Nema procene	Nema procene
Ukupno	1158	Nema procene	595	Nema procene	1228
Neto ekonomska prilagodavanja	+1080	-1566	-477	-1227	-222

Izvor: Prilagođeno prema: Buckwell, 2005, p. 189.

Analiza iz prethodne tabele bazirana je na informacijama koje proizvodi zeleno računovodstvo, a koje "razlikuje ili teži da razlikuje tok novca, promene u ceni i u broju akcija preduzeća, efekte koji potiču od agrosektora nasuprot onih koji potiču iz ostalih sektora, i efekte agrosektora na ukupno ekonomsko blagostanje nasuprot efekata iz ostalih sektora" (Buckwell, 2005, 190). Međutim, teoretičar Buckwell, je isticao da treba biti obazriv prilikom korišćenja ovih podataka, ako se uzme u obzir činjenica da je "zeleno računovodstvo tek na početku svog razvoja" (Buckwell, 2005, 190), odnosno u pitanju je mlada računovodstvena disciplina.

Kao što se može videti iz tabele, uticaj agrosektora na prirodnu sredinu može biti kako negativan tako i pozitivan. Analizom podataka iz tabele može se zaključiti sledeće (Buckwell, 2005, 190):

- agrosektor ima pozitivne i negativne efekte na prirodnu sredinu i ovi efekti su, prema podacima različitih istraživanja prikazanim u tabeli, slično procenjeni;
- postoji određena varijacija u individualnim komponentama pojedinih studija;
- najveći negativni efekti ispoljeni su na vazduhu i vodi;
- najveći pozitivni efekti su ostvareni na prirodnom staništu i vrstama, kao i na pejzažu, s tim što poslednja studija pokazuje više pozitivnih efekata nego druge;
- definisanje granica sektora pravi veliku razliku u rezultatima studija – na primer, Vitbi i Adger su u svojoj studiji iz 1993. analizirali ceo agrosektor (obuhvatili su i poljoprivredu i šumarstvo) i doneli su različit zaključak u odnosu na ostale studije kada je u pitanju uticaj na vazduh (pozitivan efekat).

Poslednja studija, kao najobimnije istraživanje koje je sprovedeno, obezbeđuje objedinjavanje teorijskih osnova zelenog računovodstva i povezivanje sa konceptom održivosti. Koristi metodologiju koja obezbeđuje opis i kvantifikaciju pozitivnih i negativnih fizičkih efekata agrosektora na okruženje. Studija obuhvata relevantnu literaturu o ekonomskoj vrednosti ovih uticaja i razvija metod transfera benefita kako bi se omogućilo njihovo korišćenje, ali i povezuje fizičke i finansijske podatke koristeći njihovu međuzavisnost kako bi se objasnio doprinos agrosektora ovim efektima (Buckwell, 2005, 190). U analizi je moguće uočiti i pretpostaviti da i sami istraživači imaju svoje dileme. Ovo je očigledno kroz nedostatak sumiranja rezultata i davanje mišljenja o pozitivnom ili negativnom uticaju agrosektora na prirodu. Takođe, nema izvedenih zaključaka o efektima bilo koje od četiri aktivnosti koje su autori predložili za konstruisanje finansijskog bilansa prirodne sredine, a to su (Buckwell, 2005, 190):

- 1) utvrđivanje ekonomske mere održivosti agrosektora i prave mere kvaliteta života;
- 2) utvrđivanje indikatora koji pokazuje stepen u kome je agrosektor neto donator nacionalnom bogatstvu, kao i koliki su efekti na blagostanje od strane ostalih sektora;

- 3) prikupljanje informacija koje se mogu koristiti za definisanje agrarne politike;
- 4) prikupljanje inputa za cost-benefit analizu, odnosno analizu troškova i koristi agrosektora i sa njima povezane politike zaštite prirodne sredine.

Uprkos prethodnom, određeni autori (Pezzey et al., 2005) smatraju da je poslednja studija iz tabele dala veliki doprinos razvoju zelenog računovodstva i da "prezentovani okvir zelenog računovodstva nema grešaka (jazova) u svom teorijskom razvoju". Međutim, "na osnovu same činjenice da decenija i više stoji između prve i poslednje procene troškova iz tabele sasvim je jasno da je empirijska baza za definisanje ovih kalkulacija različita, odnosno da je prezentovani okvir sa jazovima" (Buckwell, 2005, 190).

Na osnovu podataka iz tabele uočava se da od pet obuhvaćenih studija, čak četiri pokazuju neto negativan uticaj agrosektora na prirodnu sredinu. Različitim rezultatima ovih istraživanja doprinosi i činjenica da se fizički i finansijski podaci odnose na različite periode i da su utvrđeni pri različitim računovodstvenim uslovima (politikama). To znači da treba isticati potencijalni doprinos zelenog računovodstva na smanjenje ovog negativnog uticaja. Zatim, samo je poslednja studija izračunala koliki je negativni uticaj agrarnog sektora na stvaranje otpada, dok nijedna od njih nije bila u mogućnosti da utvrdi uticaj agrarnog sektora na dalje obnavljanje i razvijanje prirodnih resursa. Smatramo da ta nemogućnost nastaje usled nepredvidivog karaktera raznih mera i instrumenata agrarne politike u dovoljno dugom vremenom periodu.

Uzimajući u obzir sve rezultate, zapažanja i razlike u obuhvatnosti pojedinih studija, kao i zbog postojanja "trenutnih ograničenja u podacima i nekompletnog razumevanja međuzavisnosti koja postoji između prakse agrosektora i njihovih inputa, prirodne sredine i ekonomskih rezultata" ističe se da upoređivanja različitih studija i sagledavanje kvaliteta prirodnih resursa u vremenu "ostaje cilj pre nego realnost ovog trenutka" (Buckwell, 2005, 190).

Ono što je bitno napomenuti je da su ovi radovi objavljeni u desetogodišnjem periodu na razmeđu 20. i 21. veka i da pokazuju da se još tada znalo, a ne samo pretpostavljalo kuda vodi agresivno korišćenje prirodnog kapitala u agrarne svrhe. Agrarni sektor je neodvojiv od prirode u kojoj se realizuje poljoprivredna proizvodnja i to je glavna poruka koju daje nova "zeleni" reforma agrarne politike EU. Zato preduzeća svoje napore treba da usmere ka prepoznavanju ekoloških trendova, jer pravovremena identifikacija dovodi kako do njihovog smanjenja tako i do smanjenja negativnog uticaja na životnu sredinu. Efikasnim upravljanjem ekološkim troškovima olakšava se donošenje poslovnih odluka u preduzeću i doprinosi povećanju ekoloških performansi, što je u skladu sa ciljem preduzeća da prikaže dobru sliku o sebi.

4. Zaključak

Budući da je težnja za konstantnim rastom agrarne proizvodnje iznedrila ekološke probleme i degradaciju životne sredine, Evropska komisija je, prvo, kreirala novu strategiju "Evropski zeleni dogovor" sa ciljem transformacije celokupne ekonomije EU u resursno efikasnu i konkurentnu ekonomiju, i drugo, izvršila reformu agrarne politike u smeru njenog "ozelenjavanja". Njen cilj je da Evropa bude prvi klimatski neutralan kontinent, što podrazumeva da se koriste obnovljivi izvori energije i da se rast obezbedi bez nastanka neotklonjive štete na prirodnim resursima.

Zeleno računovodstvo u funkciji nove agrarne politike Evropske unije

Zeleno računovodstvo, kao mlada računovodstvena disciplina, predstavlja izvor informacija neophodnih za realizaciju nove reforme "zelene" agrarne politike EU. Doprinos zelenog računovodstva ogleda se u adekvatnom vrednovanju prirodnog kapitala, njegovom detaljnijem obuhvatanju u finansijskim izveštajima, kao i u naglašavanju jednake važnosti prirodnom kapitalu kao i ostalim vrstama kapitala za poslovanje preduzeća.

Jedna od glavnih svrha računovodstva je da obezbedi komparacije finansijskih podataka. Stoga smo u ovom radu razmatrali uticaj agrarnog sektora na prirodni kapital posmatrano iz ugla različitih teoretičara na bazi informacija zelenog računovodstva. Na osnovu prvih studija sprovedenih na ovu temu u Ujedinjenom kraljevstvu utvrđeno je da su teoretičari imali različita zapažanja po pitanju uticaja (pozitivnog ili negativnog) agrarnog sektora na prirodnu sredinu. S obzirom na to da Ujedinjeno kraljevstvo nije više država članica EU biće zanimljivo posmatrati koja država će preuzeti primat kada su u pitanju empirijska istraživanja na temu uticaja agrarnog sektora na prirodni kapital. Ono što je sigurno je to da EU poslednjih decenija menja svoje prioritete u nastojanju da u što većoj meri obezbedi poštovanje principa održivog razvoja i smanji negativne efekte poljoprivrede na životnu sredinu. Zaključak je da značajnu pomoć u sprovođenju "zelene" reforme agrarne politike može pružiti zeleno računovodstvo svojim metodama vrednovanja prirodnog kapitala.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Literatura

- Adger, W.N., Whitby, M.C. (1993) Natural resource accounting in the land use sector: theory and practice. *European Review of Agricultural Economics*: 20, str. 77-97.
- Antić, Lj., Stevanović, T., Milenović, J. (2021). Environmental activity-based costing as an instrument of environmental management accounting (Obračun ekoloških troškova zasnovan na aktivnostima kao instrument ekološkog upravljačkog računovodstva). *Ekonomski pogledi*: Vol. 23, No. 1, str. 53-68.
- Arsenijević, A., Antić, Lj., Stevanović, T. (2023) Potencijali primene throughput računovodstva, *International Scientific Conference – Smart and sustainable: trends and perspectives*, Faculty of Economics, University of Niš, 2023, 401-408.
- Blanco, M, Ramos, F., Von Doorslaer, B., Martinez, P., Fumagalli, D., Ceglar, A., Fernández, F. J. (2017). Climate change impact on EU agriculture: A regionalized perspective taking into account market - driven adjustment, *Agricultural System*, No. 156 (2017), str. 52-66.
- Bremmer, J., Gonzalez-Martinez, A., Jongeneel, R., Huiting, H., & Stokkers, R. (2021). Impact Assessment Study on EC 2030 Green Deal Targets for Sustainable Food Production. Wageningen, Wageningen Economic Research, Report.
- Buckwell, A. (2005) Green Accounting for Agriculture. *Journal of Agricultural Economics*: 56(2), str. 187-215.
- Coderoni, S., Helming, J., Pérez-Soba, M., Sckokai, P., & Varacca, A. (2021). Key policy questions for ex-ante impact assessment of European agricultural and rural policies. *Environmental Research Letters*, 16(9), 094044.
- Dobbs, M., Gravey, V., & Petetin, L. (2021). Driving the European Green Deal in turbulent times. *Politics and Governance*, 9(3), str. 316-326.

- Đurić, K., Tomaš Šimin, M., Glavaš Trbić, D., Lukač Bulatović, M. (2020). Izazovi zajedničke agrarne politike Evropske unije u periodu posle 2020. godine. *Ekonomija - teorija i praksa*, godina XIII, broj 3, str. 34-47.
- EFTEC/IEEP (2004) Framework for Environmental Accounts for Agriculture. Available under Economic Reports: www.defra.gov.uk
- Environment Agency (2002) Agriculture and Natural Resources: Benefits, Costs and Potential Solutions. Prepared for Land Quality: www.environment-agency.gov.uk
- European Commission (2022). The common agricultural policy. Retrieved from https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-2023-27_en
- Hartridge, O., Pearce, D. (2001) Is UK Sustainable? Environmentally adjusted Economic Accounts for UK Agriculture. Economic Paper: University of London.
- International Federation of Accountants (2005). International Guidelines Document: Environmental Management Accounting. New York: IFAC.
- Jongeneel, R., Silvis, H., Martinez, A. G., & Jager, J. (2021). The Green Deal: An assessment of impacts of the Farm to Fork and Biodiversity Strategies on the EU livestock sector.
- Jović, L.V., Đokić, D., Zekić, S. (2022). Nova zajednička agrarna politika Evropske unije (2023-27) i potencijalne implikacije na poljoprivredu Srbije. XXVII Internacionalni naučni skup "Strategijski menadžment i sistemi podrške odlučivanju u strategijskom menadžmentu", Subotica, str. 263-269.
- Long, T. B., & Blok, V. (2021). Niche level investment challenges for European Green Deal financing in Europe: lessons from and for the agri-food climate transition. *Humanities and Social Sciences Communications*, 8(1), 1-9.
- Pezzey, J.V.C., Hanley, N., Turner, K., Tinch, D. (2005) Augmented Sustainability Measures for Scotland. *Ecological Economics*, vol. 57, no. 1, pp. 1-60.
- Pretty, J.N., Brett, C., Gee, D., Hine, R.E., Mason, C.F., Morrison, J.I.L., Raven, H., Rayment, M.D., Van der Bijl, G. (2000) An Assessment of the Total External Costs of UK Agriculture. *Agricultural Systems*: 65, str. 113-136.
- Radukić, S. & Stevanović, T. (2011). Ekološki zahtevi i njihov računovodstveni tretman. *Ekonomске teme*, 111-121.
- Sekerez, V. (2016). Regulatorni okvir i kvalitet izveštavanja o održivom razvoju. *Ekonomске ideje i praksa*, 20, str. 53-68.
- Wieliczko, B. (2019). Planned Shape of the CAP 2021 – 2027 versus Globalisation and Integration Process, *Problems of World Agriculture*, 19(2), 224 – 232.

GREEN ACCOUNTING IN THE FUNCTION OF THE NEW AGRICULTURAL POLICY OF THE EUROPEAN UNION

Abstract: *The EU's common agricultural policy is a complex and long-term policy for managing agricultural and rural development. After numerous reforms that failed to maintain the quality of natural capital, the European Commission decided on a radical solution in the form of a new conception of "green" agricultural policy. Green accounting as a young accounting discipline represents a reliable information base for the realization of the new reform of the "green" agricultural policy of the EU, which is shown on the basis of the results of the first research conducted on the topic of the contribution of green accounting to the preservation of natural capital. In conditions such as new agricultural policy measures that should prevent the devastation of natural capital, green accounting can be of exceptional importance.*

Key words: *environmental accounting, natural capital, EU's green agricultural policy*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**PRAVNI ASPEKTI I STATUS FENOMENA VEŠTAČKE
INTELIGENCIJE U PRAVU MEĐUNARODNE TRGOVINE**

Tamara Milenković-Kerković*

Ružica Petrović*

Dragana Radenković Jocić*

Abstrakt: Veštačka inteligencija (AI) je postala glavna tehnološka poluga XXI veka. Pod njenim uticajem menjaju se društveni odnosi u jednoj zemlji, zanimanja, trgovinske politike, pravni i ekonomski odnosi na međunarodnom nivou i delovanje međunarodnih organizacija, koje su primorane da svoju tradicionalnu delatnost transformišu i prilagode novonastalim okolnostima. Pitanje uticaja AI na pravo uopšte, a posebno na međunarodno trgovinsko pravo, zauzima značajnu poziciju poslednjih godina. Ova tehnologija pruža mnogo mogućnosti, ali istovremeno predstavlja opasnost za pojedince i privredne subjekte. Zato se pravo trudi da zaštiti subjekte u pravu normama, smernicama i principima i da što pre dođe do specifičnih AI pravila. Kako je život uvek brži od prava, subjekti su primorani da primenjuju neka već postojeća pravila na novonastale okolnosti. To predstavlja veliki izazov za međunarodno trgovinsko pravo.

Ključne reči: Veštačka inteligencija (AI), regulativa, sporazumi o digitalnom partnerstvu, WTO sporazumi

Uvod

Četvrta industrijska revolucija uticala je na korenitu transformaciju društvenih i pravnih odnosa, a možda najviše na promenu privrednih odnosa. Razvoj tehnologije izmenio je i unapredio proizvodnju, distribuciju i prodaju proizvoda i usluga. Nove digitalne tehnologije iznedrile su nove proizvode i nove načine pružanja usluga. Kao

* Ekonomski fakultet Univerziteta u Nišu, Srbija, ORCID 0009-0004-0342-6194,

✉ tamara.kerkovic@eknfak.ni.ac.rs

* Ekonomski fakultet Univerziteta u Nišu, Srbija, ORCID 0000-0002-7427-6486,

✉ ruzica.petrovic@eknfak.ni.ac.rs

* Ekonomski fakultet Univerziteta u Nišu, Srbija, ORCID 0000-0002-3272-7488

✉ draganarj61@gmail.com

UDK 004.8:[347.7:339.56

dominantna tehnologija u XXI veku pojavljuje se veštačka inteligencija (eng. *Artificial Intelligence - AI*). Iako ne predstavlja apsolutno nov koncept, veštačka inteligencija se tek u poslednjoj deceniji uvrstila u globalna pitanja koja zahtevaju brzu intervenciju. Kako je reč o tehnologiji koja se jako brzo razvija i usložnjava, raste potreba da se društvo, pojedinci i čitavo čovečanstvo zaštiti. Veštačka inteligencija pruža mogućnost da se unapredi međunarodna prodaja i potrošnja dobara i usluga koje se oslanjaju na ovu tehnologiju. Intenzivira se promet AI-proizvoda, usluga koje su podržane veštačkom inteligencijom, ali i prekogranični protok podataka, kao jedne od osnovnih komponenti veštačke inteligencije. Ovakvo stanje u globalnoj ekonomiji zahteva adekvatnu reakciju međunarodnog trgovinskog prava.

Rad se bavi pitanjem koncepta veštačke inteligencije i njenih komponenti, kao i pitanjem pojedinih nacionalnih regulativa koje normiraju sve ili samo neke od osnovnih elemenata AI koncepta. Zatim se autori trude da ilustruju probleme sa kojima se multilateralni okvir međunarodne trgovine suočava u vremenu dominacije AI i na koji način pokušava da odgovori na njih. Na kraju, rad daje prikaz odabranih preferencijalnih trgovinskih sporazuma, koji se odnose na digitalnu trgovinu uopšteno, a čije odredbe mogu poslužiti kao relevantne za AI trgovinu, u nedostatku jednog sveobuhvatnog multilateralnog sporazuma.

1. Koncept veštačke inteligencije kao pravni fenomen

1.1. Komponente AI iz perspektive uporedno pravnog regulisanja

Uprkos činjenici da je interesovanje za veštačku inteligenciju izuzetno poraslo proteklih godina, akademska i stručna javnost još uvek nije iznedrila preciznu i jedinstvenu definiciju ove pojave. Najčešći pristup u određivanju ovog fenomena jeste takav da se veštačka inteligencija određuje definisanjem odnosa između mašine i čoveka, ili određenjem inteligencije uopšte. Često se sreću definicije da su to mašine koje se ponašaju kao ljudi ili jesu sposobne da izvedu radnje koje zahtevaju inteligenciju (Samoili et al., 2020). AI je inkorporacija ljudske inteligencije u mašine (Jakhar & Kaur, 2020). Za Evropsku komisiju, veštačka inteligencija predstavlja tehnologiju koja kombinuje podatke, algoritme i računarsku snagu (European Commission, 2020). U članu 3 EU AI Act-a se navodi da je sistem AI sistem koji je zasnovan na mašinama i koji može za dati skup ciljeva, definisan od strane ljudi, generisati rezultate kao što su odluke, preporuke ili predviđanja koje utiču na okruženje (fizičko ili virtuelno) sa kojim stupaju u interakciju.¹

OECD grupa eksperata za veštačku inteligenciju određuje AI sisteme kao sisteme zasnovane na mašinama koji mogu da daju predviđanja, preporuke ili odluke koje utiču na realno ili virtuelno okruženje, s obzirom na skup definisanih ciljeva od strane ljudi, i dizajnirani su da rade na različitim nivoima autonomije (OECD, 2019:15).

¹Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act), dostupno na: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206>, pristupljeno: 1.8.2024.

Pravni status veštačke inteligencije u kontekstu međunarodnog trgovinskog prava

Visoka grupa eksperata za veštačku inteligenciju (eng. *The High-Level Expert Group on Artificial Intelligence*), imenovana od strane Evropske komisije za adekvatno sprovođenje strategije razvoja AI na nivou Evrope, dala je svoju definiciju veštačke inteligencije i AI sistema. Sistemi veštačke inteligencije su softverski (a možda i hardverski) sistemi koje su dizajnirali ljudi, da, s obzirom na složen zadati cilj, deluju u fizičkoj ili digitalnoj dimenziji sagledavajući svoje okruženje kroz prikupljanje podataka, tumačenje prikupljenih strukturiranih ili nestrukturiranih podataka i kroz rasuđivanje zasnovano na znanju. Oni obrađuju informacije izvedene iz ovih podataka i odlučuju o najboljim akcijama koje treba preduzeti da bi se postigao zadati cilj. AI sistemi mogu ili da koriste simbolička pravila ili da uče kroz numerički model, a takođe mogu da prilagode njihovo ponašanje analizirajući kako na okolinu utiču njihove prethodne akcije (Samoili et al., 2020:9).

Napred navedena definicija prihvaćena je i u Strategiji razvoja veštačke inteligencije u Republici Srbiji za period 2020–2025. godine. U njoj se navodi da se veštačka inteligencija odnosi na sisteme koji pokazuju razumno, inteligentno, ponašanje na osnovu analize svog okruženja i donose odluke – sa određenim stepenom autonomije – da ostvare konkretne ciljeve. Sistemi zasnovani na veštačkoj inteligenciji mogu biti bazirani isključivo na softveru i delovati u virtuelnom svetu (na primer, virtuelni asistenti, softveri za analizu fotografija, internet pretraživači, sistemi za prepoznavanje govora i lica) ili mogu biti ugrađeni u uređaje – hardver (na primer, napredni roboti, autonomna vozila, dronovi i slično) (Vlada RS, 2020:5).

Kao i većina tehnologija koje su digitalne, veštačka inteligencija se oslanja na tri ključne komponente: podatke, algoritme i mikroprocesore (Soprana, 2022). Sa stanovišta međunarodnog trgovinskog prava značajno je kako regulativa sve tri komponente u konačnom utiče na međunarodnu trgovinu.

Komercijalna primena AI i njen razvoj zasnovani su prvenstveno na podacima. Veštačkoj inteligenciji se moraju omogućiti veliki skupovi podataka (eng. *Big Data*) kako bi se dizajnirali AI modeli za predviđanje i analizu (Soprana, 2022:69). Podacima se obučavaju i AI algoritmi, koji predstavljaju specifične načine rešavanja nekog zadatog problema. Da bi se kreirali veliki skupovi podataka i omogućio pristup veštačke inteligencije njima, zahteva se nesmetan protok podataka preko granica (eng. *Cross-border Data Flow*) (Soprana, 2022). Norme i propisi koji se odnose na prekogranične tokove podataka mogu ometati AI trgovinu, pre svega da predstavljaju prepreku trgovini uslugama koje pokreće veštačka inteligencija. Pod takvim propisima podrazumevaju se zahtevi za lokalizaciju podataka i ograničenja u obliku zakona o zaštiti ličnih podataka i privatnosti (Casalini & González, 2019). Kina je 2017. godine usvojila Zakon o sajber bezbednosti.² U članu 37 ovog zakona navodi se da će operateri koji prikupljaju ili proizvode lične informacije ili važne podatke tokom operacija na kopnenoj teritoriji Narodne Republike Kine, iste čuvati unutar kontinentalne Kine. Kada je zbog poslovnih zahteva zaista neophodno obezbediti ih van kopna, operateri će slediti mere koje su zajednički formulisali državna odeljenja za sajber bezbednost i relevantna odeljenja Državnog saveta, a sve u cilju da bi se izvršila bezbedonosna procena i zaštita ličnih podataka. Na sličan način, Zakon o sajber bezbednosti Vijetnama iz 2018. godine (član 26.3), obavezuje entitete koji pružaju usluge na telekomunikacionoj mreži i internetu i u sajber prostoru u Vijetnamu, i uz to

² Cybersecurity Law of the People's Republic of China, dostupno na: <https://digichina.stanford.edu/work/translation-cybersecurity-law-of-the-peoples-republic-of-china-effective-june-1-2017/>, pristupljeno: 1.8.2024.

prikupljaju, analiziraju i obrađuju lične podatke korisnicima, iste skladište na teritoriji Vijetnama u vremenskom periodu utvrđenom u nacionalnom zakonodavstvu.³ Što se tiče zakona o zaštiti podataka i privatnosti, naiznčajniji primeri su GDPR - General Data Protection Regulation na nivou EU i Australia Privacy Act. Navedena uredba EU je na snazi od maja 2018. godine i predstavlja opšteprihvaćeni standard za zaštitu podataka. GDPR kao ideju vodilju promovise regulisanje obrade i slobodnog protoka ličnih podataka u EU.⁴ Australijski Zakon o privatnosti zahteva od entiteta da preduzmu razumne korake kako bi osigurali da njihov korisnik u inostranstvu ne prekrši australijske principe privatnosti i pre nego što podaci mogu da se prenesu preko granica.⁵

Poslednjih nekoliko godina pojedine države se odlučuju da kreiraju propise i mere koji se odnose na funkcionisanje algoritama i na taj način utiču na trgovinu proizvodima i uslugama koji su podržani veštačkom inteligencijom. Neke zemlje su nedavno uvele zakone koji zahtevaju pristup, otkrivanje ili prenos izvornog koda (eng. *source code*) kao preduslov za odobravanje pristupa njihovom tržištu (Soprana, 2022:86). Već pomenuti Zakon o sajber bezbednosti Kine aahteva od kompanija da otkriju izvorni kod kako bi dobili odobrenje od regulatornih agencija, što ih dovodi u tešku poziciju da biraju između traženja tržišnih mogućnosti u Kini ili zaštite svoje intelektualne svojine od potencijalnog prisvajanja. U Rusiji, s druge strane, propust kompanija da se izričito pridržavaju zahtevi da se algoritmi i izvorni kodovi dele sa državnim organima dovodi do blokiranja njihovih usluga u zemlji, u skladu sa usvojenim merama za borbu protiv terorizma i zaštiti javne bezbednosti (Lee-Makiyama, 2018:6).

Pored podataka i algoritama, za funkcionisanje AI sistema neophodan je i hardver. Reč je o računarskoj infrastrukturi na kojoj rade AI sistemi. Na ovu komponentu veštačke inteligencije jako utiču mere trgovinskih politika različitih zemalja. Kako je reč o hardveru, odnosno o proizvodima, navedene mere imaju direktan uticaj na trgovinu robom i na taj način spada u delokrug GATT-a. Istovremeno mogu imati indirektan uticaj na trgovinu AI uslugama, pa će posledično biti relevantne i odredbe GATS-a (Soprana, 2022:90).

1.2. Prednosti i rizici primene AI u međunarodnoj trgovini robom i uslugama

Primena veštačke inteligencije sa sobom nosi niz prednosti. Pruža efikasnost, jednostavnost i brzinu prilikom rešavanja brojnih problema, rukovodeći se ogromnim količinama podataka, koje AI sistemi mogu brzo da obrađuju. AI rešava zadatke koji su povezani sa ljudskim radom i razmišljanjem i prepoznaje trendove i obrasce brže i lakše od ljudi (Khanzode & Sarode, 2020).

Različiti akteri u međunarodnoj razmeni mogu imati koristi od primene AI sistema. Proizvođači i pružaoci usluga imaju koristi od povećane automatizacije, povećane

³ Law No. 24/2018/QH14 on Cybersecurity, (2018), dostupno na: <https://resourcehub.bakermckenzie.com/en/resources/global-data-privacy-and-cybersecurity-handbook/asia-pacific/vietnam/topics/key-data-privacy-and-cybersecurity-laws>, pristupljeno: 1.8.2024.

⁴ Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), dostupno na: <https://eur-lex.europa.eu/eli/reg/2016/679/oj>, pristupljeno: 1.8.2024.

⁵ Australian Government (2019), Privacy Act 1988 - Compilation N. 82 Part III, APP 8.1., dostupno na: <https://www.legislation.gov.au/C2004A03712/2019-08-13/text>, pristupljeno: 1.8.2024.

Pravni status veštačke inteligencije u kontekstu međunarodnog trgovinskog prava

produktivnosti i smanjenja troškova transakcija. Pojedini autori su procenili da povećanje od 10% u digitalnoj povezanosti, uzrokuje smanjenje troškova međunarodne trgovine robom i uslugama za 2% (Bellucci, 2023:10). Usluge koje su bile neprofitabilne, nedostupne ili neizvodljive u drugim okolnostima, uz korišćenje AI tehnologija postaju dostupne zainteresovanim licima (Ballell, 2019). Finansijske usluge su jedna od oblasti gde sistemi AI imaju potencijal da povećaju efikasnost i sigurnost transakcija i da učine da ove usluge budu inkluzivnije i pristupačnije za sve kategorije lica (OECD, 2022). Potrošači bi, s druge strane, mogli imati koristi od personalizacije i prilagođavanja usluga, što bi smanjilo zamor od donošenja odluka i izgubljeno vreme na istraživanje dostupnih opcija (Puntoni et al., 2021). Sistemi AI bi takođe mogli biti korisni za društvo u celini, jer bi se tehnologije zasnovane na mašinskom učenju mogle primeniti za rešavanje nekih postojećih globalnih problema, igrajući ključnu ulogu u borbi protiv klimatskih promena ili velikih epidemija poput pandemije COVID-19 (Soprana, 2022:58).

Pored nesumnjivih prednosti za međunarodnu trgovinu robom i uslugama, primena AI sistema povezana je sa brojnim rizicima. Među pitanjima koja zahtevaju adekvatnu reakciju kako bi se neutralisao visok nivo rizika, jesu privatnost, zaštita ličnih podataka i sajber bezbednost (Soprana, 2022:59). U literaturi se često ističe još jedan rizik koji narušava poverenje čoveka u AI tehnologiju, a radi se o nedostatku transparentnosti načina na koji AI algoritmi funkcionišu i isporučuju svoje rezultate (Burrell, 2016). Kako čovek po svojoj prirodi ima averziju prema nepoznatom, ova karakteristika AI sistema bitno utiče na subjekte da utočište od rizika traže u regulativi. Zato privredni subjekti, organizacije civilnog društva i međunarodne organizacije teže da obezbede adekvatan normativni okvir za veštačku inteligenciju kao složen fenomen.

2. Delovanje WTO u novom tehnološkom okruženju

2.1. Da li je postojeći okvir WTO primenljiv na AI trgovinu?

Kako je u svetu zabeležen trend rasta AI regulative, naročito AI principa i smernica, otvara se dilema da li ovakva vrsta regulative može stvoriti nejasnoće u pravu WTO. Tačnije, postavlja se pitanje da li su tradicionalna trgovinska pravila adekvatna za trgovinske politike država kojima one žele da podstaknu AI trgovinu i inovacije (Peng et al., 2024:13).

Da bi se došlo do odgovora na postavljeno pitanje, potrebno je odrediti na koji način multilateralni okvir međunarodne trgovine, oličen u WTO, direktno ili indirektno reguliše pitanje veštačke inteligencije. To dalje znači da je neophodno odrediti stepen primenljivosti postojećih WTO sporazuma na sve one mere koje bi mogle delovati kao trgovinska ograničenja. Tu spadaju mere vlada članica koje se eksplicitno odnose na veštačku inteligenciju (specifične AI mere), ali i one koje za predmet regulisanja imaju neko drugo pitanje, ali utiču na sve digitalne tehnologije, pa su zato relevantne i za veštačku inteligenciju (npr. mere vezane za prekogranične tokove podataka, regulisanje digitalne trgovine) (Soprana, 2022).

Multilateralni međunarodni ekonomski poredak funkcioniše pod okriljem WTO od njenog osnivanja. WTO sporazumi, naročito GATT, GATS, TRIPS, skoro tri decenije uspešno uređuju i podržavaju međunarodnu trgovinu. GATT i GATS u svojim domenima vrlo uspešno usmeravaju trgovinu robom i uslugama pružajući sigurnost globalnim ekonomskim odnosima. Međutim, razliku između robe i usluga kao i njihovu klasifikaciju,

u doba dominacije sistema AI je jako teško uskladiti sa realnošću. Usluge koje su podržane veštačkom inteligencijom, iako su očigledno usluge, mogu izbeći utvrđenu GATS klasifikaciju usluga. To može dovesti do proizvoljnog tumačenja da li je u pitanju nova usluga ili je samo novi način pružanja već postojeće usluge u GATS klasifikaciji. Nekada je vrlo teško odrediti da li je reč o analognoj usluzi koja se obavlja na digitalan način, pa samim tim spada u delokrug GATS sporazuma (Peng, 2024:9). Prema nekim mišljenjima, GATS sporazum počiva na principu tehnološke neutralnosti (Soprana, 2022:173). Ovaj princip nalaže da se GATS obaveze odnose na usluge pružene na bilo koji način i bilo kojom dostupnom tehnologijom. Analogno ovoj situaciji postoji i dilema vezana za trgovinu AI proizvodima, onim proizvodima koji imaju u sebi ugrađenu veštačku inteligenciju i mere trgovinskih politika koje se odnose na te proizvode.

2.2. JSI pregovori – pokušaj da se dođe do novog plurilateralnog sporazuma

Iako je WTO dugo godina bila glavni i jedini multilateralni regulator međunarodne trgovine, na osnovu predloženih izazova, s pravom se možemo zapitati da li će ona to i ostati kada je reč o upravljanju veštačkom inteligencijom ili joj je potrebna reforma?

WTO je prepoznala značaj novih tehnologija i elektronske trgovine, pa je u maju 1998. godine na Drugoj ministarskoj konferenciji u Ženevi usvojila Deklaraciju o globalnoj elektronskoj trgovini (eng. *Declaration on Global Electronic Commerce*) (WTO, 1998). Kao što je naloženo Deklaracijom, Generalni savet je uspostavio Program rada u vezi sa svim pitanjima o globalnoj elektronskoj trgovini (eng. *Work Programme on Electronic Commerce*), u septembru 1998. godine. Međutim, u periodu od 1998. do 2015. godine ovaj program bio je u fazi mirovanja (Neufeldt, 2023:18). Zatim su se pojavila nova pitanja, koja su podstakla akciju u okviru WTO. Generalni savet je zvanično odlučio 2019. godine da ponovo osnaži rad u okviru Programa rada o elektronskoj trgovini (WTO, 2019).

Na 11. Ministarskoj konferenciji u decembru 2017. godine, grupa od 71 članice WTO složila se da pokrene istraživački rad u pravcu budućih pregovora WTO o trgovinskim aspektima e-trgovine (WTO, 2017). U januaru 2019. 76 članica WTO je u zajedničkom saopštenju potvrdilo nameru da započne ove pregovore (WTO, 2019a). Od 25. juna 2024. u ovim diskusijama učestvuje 91 članica WTO, što čini preko 90% globalne trgovine. Kao što je slučaj sa svim inicijativama zajedničkih izjava (eng. *Joint Statement Initiatives*), učešće u JSI-u za elektronsku trgovinu otvoreno je za sve članice WTO. Cilj ovih pregovaračkih faza je da se dođe do konsolidovanog pregovaračkog teksta, koji bi odražavao izjave svih JSI učesnika. Od početka pregovora, bilo je više verzija pregovaračkih tekstova. Do jedinstvenog pregovaračkog teksta Sporazuma o elektronskoj trgovini došlo se 26. jula 2024. godine (eng. *Agreement on Electronic Commerce*) (WTO, 2024). Ono oko čega su JSI učesnici postigli dogovor jesu: opšte odredbe i definicije, odnos sa drugim WTO sporazumima, elektronski potpis, e-fakture, elektronski ugovori i plaćanja. Takođe, nacrt Sporazuma sadrži deo koji se tiče carina na elektronske prenose, zaštitu potrošača u online okruženju, sajber bezbednosti i zaštite ličnih podataka (WTO, 2024). Ono što se može primetiti iz strukture, to je da nedostaju odredbe o prekograničnim tokovima podataka, izvornom kodu (eng. *Source Code*) i pristupu tržištima (eng. *Market Access*). Očigledno da su za JSI učesnike ovo bila pitanja povodom kojih se nisu mogli saglasiti, niti učiniti ustupke.

Pravni status veštačke inteligencije u kontekstu međunarodnog trgovinskog prava

Ono što možemo da očekujemo u budućnosti, to je da se JSI učesnici izjasne o pravnoj arhitekturi budućeg Sporazuma o elektronskoj trgovini. Čini se da u ovom trenutku kreiranje multilateralnog trgovinskog sporazuma nije moguće, zbog širokog spektra pitanja oko kojih WTO članice ne mogu postići konsenzus, i da je za trenutno stanje u međunarodnom ekonomskom poretku ipak prihvatljivije da to bude plurilateralni sporazum, koji bi obavezivao samo članice potpisnice sporazuma (Neufeldt, 2023).

3. AI i preferencijalni trgovinski sporazumi

U ovom delu analiziraćemo relevantne odredbe o digitalnoj trgovini u odabranim preferencijalnim trgovinskim sporazumima i o veštačkoj inteligenciji, koje se vrlo retko sreću u postojećim sporazumima.

3.1. Sporazum o partnerstvu u oblasti digitalne ekonomije (DEPA)

Ovaj sporazum zaključili su Čile, Novi Zeland i Singapur 2020. godine. U maju ove godine, Sporazumu je pristupila Koreja. U junu mesecu, šest novih država otpočele su proces sticanja statusa člana (Kina, Kanada, Kostarika, Peru, Ujedinjeni Arapski Emirati i Salvador).⁶ DEPA je začetnik nove vrste trgovinskih sporazuma koji regulišu ekonomiju i trgovinu u digitalnoj eri. Pre zaključenja DEPA sporazuma (eng. *Digital Economy Partnership Agreement*) nijedan preferencijalni trgovinski sporazum nije uključivao odredbe koje se eksplicitno odnose na veštačku inteligenciju (Soprana, 2022:233). U članu 8.2 DEPA sporazuma navedeno je:⁷

1. Strane konstatuju da je upotreba veštačke inteligencije (AI) postala sve učestalija u digitalnoj ekonomiji.
2. Strane prepoznaju ekonomski i društveni značaj razvoja etičkih okvira i smernica za upravljanje AI, kako bi se ova tehnologija koristila pouzdano, bezbedno i odgovorno. Imajući u vidu prekograničnu prirodu digitalne ekonomije, Strane dalje priznaju prednosti razvoja međusobnog razumevanja i konačnog obezbeđivanja usklađenosti AI okvira na međunarodnom nivou, kako bi se, koliko je to moguće, olakšalo usvajanje i korišćenje AI tehnologija.
3. U tom cilju, Strane će nastojati da promovišu usvajanje etičkih okvira i okvira upravljanja koji podržavaju pouzdane, bezbedne i odgovorne načine korišćenja AI tehnologija (AI Governance Frameworks).
4. U usvajanju okvira upravljanja veštačkom inteligencijom, Strane će nastojati da uzmu u obzir međunarodno priznate principe ili smernice, uključujući transparentnost, pravičnost i vrednosti koje su usmerene na čoveka.

Iako je veštačkoj inteligenciji posvećen samo jedan član ovog sporazuma, njegov značaj je izuzetan. Najpre, prvi put spominje tehnologiju koja predstavlja digitalnu revoluciju XXI veka, dok mnoge druge tehnologije (blokčejn, Internet of Things) čekaju da ih trgovinski sporazumi prepoznaju i normiraju (Soprana, 2022:234). Zatim, upućuje na

⁶ Više o DEPA sporazumu videti na: <https://www.mti.gov.sg/Trade/Digital-Economy-Agreements/The-Digital-Economy-Partnership-Agreement>

⁷ Digital Economy Partnership Agreement, dostupno na: <https://www.mti.gov.sg/Trade/Digital-Economy-Agreements/The-Digital-Economy-Partnership-Agreement>, pristupljeno: 2.8.2024.

promenu svesti kreatora međunarodnih pravila i njihovog razumevanja stanja i perspektiva međunarodne trgovine robom i uslugama. Ako dodamo još i činjenicu da je EU AI Act stupio na snagu 1. avgusta ove godine, jasno je da se kreira jedan pozitivan ambijent za razvoj AI trgovine.

3.2. Sporazum o digitalnoj trgovini između SAD, Meksika i Kanade (USMCA)

USMCA sporazum (eng. *The United States Mexico Canada Agreement and the United States–Japan Digital Trade Agreement*) sadrži posebno poglavlje koje nosi naziv Digitalna trgovina. U članu 19.1 se definiše algoritam kao niz koraka koji se preduzimaju za rešavanje problema ili dobijanje rezultata. Član 19.12 propisuje zabranu lokalizacije podataka, čime jasno propagira osnovno pravilo o slobodi protoka informacija.⁸ Član 19.11 precizira da strane mogu usvojiti ili zadržati meru koja nije u skladu sa slobodnim protokom podataka, ako je to neophodno za postizanje legitimnog cilja javne politike, pod uslovom da nema proizvoljne ili neopravdane diskriminacije niti prikrivenog ograničenja trgovine. Ograničenja prenosa informacija ne mogu biti veća nego što je potrebno da bi se postigao legitimni cilj.

Osim uobičajenih sličnosti sa ostalim digitalnim trgovinskim sporazumima, USMCA uvodi neke novine (Burri, 2021:13). USMCA odstupa od standardnog liberalnog pristupa SAD i signalizira poštovanje nekih principa zaštite podataka i smernica relevantnih međunarodnih tela. Nakon prepoznavanja ekonomskih i društvenih koristi od zaštite ličnih podataka korisnika digitalne trgovine i doprinosa koji to daje jačanju poverenja potrošača u digitalnu trgovinu, član 19.8 zahteva od strana da usvoje ili održavaju pravni okvir koji obezbeđuje zaštitu ličnih podataka učesnika digitalne trgovine.

Iz navedenog zaključujemo da USMCA sporazum indirektno reguliše pitanje veštačke inteligencije, propisujući pravila o njenim ključnim komponentama – podacima i algoritmima.

3.3. Sporazum o ekonomskom partnerstvu između EU i Japana

Sekcija F ovog sporazuma (eng. *Agreement between the European Union and Japan for an Economic Partnership*) odnosi se na elektronsku trgovinu. U članu 8.73(1) pronalazimo odredbe o dobrovoljnom prenosu izvornog koda. Strana ne može zahtevati prenos ili pristup izvornom kodu softvera u vlasništvu lica druge strane. Ništa u ovom stavu ne sprečava prenos ili odobravanje pristupa izvornom kodu u komercijalnim ugovorima, ili dobrovoljni prenos ili odobravanje pristupa izvornom kodu, na primer, u kontekstu javnih nabavki.⁹ Član 8.83 odnosi se na slobodan protok podataka. Strane su se sporazumele da će u roku od tri godine od stupanja na snagu ovog sporazuma ponovo proceniti potrebu za uključivanjem odredbe o slobodnom protoku podataka u ovaj ugovor.

⁸ The United States Mexico Canada Agreement and the United States–Japan Digital Trade Agreement, dostupno na: <https://ustr.gov/trade-agreements/free-trade-agreements/united-states-mexico-canada-agreement/agreement-between>, pristupljeno: 3.8.2024.

⁹ Agreement between the European Union and Japan for an Economic Partnership, dostupno na: https://eur-lex.europa.eu/eli/agree_internation/2018/1907/oj/eng, pristupljeno: 3.8.2024.

Zaključak

Postojeći okvir međunarodnog trgovinskog prava nailazi na izazove i pored njegove fleksibilnosti. Sporazumi koji su kreirani u drugoj polovini XX veka teško da mogu u potpunosti obuhvatiti novonastale pravne situacije. Stoga je jako bitno proceniti do koje je mere postojeći okvir ekstenzivan i do kada je racionalno nove pravne situacije klasifikovati kao već poznate i na njih primeniti stara pravila. Pitanje pravnog statusa veštačke inteligencije je vrlo kompleksno u vremenu kada se i veštačka inteligencija i međunarodno trgovinsko pravo razvijaju istovremeno. Ostaje nam da pratimo i analiziramo delatnost WTO u novom kontekstu, ali i razvoj pravne arhitekture digitalnih trgovinskih sporazuma koji su u ekspanziji.

Napomena:

Rad je rezultat istraživanja po osnovu obaveza po Ugovoru o prenosu sredstava za finansiranje NIR u 2024. godini (evidencioni broj 451-03-65/2024-03), zaključenog između Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije i Ekonomskog fakulteta Univerziteta u Nišu.

Literatura

- Agreement between the European Union and Japan for an Economic Partnership, dostupno na: https://eur-lex.europa.eu/eli/agree_internation/2018/1907/oj/eng, pristupljeno: 3.8.2024.
- Australian Government (2019), Privacy Act 1988 - Compilation N. 82 Part III, APP 8.1., dostupno na: <https://www.legislation.gov.au/C2004A03712/2019-08-13/text>, pristupljeno: 1.8.2024.
- Ballell, T. R. D. L. H. (2019). Legal challenges of artificial intelligence: modelling the disruptive features of emerging technologies and assessing their possible legal impact. *Uniform Law Review*, 24(2), 302-314.
- Bellucci, C., Rubínová, S., & Piermartini, R. (2023). *Better together: How digital connectivity and regulation reduce trade costs* (No. ERSD-2023-07). WTO Staff Working Paper.
- Burrell, J. (2016). How the machine 'thinks': Understanding opacity in machine learning algorithms. *Big data & society*, 3(1), 2053951715622512.
- Burri, M. (2021). A WTO Agreement on Electronic Commerce: An Inquiry into Its Legal Substance and Viability. *Geo. J. Int'l L.*, 53, 565.
- Casalini, F., & González, J. L. (2019). Trade and cross-border data flows. OECD publishing.
- Cybersecurity Law of the People's Republic of China, dostupno na: <https://digichina.stanford.edu/work/translation-cybersecurity-law-of-the-peoples-republic-of-china-effective-june-1-2017/>, pristupljeno: 1.8.2024.
- Digital Economy Partnership Agreement, dostupno na: <https://www.mti.gov.sg/Trade/Digital-Economy-Agreements/The-Digital-Economy-Partnership-Agreement>, pristupljeno: 2.8.2024.
- European Commission (2020), 'White Paper on Artificial Intelligence: A European Approach to Excellence and Trust' Brussels: European Commission.
- Jakhar, D., & Kaur, I. (2020). Artificial intelligence, machine learning and deep learning: definitions and differences. *Clinical and experimental dermatology*, 45(1), 131-132.
- Khanzode, K. C. A., & Sarode, R. D. (2020). Advantages and disadvantages of artificial intelligence and machine learning: A literature review. *International Journal of Library & Information Science (IJLIS)*, 9(1), 3.

- Law No. 24/2018/QH14 on Cybersecurity, (2018), dostupno na: <https://resourcehub.bakermckenzie.com/en/resources/global-data-privacy-and-cybersecurity-handbook/asia-pacific/vietnam/topics/key-data-privacy-and-cybersecurity-laws>, pristupljeno: 1.8.2024.
- Lee-Makiyama, H. (2018). Briefing note: AI& Trade Policy. *Tallinn Digital Summit*.
- Neufeldt, C. L. J. O. J. (2023). *The Joint Statement Initiative on Electronic Commerce as a Remedy for the Digital Trade Challenge to Global Trade Governance* (Master's thesis, Harvard University).
- OECD (2019). *Artificial Intelligence in Society*. Paris: OECD Publishing.
- OECD (2022). *Artificial Intelligence and International Trade: Some Preliminary Implications*. Paris: OECD Publishing.
- Peng, S. Y., Lin, C. F., & Streinz, T. (2024). Artificial Intelligence and International Economic Law. *Artificial Intelligence and International Economic Law*, Query date, 10, 42.
- Puntoni, S., Reczek, R. W., Giesler, M., & Botti, S. (2021). Consumers and artificial intelligence: An experiential perspective. *Journal of Marketing*, 85(1), 131-151.
- Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), dostupno na: <https://eur-lex.europa.eu/eli/reg/2016/679/oj>, pristupljeno: 1.8.2024
- Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act), dostupno na: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206>, pristupljeno: 1.8.2024.
- Samoili, S., Cobo, M. L., Gómez, E., De Prato, G., Martínez-Plumed, F., & Delipetrev, B. (2020). AI Watch. Defining Artificial Intelligence. Towards an operational definition and taxonomy of artificial intelligence.
- Soprana, M. (2022). Governing Artificial Intelligence: The Role of International Trade Law.
- Strategija razvoja veštačke inteligencije u Republici Srbiji za period 2020–2025. Godine, dostupno na: <https://www.srbija.gov.rs/tekst/437277>, pristupljeno: 31.7.2024.
- The United States Mexico Canada Agreement and the United States–Japan Digital Trade Agreement, dostupno na: <https://ustr.gov/trade-agreements/free-trade-agreements/united-states-mexico-canada-agreement/agreement-between>, pristupljeno: 3.8.2024.
- World Trade Organization (1988). Ministerial Declaration on Global Electronic Commerce of 20 May 1998, WTO Doc. WT/MIN(98)/DEC/2, dostupno na: https://www.wto.org/english/tratop_e/ecom_e/mindec1_e.htm, pristupljeno: 2.8.2024.
- World Trade Organization (2017). Joint Statement on Electronic Commerce of 13 December 2017, WTO Doc. WT/MIN(17)/60, dostupno na: <https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/WT/MIN17/60.pdf&Open=True>, pristupljeno: 2.8.2024.
- World Trade Organization (2019). Work Programme on Electronic Commerce: General Council Decision; Adopted on 10 December 2019, WTO Doc. WT/L/1079, dostupno na: https://www.wto.org/english/news_e/news19_e/sum_gc_dec19_e.htm, pristupljeno: 2.8.2024.
- World Trade Organization (2019a). Joint Statement on Electronic Commerce of 25 January 2019, WTO Doc. WT/L/1056, dostupno na: <https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/WT/L/1056.pdf&Open=True>, pristupljeno: 2.8.2024.

World Trade Organization (2024). Joint Statement on Electronic Commerce of 26 July 2024, WTO Doc. INF/ECOM/87, dostupno na: <https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/INF/ECOM/87.pdf&Open=True>, pristupljeno: 2.8.2024.

LEGAL ASPECTS AND STATUS OF THE ARTIFICIAL INTELLIGENCE PHENOMENON IN INTERNATIONAL TRADE LAW

Abstract: *Artificial intelligence (AI) has become the main technological lever of the XXI century. Under its influence, social relations in a country, occupations, trade policies, legal and economic relations at the international level and the activities of international organizations are changing, which are forced to transform traditional activities and adapt them to new circumstances. The question of the impact of AI on law in general, and on international trade law in particular, has occupied a significant position in recent years. This technology provides many opportunities, but at the same time it poses a danger for individuals and economic entities. That is why the law is trying to protect subjects in the law with norms, guidelines and principles and to come up with specific AI rules as soon as possible. As life is always faster than law, subjects are forced to apply some already existing rules to newly created circumstances. This represents a major challenge for international trade law.*

Keywords: *Artificial Intelligence (AI), Regulation, Digital Partnership Agreements, WTO agreements.*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

VOLATILITY AND STABILITY OF STABLECOINS

Ognjen Radović, PhD*

Jelena Radojičić, PhD •

Vesna Stanković •

Abstract: *This paper explores the volatility and stability of stablecoins using GARCH(1,1) models with t-distribution of innovation processes and t-GARCH(1,1). We focused on analyzing the most significant stablecoins pegged to the US dollar (USDC, USDT, FRAX, BUSD, DAI) and compared their volatility with that of traditional cryptocurrencies (BTC, ETH), fiat currency (EUR/USD), market indices (NASDAQ, S&P 500), and commodities (oil, gold, silver). The models used allow for accurate risk assessment and potential loss estimation through Value-at-Risk (VaR) and Expected Shortfall (ES) metrics. The results show that although stablecoins generally exhibit lower volatility compared to cryptocurrencies, their stability can be compromised during market shocks. These findings are significant for investors and regulators in managing risks and making investment decisions.*

Keywords: *stablecoins, cryptocurrency, risk management, volatility.*

1. Introduction

Stablecoins are a specific type of digital currency designed to maintain a stable value by pegging their price to other assets, typically those with low volatility, such as fiat currencies, other cryptocurrencies, financial instruments, or commodities. The stability of stablecoins' value is achieved through various stabilization mechanisms, including collateralization with other assets and algorithmic adjustments of supply based on market demand. Stablecoins are classified into three main categories based on their governance

* University of Niš, Faculty of Economics, Serbia, ORCID 0000-0001-7428-565X,
✉ ognjen.radovic@ekonomski.rs;

• University of Niš, Faculty of Economics, Serbia, ORCID 0000-0003-3444-0138,
✉ jelena.radojicic@ekonomski.rs;

• PhD student, University of Niš, Faculty of Economics, Serbia,
✉ vesna.mladenovic777@gmail.com;

models and sources of collateral: centralized stablecoins backed by traditional assets like fiat currencies (e.g., Tether, USD Coin), decentralized stablecoins backed by crypto assets like Ethereum (e.g., DAI), and decentralized algorithmic stablecoins (Shah & Bahri, 2023). By combining the technological advantages of digital currencies with reduced price volatility, stablecoins play a crucial role in the crypto ecosystem by: (a) providing a stable medium of exchange that facilitates cryptocurrency trading, (b) enabling efficient financial transactions, and (c) supporting the infrastructure of the decentralized finance (DeFi) market (Hoang & Baur, 2021; Liao & Carmichael, 2022; Kosse et al., 2023). For example, Tether (USDT/USD) is the most well-known stablecoin pegged to the US dollar and is used for trading and hedging against volatility in crypto markets. Binance USD (BUSD/USD), a stablecoin fully backed by US dollar reserves, is also used for trading but within the Binance ecosystem. DAI (DAI/USD), which maintains its value stability through smart contracts on the Ethereum blockchain, is used in the DeFi environment. Although stablecoins are promoted as safe cryptocurrencies, they are not without risks. Their stability can be affected by the volatility of the underlying assets they are linked to (Hoang and Baur, 2021). Due to differences in market capitalization, liquidity, and transparency, even stablecoins backed by the same asset can vary in terms of stability (Kosse et al., 2023). Stablecoins backed by traditional assets are generally considered less risky compared to decentralized algorithmic stablecoins or stablecoins backed by crypto assets (Shah & Bahri, 2023; Diaz et al., 2023).

The increased volatility exhibited by cryptocurrencies such as Bitcoin, Ethereum, and Ripple has garnered significant attention from investors, financial institutions, and policymakers due to its implications for asset allocation, risk management, and market stability (Wang et al., 2023; Dudek et al., 2024). Various methodologies have been employed to predict cryptocurrency volatility, encompassing traditional econometric models such as GARCH, EGARCH, and TGARCH, along with more sophisticated machine learning approaches like LSTM and SVR (Wang et al., 2023; Dudek et al., 2024). Comparative studies between statistical and machine learning techniques for volatility prediction have not identified a single optimal method, as model performance depends on the specific cryptocurrency, error metric, and forecast horizon (Dudek et al., 2024). The empirical literature on cryptocurrency volatility, including studies utilizing GARCH-type models, often focuses on more volatile assets such as Bitcoin (Lopez-Martin et al., 2022; Amirshahi and Lahmiri, 2023). The robustness, flexibility, and ability of GARCH models to capture volatility persistence in cryptocurrency returns and leverage effects, as well as incorporate external factors like market sentiment and trading volume (Wang et al., 2023; Palamalai et al., 2021), make them valuable tools for modeling the price volatility of stablecoins. Hoang and Baur (2021) demonstrated using the T-GARCH model that selected stablecoins exhibit lower average long-term volatility, suggesting a certain level of stability, though no stablecoin shows absolute stability. Additionally, their results reveal that stablecoins have relatively higher volatility compared to fiat currencies but lower volatility than Bitcoin. Shah & Bahri (2023) use various statistical models, including GARCH and Extreme Value Theory, to analyze the volatility and risk of stablecoins, comparing stablecoin volatility behavior with that of traditional cryptocurrencies, stock indices, and fiat currencies. Stablecoins exhibit lower volatility compared to traditional cryptocurrencies like Bitcoin and are less affected by market fluctuations; however, their stability declines during market crises. Overall, studies confirm that the GARCH model and its variants provide a robust framework for assessing and understanding the volatility of stablecoins, which can help maintain their stability and mitigate risks associated with more volatile assets. For instance, integrating stablecoins into financial portfolios can improve diversification and reduce overall portfolio risk (Wang et al., 2020).

In this paper, we analyze the volatility and stability of the most significant stablecoins (USDC, USDT, FRAX, BUSD, DAI) using the GARCH(1,1) model with t-distributed innovation processes, t-GARCH(1,1), and compare them with the volatility of traditional cryptocurrencies (BTC, ETH), fiat currency (EURO), market indices (NASDAQ, SP500), and commodities (oil, gold, silver). The paper is structured as follows. Section 2 presents the methodology for volatility and risk assessment, and the research results are presented in Section 3. Finally, the main conclusions of the paper are summarized.

2. Methodology

Since financial returns often exhibit pronounced volatility changes and fat tails (meaning that extreme values occur more frequently than predicted by a normal distribution), we use the GARCH(1,1) model with a t-distribution for volatility estimation. The t-distribution, with its heavier tails, provides a better fit for these extreme values, thereby improving the accuracy of risk measures such as Value-at-Risk (VaR) and Expected Shortfall (ES) (Qiu et al., 2024).

The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, specifically the GARCH(1,1) variant, is a widely used statistical tool in the analysis of financial time series for modeling and forecasting volatility. The mathematical formulation of the GARCH(1,1) model is given through two main equations: the mean equation and the variance equation. The mean equation typically takes the form:

$$y_t = \mu + \epsilon_t \quad (1)$$

where y_t is the return series, μ is the mean of the series, and ϵ_t is the error term. The variance equation, which is the core of the GARCH model, is expressed as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (2)$$

where σ_t^2 is the conditional variance at time t , α_0 is the constant, α_1 is the coefficient for the lagged squared error term ϵ_{t-1}^2 , and β_1 is the coefficient for the lagged conditional variance σ_{t-1}^2 (Qiu et al., 2024). This model captures volatility clustering, a common phenomenon in financial markets where high-volatility events tend to occur together (Palamalai et al., 2021). Empirical studies have shown that the GARCH model parameters are statistically significant for various cryptocurrencies, including stablecoins, and that the models pass diagnostic tests for ARCH effects and autocorrelation, ensuring their robustness (Lopez-Martin et al., 2022; Palamalai et al., 2021). Additionally, the flexibility of the GARCH model allows it to adapt to different innovation process distributions, such as normal, skewed normal, and Student's t-distribution, enhancing its applicability to the unique characteristics of stablecoin returns (Bergsli et al., 2022). In this paper, we use the GARCH(1,1) model with a t-distribution of innovation processes, known as t-GARCH(1,1). According to empirical studies, the Student's t-distribution provides a better fit for financial data, including cryptocurrency returns, compared to the normal distribution due to its ability to capture the fat tails and asymmetry observed in such data (Lopez-Martin et al., 2022). Moreover, the Student's t-distribution is frequently used in econometrics and finance for modeling returns and residuals in time series because it can handle non-normality and volatility clustering, which are common in financial time series (Amirshahi & Lahmiri, 2023). The tail behavior of this distribution is particularly useful for risk management and

Value at Risk (VaR) calculations, as it provides a more accurate estimate of extreme losses compared to the normal distribution (Lopez-Martin et al., 2022).

To assess risk and potential losses, this paper utilizes Value-at-Risk (VaR) and Expected Shortfall (ES) models. Value-at-Risk (VaR) is a widely used risk measure in finance that estimates the maximum potential loss in the value of a portfolio over a specified time period for a given confidence level. Mathematically, VaR at confidence level α can be defined as the α -quantile of the portfolio return distribution. Formally, if A_i denotes the return of an asset at time i , and F_{A_i} is the cumulative distribution function of A_i conditioned on the information set $\mathcal{I}_{i-1}$, then VaR at the α level is given by the following formula (Lopez-Martin et al., 2022; Lazar et al., 2024):

$$\text{VaR}_\alpha = \inf\{A_i | F_{A_i}(A_i | \mathcal{I}_{i-1}) \geq \alpha\}. \quad (3)$$

This quantile-based approach is the foundation for calculating VaR, whether using parametric methods such as the GARCH model, which incorporates conditional heteroskedasticity, or non-parametric methods like Monte Carlo simulations, which rely on repeated sampling to estimate the return distribution (Lazar et al., 2024). For example, the GARCH-based formula for VaR is expressed as:

$$\text{VaR}_\alpha = \mu_{t-1} + \sigma_{t-1} t_{\alpha, v}. \quad (4)$$

where μ_{t-1} is the conditional mean, σ_{t-1} is the conditional volatility, which in our case is calculated using the t-GARCH(1,1) model, and $t_{\alpha, v}$ is the quantile of the t-distribution with v degrees of freedom at the confidence level α (Yang & Xu, 2021). Despite its popularity, VaR has limitations, such as not being a coherent risk measure because it does not satisfy the property of sub-additivity, meaning that the total VaR of a combined portfolio can be greater than the sum of the individual VaRs. This limitation has led to the development of alternative risk measures, such as Expected Shortfall (ES), which provides more accurate information about tail risk by considering the average loss beyond the VaR threshold (Moutanabbir & Bouaddi, 2024; Chen & Cheng, 2022).

Expected Shortfall (ES), also known as Conditional Value-at-Risk (CVaR), is a risk measure that quantifies the expected return on assets or a portfolio in the worst $q\%$ of scenarios, providing a more comprehensive view of tail risk compared to Value-at-Risk (VaR) (Som & Kayal, 2022). ES is defined as the expected loss given that the loss exceeds the VaR threshold, making it a conditional risk measure that captures the tail behavior of the loss distribution (Cheung & Yuen, 2020). Unlike VaR, which only considers a quantile of the loss distribution and can ignore the shape and structure of the tail, ES is a coherent risk measure, meaning it satisfies properties such as sub-additivity, which VaR does not satisfy (Lazar et al., 2024). This coherence makes ES particularly valuable in risk management, as it provides a more reliable assessment of extreme risks. The Basel Committee on Banking Supervision recognized the limitations of VaR and proposed a shift from VaR at the 1% level to ES at the 2.5% level, motivated by the need for more robust risk measures following the global financial crisis of 2008 (Lazar et al., 2024). The mathematical formulation of ES can be expressed as the conditional expected value of losses given that they exceed VaR, which is mathematically represented as:

$$ES_\alpha = E[L | L > \text{VaR}_\alpha], \quad (5)$$

Volatility and stability of stablecoins

where L denotes the loss, and α is the confidence level. In our calculations, the Expected Shortfall (ES) at the confidence level α for a t-distribution with v degrees of freedom can be calculated as:

$$ES_{\alpha} = \mu + \sigma \frac{v+t_{\alpha}^2}{v-1} \frac{t_{\alpha}}{\sqrt{v}} \quad (6)$$

where σ is calculated using the t-GARCH(1,1) model, and t_{α} is the density function of the t-distribution with v degrees of freedom at the confidence level α (Lazar et al 2024; Barson & Owusu, 2024). For an accurate estimation of ES, various methods have been proposed, including non-parametric approaches, robust statistical techniques, and high-dimensional models. Overall, ES is a superior risk measure that addresses the shortcomings of VaR by considering the severity of losses beyond the VaR threshold, providing a more comprehensive assessment of financial risk (Cheung & Yuen, 2020; Lazar et al., 2024).

3. Empirical analysis

In this paper, we analyze the volatility and stability of the most significant stablecoins. The selected financial data series consist of 1,202 daily returns for various financial instruments during the period from December 28, 2020, to April 12, 2024. These data series include return series for several stablecoins pegged to the US dollar: Tether (USDT/USD), USD Coin (USDC/USD), FRAX (FRAX/USD), Binance (BUSD/USD), and DAI (DAI/USD), as well as for the cryptocurrencies Bitcoin (BTC/USD) and Ethereum (ETH/USD). Additionally, they include traditional financial instruments such as the EUR/USD currency pair, NASDAQ and S&P 500 indices, and the prices of oil (BRENT/USD), silver (XAG/USD), and gold (XAU/USD). These data series provide insights into volatility, return distribution symmetry, and extreme values (fat tails) under various market conditions, which can be crucial for risk analysis and investment decision-making.

Table 1. Descriptive statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera
USDCUSD	0.000000	0.000003	0.020951	-0.028393	0.001181	-6.895438	370.038400	6756610.0
USDTUSD	0.000001	-0.000004	0.009122	-0.011360	0.000652	-1.974227	115.293900	632327.7
FRAXUSD	0.000009	0.000031	0.079001	-0.078741	0.005971	0.177642	56.745660	144676.8
BUSDUSD	0.000002	0.000000	0.021781	-0.013637	0.001286	2.024054	99.500280	467212.0
DAIUSD	-0.000002	-0.000013	0.019036	-0.025446	0.001643	-1.262495	87.830820	360732.4
BTCUSD	0.000825	0.000259	0.177455	-0.167827	0.033824	-0.202988	6.362068	574.4
ETHUSD	0.001363	0.001095	0.234897	-0.325573	0.043731	-0.403341	8.667334	1641.2
EURUSD	-0.000111	0.000002	0.021031	-0.017024	0.004132	0.106605	5.397612	290.2
NASDAQ	0.000294	0.000577	0.073973	-0.060287	0.012107	-0.205189	6.124337	497.3
SP500	0.000273	0.000340	0.055385	-0.046772	0.008949	-0.213330	6.552167	641.1
BRENTUSD	0.000480	0.001745	0.090304	-0.141454	0.019475	-0.728122	8.302888	1514.6
XAGUSD	0.000091	-0.000177	0.083834	-0.067099	0.014359	0.146300	6.174277	508.9
XAUUSD	0.000200	0.000168	0.034044	-0.040450	0.007419	-0.138928	6.038878	466.4

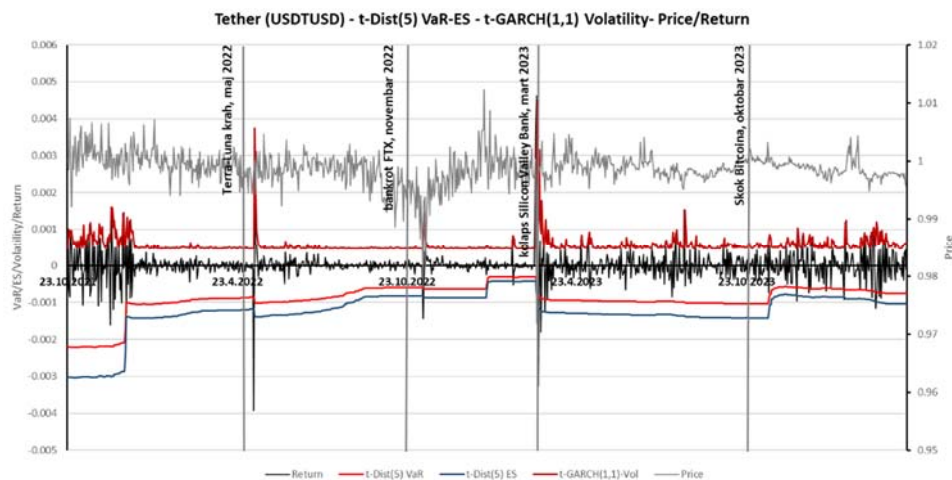
Source: Author's calculations

Table 1 presents the basic statistical indicators (descriptive statistics) for various stablecoins (USDC, USDT, FRAX, BUSD, DAI), cryptocurrencies (BTC, ETH), currencies (EURO), market indices (NASDAQ, SP500), and commodities (oil, gold, silver). Most

stablecoins exhibit significantly high negative skewness (USDCUSD, USDTUSD, DAIUSD) or positive skewness (FRAXUSD, BUSDUSD), as well as extreme kurtosis values, indicating the presence of extreme values and a significant deviation from the normality of the return distribution. The major cryptocurrencies (BTCUSD and ETHUSD) show less extreme values in terms of skewness and kurtosis compared to stablecoins, but still exhibit significant deviations from normality. Traditional financial instruments (EURUSD, NASDAQ, SP500, BRENTUSD, XAGUSD, XAUUSD) also show slight deviations from normality, but their Jarque-Bera test values are significantly lower compared to cryptocurrencies, indicating fewer extreme values and a distribution closer to normality. This simple descriptive analysis highlights the volatility and risks associated with different financial instruments, particularly stablecoins and cryptocurrencies, compared to traditional financial markets. The significant deviation from a normal distribution justifies the use of volatility and risk models with a t-distribution.

In this paper, for each stablecoin and selected financial series, the t-GARCH(1,1) volatility model was calculated, as well as the Value-at-Risk (t-Dist(5) VaR) and Expected Shortfall (t-Dist(5) ES) models for quantifying risk and potential losses according to the corresponding t-GARCH(1,1) model. Data from the period of December 28, 2020, to October 22, 2021, were used for creating and initially calculating the models. Due to limitations in the study, Figure 1 presents the calculation results for the stablecoin Tether (USDTUSD). In Figure 2, only the Expected Shortfall (t-Dist(5) ES) model for quantifying the risk of stablecoins is graphically displayed in comparison with cryptocurrencies and traditional financial instruments.

Figure 1. Volatility of Tether (USDTUSD) Returns



Source: Author's calculations

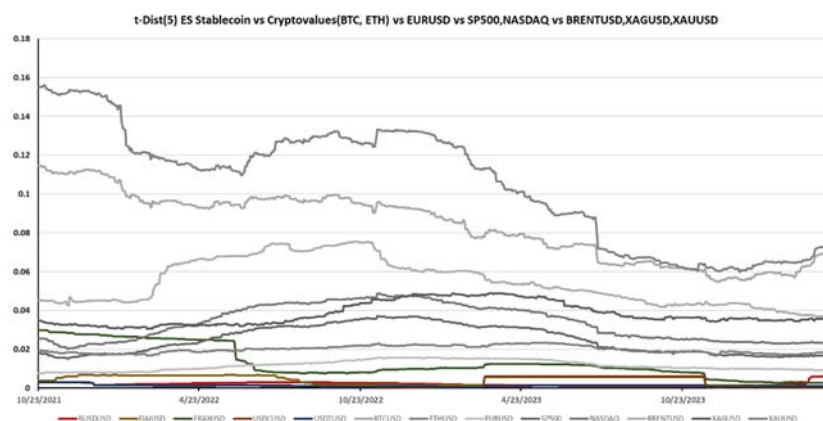
Figure 1 illustrates the fluctuation and returns for Tether (USDT/USD) using the t-Dist(5) VaR, t-Dist(5) ES, and t-GARCH(1,1) models for quantifying risk and volatility over the period from October 23, 2021, to April 12, 2024. The figure highlights key crises and events during the observed period:

Volatility and stability of stablecoins

- **Terra-LUNA crash, May 2022:** TerraUSD lost its peg to the US dollar, causing market panic and a significant drop in the value of the Terra (LUNA) token. This event led to substantial losses for investors and raised questions about the stability of algorithmic stablecoins.
- **FTX bankruptcy, November 2022:** FTX, one of the largest crypto exchanges, experienced financial collapse in November 2022 due to solvency issues. This triggered market panic, widespread distrust in centralized crypto exchanges, user withdrawals, and a significant decline in the value of many cryptocurrencies.
- **Silicon Valley Bank collapse, March 2023:** Silicon Valley Bank (SVB), a significant bank specializing in providing services to startups and tech companies, held reserves in US dollars for Circle, the issuer of USD Coin. In March 2023, SVB collapsed due to liquidity issues, leading investors to start withdrawing their USD Coins, resulting in an outflow of \$5.8 billion (14%) in one week (Kosse et al., 2023).
- **Bitcoin price surge, October 2023:** Bitcoin reached a value of \$35,000 in late October 2023, the highest level in the past 16 months. This surge was partially driven by expectations of the approval of a Bitcoin ETF in the United States, the acceptance of cryptocurrencies as a means of payment by large companies, and innovations like the tokenization of central bank digital currencies (CBDCs) explored by Mastercard. All of this increased investor optimism and led to a rise in the cryptocurrency market as a whole, as well as the stabilization of the market. These factors combined contributed to the reduction in Tether's volatility, as can be seen in Figure 1.

During the marked market shocks, a significant spike in volatility can be observed, signaled by the sharp rise in the t-GARCH(1,1) line. These events also caused an increase in VaR and ES values, indicating a growing risk. Conversely, in October 2023, after the surge in Bitcoin's price, volatility and risk decreased, which is reflected in the stabilization of the lines. Regarding the price, it shows relative stability for Tether, with minimal fluctuations around the nominal value of \$1, which is typical for stablecoins. However, the graph indicates that despite the stable price, volatility and risk can vary significantly depending on market conditions, highlighting the importance of continuous market and risk monitoring even for stablecoins like Tether.

Figure 2. t-Dist(5) ES (Expected Shortfall) of stablecoins compared to cryptocurrencies and traditional financial instruments



Source: Author's calculations

Figure 2 displays the t-Dist(5) ES (Expected Shortfall) for various asset classes, including stablecoins (BUSDUSD, DAIUSD, FRAXUSD, USDCUSD, USDTUSD), cryptocurrencies (BTCUSD, ETHUSD), the EURUSD currency pair, indices (SP500, NASDAQ), and the prices of crude oil (BRENTUSD), silver (XAGUSD), and gold (XAUUSD) during the period from October 23, 2021, to October 23, 2023. The chart shows that stablecoins have the lowest ES values, indicating their predictable stability and minimal risk of loss compared to other assets. Cryptocurrencies like Bitcoin and Ethereum exhibit significantly higher ES values, reflecting their high volatility and risk, especially during market disruptions. Assets such as EURUSD, SP500, NASDAQ, and commodities (oil, silver, gold) show varying ES values, but all fall between stablecoins and cryptocurrencies in terms of risk level. Periods of sharp increases in ES values, particularly for cryptocurrencies and commodities, can be linked to market shocks and global economic instability. For instance, during certain periods such as early 2022 and mid-2023, an increase in ES is observed, indicating times of heightened risk.

4. Conclusion

The paper provides basic information about stablecoins, highlighting their role in the crypto ecosystem and the reasons they have attracted the attention of researchers and investors. Stablecoins, offered as a solution to reduce the price volatility that affects cryptocurrencies, have become crucial for cryptocurrency trading and the development of decentralized finance (DeFi).

In this paper, we analyzed 1,202 daily returns of various financial instruments over the period from December 28, 2020, to April 12, 2024. The financial series included stablecoins pegged to the US dollar (Tether (USDT/USD), USD Coin (USDC/USD), FRAX (FRAX/USD), Binance USD (BUSD/USD), and DAI (DAI/USD)), cryptocurrencies (Bitcoin (BTC/USD) and Ethereum (ETH/USD)), and traditional financial instruments (EUR/USD currency pair indices, NASDAQ and S&P 500, and the prices of oil (BRENT/USD), silver (XAG/USD), and gold (XAU/USD)). The results show that although stablecoins are designed to minimize volatility, their stability depends on the stability of the underlying assets and the mechanisms used to maintain their peg. The research found that stablecoins exhibit lower volatility compared to traditional cryptocurrencies like Bitcoin and Ethereum, but their volatility can still be influenced by market conditions and key events. The analysis highlighted that significant market events, such as the Terra-LUNA crash and the FTX bankruptcy, caused substantial increases in the volatility of stablecoins, indicating their sensitivity to market shocks. The study emphasizes the contrast between the expected stability of stablecoins and the high risk associated with more volatile assets. It also underscores the critical role of stablecoins in the broader cryptocurrency ecosystem for risk management and financial stability. The insights derived from this analysis are vital for investors when making decisions about portfolio diversification and risk management across different asset classes and highlight the importance of stablecoins in the cryptocurrency market.

References

- Amirshahi, B., & Lahmiri, S. (2023). Hybrid deep learning and GARCH-family models for forecasting volatility of cryptocurrencies. *Machine Learning with Applications*, 12. <https://doi.org/10.1016/j.mlwa.2023.100465>

Volatility and stability of stablecoins

- Barson, Z., & Owusu, P. (2024). Tail risk modelling of cryptocurrencies, gold, non-fungible token, and stocks. *Research in Globalization*. 8. <https://doi.org/10.1016/j.resglo.2024.100229>
- Bergsli, L. Ø., Lind, A. F., Molnár, P., & Polasik, M. (2022). Forecasting volatility of Bitcoin. *Research in International Business and Finance*. 59. <https://doi.org/10.1016/J.RIBAF.2021.101540>
- Chen, K., & Cheng, T. (2022). Measuring tail risks. *The Journal of Finance and Data Science*. 8, 296–308. <https://doi.org/10.1016/j.jfds.2022.11.001>
- Cheung, K. C., & Yuen, F. L. (2020). On the uncertainty of VaR of individual risk. *Journal of Computational and Applied Mathematics*. 367. <https://doi.org/10.1016/J.CAM.2019.112468>
- Díaz, A., Esparcia, C., & Huélamo, D. (2023). Stablecoins as a tool to mitigate the downside risk of cryptocurrency portfolios. *North American Journal of Economics and Finance*. 64. <https://doi.org/10.1016/j.najef.2022.101838>
- Dudek, G., Fiszeder, P., Kobus, P., & Orzeszko, W. (2024). Forecasting Cryptocurrencies Volatility Using Statistical and Machine Learning Methods: A Comparative Study. *Applied Soft Computing Journal*, 151. <https://doi.org/10.1016/j.asoc.2023.111132>
- Hoang, L. T. & Baur, D. G. (2021). How stable are stablecoins? *The European Journal of Finance*, 1–17. <https://doi.org/10.1080/1351847X.2021.1949369>
- Karimi, P., Mirzaee Ghazani, M., & Ebrahimi, S. B. (2023). Analyzing spillover effects of selected cryptocurrencies on gold and brent crude oil under COVID-19 pandemic: Evidence from GJR-GARCH and EVT copula methods. *Resources Policy*. 85. <https://doi.org/10.1016/j.resourpol.2023.103887>
- Kosse, A. , Glowka, M., & Mattei, I. (2023) Will the real stablecoin please stand up? *BIS Papers No 141*. BIS Monetary and Economic Department. <https://www.bis.org/publ/bppdf/bispap141.pdf>
- Kyriazis, N. A., Daskalou, K., Arampatzis, M., Prassa, P., & Papaioannou, E. (2019). Estimating the volatility of cryptocurrencies during bearish markets by employing GARCH models. *Heliyon*. 5(8). <https://doi.org/10.1016/J.HELİYON.2019.E02239>
- Lazar, E., Pan, J., & Wang, S. (2024). On the estimation of Value-at-Risk and Expected Shortfall at extreme levels. *Journal of Commodity Markets*. 34. <https://doi.org/10.1016/j.jcomm.2024.100391>
- Liao, G. Y., & Caramichael J. (2022) Stablecoins: Growth Potential and Impact on Banking. *International Finance Discussion Papers 1334*. Washington: Board of Governors of the Federal Reserve System. <https://doi.org/10.17016/IFDP.2022.1334>
- López-Martín, C., Arguedas, R., & Benito Muela, S. (2022). A cryptocurrency empirical study focused on evaluating their distribution functions. *International Review of Economics and Finance*, 79. <https://doi.org/10.1016/j.iref.2022.02.021>
- Moutanabbir, K., & Bouaddi, M. (2024). A new non-parametric estimation of the expected shortfall for dependent financial losses. *Journal of Statistical Planning and Inference*. 232. <https://doi.org/10.1016/j.jspi.2024.106151>
- Palamalai, S., Kumar, K. K., & Maity, B.. (2021). Testing the random walk hypothesis for leading cryptocurrencies. *Borsa Istanbul Review*, 21(3), 256–268. <https://doi.org/https://doi.org/10.1016/j.bir.2020.10.006>
- Palamalai, S., Kumar, K. K., & Maity, B.. (2021). Testing the random walk hypothesis for leading cryptocurrencies. *Borsa Istanbul Review* 21(3), 256–268. <https://doi.org/10.1016/J.BIR.2020.10.006>

- Qiu, Z., Lazar, E., & Nakata, K.. (2024). VaR and ES forecasting via recurrent neural network-based stateful models. *International Review of Financial Analysis*. 92. <https://doi.org/10.1016/j.irfa.2024.103102>
- Shah, A. & Bahri, A. (2023) Tokenomics: How “Risky” are the Stablecoins?," *MPRA Paper 119646*, University Library of Munich, Germany. <https://mpra.ub.uni-muenchen.de/119646/>
- Som, A., & Kayal, P.. (2022). A multicountry comparison of cryptocurrency VS gold: Portfolio optimization through generalized simulated annealing. *Blockchain: Research and Applications*. 3(3). <https://doi.org/10.1016/j.bcr.2022.100075>
- Wang, G., Ma, X. & Wu, H. (2020) Are stablecoins truly diversifiers, hedges, or safe havens against traditional cryptocurrencies as their name suggests? *Research in International Business and Finance*, 54, 101225. <https://doi.org/10.1016/j.ribaf.2020.101225>
- Wang, Y., Andreeva, G. & Martin-Barragan, B.. (2023) Machine Learning Approaches to Forecasting Cryptocurrency Volatility: Considering Internal and External Determinants, *International Review of Financial Analysis*, 90.
- Yang, L., & Xu, H.. (2021). Climate Value at Risk and Expected Shortfall for Bitcoin market. *Climate Risk Management*. 32. <https://doi.org/10.1016/J.CRM.2021.100310>

VOLATILNOST I STABILNOST STEJBLKOINA

Abstract: U ovom radu istražujemo volatilnost i stabilnost stejblkoina (stablecoina) koristeći modele GARCH(1,1) sa t-distribucijom inovacionih procesa i t-GARCH(1,1). Fokusirali smo se na analizu najznačajnijih stejblkoina vezanih za američki dolar (USDC, USDT, FRAX, BUSD, DAI) i uporedili ih sa volatilnošću tradicionalnih kriptovaluta (BTC, ETH), fiat valute (EUR/USD), tržišnih indeksa (NASDAQ, S&P 500) i roba (nafta, zlato, srebro). Korišćeni modeli omogućavaju preciznu procenu rizika i potencijalnih gubitaka kroz Value-at-Risk (VaR) i Expected Shortfall (ES) metrike. Rezultati pokazuju da iako stejblkoini generalno pokazuju nižu volatilnost u poređenju sa kriptovalutama, njihova stabilnost može biti ugrožena tokom tržišnih šokova. Ovi nalazi su značajni za investitore i regulatore pri upravljanju rizicima i donošenju investicionih odluka.

Keywords: stejblkoini, kriptovalute, upravljanje rizikom, volatilnost.



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference
CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES

Pregledni naučni rad

**THE POTENTIAL OF INFORMATION SYSTEMS IN IMPROVING
AND REDESIGNING BUSINESS PROCESSES**

Slavoljub Milovanović, PhD*

Jovica Stanković PhD*

***Abstract:** Today, many organizations are focused to development of new information systems which can improve their business processes. Some of the information system projects generate radical restructuring and transformation of business processes while the others generate more incremental changes. Radical transformation of business processes is known as business process reengineering. Various information systems can be effectively used in business process reengineering and business process management. Impact of information systems is multiple and because of that, abilities of the systems in radical and incremental transformations of business processes will be analysed in the paper.*

***Keywords:** Information technologies and systems, Business process reengineering, Business process improving*

1. Introduction

Many companies have begun to look at and understand information systems (IS) and business activities, as well as the relationship between them, from a broader perspective. It was observed that information systems and designing business processes are mutually dependent, that is, in the so-called recursive relation. When thinking about an information system, it is taken into account how the system can support new or redesigned business processes instead of business functions. On the other hand, business processes and their design and improvement should be considered together with the possibilities provided by IS. (Dumas et al. 2018)

Therefore, the main disadvantage of the classic approach to automating business processes is that the business process itself is designed first, and then the IS that supports

*Faculty of Economics, University of Niš, Serbia, ORCID 0000-0002-0128-7301

✉ slavoljub.milovanovic@eknfak.ni.ac.rs

*Faculty of Economics, University of Niš, Serbia, ORCID 0000-0002-9174-0260

✉ jovica.stankovic@eknfak.ni.ac.rs

UDC 007:004]:005.4

such a process is developed. Modern design of business processes and information systems means that in the earlier stages of the project, information technologies are taken into account, which not only support the business process, but can radically transform it. Since business processes often exceed the boundaries of one organizational unit and company function, it is necessary to form teams whose members can belong to different business functions, which means that new, more flexible organizational forms are needed for designing business processes and information systems. Given that most processes have an interfunctional nature (passing through multiple functions), it is not always easy to identify the head of a function who should take responsibility for a business process. (Baiyere et al. 2020)

The main goal of this paper is to make a comparison between radical transformation and incremental improvement of business processes and to highlight the role and potential of information technologies and systems in these improvements and changes. In addition, the stages in designing business processes and the role of information systems in process execution, data collection and storage, as well as process performance control are considered.

2. Improvement and reengineering of business processes

Excellence in the performance of business processes represents a standard for all significant measures of competitive performance in an organization (Smith, 2003). We can single out the following as significant criteria:

- Consumer satisfaction - represents the result of optimizing business processes with the aim of fulfilling the needs, demands and wishes of consumers;
- Cost reduction - is the result of optimization of operations and procurement processes;
- Reducing the time cycle of sales - the result of optimization in the field of production and logistics;
- Quality – the result of optimizing the design, development and production processes;
- Differentiation - the result of optimizing marketing and innovation activities/processes;
- Productivity - the result of optimization of each individual business process.

The question arises - how can an organization ensure excellence in business processes? In their book "Reengineering the corporation", Michael Hammer and James Champy (1993), argued that American companies must radically redesign their business processes in order to reduce costs, improve quality and thus become more competitive. The authors also state that the key to such changes lies precisely in information technologies. Radical redesign, known as business process reengineering, is a strategy for improving the productivity and profitability of an organization's business processes. An important part of this strategy is the review of business processes, followed by the determination of the best ways to reconstruct the process with the aim of improving business functions. The popularity of business process reengineering has increased due to the unique capabilities of information technology, such as the automation and standardization of many process activities. Business processes and their improvement should be considered together with the capabilities provided by IT.

Although some organizations have successfully implemented business process reengineering, many organizations have found that this strategy is too difficult, too radical,

The Potential of Information Systems in Improving and Redesigning Business Processes

too time-consuming and too comprehensive. The impact it has on employees, existing investments in information systems, and even organizational culture is too great. The result of criticism is a less radical and incremental approach that disrupts organizational flows less and is called business process improvement.

Improvement of business processes is focused on reducing variations in business processes, identifying their causes in the processes themselves and their outputs. The improvement of business processes is most often performed by teams of employees that include an expert or manager of the process and other individuals who are employed within the process itself.

Six Sigma is a popular methodology on which business process improvement initiatives are based. Its goal is to ensure that the process does not have more than 3-4 defects in a million outputs, using statistical methods to analyze the process. The Six Sigma methodology was developed at Motorola in the 1980s, and is now used in companies around the world. This methodology is particularly applicable in manufacturing companies, where product defects can be easily defined and measured. In the past, the Six Sigma methodology has been reshaped to focus less on defects and more on customer value. The result of this transformation is that it can now also be applied to services. Today, the instruments of Six Sigma methodology are widely used in the field of financial and health services. (Schulte et al. 2015)

Although business process improvement initiatives do not provide the drastic improvement in performance that reengineering promises, many organizations prefer this method because it is less risky and costs less. All employees can be trained to apply business process improvement techniques during their work and thus identify opportunities for improvement. Therefore, it can be said that business process improvement projects generally go from the bottom up, unlike business process reengineering. In general, business process improvement projects require less time, and even if they are unsuccessful, they consume significantly less resources than reengineering projects. However, if it is no longer possible to achieve incremental, gradual improvements, in that case the company should consider reengineering business processes. (Butt, 2020)

3. Designing business processes

Regardless of the methodology, designing business processes generally consists of five basic phases: definition, measurement, analysis, improvement and control (Zott, & Amit, 2010).

1) In the definition phase, the business process design team documents existing process activities, process resources, inputs, and outputs, usually as a graphical process map or diagram. The same team also documents everything related to the client (consumer), including the client's requirements for the output of the process, along with a description of the problem to be solved.

2) In the measurement phase, the business process design team identifies relevant process indicators, such as the time and costs required to create one output (product or service). The team then collects data to understand how the measurement methodology evolves over time. Sometimes the data already exists, in which case it can be extracted from the information system that supports the process. Often, however, the business

process design team needs to combine operational process data, already stored in the company's information system, with other data sources, such as customer and employee observations, interviews, and surveys.

3) In the analysis phase, the business process design team reviews the process map and collected data to identify process problems (such as reduced efficiency or effectiveness) and their causes. If possible, the team should create a scale for measuring the process (benchmarking), that is, compare the performance of the process with similar processes in other companies or other parts of the organization. The business process design team may use applications such as statistical analysis software or simulation packages at this stage. Typically, process simulation software is used in the analysis phase. By using such software, a double benefit is achieved. First, it allows the process manager to quickly simulate the actual state for a specific period of time (for example, a working day, week, or month). The manager then evaluates the performance of the process over time, without having to observe the process in practice. Second, it allows the manager to create multiple scenarios, for example, using a different amount of resources in the process and/or using a different configuration of process steps. Process simulation is extremely useful for process managers because it is a risk-free and inexpensive test of an improvement solution that does not have to be implemented with real resources. (Mendling et al. 2020)

4) In the improvement phase, the business process design team identifies possible solutions to eliminate the cause of the problem, maps the resulting process alternatives, selects and implements the best solution. The most common way to improve a process is to eliminate process activities that do not add value to the output and rearrange the activities in a way that reduces delay or improves resource utilization. When eliminating and reorganizing, care must be taken not to eliminate the internal controls of process activities that safeguard the company's assets, guarantee the accuracy of financial reporting, and ensure compliance with rules and regulations. (Kerpedzhiev et al. 2021)

5) In the control phase, the business process design team establishes a procedure for measuring and monitoring process improvement after the solution is implemented, to ensure the stability of the process performance. Information systems can be very useful in the control phase.

More than a hundred software companies provide tools for various business process management and improvement projects, including IBM, Oracle and TIBCO. Software tools help companies identify processes that require improvement, create new processes, define business rules for performing those new processes and integrate them into existing business systems. Also, they provide the ability to monitor process performance improvements and measure the impact of process changes on key business indicators. (Fischer et al. 2020)

4. Support of information systems for managing business processes

The use of information systems is a critical factor in the success of organizational processes. Information systems facilitate communication and coordination between different functional areas and enable easy exchange and access to data in the business process. Information systems have a particularly important role in three areas:

- Execution of processes;
- Collection and storage of data;

The Potential of Information Systems in Improving and Redesigning Business Processes

- Monitoring and control of process performance.

In some cases, the process activity is fully automated, ie. it is carried out exclusively through the information system. In other cases, IS must rely on managers' judgments, expertise, and intuition. (Barmuta et al. 2020)

Process execution. Information systems help organizations to perform their processes efficiently and effectively. Information systems are usually embedded in processes and play a key role in performing the processes themselves. In other words, information systems and processes are intertwined. If the IS is not functioning, the processes cannot be executed. IS assists processes by informing people when a particular task needs to be performed, providing the necessary data to complete that task and, in some cases, providing the means to complete those tasks. For example, in the procurement process, IS generates procurement requests and informs the procurement department that it is necessary to react. In the sales process, IS will inform the employees in the warehouse about whether the shipments are ready for delivery. IS also supplies them with lists of products that must be included in the shipment and where those products can be found within the warehouse. (Evans, 2017)

Data collection and storage. Processes create data such as dates, times, product codes, their quantities, prices and location, and in addition, who did what, where and when. IS collects and stores all that data which is usually called process or transactional data. Data related to who completed which activity, where and when are generated and automatically collected by information systems. Other data is generated outside the information system and must be entered into it. Data entry can be done in a number of ways, from manual entry to automated data entry through bar codes or machine-readable RFID (radio frequency identification) tags. For example, when an order is received from a customer via email or phone in the sales process, the person receiving the order must enter information such as the customer's name, order item, and quantity. (Gronwald, 2017)

A significant advantage of using information systems compared to manual systems is that data needs to be entered only once. Furthermore, once they have been entered, other employees within the process can easily access them and there is no need for additional entry. Data collected by IS can provide instant feedback. For example, IS may use the data to create an invoice or create recommendations for additional or alternative products.

Monitoring and control of process performance. Information systems also contribute to monitoring the state of business processes, i.e. show how well processes are performing. Information systems perform this activity by evaluating process information. For example, a company may be interested in a specific customer order, in terms of where that order is in the sales process and how much progress has been made in fulfilling it. (Hayes, 2018)

Not only can information systems be of great use in process monitoring, but they can also indicate problems that arise. Information systems perform this role by comparing information with standards, ie. what the company expects or wants, to determine whether the performance of the process is within the expected framework. Standards are defined by management based on organizational goals. If, according to the information provided by the information systems, the processes do not correlate with the set standards, then the company will assume that there is a problem. Some problems can be routinely and automatically detected by the information system, while others require personal

information review and assessment. For example, IS can calculate the expected delivery date of some goods, and then determine whether the actual time matches the set standard.

Monitoring of business processes helps to detect problems. In such cases, IS can help diagnose the cause of the problem by supplying managers with additional, detailed information. For example, if the average time to process customer orders increased compared to the previous month, the observed problem could be a symptom of another problem. The manager can determine what kind of problem it is with an additional review of the information.

5. Support of information systems for reengineering of business processes

Innovative model of development of information systems that should support business processes takes into account the recursive relationship between IT (Information Technology) and business processes. The traditional method of developing information systems does not take into account this relationship, but begins with determining the information needs of a business function or process, and then continues with the analysis of IT capabilities to support those functions and processes. However, IT can create new options in the design of business processes, as it helps to rethink some traditional assumptions about the organization of work that prevent the efficient development of processes. In other words, IT should be enabled to influence the process design from the very beginning. However, following these steps and instructions does not automatically guarantee that business process reengineering will be successful. The company's IT infrastructure should enable support for changes in business processes that cross the boundaries of functions, business units and companies. Most business process reengineering projects do not achieve significant improvements in business performance. A redesigned business process or new IS inevitably affects jobs, skill requirements, workflows, and reporting relationships. The fear of those changes causes resistance, confusion, and even a conscious effort to prevent the changes, all of which reduce the business performance gained through process reengineering. (Laudon, K. & Laudon, J. 2018)

Top management should not look at business processes from a narrow perspective, but develop a broader strategic vision related to those processes. For example, the management of Mitsubishi Heavy Industries made great strides in reducing costs and speeding up product development, which allowed the company to regain leadership in the world shipbuilding market. This company has redesigned the entire production process with the aim that cost-inefficient, labor-intensive tasks are performed with machines, robots and computer-aided design tools. Therefore, firms should identify a few core business processes that need to be redesigned, focusing on those with the greatest potential benefits. (Yang et al. 2020)

In order to compare with planned performance, the performance of existing business processes must be measured. For example, if the goal of process reengineering is to reduce the time and costs of new product development or order fulfillment, the organization should measure the time and costs required by existing, unchanged processes.

As we have already emphasized, business processes and their improvement should be considered together with the possibilities provided by IT. The complete possibilities of using IT in the reengineering of business processes are shown in table 1.

The Potential of Information Systems in Improving and Redesigning Business Processes

Table 1. IT Capabilities in business process reengineering

IT Capabilities	Business Impact/Benefits
Transactional	IT can transform unstructured processes into routine transactions
Geographical	IT can transfer information with great speed and ease between two remote locations, so that the process is independent of geographic space
Automation	IT can reduce or completely replace human work in processes
Analytical	IT can provide complex analytical methods for process analysis
Information	IT can provide a large amount of detailed information about the process
Sequential	IT allows changing the order of tasks in the process, so that it is possible to perform multiple tasks simultaneously
Knowledge Management	IT allows the storage and dissemination of knowledge and expertise for process improvement
Monitoring	IT allows detailed monitoring of the status of tasks, inputs and outputs
Eliminating intermediaries	IT can be used to connect two parties within a process that would otherwise communicate through an intermediary (internal or external)

Source: Davenport & Short, 1990.

In this context, business process reengineering with the support of IT can take place in five main steps: creating a business vision and process goals, identifying the processes that need to be redesigned, understanding and measuring existing processes, identifying IT opportunities and designing and building prototypes of new processes. (Wirtz, 2020)

Creation of business vision and process goals. In the past, redesigning business processes was usually aimed at simply "streamlining" the process, that is, eliminating obvious bottlenecks and inefficiencies. The redesign did not include any business vision or context. However, successful redesign can only be achieved if top management develops a broad strategic vision into which business process reengineering fits. Specific goals of business process reengineering arise from each strategic vision, which can most often be: reduction of time and costs, quality of output, quality of work environment (life)/learning/empowerment. (Pugh, 2016)

Identifying processes that need to be redesigned. Due to the large number of business processes that exist in one company, only those that are critical for the functioning and success of the company should be identified. The first approach to identifying business processes consists in trying to identify all processes, in order to make a priority among them from the point of view of the urgency of redesign. The essence of the second approach is reflected in identifying only the most important processes or those that are in the greatest conflict with the business vision and goals.

Understanding and measuring existing processes. There are two primary reasons for understanding and measuring the process before redesigning. First, the problems must be understood, so that they do not repeat themselves. Second, accurate measurement can serve as a guide for future improvements. If the goal of reengineering is to reduce time and costs, then the time and costs of a certain process should be accurately measured.

Identifying IT opportunities. Until recently, the possibilities of IT were considered only after business process reengineering. First, the needs of the process or some other business entity were defined, and only then was the IS developed that would meet those needs. The problem with this traditional approach is that awareness of IT capabilities can and should influence the business process project. It is very useful to have a list of the basic possibilities of IT in improving business processes. One such list of capabilities with the impact and benefits that can be obtained is shown in Table 1. In the broadest sense, all these opportunities include the improvement of coordination and access to information across organizational units. In this way, more effective management of interconnected tasks would be enabled. (Rogers, 2016)

Designing and Prototyping a New Process. The end result of reengineering is not a process project but its prototype. The prototype is further refined through successive iterations. The main factors and tactics to consider in creating and refining a process prototype include: using IT as a design tool, defining different criteria for evaluating project alternatives, and creating an organizational prototype that includes creating a prototype of a software application to support the business process, as well as building a prototype of the business process itself and the corresponding organizational structure.

6. Conclusion

The role of information technology and systems in organizations is no longer just administrative and technical. It consists not only in the automation of repetitive operational tasks, but in the complete restructuring and redesign of key business processes and total quality management of products, services and processes. Whether this role will be strengthened in a specific organization depends mostly on the commitment and ability of the management. It also depends on the management structures of the organization whether information systems will be used for a radical change in business processes or for incremental improvements. That is why this paper briefly explains in which direction the management should think when initiating the implementation of new information systems and how to use the potential of those systems in the best possible way. Future research on this problem would be focused on studying the practice of domestic companies, when it comes to reengineering and improvement of business processes. The sample, which would include a certain number of companies from different sectors, would show whether companies undertake projects in these domains and what their experiences are.

Acknowledgement:

The work is the result of research based on the obligations under the Agreement on the transfer of funds for the financing of NIR in 2024 (registration number 451-03-65/2024-03), concluded between the Ministry of Science, Technological Development and Innovation of the Republic of Serbia and the Faculty of Economics, the University of Niš.

References

Baiyere, A., Salmela, H., & Tapanainen, T. (2020). Digital transformation and the new logics of business process management. *European journal of information systems*, 29(3), 238-259.

The Potential of Information Systems in Improving and Redesigning Business Processes

- Barmuta, K. A., Akhmetshin, E. M., Andryushchenko, I. Y., Tagibova, A. A., Meshkova, G. V., & Zekiy, A. O. (2020). Problems of business processes transformation in the context of building digital economy. *Entrepreneurship and Sustainability Issues*, 8(1), 945.
- Butt, J. (2020). A conceptual framework to support digital transformation in manufacturing using an integrated business process management approach. *Designs*, 4(3), 17.
- Davenport, T. H., Short, J. E. (1990). The New Industrial Engineering, *Sloan Management Review*, 31(4), 11-27.
- Dumas, M., Rosa, L. M., Mendling, J., & Reijers, A. H. (2018). *Fundamentals of business process management*. Springer-Verlag.
- Evans, J. R. (2017). *Business Analytics: Methods, Models, and Decisions* (Vol. 3). Upper Saddle River, NJ: Pearson.
- Fischer, M., Imgrund, F., Janiesch, C., & Winkelmann, A. (2020). Strategy archetypes for digital transformation: Defining meta objectives using business process management. *Information & Management*, 57(5), 103262.
- Gronwald, K. (2017). *Integrated Business Information Systems - A Holistic View of the Linked Business Process Chain ERP-SCM-CRM-BI-Big Data*. Germany, Berlin: Springer-Verlag GmbH
- Hammer, M. and Champy, J. (1993) *Reengineering corporation*, Harper Collins Inc., New York.
- Hayes, J. (2018). *The Theory and Practice of Change Management*. Palgrave: Macmillan.
- Kerpedzhiev, G. D., König, U. M., Röglinger, M., & Rosemann, M. (2021). An exploration into future business process management capabilities in view of digitalization: results from a Delphi study. *Business & Information Systems Engineering*, 63(2), 83-96.
- Laudon, K. C. & Laudon, J. P. (2018). *Management Information Systems: Managing the Digital Firm*, 12th Edition. Harlow: Pearson Education, Inc,
- Mendling, J., Pentland, B. T., & Recker, J. (2020). Building a complementary agenda for business process management and digital innovation. *European journal of information systems*, 29(3), 208-219.
- Pugh, L. (2016) *Change Management in Information Services*. London: Taylor and Francis Group.
- Rogers, D. L. (2016). *The Digital Transformation Playbook: Rethink Your Business for the Digital Age*. New York: Columbia University Press.
- Schulte, S., Janiesch, C., Venugopal, S., Weber, I., & Hoenisch, P. (2015). Elastic Business Process Management: State of the art and open challenges for BPM in the cloud. *Future Generation Computer Systems*, 46, 36-50.
- Smith, H. (2003). Business process management—the third wave: business process modelling language (bpml) and its pi-calculus foundations. *Information and Software Technology*, 45(15), 1065-1069.
- Wirtz, B. W. (2020). *Business model management: design-process-instruments*. Springer Nature.
- Yang, R., Wakefield, R., Lyu, S., Jayasuriya, S., Han, F., Yi, X., ... & Chen, S. (2020). Public and private blockchain in construction business process and information integration. *Automation in construction*, 118, 103276.
- Zott, C., & Amit, R. (2010). Business model design: An activity system perspective. *Long range planning*, 43(2-3), 216-226.

POTENCIJAL INFORMACIONIH SISTEMA U UNAPREĐENJU I REDIZAJNIRANJU POSLOVNIH PROCESA

Apstrakt: *Danas su mnoge organizacije fokusirane na razvoj novih informacionih sistema koji mogu unaprediti njihove poslovne procese. Neki od projekata informacionih sistema generišu radikalno restrukturiranje i transformaciju poslovnih procesa, dok drugi generišu inkrementalne promene. Radikalna transformacija poslovnih procesa poznata je kao reinženjering poslovnih procesa. Različiti informacioni sistemi se mogu efikasno koristiti u reinženjeringu poslovnih procesa i upravljanju poslovnim procesima. Uticaj informacionih sistema je višestruk i zbog toga će u radu biti analizirane mogućnosti ovih sistema u radikalnim i inkrementalnim transformacijama poslovnih procesa. Ključne reči:.*

Ključne reči: *Informacione tehnologije i sistemi, reinženjering poslovnih procesa, unapređenje poslovnih procesa*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**ZNAČAJ VEŠTAČKE INTELIGENCIJE ZA ODRŽIVI RAZVOJ
NAFTNE INDUSTRIJE**

Marija Petrović-Randelović, PhD*

Jovanka Biljan, PhD*

Miloš Cvetković, MSc♦

Apstrakt: Naftnu industriju, kao ključnu granu industrije u globalnoj ekonomiji, zahvatio je talas transformacije vođen tehnološkim napretkom, posebno u oblasti veštačke inteligencije. Zbog složenosti operacija i visokog rizika prilikom donošenja odluka, ova industrijska grana sve više se okreće ka primeni veštačke inteligencije u cilju povećanja efikasnosti, bezbednosti i unapređenja konkurentskih performansi. Brzina kojom se vrši integracija veštačke inteligencije u različite industrijske aktivnosti određuje mogućnost prilagođavanja ove industrijske grane aktuelnim trendovima u globalnoj ekonomiji. Naročito, sve veći ekološki pritisak i potreba za održivim razvojem postavljaju složena pitanja o ulozi nafte i gasa u promenljivoj energetske ekonomiji i položaju naftne industrije u ostvarivanju održivog razvoja globalne ekonomije. Imajući to u vidu, cilj ovog rada je da na osnovu analize mogućnosti, prednosti i budućih trendova u primeni veštačke inteligencije u naftnoj industriji, ukaže na značaj veštačke inteligencije za održivi razvoj ove industrijske grane. Jasnije razumevanje odnosa između veštačke inteligencije, naftne industrije i održivog razvoja bi trebalo da omogućiti naftnim kompanijama donošenje efikasnijih odluka u pogledu primene takvih razvojnih modela koji će doprineti unapređenju održivih performansi naftne industrije u celini.

Ključne reči: naftna industrija, veštačka inteligencija, održivi razvoj.

* Univerzitet u Nišu, Ekonomski fakultet, Srbija, <https://orcid.org/0000-0003-2905-1023>,
✉ marija.petrovic@eknfak.ni.ac.rs

• Faculty of Tourism and Hospitality, Ohrid, University St. Kliment Ohridski, Bitola, North Macedonia, ✉ jovanka.biljan@uklo.edu.mk

♦Doktorand Univerziteta u Nišu, Ekonomski fakultet, Srbija,
✉ miloscvetkovic89@gmail.com

1. Uvod

Primena veštačke inteligencije (AI), kao najvažnije tehnologije opšte namene u savremenom digitalnom dobu, u industrijskom sektoru značajan je pokretač rasta i razvoja, ali i unapređenja konkurentskih performansi ovog sektora. Međutim, koristi od AI rešenja nisu nužno ograničene samo na kompanije iz digitalno pametnih industrija. Kompanije iz oblasti naftne industrije, građevinarstva i rudarstva sve više se suočavaju sa potrebom da se prilagođavaju zahtevima digitalnog doba, odnosno da u svom poslovanju primenjuju AI rešenja u cilju opstanka na brzo rastućem i promenljivom tržištu. Iako je ideja o primeni veštačke inteligencije u naftnoj industriji nastala još 70-ih godina XX veka, aktivnosti u pravcu primene savremenih tehnoloških rešenja u ovoj industrijskoj grani počele su da se intenziviraju u poslednjih nekoliko godina. To se vremenski poklopilo sa eksponencijalnim rastom sposobnosti veštačke inteligencije i uvođenju koncepta Nafta i gas 4.0, čiji je osnovni cilj ostvarivanje veće vrednosti korišćenjem naprednih digitalnih tehnologija. Naime, inicijativa Svetskog ekonomskog foruma pokrenuta 2015. godine odredila je digitalizaciju kao trend razvoja. Pandemija je ubrzala digitalizaciju i kompanije su uvidele da moraju postati fleksibilnije kako bi odgovorile na velike poremećaje i fluktuacije tražnje, budući da je kriza pandemije smanjila tražnju za naftom i gasom. "Pojedine kompanije i stručnjaci smatraju da „Nafta i gas 4.0“ može u potpunosti da promeni status quo industrije nafte i gasa, što može doneti ogromne koristi jer ubrzava digitalizaciju i inteligentnost industrije nafte i gasa. Međutim, „Nafta i gas 4.0“ je još uvek u fazi razvoja" (Lu et al., 2019, p. 68).

Značaj naftne industrije za rast globalne ekonomije se ne sme potceniti, budući da ona zauzima značajno mesto i ima veliku ulogu u pokretanju privrednog razvoja mnogih zemalja. Veštačka inteligencija u savremenim uslovima sve više određuje rast mnogih industrijskih grana, tako da ni naftna industrija ne ostaje van delokruga njenih globalnih uticaja. Uprkos brojnim izazovima u ovoj industrijskoj grani, veštačka inteligencija je dovela do promene razvojne paradigme, što je rezultiralo u stvaranju novih razvojnih mogućnosti, kao što je inteligentno bušenje, koje oblikuje budući komercijalni razvoj. Koristi od primene veštačke inteligencije na ceo tok operacija u okviru naftne industrije danas postaju sve evidentnije.

Naftna industrija mora biti dovoljno fleksibilna kako bi pružila stratešku reakciju na promene u cenama sirovina i tražnji za proizvodima kao rezultat promene globalne ekonomije. Pored uvođenja značajnih promena u preradi uglavodnika, istraživanja pokazuju da kompanije počinju da investiraju u čistiju proizvodnju goriva, molekularnu reciklažu, smanjenje plastičnog otpada i efikasnije, i ekološki prihvatljivije proizvodne metode. Takvo ponašanje kompanija iz oblasti naftne industrije u skladu je sa naporima globalne ekonomije za ostvarivanje održivog razvoja i unapređenja njihovih ekoloških performansi.

Budući da su istraživanja odnosa između veštačke inteligencije, naftne industrije i održivog razvoja relativno oskudna, usled ograničene dostupnosti podataka i činjenice da je koncept Nafta i gas 4.0 tek u začetku, ovaj rad bi trebalo da doprinese jasnijem razumevanju njihovih međusobnih odnosa i postavljanju osnove za buduća istraživanja. Imajući to u vidu, nakon uvodnih razmatranja, u drugom delu rada ukazano je na mogućnosti primene veštačke inteligencije u naftnoj industriji. U trećem delu rada identifikovane su prednosti primene veštačke inteligencije u ovoj industrijskoj grani. Nakon

ukazivanja na buduće trendove u primeni veštačke inteligencije u naftnoj industriji, u zaključku je izvršena sinteza ključnih razmatranja navedenog problema.

2. Mogućnosti primene veštačke inteligencije u naftnoj industriji

Naftna industrija ima značajan uticaj na proizvodnju energije širom sveta. Ona se deli na uzvodnu, srednju i nizvodnu. Uzvodni tok pokriva podpovršinski (rudarski) deo industrije, uključujući istraživanje, praćeno razvojem polja i proizvodnjom sirove nafte ili gasa. Srednji tok označava transport nafte i gasa, a nizvodni je rafinerija, odnosno proizvodnja goriva, maziva, plastike i drugih proizvoda. Sa pojavom veštačke inteligencije otvorene su nove mogućnosti za ostvarivanje brojnih prednosti i koristi u naftnoj industriji. Ključni značaj primene veštačke inteligencije i algoritama mašinskog učenja je da obezbedi tačno predviđanje za rešavanje problema na osnovu dostupnih podataka i iskustava uz minimalne troškove. Primena AI u uzvodnim operacijama je naročito interesantna, budući da je to kapitalno najintenzivniji i najvažniji od tri segmenta u poslovanju sa naftom i gasom.

Istraživanje nafte i gasa je složen, dugotrajan i kapitalno intenzivan proces. On uključuje seizmičko istraživanje, snimanje bušotina i laboratorijsku analizu jezgra. Sve ove studije, pregledi i testovi imaju za posledicu stvaranje 3D modela, koji se zatim analiziraju za nalazišta nafte i gasa. Veštačka inteligencija omogućava da se ubrzaju i izbegnu višestruki procesi u istraživanju nafte. Njena primena je usmerena ka stvaranju efikasnog, pouzdanog i produktivnog sistema, koji je zasnovan na najboljoj međunarodnoj praksi. Oblasti primene veštačke inteligencije u ovoj industrijskog grani su brojne, među kojima se ističu optimizacija proizvodnje, automatizacija zadataka, proizvodnja ugljovodonika, kao i monitoring rada elektro potapajućih pumpi.

Usled promenljivosti i nemogućnosti predviđanja cene nafte, delovanjem faktora koji povećavaju rizik i neizvesnost u pogledu međunarodne bezbednosti, terorizma, globalnog zagrevanja, itd. (Asokan, 2019), multinacionalne korporacije iz oblasti naftne industrije svoje aktivnosti usmeravaju ka optimizaciji proizvodnje. Primena veštačke inteligencije i mašinskog učenja omogućava ažuriranje u realnom vremenu i doprinosi stvaranju optimalnog radnog okruženja, kroz prikupljanje podataka preko različitih senzora i uređaja. Shodno tome, primena AI metodologija i tehnika za optimizaciju proizvodnje u naftnoj industriji, zasnovanih na različitim statističkim modelima, olakšava proces donošenja odluka, povećavajući produktivnost i prinos na ulaganja. Sposobnost veštačke inteligencije i tehnika mašinskog učenja da brzo analiziraju ogromne količine podataka poredstavlja posebnu prednost u odnosu na tradicionalne metode. Kompanije koriste različite tehnike, uključujući fuzzy logiku, veštačke neuronske mreže i genetske algoritme, da bi iskoristile prepoznavanje obrazaca i optimizaciju parametara za preciznije predviđanje proizvodnje (Ashour, 2023).

Automatizacija predstavlja jednu od oblasti u inteligentnom računarstvu, koja je primenjena u mnogim industrijskim granama. U naftnoj industriji, automatizacija procesa proizvodnje predstavlja determinantnu njenog rasta, budući da obezbeđuje veću proizvodnju, i kreće se u rasponu od 60% do 90% celokupnog procesa planiranja, proizvodnje, održavanja i marketinga. Ona omogućava minimiziranje rizika uz manje ljudske greške i povećanje efikasnosti celokupnog sistema.

Proizvodni procesi u naftnoj industriji podrazumevaju istraživanje, iskopavanje i bušenje ili istraživanje ležišta ugljovodonika ispod površine zemlje, bilo u dubokom moru, na moru ili na kopnu bez obzira na vremenske ili klimatske uslove. Primenom AI alata analiziraju se podaci o sigurnosti i operacijama u ekstremnom okruženju, čime se olakšava identifikovanje rizika i donošenje efikasnijih odluka, koje smanjuju mogućnost ljudskih akcidenata i doprinose povećanju proizvodnog kapaciteta kompanije.

Elektro potapajuće pumpe predstavljaju važnu opremu za vađenje nafte iz dubine zemlje i jedan od najčešće korišćenih sistema za veštačko podizanje, jer mogu da stvaraju visok protok čak i u veoma dubokim bunarima. Ova oprema se može koristiti za efikasno bušenje na moru, posebno u veoma teškim i promenljivim vremenskim uslovima (Pham et al., 2021; Rensburg, 2019). Kvarovi na ovim pumpama mogu izazvati prekid u proizvodnji nafte i uzrokovati velike troškove. Veštačka inteligencija poboljšava analizu višestrukih podataka u realnom vremenu i pruža digitalnu mapu rada elektro potapajuće pumpe, ali i otkriva anomalije u skupovima podataka i šalje rani signal upozorenja operativnom timu nekoliko dana pre nego što bi moglo da dođe do potencijalnog kvara opreme.

Optimizacija i održavanje rezervoara je od velikog značaja za životni ciklus proizvoda u naftnoj industriji. Implementacija tehnika i alata veštačke inteligencije je neophodna kako bi se izvršila klasifikacija rezervoara i modeliranje terenskog nadzora korišćenjem veštačkih neuronskih mreža, ekspertskih sistema za optimizaciju proizvodnje. Posledično, poboljšava se funkcionalnost rezervoara korišćenjem veštačke inteligencije. Seizmički snimci i podaci o karotaži bunara se koriste za određivanje topologije rezervoara i karakteristika bunara. Algoritmi mašinskog učenja značajno su poboljšali vreme potrebno za obradu ovih podataka i tačnost rezultata. Rezultati izvršenih istraživanja potvrđuju da se preciznost može postići do 92% i da je proces 1000 puta brži od ručnog mapiranja (IBM, 2021).

Kompanije iz oblasti naftne industrije praktikuju redovno održavanje opreme. Međutim, korišćenje senzora i veštačke inteligencije omogućava praćenje operativnog stanja opreme i identifikovanje anomalija, a time i prediktivno održavanje. Primenom algoritama mašinskog učenja i analitike podataka, praktično se dolazi do rešenja koja identifikuju probleme kako bi se sprečili skupi kvarovi.

3. Prednosti primene veštačke inteligencije u naftnoj industriji

Primena veštačke inteligencije u naftnoj industriji omogućava uvid u ceo lanac vrednosti i ostvarivanje brojnih koristi za naftne kompanije. Postoje mnoge oblasti u kojima AI poboljšava efikasnost u naftnoj industriji, kao što je održavanje opreme i modeliranje rezervoara. Na primer, sistemi zasnovani na veštačkoj inteligenciji koji koriste mašinsko učenje i duboko učenje mogu pomoći operaterima uzvodno da pronađu optimalne bunare.

Upotreba veštačke inteligencije omogućava ostvarivanje većeg obima proizvodnje u relativno niže troškove. Na primer, prediktivno održavanje obezbeđuje ex ante predviđanje kvarova opreme, što omogućava pravovremeno održavanje i smanjivanje vremena zastoja. Neplanirani kvarovi na opremi mogu koštati 2-3 miliona dolara dnevno na priobalnim naftnim i gasnim platformama (Sircar et al., 2021). Osim toga, primena veštačke inteligencije doprinosi i racionalizaciji operacija, pomažući u donošenju odluka, upravljanju zadacima koji se ponavljaju, kao i upravljanju lancem snabdevanja i kontroli. Na

Značaj veštačke inteligencije za održivi razvoj naftne industrije

primer, moguće je iskoristiti mašinsko učenje kako bi se pregledali veliki skupovi podataka da bi se identifikovali obrasci i dale preporuke u pogledu ostvarivanja različitih zadataka. Analiza transportnih ruta primenom AI rešenja mogla bi rezultirati optimizacijom rute, dok analiza podataka o vremenskim obrascima i bušenju bi mogli dovesti do sigurnijih radnih uslova.

AI rešenja pružaju naftnim kompanijama nove metode za praćenje bezbednosti radnika i opreme na lokacijama koje karakteriše teška oprema, visok pritisak i visoka temperatura. Moguće je koristiti duboko učenje i algoritme kompjuterskog vida u sistemima koji otkrivaju kršenja bezbednosti. Na primer, rešenja za prepoznavanje obrazaca mogu da analiziraju video strimove sa sajtova, pomažući da se identifikuje osoblje koje nije adekvatno zaštićeno. Pored toga, operateri mogu biti obavešteni o ex ante bezbedonosnom statusu aktive, kako bi se sprečili bezbednosni incidenti (Koroteev & Tekic, 2021). Sistemi veštačke inteligencije mogu, takođe, da pomognu u praćenju nivoa toksičnosti i da obezbede blagovremena upozorenja kako bi se izbegli katastrofalni događaji.

Međutim, primena veštačke inteligencije u naftnoj industriji praćena je brojnim izazovima, među kojima se ističu:

1. nepostojanje jedinstvene i kvalitetne baze podataka. Postojanje podataka u različitim formatima i različitog kvaliteta otežava mogućnost njihove integracije. Osim toga, bez kvalitetnih podataka, rezultati AI modela mogu biti pogrešni ili neefikasni;
2. etička pitanja i nivo veština. Sistemi veštačke inteligencije koriste velike skupove podataka, koji mogu uključivati lične ili geološke podatke, a koji mogu zahtevati različite načine obrade u zavisnosti od jurisdikcije. Oni moraju biti pravilno procenjeni kako bi se izbegla pristrasnost i povećala transparentnost. Osim toga, korišćenje AI rešenja, na primer autonomne opreme, robota vođenih veštačkom inteligencijom, zahteva odgovarajući nivo znanja i veština radnika.

4. Budući trendovi u primeni veštačke inteligencije u naftnoj industriji

Mnoge kompanije iz oblasti naftne industrije su pronašle način da integrišu veštačku inteligenciju u svoje poslovanje. Od bušenja uz pomoć veštačke inteligencije do kancelarijskih operacija, naftne kompanije su ostvarile višestruke koristi, od smanjenja troškova do poboljšanja efikasnosti.

Prema Izveštaju Mordor Intelligence (2024), primena veštačke inteligencije je u porastu u naftnoj industriji, uključujući analizu rezervoara i optimizaciju bušenja do bezbednosnog praćenja i smanjenja emisija. Naftna industrija suočila se sa ozbiljnim problemima tokom pandemije korona virusa COVID-19. Globalno zatvaranje fabrika koje je usledilo usled perioda smanjene ekonomske aktivnosti, dovelo je do značajnog opadanja tražnje za naftom, što se odrazilo i na nagli pad cena sirove nafte u međunarodnim okvirima. Usled toga, proizvodne i aktivnosti istraživanja i razvoja bile su znatno otežane, što je uticalo na sporiji tempo usvajanja AI tehnologija.

Međutim, nakon perioda oživljavanja globalne ekonomske aktivnosti dolazi do naglog povećanja primene AI rešenja u naftnoj industriji. Veštačka inteligencija, posebno u obliku prediktivnog održavanja, transformiše način upravljanja aktivom u naftnoj industriji. Vodeća kompanija za softversku inteligenciju za preduzeća, C3 AI, je oktobra 2023. godine najavila saradnju sa Shell-om, integrišući softver za prediktivno održavanje u aplikaciju za

pouzdanost C3 AI. Ovo strateško partnerstvo u skladu je sa trendom rastućeg usvajanja AI platformi u industriji nafte i gasa, i indikator je daljeg širenja tržišta.

Primena veštačke inteligencije na tržištu nafte i gasa je fragmentisana, usled prisustva kako globalnih giganta, tako i brojnih malih i srednjih preduzeća. Među liderima u primeni veštačke inteligencije ističu se IBM Corporation, Fugenk Technologies, C3.AI Inc., Microsoft Corporation i Intel Corporation. Ove kompanije se sve više okreću strateškoj saradnji i akvizicijama kako bi ojačale svoje portfelje proizvoda i osigurale konkurentsku prednost. Procenjuje se da će primena veštačke inteligencije na tržištu nafte i gasa u 2024. godini iznositi 3,14 milijardi USD, uz očekivanje daljeg povećanja do 2029. godine u iznosu od 5,70 milijardi USD, sa godišnjom stopom rasta od 12,61% tokom predviđenog perioda (2024-2029). Naftne kompanije iz Severne Amerike predstavljaju najveće tržište za veštačku inteligenciju u 2024. godini, zbog razvoja saradnje sa softverskim kompanijama za veštačku inteligenciju i dobavljačima IT sistema. Međutim, procenjuje se da će azijsko-pacifički region ostvariti najvišu stopu rasta tokom predviđenog perioda.

Prema poslednjim procenama, utvrđeno je da naftna industrija učestvuje sa oko 3% u kreiranju svetskog BDP-a, uz očekivanje da će se u narednih deset godina to učešće povećati na više od 5% (Leal Filho et al. 2022). Uprkos činjenici da naftna industrija igra važnu ulogu u globalnoj ekonomiji, njen uticaj na životnu sredinu postavlja važna pitanja o održivosti i budućnosti korišćenja fosilnih goriva. Potrebno je razvijati održivije prakse i alternativne izvore energije kako bi se smanjio negativan uticaj na životnu sredinu. Posmatrano sa aspekta održivog razvoja, očekuje se da će primena veštačke inteligencije u naftnoj industriji doprineti povećanju održivosti operacija u ovoj industrijskoj grani.

Naftnoj industriji je potrebna održivost zbog sve veće složenosti operacija i zahteva tržišta, koji podstiču kompanije da usvoje naprednije industrijske metode od tradicionalnih (Di Vaio et al., 2020). Pod održivim razvojem naftne industrije podrazumeva se razvoj takvih politika i procedura koje omogućavaju industriji da zadovolji svoje trenutne potrebe za energijom, dok istovremeno štiti životnu sredinu za budućnost generacije. Veštačka inteligencija može podržati održivi razvoj naftne industrije povećanjem efikasnosti, smanjenjem otpada i boljom zaštitom radnika. Razvijene privrede treba da ulažu u takvu tehnologiju, budući da je to jedini način na koji naftna industrija može napredovati na visokokonkurentnom tržištu, koji je umnogome određen globalizacijom. Tipičan primer je vlada SAD, koja je u cilju razvoja naftne industrije uložila oko 52, 9 milijardi USD za uvođenje veštačke inteligencije u različitim industrijskim segmentima. Pored SAD-a, i Kina je uložila 17, 2 milijarde USD u povećanje primene veštačke inteligencije u naftnoj industriji.

U zavisnosti od zahteva, mašine se mogu programirati da obavljaju bilo koju specifičnu funkciju koje se tiču njihovog okruženja (Desai et al. 2021). To je osnovni nivo AI, poznat kao uska veštačka inteligenciju, koja se dalje proširuje integracijom ljudske inteligencije, opšte poznata kao opšta veštačka inteligencija. Oponašanje ljudske inteligencije je glavni prioritet računara kada rade u AI, i to je razlog što oni pružaju efektivnu sposobnost da se poboljša održivost u aplikacijama bez ikakve ljudske intervencije.

Primena koncepta cirkularne ekonomije u naftnoj industriji može doprineti povećanju održivosti ove industrijske grane. Cirkularna ekonomija predstavlja osnovnu alternativu linearnom "uzmi - napravi - koristi - baci", ekonomskom modelu koji trenutno prevladuje. Kao model ekonomskog razvoja koji se fokusira na minimiziranje otpada i

Značaj veštačke inteligencije za održivi razvoj naftne industrije

maksimalno korišćenje resursa, ona teži da zadrži proizvode, materijale i resurse u upotrebi što je duže moguće kroz reciklažu, ponovnu upotrebu i obnovu. Zapravo, otpad i korišćenje resursa su svedeni na minimum, a kada proizvod dostigne kraja svog veka, ponovo se koristi za stvaranje dodatne vrednosti (Nacionalni naftni komitete Srbije – Svetskog naftnog saveta, 2017).

Veštačka inteligencija može značajno doprineti primeni koncepta cirkularne ekonomije u naftnoj industriji kroz: (1) optimizaciju procesa, kroz analizu i optimizovanje procesa proizvodnje i rafinacije nafte, smanjujući otpad i povećavajući efikasnost korišćenja resursa; (2) prediktivno održavanje, korišćenjem mašinskog učenja može se predvideti kada će biti potrebna popravka opreme, čime se smanjuje rizik od zastoja i produžava vek trajanja mašina; (3) upravljanje otpadom, identifikovanjem i klasifikovanjem otpada koji nastaje tokom različitih procesa, omogućavajući efikasnije recikliranje i ponovnu upotrebu materijala; (4) analizu životnog ciklusa proizvoda i identifikovanjem načina za smanjenje uticaja na životnu sredinu, čime se povećava održivost; (5) inovacije u proizvodnji, analizom podataka i primenom simulacija, čime se podržava razvoj novih, ekološki prihvatljivijih tehnologija i materijala koji mogu zameniti tradicionalne procese; (6) povezivanje sa dobavljačima, poboljšanjem upravljanja lancem snabdevanja kroz optimizaciju saradnju sa dobavljačima koji primenjuju održive prakse; (7) prikupljanje i analizu podataka, identifikovanjem obrazaca i trendova koji pomažu u donošenju odluka o održivosti; i (8) edukaciju i podizanje svesti zaposlenih, kreiranjem edukativnih programa i alata za obuku zaposlenih o značaju cirkularne ekonomije i održivih praksi.

5. Zaključak

Svet je danas suočen sa izazovom urgentnog rešavanja dva ključna problema bez presedana, klimatske promene i zagađenje stanja životne sredine, koji ne samo da prete ugrožavanju biodiverziteta planete Zemlje, već i egzistencije i dobrobiti njenih stanovnika. Ova globalna kriza, praćena decenijama neodržive ekološke prakse naftne industrije, podstakla je preduzimanje zajedničkih aktivnosti i inovacije u svim sferama društva.

Pitanje održivost tržišta nafte i gasa danas privlači veliku pažnju svetske zajednice iz dva osnovna razloga (Chutcheva et al, 2022). Prvo, usled ekološke prihvatljivosti nafte i gasa. Budući da proizvodnja nafte i gasa dovodi do iscrpljivanja prirodnih resursa, ona mora biti ekonomična kako bi se očuvali resursi za buduće generacije. Takođe, vađenje i transport nafte i prirodnog gasa praćeni su otpadom, koji bi trebalo da se smanji kako bi se sprečila potencijalna ekološka katastrofa (na primer, curenje gasa i izlivanje nafte). Drugo, neophodno je održavanje ravnoteže ponude i tražnje na tržištima nafte i gasa, kako ne bi došlo do nestašice energije. Kako su nafta i gas resursi koji su potrebni državi, domaćinstvima i preduzećima, održivost tržišta nafte i gasa od ključnog je značaja za obezbeđivanje energetske sigurnosti.

Ekološka održivost u istraživanju i eksploataciji nafte i gasa postala je neophodan i kritičan pristup u održanju stanja životne sredine. Modeli veštačke inteligencije i mašinskog učenja se mogu primeniti za nadzor i praćenje naftovoda čime se smanjuje mogućnost izlivanja koja će dalje degradirati životnu sredinu i ugrožavati stanje biodiverziteta. Imajući u vidu da proizvodnja nafte i gasa iscrpljuje prirodne resurse, naftna industrija bi trebalo da odigra ključnu ulogu u smanjenju ekološkog pritiska.

Sve veća primena veštačke inteligencije u okviru naftne industrije preduslov je za smanjenje troškova poslovanja. AI aplikacije, koji se primenjuju od dijagnostike kotlova do operacija bušenja, postaju sastavni deo optimizacije procesa u uzvodnim, srednjim i nizvodnim segmentima industrije. U oblastima istraživanja i proizvodnje, veštačka inteligencija se koristi za zadatke kao što su kontrola kvaliteta, prediktivno održavanje i planiranje. Primena AI tehnologija doprinosi povećanju operativne efikasnosti u eksploataciji nafte i gasa, omogućavajući kompanijama da identifikuju obrasce, automatizuju odluke i analiziraju ogromne skupove podataka sa senzora i mašina. Opremljena veštačkom inteligencijom, rešenja za prediktivno održavanje mogu da spreče kvarove opreme, omogućavajući preduzećima da planiraju održavanje, minimiziraju zastoje i optimizuju korišćenje sredstava.

Tržište veštačke inteligencije je prvenstveno vođeno potrebom industrije nafte i gasa za smanjenjem troškova proizvodnje. Suočene sa promenljivim cenama nafte, kompanije se sve okreću primeni veštačke inteligencije kako bi optimizovale svoje poslovanje, odnosno pojednostavile operacije, poboljšale efikasnost i smanjile troškove. Osim toga, optimizacija operacija bušenja, smanjenje potrošnje energije i poboljšanje upravljanja otpadom su načini na koji bi primena AI tehnologije mogla pomoći u smanjivanju ekološke štete koja nastaje vađenjem i proizvodnjom nafte i gasa.

U borbi protiv klimatskih promena i zaštiti životne sredine, tranzicija ka čistim i obnovljivim izvorima energije u okviru naftne industrije sve više dobija na značaju. Očekuje se da će naftna industrija odigrati ključnu ulogu ispunjavanju energetskih potreba na putu prelaska ka zelenom poslovanju. Veštačka inteligencija se može koristiti za olakšavanje stvaranja obnovljivih izvora energije. Naftna industrija može smanjiti svoje negativne efekte na životnu sredinu prelaskom na obnovljive izvore energije, kao što su solarna i energija vetra.

Naftna industrija se trenutno suočava sa najvećim ekološkim izazovima u čitavoj svojoj istoriji. Maksimiziranje pozitivnih uticaja naftne industrije na životnu sredinu moguće ukoliko se naftne kompanije u potpunosti posvete istovremenom rešavanju pitanja ekološke, socijalne i ekonomske održivosti. Imajući u vidu da nafta i gas i dalje predstavljaju ključne resurse za podmirivanje globalne potražnje za energijom, naftne kompanije bi trebalo da svoje aktivnosti usmere ka razvoju nove strategije održivosti koja uključuje primenu veštačke inteligencije u rešavanju ekoloških problema. Poboljšano donošenje odluka, identifikovanje rizika, komunikacija i saradnja sa zainteresovanim stranama predstavljaju načine na koje AI može da doprinese održivom razvoju naftne industrije. Primenom veštačke inteligencije, naftna industrija može postati otpornija i održivija, čime se smanjuje negativan uticaj na životnu sredinu i doprinski globalno održivom razvoju. Stoga, ulaganje u primenu AI tehnologije i inovacije može preusmeriti naftnu industriju na put prema održivijem poslovanju.

References

- Ashour, M. A. H. (2023). Optimizing gas production forecasting in Iraq using a hybrid artificial intelligence model. In: *IEEE 14th Control and System Graduate Research Colloquium ICSGRC* (pp. 220-223). Shah Alam, Malaysia, Retrieved from: <https://ieeexplore.ieee.org/document/10215424>, Accessed on 15 August 2024.

- Asokan, A. (2019). Five ways AI and advanced analytics is used in the oil and gas industry, *CIM*, Retrieved from: <https://analyticsindiamag.com/ai-origins-evolution/five-ways-ai-advanced-analytics-is-used-in-the-oil-gas-industry/>, Accessed on 15 August 2024.
- Chutcheva, Y. V., Kuprianova, L. M., Seregina, A. A. & Kukushkin, S. N. (2022). Environmental management of companies in the oil and gas markets based on AI for sustainable development: An international review. *Frontiers in Environmental Science*, 10, 952102.
- Desai, J. N., Pandian, S. & Vij, R. K. (2021). Big data analytics in upstream oil and gas industries for sustainable exploration and development: A review. *Environmental Technology & Innovation*, 21, 101186.
- Di Vaio, A., Palladino, R., Hassan, R. & Escobar, O. (2020). Artificial intelligence and business models in the sustainable development goals perspective: a systematic literature review. *Journal of Business Research*, 121: 283–314.
- IBM. (2021). Energizing the oil and gas value chain with AI, Retrieved from: <https://www.ibm.com/downloads/cas/Z79PALP0>, Accessed on 15 August 2024.
- Koroteev, D. & Tekic, Z. (2021). Artificial intelligence in oil and gas upstream: Trends, challenges, and scenarios for the future. *Energy and AI*, 3, 100041.
- Lu, H., Guo, L., Azimi, M. & Huang, K. (2019). Oil and Gas 4.0 era: A systematic review and outlook. *Computers in Industry*, 111, 68-90.
- Mordor Intelligence (2024). AI in Oil and Gas Market Analysis - Industry Report, Size & Forecast (2024 - 2029), Retrieved from: <https://www.mordorintelligence.com/industry-reports/ai-market-in-oil-and-gas>, Accessed on 15 August 2024.
- Nacionalni naftni komitete Srbije – Svetskog naftnog saveta (2017) Cirkularna ekonomija, Retrieved from: <https://www.wpcenergyserbia.rs/media/17-APRIL-19.pdf>, Accessed on 15 August 2024.
- Pham, S. T., Vo, P. S. & Nguyen, D. N. (2021). Effective electrical submersible pump management using machine learning. *Open Journal of Civil Engineering*, 11 (2), 70-80.
- Sircar, A., Yadav, K., Rayavarapu, K., Bist, N. & Oza, H. (2021). Application of machine learning and artificial intelligence in oil and gas industry, *Petroleum Research*, 6 (4), 379-391.
- Van Rensburg, N. J. (2029). Autonomous well surveillance for ESP pumps using artificial intelligence. In: *SPE Oil and Gas India Conference and Exhibition* (Article No. SPE-194587-MS). Mumbai, Retrieved from: <https://www.scrip.org/%28S%28vtj3fa45qm1ean45vvffcz55%29%29/reference/referencespapers?referenceid=2938833>, Accessed on 15 August 2024.

THE IMPORTANCE OF ARTIFICIAL INTELLIGENCE FOR THE SUSTAINABLE DEVELOPMENT OF THE OIL INDUSTRY

Abstract: *The oil industry, as a key industry in the global economy, has been swept by a wave of transformation driven by technological advances, especially in the field of artificial intelligence. Due to the complexity of operations and high risk when making decisions, this industry is increasingly turning to the application of artificial intelligence in order to increase efficiency, safety and improve competitive performance. The speed with which artificial intelligence is integrated into various industrial activities determines the ability of this industrial branch to adapt to current trends in the global economy. In particular, increasing environmental pressure and the need for sustainable development raise complex questions about the role of oil and gas in the changing energy economy and the position of the oil industry in achieving sustainable development of the global economy. Having that in mind, the aim of this paper is to point out the importance of artificial intelligence for the sustainable development of this industrial branch based on the analysis of possibilities, advantages and future trends in the application of artificial intelligence in the oil industry. A clearer understanding of the relationship between artificial intelligence, the oil industry and sustainable development should enable oil companies to make more effective decisions regarding the application of such development models that will contribute to the improvement of the sustainable performance of the oil industry as a whole.*

Keywords: *oil industry, artificial intelligence, sustainable development.*



Faculty of Economics, University of Niš
18 October 2024

International Scientific Conference

**CIRCULAR ECONOMY:
TRENDS AND PERSPECTIVES**

Pregledni naučni rad

**POTENTIAL FOR THE DEVELOPMENT OF THE SPACE
INDUSTRY AND THE SPACE PROGRAM IN SERBIA**

Zoran Tomić, MSc*

***Abstract:** Serbia is one of the few countries in Europe that is not actively involved in the space industry and does not have its own space program. The development of the space industry in the previous period shows that in the future it will play an important role for the development of every country, especially because more and more emphasis is placed on the process of digitization and development of communication. That is why the Ministry of Science, Technological Development and Innovation is taking steps to make Serbia a part of this group of countries, and this paper will present the potential and reasons why Serbia should develop its space industry and space program.*

***Keywords:** space industry, space program, Serbia, satellites.*

1. Introduction

The space economy is in an upward trend with significant potential for the development of countries, their economies and the world economy. Estimates say that by 2035 the value of the global space economy will be \$1.8 trillion, a drastic increase from the estimated value of \$630 million in 2023 (Acket-Goemaere et al. 2014), and which coincides with the prediction of ESA (ESA, 2019). According to the OECD (2022), the space economy is defined as a range of activities in the use of resources to create value and benefit people through research, understanding, management and use of space. The space economy includes a range of activities including: satellite production, production of ground equipment for communication with satellites and space exploration, remote monitoring of the Earth, telecommunication satellites, satellite navigation, space tourism, as well as exploration of space resources and their acquisition.

* Special Advisor to the Minister, Ministry of Science, Technological Development and Innovation of the Republic of Serbia, PhD student at Faculty of Economics, University of Niš, Serbia, ✉ zoran.tomic@nitra.gov.rs
UDC 658.1:629.78(497.11)

In 2023, the main segment of the development of the space economy was the development of applications, the value of which amounted to 330 billion dollars, while the growth estimate is estimated at twice the value of the nominal growth of GDP at the world level (Acket-Goemaere et al. 2014). According to estimates by the Space Foundation organization, in 2023, the world space economy will reach \$570 billion in value, which is a 7.4% increase compared to 2022, and the structure itself is as follows. The largest part was realized through the realization of commercial products and services (\$321.4 billion), then in the construction of commercial infrastructure and support \$123.8 billion, while the value of the world budget in space agencies and projects is \$125.2 billion, of which the largest part refers to the USA (Space Foundation, 2024).

An increasing number of countries are becoming part of the space economy, and the number of established national space agencies speaks in support. During the Cold War, by the end of the 90s, there were 33 space agencies, and by 2023, another 42 space agencies were formed. A smaller number was created by the collapse of the former USSR, but the rest were formed by the states in order to deal with the strategy of developing the space program and the space industry in the said states. Unlike the earlier concept that prevailed during the Cold War, until 2011, when agencies were only financed by states, today we have an increasing use of public-private partnerships as a way of financing the work of agencies, but also the development of the space industry through venture capital market (Weinzierl, 2018).

In this paper, we will analyze the impact of the development of the space industry on the socio-economic factors of the development of countries by citing practical examples of developed and developing countries and analyze the potential for the development of the space industry and the space program in the Republic of Serbia, as well as specify the concrete steps that have been taken so far by Ministry of Science, Technological Development and Innovation.

2. Socio-economic impact of space industry and space program development

Investing in the space economy does not only have an effect on increasing the country's GDP, but also on the development of science and technology, and on increasing the security of the country itself. By investing in this sector, the country can become an important part of numerous world programs either through the production of applications, software, hardware or through specialization, such as the example of Canada and the famous Canadian arm used on the ISS. Investing in the space economy also has a socio-economic impact on the development of the country itself. It includes the creation of high-value products and services, retention of brain drain, involvement in global projects, development of products and technologies that will make life easier, application of satellite technology in all aspects of citizens' lives, improvement of the education system...

During the formation of the space industry and space program, especially in developing countries, there are certain opportunities, but also obstacles that they face. Some of the opportunities that can be used are (Ntlhe & Magagula, 2016):

- use of space for social needs - through the use of space and space technologies, it is possible to influence the reduction of poverty, hunger, the reduction of the risk of

Potential for the development of the space industry and the space program in Serbia

unfortunate events, obtaining adequate data for the development of national policies and strategies

- development of human capacities - through the development of the space industry, there is a need to invest in all other areas in order to ensure adequate personnel for this sector, from the youngest age (preschool) to school age and university education, but also investments through the NGO sector as a measure to popularize the space industry and technology among citizens and spread awareness of the importance of the development of this sector
- international cooperation - a large number of countries are not able to independently develop their space industry and program, for which there is no need in today's time of globalization. Through the sharing of knowledge, it is possible to avoid mistakes that other countries have already made and to skip numerous stages of the development of this program, but above all to get the necessary funds for investing in the development of this sector.
- industry development - through the development of programs to meet the needs of the state, its organs and sub-states, the necessary industry will be developed in parallel to meet those needs within the country itself. The goal is not for the country to be dependent on the provision of services by larger space powers, but to develop its own capacities that can satisfy those needs (of course, not all segments can be satisfied, such as the launch of a satellite, which depends on the existence of a cosmodrome and the geographical location of the country).

In addition to opportunities, there are also challenges that the country must face through the development of the space industry and space program: lack of awareness of the need to develop this sector, skills, educational capacities, financial resources, coordination.

Several studies have been done where the analysis of the impact of the development of the space industry on the economies of countries was carried out, using the example of the USA, the UK and France. In France, it was determined that 21% of the GDP of French Guinea was realized for the period 1965-75. while in the later period that share fell with the development of commercial services by the private sector. In the USA, an analysis done in 2009 found that every dollar invested in the space transportation industry resulted in \$4.9 of indirect economic impact on the country's GDP. In the UK, the space industry was found to have a multiplier of 1.91. In Norway, where the space program is small, a positive multiplier effect was determined in the period from 1990 to 2009, where the space industry through participation in joint ESA projects achieved a significant export result, which was estimated at 4.7 million Norwegian kroner. In Belgium, the amount of 1.4 million euros was achieved in the period up to 2009, and in Denmark 3.7 million euros (OECD, 2012). In Australia, the space sector employs between 9,500 and 11,500 people and generates profits of \$3-4 billion annually (Asia Pacific Aerospace Consultants, 2017).

Developing countries, such as African countries, have also become involved in the space industry through joint cooperation. Thus, the Republic of South Africa, through the establishment of its space agency (SANSA), began to implement the national space strategy formulated in 2008 (Ntlhe & Magagula, 2016). Egypt has also become part of this race through the establishment of cooperation with China where they launched their satellite MIRSAT and MIRSAT-2 is being prepared for remote observation of the Earth (Geopolitika, 2023). How important it is for every country to be involved in this segment,

even Serbia speaks in favor of the analysis of the World Economic Forum on the future of space until 2035, where it was determined (WEF, 2024):

- that space will be a significant part of the global economy - with an estimate of \$1.8 trillion and an average growth rate of 9% it will have a significant impact on GDP growth
- space will increasingly influence the connection of people and the development of goods - digital communication will achieve 60% of the global space economy by 2035
- influence of space will go significantly beyond this framework - the development of technologies and applications will find significant application in other sectors and segments (as it was before: aluminum foil, pure foam, lenses, LED lighting , water purification system...)
- the return of funds through the space industry will be more than just financial - in addition to the financial return, it will have an impact on the prevention of weather disasters, the observed climate change, the improvement of humanitarian responses and the expansion of well-being

3. Serbia's potential for the development of the space industry and space program

The potential for the development of the space industry is currently not being used in Serbia. The former Yugoslavia was a signatory to several important agreements that regulated the framework for space exploration and the development of the space industry. She was also a member of COPUOS (2024) in the UN until the collapse of the country in 1992. Today, Serbia has not yet become a member of this committee, where important decisions are made regarding the further directions of space research, technology development, and missed opportunities for the country's inclusion in the global trends of the space industry. COPUOS has two subcommittees, Science and Technology and Law. The inclusion of Serbia in COPUOS will give the country the opportunity to play an active role in the further development of space exploration strategies and the development of space law, which with the accelerated development of technology and projects aimed at the development of technologies for space mining and colonization plays an important role.

In the previous period, Serbia signed two Memorandums of Understanding. One with Russia in 2019 (Government of Republic of Serbia, 2019) and the second with the People's Republic of China in 2024 (Government of Republic of Serbia, 2024) which define the framework for further cooperation between Serbia and these countries in the field of space research and development of the space industry. All areas are covered: infrastructure, electrical energy network, agriculture, environmental protection, water management, deep space research, joint development of technologies. The Belgrade Astronomical Observatory has just signed a memorandum with the Chinese National Space Agency, making Serbia an official part of the international project to build the International Lunar Research Station (ILRS, 2021).

As far as scientific institutions in Serbia in the field of space industry and space program are concerned, the following are included: Astronomical Observatory Belgrade, BioSecne Institute Novi Sad, Mihajlo Pupin Institute, Faculty of Mathematics in Belgrade, Faculty of Mechanical Engineering in Belgrade and ETF in Belgrade. Astronomical observatory Belgrade was formed in 2023 Research unit (RU) for Space Research and Technologies (AOB, 2024) follows the development and trends in space research and new technologies, especially in the domain of the space industry (satellite development sector).

Potential for the development of the space industry and the space program in Serbia

The main goal of this RU for the next 3 years is to work on a project called MOSAIC, which concerns the development of the first Serbian scientific satellite of small dimensions (better known as CubeSat, which is a class of nano satellites). The production of satellites here in Serbia will enable the first necessary steps for our country to join the group of 106 countries in the world that already have a developed space program or space agencies.

A CubeSat is a miniature satellite that can be made of one or more units, where one unit is a cube-shaped satellite. CubeSat belongs to the group called nano satellites (all satellites smaller than 10 kg). The goal of this satellite will be to study the activity of the Sun in 2025/26 (depending on when it is launched), to test the equipment for communication with the satellite, which should be home-made, and to master the technique for managing the satellite and guiding it in space.

In addition to AOB, the Committee for the Development of Serbia's Space Program is another organization that has had experience in the creation and launch of cube satellites in the project with India and through the development of its own projects for remote detection and monitoring of objects in low orbit, agricultural crops, water quality, etc. In Serbia, there are currently a total of 28 registered astronomical societies that deal with the promotion of astronomy and astronautics, but it has been determined in the research so far that only 10 societies are active, mostly in the field of organizing lectures and observing activities.

BioSence institute deals with research in the sphere of agriculture, for which it uses space technology, primarily satellite images. In the previous work, images from the Copernicus satellite, which are the property of the EU, were used, but through cooperation with China, the intention is to use images obtained by Chinese partners that will help further development in the field of: insurance in agriculture, improvement of monitoring the development of agricultural crops, assistance the state in obtaining the data needed for the development of agricultural development strategies, which was given a concrete example through the development of the eAgrar system.

When it comes to business entities, it is currently difficult to obtain information about active companies that are engaged in the development of technologies that are used, so the task in the future must be the identification of business entities in this field, their connection and the realization of international cooperation in order to start this sector and developed in Serbia. For this reason, the Ministry of Science, Technological Development and Innovation has launched a series of activities in this field in order to raise the capacities of the scientific sector, but also through innovation and cooperation between science and business to form and develop the space industry in Serbia as well. That is why the first activities are the return of Serbia to COPUOS and the establishment of cooperation with other countries and institutions in order to start with the education of young people and the formation of human resources that would start this sector.

4. Conclusion

The space industry is a development opportunity for many countries. More and more jobs and the quality of life on Earth depend on the established better communication and digitization process. Satellites and their constellations play a significant role in the entire process, but also in the development of new technologies. Thanks to that, today the

process of making and launching satellites has become cheaper, which is why 106 countries in the world are already actively involved in this process. Serbia is a country that has potential and needs for the development of the space program and the space industry, which should be used. In addition to contributing to GDP growth, it will also contribute to raising the standard of living of citizens, retaining young people and preventing brain drain, but also a chance for Serbia as a country to take a leading position in the region in this segment. That is why the Ministry of Science, Technological Development and Innovation has taken steps to make Serbia an active part of this growing EU community. In addition to signing two memorandums of cooperation with Russia and China and supporting the initiatives of scientific institutions in Serbia for the development of the domestic MOZAIC cube satellite, it is necessary in the following period to return Serbia to COPUOS membership, to establish stronger and more specific cooperation with foreign countries and institutions, and also to create a domestic agency that will take over all these tasks, primarily tasks of coordinating activities and creating a national strategy for the development of the space program and the space industry.

References

- Acket-Goemaere et al. 2014, *Space: The \$1.8 trillion opportunity for global economic growth*, <https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/space-the-1-point-8-trillion-dollar-opportunity-for-global-economic-growth#/>
- European Space Agency, 2019, What is the Space Economy, https://space-economy.esa.int/article/33/what-is-the-space-economy#_ftn1
- OECD (2012), *OECD Handbook on Measuring the Space Economy*, OECD Publishing, <http://dx.doi.org/10.1787/9789264169166-en>
- OECD, 2022, *OECD Handbook on Measuring the Space Economy, 2nd Edition*, OECD Publishing, Paris, <https://doi.org/10.1787/8bfef437-en>.
- Space Foundation, 2024, *Space Foundation Announces \$570B Space Economy in 2023, Driven by Steady Private and Public Sector Growth*, <https://www.spacefoundation.org/2024/07/18/the-space-report-2024-q2/>
- Weinzierl M., 2018, *Space, the Final Economic Frontier*, Journal of Economic Perspectives—Volume 32, Number 2—Spring 2018—Pages 173–192
- Ntlhe B.N., Magagula G., 2016, *Developing a Space Program in a Developing Country: Opportunities and Challenges*, SpaceOps Conference, Daejeon, Korea, <https://arc.aiaa.org/doi/pdf/10.2514/6.2016-2344>
- Asia Pacific Aerospace Consultants, 2017, *Briefing Paper to the NSW Government on NSW Space Capabilities and the Review of Australia's Space Industry*.
- Geopolitika, 2023, *Kina i Egipat potpisali sporazume o istraživanju svemira*, <https://www.geopolitika.news/vijesti/kina-i-egipat-potpisali-sporazume-o-istrazivanju-svemira/>
- World Economic Forum, 2024, *Space: The \$1,8 Trillion Opportunity for Global Economic Growth, Insight Report April 2024*, McKinsey & Company, https://www3.weforum.org/docs/WEF_Space_2024.pdf
- COPUOS, <https://www.unoosa.org/oosa/en/ourwork/copuos/index.html>
- <https://www.srbija.gov.rs/vest/en/136133/serbia-russia-sign-interstate-agreements.php>
- <https://www.srbija.gov.rs/vest/en/222559/raising-strategic-partnership-between-serbia-china.php>
- ILRS, 2021, <https://www.cnsa.gov.cn/english/n6465652/n6465653/c6812150/content.html>
- AOB, 2024, <https://www.aob.rs/en/research-en/research-units/298-research-unit-for-space-science-and-technologies>

POTENCIJALI ZA RAZVOJ SVEMIRSKJE INDUSTRIJE I SVEMIRSKOG PROGRAMA U SRBIJI

Apstrakt: *Srbija je jedna od retkih zemalja u Evropi koja nije aktivno uključena u svemirsku industriju i nema svoj svemirski program. Razvoj svemirske industrije u prethodnom period govori da će u budućnosti igrati važnu ulogu za razvoj svake zemlje, posebno jer se sve veći akcenat stavlja na proces digitalizacije i razvoja komunikacije. Zbog toga Ministarstvo nauke, tehnološkog razvoja i inovacija preduzima korake kako bi Srbija postala deo ove grupacije država i u ovom radu biće predstavljeni potencijali i razlozi zašto Srbija treba da razvija svoju svemirsku industriju i svemirski program.*

Ključne reči: *svemirska industrija, svemirski program, Srbija, sateliti*

CIRCULAR ECONOMY: TRENDS AND PERSPECTIVES

18th October 2024, Niš

THE SCIENTIFIC COMMITTEE:

1. Dr Tadija Đukić, dean, Faculty of Economics Niš, president
2. Dr Dragana Radenković Jocić, vice-dean, Faculty of Economics Niš
3. Dr Biljana Đorđević, vice-dean, Faculty of Economics Niš
4. Dr Ivan Marković, vice-dean, Faculty of Economics Niš
5. Dr Pavle Petrović, SANU
6. Dr Zoran Stefanović, Faculty of Economics Niš
7. Dr Tamara Milenković Kerković, Faculty of Economics Niš
8. Dr Jelena Z. Stanković, Faculty of Economics Niš
9. Dr Mirjana Jemović, Faculty of Economics Niš
10. Dr Panayiotis Kontakos, University of Central Lancashire, Cyprus
11. Dr Jason Papathanasiou, University of Macedonia, Thessaloniki, Greece
12. Dr Marijana Božinova, rector, D. A. Tsenov Academy of Economics Svištov, Bulgaria
13. Dr Ronald Hochreiter, WU Vienna University of Economics and Business, Austria
14. Dr Dimitar Panajotov Dimitrov, rector, UNWE, Sofia, Bulgaria
15. Dr Sylvie Rochhia, ISEM, Université Nice Sophia Antipolis, France
16. Dr Jürgen Jerger, University of Regensburg, Dept. of Economics and Leibniz Institute for East and Southeast European Studies, Germany
17. Dr Mike Danilovic, Halmstad University, Sweden
18. Dr Saša Drezgić, dean, University of Rijeka, Faculty of Economics, Croatia
19. Dr Milena Jakšić, dean, Faculty of Economics Kragujevac
20. Dr Nebojša Gvozdenović, dean, Faculty of Economics Subotica
21. Dr Mijat Jocović, dean, Faculty of Economics, Podgorica, Montenegro
22. Dr Milenko Krajišnik, dean, Faculty of Economics Banja Luka, Republic of Srpska, BiH
23. Dr Marko Đogo, dean, Faculty of Economics Istočno Sarajevo, Republic of Srpska, BiH
24. Dr Vesna Petrović, dean, Faculty of Business Economy Bijeljina, Republic of Srpska, BiH
25. Dr Predrag Trpeski, dean, Faculty of Economics Skoplje, North Macedonia
26. Dr Tomaž Turk, dean, Faculty of Economics Ljubljana, Slovenia
27. Mr Bojan Sešel, Celje School of Economics, Vocational College, Slovenia.

ORGANIZING COMMITTEE:

1. Dr Dragana Radenković Jocić, vice-dean, Faculty of Economics Niš, president,
2. Dr Biljana Đorđević, vice-dean, Faculty of Economics Niš, member,
3. Dr Ivan Marković, vice-dean, Faculty of Economics Niš, member,
4. Dr Dragan Petrović, Faculty of Economics Niš, member,
5. Dr Goran Milovanović, Faculty of Economics Niš, member,
6. Jovana Milenović, Faculty of Economics Niš, member,
7. Milica Ristić Cakić, Faculty of Economics Niš, member,
8. Ivana Randelović, Faculty of Economics Niš, member,
9. Marina Stanojević, Faculty of Economics Niš, member.

REVIEWERS:

1. Biljana Đorđević, Faculty of Economics Niš
2. Bojana Novičević Čečević, Faculty of Economics Niš
3. Dejan Đorđević, Faculty of Economics Niš
4. Dejan Spasić, Faculty of Economics Niš
5. Dragan Petrović, Faculty of Economics Niš
6. Dragana Radenković Jocić, Faculty of Economics Niš
7. Igor Mladenović, Faculty of Economics Niš
8. Ivan Marković, Faculty of Economics Niš
9. Ivana Kostadinović, Faculty of Economics Niš
10. Jelena Radojičić, Faculty of Economics Niš
11. Jovica Stanković, Faculty of Economics Niš
12. Maja Ivanović Đukić, Faculty of Economics Niš
13. Marija Radosavljević, Faculty of Economics Niš
14. Marina Đorđević, Faculty of Economics Niš
15. Milica Đorđević, Faculty of Economics Niš
16. Mirjana Jemović, Faculty of Economics Niš
17. Nebojša Stojković, Faculty of Economics Niš
18. Ognjen Radović, Faculty of Economics Niš
19. Snežana Radukić, Faculty of Economics Niš
20. Srđan Marinković, Faculty of Economics Niš
21. Vinko Lepojević, Faculty of Economics Niš
22. Vladislav Marjanović, Faculty of Economics Niš
23. Zoran Stefanović, Faculty of Economics Niš
24. Žarko Popović, Faculty of Economics Niš

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

338.1:502.131.1(082)
658.567(082)
316.42:502.131.1(082)
658:[004:007(082)
330.35(082)

INTERNATIONAL scientific conference Circular economy: trends and perspectives (2024 ; Niš)

Circular economy: trends and perspectives : [proceedings of the International scientific conference, Niš, October 18th, 2024] / [organized] Faculty of Economics ; editors Vladislav Marjanović, Dejan Đorđević. - Niš : University, Faculty of Economics, 2024 (Niš : Grafika Galeb). - [10], 433 str. : graf. prikazi, tabele ; 24 cm

Tiraž 100. - Str. [3-4]: Preface / editors. - Bibliografija uz svaki rad. - Apstrakti ; Abstracts.

ISBN 978-86-6139-242-9

а) Циркуларна економија -- Зборници б) Одрживи развој -- Друштвено-економски аспект -- Зборници в) Предузећа -- Пословање -- Информациона технологија -- Зборници г) Привредни раст -- Зборници

COBISS.SR-ID 161206793