The Position of European Union Countries According to Poverty Before and After the COVID-19 Crisis

Kraje Unii Europejskiej a ubóstwo, przed i po kryzysie COVID-19

Milan Marković

University of Niš, Innovation Centre of the University of Niš,
Univerzitetski trg 2, 18000 Niš, Serbia
E-mail: markovicmilan89@gmail.com, ORCID: 0000-0002-9617-6697

Abstract

The purpose of the paper is to evaluate and present the position of the European Union countries according to the poverty level before and after the COVID-19 crisis, combining five individual indicators. The GRA (Grey Relational Analysis) method was used to calculate the composite poverty indicator. To assess poverty, the study uses criteria from the official database of the European Commission and calculates the aggregate index for 2019 and 2022. All criteria in the model have the same relative importance because the method of equal weight coefficients is applied. The paper proved that the Czech Republic and Slovenia had the most favourable indicators of poverty in both periods, while Greece, Romania, Bulgaria, and Latvia occupied a critical position. In general, the countries of Southern Europe and the Baltic countries have poor poverty indicators. Compared to 2019, according to the country rankings, the poverty level is significantly higher in Finland, Germany, and Hungary, while after the pandemic, the following countries made considerable progress in reducing poverty: Poland, Belgium, Luxembourg, and Cyprus. The presented results can be useful to decision-makers at the macro level in the field of economic, social, and sustainable development policy.

Key words: poverty, social sustainability, multi-criteria ranking, composite indicator, pandemic, European Union

Streszczenie

Celem artykułu jest ocena i przedstawienie pozycji krajów Unii Europejskiej według poziomu ubóstwa przed i po kryzysie COVID-19, łącząc pięć wskaźników indywidualnych. Do obliczenia złożonego wskaźnika ubóstwa wykorzystano metodę GRA (Grey Relational Analysis). Do oceny ubóstwa w badaniu wykorzystano kryteria z oficjalnej bazy Komisji Europejskiej oraz obliczono zagregowany wskaźnik dla lat 2019 i 2022. Wszystkie kryteria w modelu mają taką samą wagę względną, ponieważ zastosowano metodę równych współczynników wagowych. W artykule wykazano, że najkorzystniejsze wskaźniki ubóstwa w obu okresach posiadały Czechy i Słowenia, natomiast krytyczne miejsce zajmowała Grecja, Rumunia, Bułgaria i Łotwa. Ogólnie rzecz biorąc, kraje Europy Południowej i kraje bałtyckie mają słabe wskaźniki ubóstwa. W porównaniu do roku 2019, według rankingów krajowych, poziom ubóstwa jest znacząco wyższy w Finlandii, Niemczech i na Węgrzech, natomiast po pandemii znaczny postęp w ograniczaniu ubóstwa poczyniły kraje: Polska, Belgia, Luksemburg i Cypr. Zaprezentowane wyniki mogą być przydatne dla decydentów na poziomie makro w zakresie polityki gospodarczej, społecznej i zrównoważonego rozwoju.

Słowa kluczowe: ubóstwo, zrównoważony rozwój społeczny, ranking wielokryterialny, wskaźnik złożony, pandemia, Unia Europejska

1. Introduction

The COVID-19 pandemic had an impact on different segments of society. First, it caused a health and economic crisis. As a rule, economic crises lead to an increase in poverty (Goedeme, Decerf, Van den Bosch, 2022), which is reflected in unfavourable prospects for social sustainability. The pandemic has created a huge social problem at the global scale due to its sudden appearance, rapid spread, as well as the uncertainty of how long it will last. Due to the lockdown and the disruption of trade flows and supply chains, concerns about future development have grown among policy makers (Mishra et al., 2020). The decline in production and the rise in unemployment were clearly manifested in the first year of the pandemic. This has contributed to the increase in global poverty (Michálek, 2023). The governments of the countries (apart from the implemented health protection measures to prevent the spread of infection) quickly defined social programs to reduce the impact of the health crisis on the economy and avoid more severe socio-economic consequences. Those measures were primarily related to financial support for the population (vulnerable categories) and postponement of the payment of tax obligations for the most sensitive parts of the economy (Đokić, 2022). The European Union has also prepared a wide range of aid measures. When talking about state aid, especially the tourism and hospitality sectors were in the centre of attention (as particularly vulnerable sectors) bearing in mind the closing of borders and restrictions on the gathering of people. The main wave of the pandemic was immediately followed by the conflict in Ukraine, which brought with it additional socio-economic consequences. High inflation due to the energy crisis and high interest rates to minimize it, had a negative impact on the living standards of the population, above all the poor who spend most of their income on food and loan repayments. In May 2023, the end of the state of emergency due to COVID-19 was declared (World Health Organization, 2023). Among the scientific community, the question of the impact of the pandemic on poverty at the global and national level has arisen. Therefore, this paper aims to rank the countries of the European Union according to the composite index of poverty before and after the main wave of the pandemic.

The paper includes several common parts, bearing in mind the IMRAD structure that researchers follow when preparing scientific papers. After an introduction and a brief review of the literature, the methodological part interprets the selected indicators from the official European database that will make up the poverty index. In the same part, the applied GRA (Grey Relational Analysis) method for the construction of the composite indicator (which is used as a basic tool for measuring poverty) is explained. Then, the results of the conducted analysis are presented, which include: (i) descriptive statistics, (ii) calculation of weight coefficients, (iii) ranking of the countries of the European Union according to the values of the composite index, and (iv) their display on the chart. The discussion reveals and comments on the position of the countries before and after the COVID-19 crisis, i.e. changes in the level of poverty compared to other countries. The paper ends with conclusions.

2. Literature review

Poverty is a crucial socioeconomic phenomenon and the main element in the assessment of social sustainability (Stanković, Džunić, Marjanović, 2022). It consists of several dimensions that should be appropriately quantified and optimized (Bárcena-Martín, Pérez-Moreno, Rodríguez-Díaz, 2020). It is a frequent indicator of the sustainable development of society, so poverty is found as the first goal within the global Sustainable Development Goals (SDGs) (Goal 1 – No poverty) (United Nations Development Programme, 2024). Poverty implies the impossibility of satisfying basic human rights and needs (most often due to a lack of funds or low wages), so it is a common subject of research by the scientific and professional community in the field of social sciences (Drago, 2021). In addition, poverty is not only the inability to achieve a certain quality of life in the material sense, but also means social exclusion (Buheji et al., 2020). Difficult access to health services, performing poorly paid jobs and exclusion from education are considered the main forms of such marginalization (Marković et al., 2022). Also, social exclusion is reflected in the reduced possibility of attending cultural, sports, and recreational activities (Menshikov et al., 2020).

In the literature, there is a small number of studies dealing with multi-criteria ranking of countries according to poverty dimensions (Herman, 2014; Łuczak, Kalinowski, 2020). The main determinant in the assessment of poverty is the poverty rate expressed as *At risk of poverty rate*. A special indicator of poverty is also material deprivation. It is introduced since living conditions, and therefore the standard of living, differ from country to country, so the previous indicator is not always adequate for international comparisons (Goedemé, Decerf, Van den Bosch, 2022). Deprivation implies the impossibility of satisfying the needs (food, bills, housing costs) that are considered necessary for a decent life (Yamaoka et al., 2021). Thus, at the level of the European Union, a composite indicator *At risk of poverty or social exclusion* (AROPE) was created, which includes three dimensions: risk of poverty (monetary dimension), material deprivation (non-monetary dimension), and living in households with low work intensity (Zins, 2020; Kovářová, 2023). This study uses five indicators of poverty and builds on the previous AROPE index because it introduces two more indicators in the proposed composite index related to the risk of poverty of employed people and the level of satisfaction of health care needs. The indicator that measures working

poverty is particularly important, bearing in mind that employees often do not earn adequate wages, especially if they work in labour-intensive activities that require a lower level of qualification or education (Herman, 2014). Additionally, people who are below the defined poverty line have a higher possibility of being affected by diseases due to lack of information, working in large groups, as well as unaffordable health care (Burlina, Rodríguez-Pose, 2024).

Agenda 2030 aimed for all people to live in prosperity by the end of this period by eradicating poverty (Rocchi et al., 2022). One of the priorities of the Europe 2020 strategy is to try to reduce poverty (Kovářová, 2023). The COVID-19 pandemic disrupted plans in improving social sustainability, among which was solving the problem of poverty. The basic research question is: In what direction did the previous global conditions (associated with the pandemic) affect the poverty of the countries of the European Union? Based on the conducted research, policy makers can define concrete measures and direct them in an adequate way towards the target countries.

3. Methodology

Composite indicators help in decision-making in situations where there are multiple attributes of a particular problem under investigation. As poverty is a multidimensional problem, there is justification for building a composite index in this case as well. The study selects the most important criteria (attributes) for assessing the state of poverty in any country. Guided by the European Commission database that provides an overview of poverty indicators, the study uses the following criteria:
1. *At-risk-of-poverty rate,*
2. *Severe material deprivation rate,*
3. *In work at-risk-of-poverty rate,*
4. *Self-reported unmet need for medical care, and*
5. *People living in households with very low work intensity.*

Table 1. Criteria description, source: European Commission (2024)

Criteria	Interpretation
At-risk-of-poverty rate (in %)	The percentage of the population with equalized disposable income below the at-risk-of-poverty threshold following social transfers is known as the at-risk-of-poverty rate. This cutoff is equivalent to 60% of the country's equalized disposable income. It is a measure of low income compared to other sectors of the national economy.
Severe material deprivation rate (in %)	The rate of material deprivation is as a measure for people's incapacity to buy items that are either desirable or essential for a sufficient or quality existence.
In work at-risk-of-poverty rate (in %)	The percentage of employed persons whose income is less than 60% of the national median equivalent disposable income (which is the poverty risk threshold).
Self-reported unmet need for medical care (in %)	The calculation is based on the assessments made by the individual (over 16) of whether they needed a diagnosis or treatment in the preceding year but were unable to get it or did not request it because of waiting lists, financial constraints, or being *too far to travel*.
People living in households with very low work intensity (in %)	Individuals under the age of fifty-nine who live in households with adult family members who have worked less than twenty percent of their potential in the last year are included in this indicator.

Each of these indicators will have equal weight in the multi-criteria model, thus avoiding bias in decision making. Composite indicators synthesize various sub-indicators and reduce them to a simple measure. For this purpose, the GRA method is applied, as a newer method for creating composite indices. It implies that the decision maker, after choosing the indicators, taking their values, and determining the weighting method, takes the following steps (Kuo, Yang, Huang, 2008; Jozić, Bajić, Celent, 2015; Abifarin, Ofodu, 2022; Alshuwaikhat, Adenle, Alotaishan, 2023; Marković, Popović, Marjanović, 2023):

(i) Normalization of the value of attribute j, alternative i (y_{ij}). Since all selected criteria are cost type, the following formula is used, where all the normalized values of the alternatives (x_{ij}) are in the range from 0 to 1.

$$x_{ij} = \left(\frac{\max(y_{ij}) - y_{ij}}{\max(y_{ij}) - \min(y_{ij})} \right)$$

(ii) Calculation of the Grey relational coefficient:

$$\gamma(x_{0j}, x_{ij}) = \frac{(\Delta_{min} + \xi \Delta_{max})}{(\Delta_{ij} + \xi \Delta_{max})}$$

where Δ_{ij} is the deviation sequence, and x_{0j} is the reference sequence: ($x_{o1}, x_{o2}, ..., x_{oj}, ..., x_{on}$) = (1, 1, …, 1, …, 1).

$$\Delta_{ij} = |x_{0j} - x_{ij}|$$

$$\Delta_{min} = min\{\Delta_{ij}, i = 1, 2, \ldots, m; j = 1, 2, \ldots, n\}$$
$$\Delta_{max} = max\{\Delta_{ij}, i = 1, 2, \ldots, m; j = 1, 2, \ldots, n\}$$

where ξ – is the distinguishing coefficient. The values of this coefficient can be from 0 to 1, but due to the adequate stability of the solution, 0.50 is the most common value in multi-attribute decision making.

(iii) Calculation of the composite index (Grey relational degree) including weight coefficients of attributes (w_{ij}):

$$\Gamma(X_0, X_i) = \sum_{j=1}^{n} w_j \gamma(x_{0j}, x_{ij})$$

where:

$$\sum_{j=1}^{n} w_j = 1$$

(iv) Ranking of the alternatives according to the decreasing values of the composite index (Grey relational degree) obtained by this procedure. In this study, countries with a higher index rank better and have lower levels of poverty.

4. Results & Discussion

The first stage in any empirical research is the presentation of descriptive statistics. The minimum, maximum, and mean values of the attributes (criteria) are displayed, as well as the size of the standard deviation. Table 2 refers to the descriptive statistics of the poverty data from 2019. Romania is the country that shows the worst values in the European Union for three indicators. Among the other countries, we single out Malta, whose residents have fully met their needs for medical care according to the Eurostat methodology. The highest deviation from the mean value is present in the Severe material deprivation rate indicator.

Table 2. Descriptive statistics (2019), source: author's calculation

	Minimum	Maximum	Mean	Std. Deviation
At-risk-of-poverty rate (in %)	10.1 (Czech Republic)	23.8 (Romania)	16.33	3.94
Severe material deprivation rate (in %)	1.4 (Luxembourg)	24.5 (Romania)	6.56	5.84
In work at-risk-of-poverty rate (in %)	2.9 (Finland)	15.7 (Romania)	7.85	3.1
Self-reported unmet need for medical care (in %)	0.0 (Malta)	15.5 (Estonia)	2.47	3.2
People living in households with very low work intensity (in %)	4.3 (Slovenia)	13.8 (Ireland)	7.66	2.62

The following Table 3 shows the values of descriptive statistics after the COVID-19 crisis (2022). Compared to the period before the pandemic, the data show lower mean values of two criteria (Severe material deprivation rate and People living in households with very low work intensity), and on the other hand, higher mean values of the other three criteria (At-risk-of-poverty rate, In work at-risk-of-poverty rate, and Self-reported unmet need for medical care).

Table 3. Descriptive statistics (2022), source: author's calculation

	Minimum	Maximum	Mean	Std. Deviation
At-risk-of-poverty rate (in %)	10.2 (Czech Republic)	22.9 (Bulgaria)	16.36	3.69
Severe material deprivation rate (in %)	1.4 (Slovenia)	24.3 (Romania)	6.09	5.3
In work at-risk-of-poverty rate (in %)	2.5 (Finland)	14.5 (Romania)	7.86	2.99
Self-reported unmet need for medical care (in %)	0.1 (Cyprus)	9.1 (Estonia)	2.56	2.5
People living in households with very low work intensity (in %)	3.5 (Luxembourg)	11.5 (Belgium)	7.05	2.54

In accordance with the application of the method of equal weight coefficients, there is the same relative importance of each of the criteria, so the weight coefficients amount to 0.20 (1/5), which is shown in Table 4.

Table 4. Weight coefficients, source: author's calculation

Criteria	Weights
At-risk-of-poverty rate (in %)	0.20
Severe material deprivation rate (in %)	0.20
In work at-risk-of-poverty rate (in %)	0.20
Self-reported unmet need for medical care (in %)	0.20
People living in households with very low work intensity (in %)	0.20

Tables 5 and 6 show the ranking of European Union members and the values of composite poverty indices based on the obtained Grey Relational Grade. First, the situation in the pre-pandemic year was presented (Table 5). The lowest level of poverty was in the Czech Republic, Slovenia, and Finland, because the highest value of the composite index was calculated for these countries. A multi-attribute analysis showed that in 2019, the countries with the highest level of poverty were Greece, Bulgaria, and Romania.

Table 5. Composite indicator of poverty (2019), source: author's calculation

Country	Composite index (2019)	Rank	Country	Composite index (2019)	Rank
Belgium	0.6473	18	Lithuania	0.5950	20
Bulgaria	0.5135	26	Luxembourg	0.7024	11
Czech Republic	0.9552	1	Hungary	0.7234	9
Denmark	0.7021	12	Malta	0.7570	5
Germany	0.7161	10	Netherlands	0.7549	6
Estonia	0.5821	21	Austria	0.7587	4
Ireland	0.6627	17	Poland	0.6830	15
Greece	0.4460	27	Portugal	0.6413	19
Spain	0.5656	22	Romania	0.5144	25
France	0.6812	16	Slovenia	0.8492	2
Croatia	0.6854	14	Slovakia	0.7534	7
Italy	0.5614	23	Finland	0.7924	3
Cyprus	0.7301	8	Sweden	0.6884	13
Latvia	0.5569	24			

Table 6 determines the state of poverty in the countries of the European Union after the crisis period. The situation at the top (according to data from 2022) has changed a little, bearing in mind that the Czech Republic, Slovenia, and Cyprus are now at the top of the list, while Greece, Romania, and Latvia are at the very bottom.

Table 6. Composite indicator of poverty (2022), source: author's calculation

Country	Composite index (2022)	Rank	Country	Composite index (2022)	Rank
Belgium	0.6827	11	Lithuania	0.5395	20
Bulgaria	0.4918	24	Luxembourg	0.7413	5
Czech Republic	0.9180	1	Hungary	0.6624	14
Denmark	0.6735	13	Malta	0.7428	4
Germany	0.6382	15	Netherlands	0.7284	6
Estonia	0.5200	23	Austria	0.7167	8
Ireland	0.6055	17	Poland	0.7228	7
Greece	0.4128	27	Portugal	0.5918	18
Spain	0.5324	22	Romania	0.4735	26
France	0.5415	19	Slovenia	0.7957	2
Croatia	0.6746	12	Slovakia	0.6932	9
Italy	0.5384	21	Finland	0.6932	10
Cyprus	0.7852	3	Sweden	0.6362	16
Latvia	0.4866	25			

For a better view of the position of the countries of the European Union according to the poverty situation, figure 1 was developed.
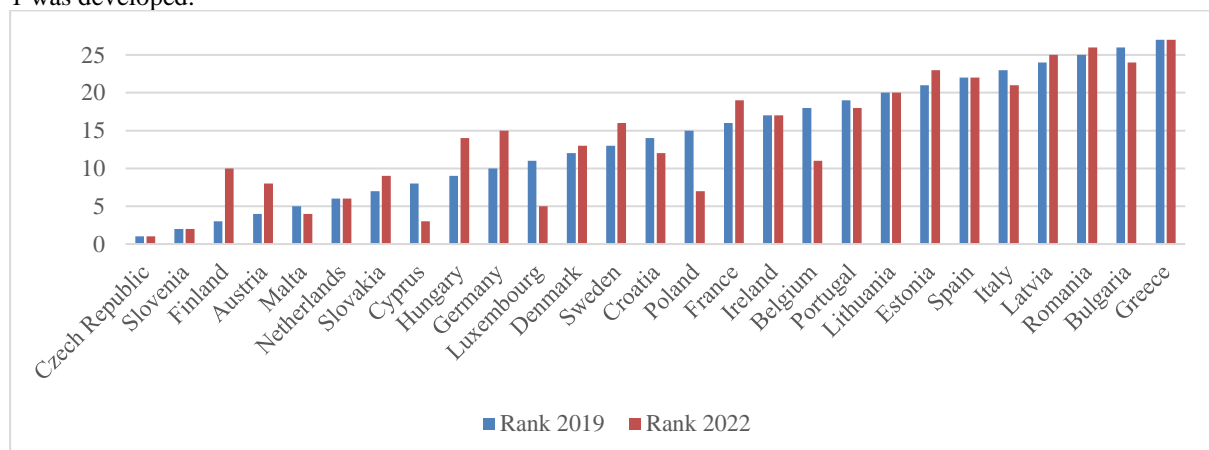

Figure 1. Position of countries according to the ranking results (2022), source: design by the author in Excel

Looking at the ranking of countries, Poland, Belgium, Luxembourg, and Cyprus are in a much better position according to the poverty level. Of the other European Union countries, Malta, Croatia, Portugal, Italy, and Bulgaria also took a better position compared to the initial period. The next member states have fallen the most in terms of poverty following the COVID-19 pandemic: Finland, Hungary, Germany, and Austria. All movements can be seen in Table 7.

Table 7 shows the changes in the ranking of countries according to the composite index. The country ranked 1 (one) has the highest index and achieves the most favourable situation in terms of poverty. The last one on the list has the position 27 (twenty-seven), with the lowest value of the composite index and the highest level of poverty in the European Union. Positive values in the *Change in position* column indicate a better ranking compared to the period before the pandemic. A negative sign indicates a worsening of poverty in relation to the other countries, while 0 (zero) indicates an unchanged position of the country.

Table 7. Ranking of countries before and after the COVID-19 crisis, source: author's calculation

Country	Rank (2019)	Rank (2022)	Change in position
Czech Republic	1	1	0
Slovenia	2	2	0
Finland	3	10	-7
Austria	4	8	-4
Malta	5	4	+1
Netherlands	6	6	0
Slovakia	7	9	-2
Cyprus	8	3	+5
Hungary	9	14	-5
Germany	10	15	-5
Luxembourg	11	5	+6
Denmark	12	13	-1
Sweden	13	16	-3
Croatia	14	12	+2
Poland	15	7	+8
France	16	19	-3
Ireland	17	17	0
Belgium	18	11	+7
Portugal	19	18	+1
Lithuania	20	20	0
Estonia	21	23	-2
Spain	22	22	0
Italy	23	21	+2
Latvia	24	25	-1
Romania	25	26	-1
Bulgaria	26	24	+2
Greece	27	27	0

5. Conclusions

The aim of the study was to assess the poverty in the European Union member states before and after the COVID-19 based on a multi-criteria analysis. The contribution of this study is to look at the positions of the countries of the European Union after the COVID-19 crisis so that social and economic policy makers can implement measures to alleviate poverty in certain countries. Four countries have significantly improved their poverty situation: Poland, Belgium, Luxembourg, and Cyprus. This means that these countries had the greatest resilience to the crisis, probably due to appropriate measures to minimize poverty. Central European countries occupy the best position in terms of poverty in both periods. On the other hand, the pandemic left the most negative consequences for Finland, Germany, and Hungary. Future research should determine the reason for the significant decline in these countries. The countries of Southern Europe and the Baltic countries have the worst social performance. Investments and greater redirection of funds to these countries in the function of economic development, as well as stimulating entrepreneurship and self-employment, must be a priority in the future, whereby each member state must be approached separately. Increasing employment (in high-tech sectors) through government measures, higher levels of

minimum wages or increasing the coverage of the population completing tertiary education can be solutions to reduce the number of people living in poverty. One-off social benefits are desirable in the first instance, but they do not have a one-sided effect on poverty. On the one hand, such aids quickly compensate for the lack of income of individuals, while on the other hand, they can have a disincentive effect on employment or continuing education of individuals.

The paper proposed a composite poverty index that can be tracked over time. It is a novel approach and applied method of multi-criteria decision-making in the assessment of the social situation in this integration of countries. The study clearly showed differences in poverty among the analysed countries. Despite significant efforts to reduce poverty and material deprivation in the pre-pandemic period, social stability has been disrupted by the emergence of the COVID-19 virus. To prevent the negative consequences of the pandemic, various financial measures were implemented at the national and supranational level. Macroeconomic policy makers remain concerned about the future, which may be full of uncertainty, given the current social and political challenges. The economic crisis, inflation, and energy crisis occurred immediately after the pandemic, so subsequent research can measure this impact on each individual country as soon as data for 2023 become available.

Acknowledgments

References

1. ABIFARIN J., OFODU J., 2022, Modelling and grey relational multi-response optimization of chemical additives and engine parameters on performance efficiency of diesel engine, *International Journal of Grey Systems*, 2(1): 16-26, https://doi.org/10.52812/ijgs.33.
2. ALSHUWAIKHAT H.M., ADENLE Y.A., ALOTAISHAN T. N., 2023, The development of a grey relational analysis-based composite index for environmental sustainability assessment: Towards a net-zero emissions strategy in Saudi Arabia, *Heliyon*, 9(7): e18192. https://doi.org/10.1016/j.heliyon.2023.e18192.
3. BÁRCENA-MARTÍN E., PÉREZ-MORENO S., RODRÍGUEZ-DÍAZ B., 2020, Rethinking multidimensional poverty through a multi-criteria analysis, *Economic Modelling*, 91: 313-325, https://doi.org/10.1016/j.econmod.2020.06.007.
4. BUHEJI M., DA COSTA CUNHA K., BEKA G., MAVRIC B., DE SOUZA Y.L., DA COSTA SILVA S.S., HANAFI M., YEIN T.C., 2020, The extent of covid-19 pandemic socio-economic impact on global poverty. a global integrative multidisciplinary review, *American Journal of Economics*, 10(4): 213-224, DOI: 10.5923/j.economics.20201004.02.
5. BURLINA C., RODRÍGUEZ-POSE A., 2024, Inequality, poverty, deprivation and the uneven spread of COVID-19 in Europe, *Regional Studies*, 58(2): 263-284, https://doi.org/10.1080/00343404.2023.2172390.
6. ĐOKIĆ M., 2022, World economy in the time of pandemic: Consequences of COVID-19 on world output, trade and employment, *Economics of Sustainable Development*, 6(1): 57-72, https://doi.org/10.5937/ESD2201057D.
7. DRAGO C., 2021, The analysis and the measurement of poverty: An interval-based composite indicator approach, E*conomies*, 9(4): 145, https://doi.org/10.3390/economies9040145.
8. EUROPEAN COMMISSION, 2024, *Eurostat database*, https://ec.europa.eu/eurostat/data/database (5.5.2024).
9. GOEDEMÉ T., DECERF B., VAN DEN BOSCH K., 2022, A new poverty indicator for Europe: The extended headcount ratio, *Journal of European social policy*, 32(3): 287-301, https://doi.org/10.1177/09589287221080414.
10. HERMAN E., 2014, Working poverty in the European Union and its main determinants: An empirical analysis, *Engineering Economics*, 25(4): 427-436, https://doi.org/10.5755/j01.ee.25.4.6339.
11. JOZIĆ S., BAJIĆ D., CELENT L., 2015, Application of compressed cold air cooling: achieving multiple performance characteristics in end milling process, *Journal of Cleaner Production*, 100: 325-332, https://doi.org/10.1016/j.jclepro.2015.03.095.
12. KOVÁŘOVÁ E., 2023, The EU Countries' Assessment with Respect to the Prevalence of Severe Material Deprivation and Determinants of Poverty: Application of Non-parametric DEA Approach, *Revija za socijalnu politiku*, 30(3): 271-291, https://doi.org/10.3935/rsp.v30i3.1840.
13. KUO Y., YANG T., HUANG G.W., 2008, The use of grey relational analysis in solving multiple attribute decision-making problems, *Computers & Industrial Engineering*, 55(1): 80-93, https://doi.org/10.1016/j.cie.2007.12.002.
14. ŁUCZAK A., KALINOWSKI S., 2020, Assessing the level of the material deprivation of European Union countries, *Plos one*, 15(9): e0238376, https://doi.org/10.1371/journal.pone.0238376.
15. 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, https://doi.org/10.5937/sjm18-40073.
16. MARKOVIĆ M., STANKOVIĆ J.J., DIGKOGLOU P., MARJANOVIĆ I., 2022, Evaluation of Social Protection Performance in EU Countries: Multiple-criteria Decision Analysis (MCDA), *Problemy Ekorozwoju – Problems of Sustainable Development*, 17(2): 124-132, https://doi.org/10.35784/pe.2022.2.13.
17. MENSHIKOV V., KOKINA I., KOMAROVA V., RUZA O., DANILEVIČA A., 2020, Measuring multidimensional poverty within the resource-based approach: a case study of Latgale region, Latvia, *Entrepreneurship and Sustainability Issues*, 8(2): 1211-1227, https://nbn-resolving.org/urn:nbn:de:0168-ssoar-88139-3.

18. MICHÁLEK A., 2023, Changes in the social situation in EU countries during COVID-19 (an alternative approach to the assessment of social indicators), *Regional Science Policy & Practice*, 15(8): 1841-1863, https://doi.org/10.1111/rsp3.12683.
19. MISHRA N.P., DAS S.S., YADAV S., KHAN W., AFZAL M., ALARIFI A., KENAWY E.R., ANSARI M.T., HASNAIN M.S., NAYAK A.K., 2020, Global impacts of pre-and post-COVID-19 pandemic: Focus on socio-economic consequences, *Sensors International*, 1: 100042, https://doi.org/10.1016/j.sintl.2020.100042.
20. ROCCHI L., RICCIOLINI E., MASSEI G., PAOLOTTI L., BOGGIA A., 2022, Towards the 2030 Agenda: measuring the progress of the European Union countries through the SDGs achievement index, *Sustainability*, 14(6): 3563, https://doi.org/10.3390/su14063563.
21. STANKOVIĆ J.J., DŽUNIĆ M., MARJANOVIĆ I., 2022, Towards an Inclusive Europe: Ranking European Countries Based on Social Sustainability Indicators, In International Conference on Decision Support System Technology, Cham, Springer International Publishing: 84-96.
22. WORLD HEALTH ORGANIZATION, 2023, https://www.who.int/director-general/speeches/detail/who-director-general-dr-tedros-end-of-2023-message--keeping-the-hope-for-health-alive (10.5.2024).
23. UNITED NATIONS DEVELOPMENT PROGRAMME, 2024, *Goal 1 – No poverty*, https://www.undp.org/sustainable-development-goals/no-poverty (10.5.2024).
24. YAMAOKA Y., ISUMI A., DOI S., OCHI M., FUJIWARA T., 2021, Differential effects of multiple dimensions of poverty on child behavioral problems: results from the A-CHILD study, *International Journal of Environmental Research and Public Health*, 18(22): 11821, https://doi.org/10.3390/ijerph182211821.
25. ZINS S., 2020, Variance Estimation by Linearisation for the At Risk of Poverty or Social Exclusion (AROPE) Rate, *Austrian Journal of Statistics*, 49(1): 33-44, http://dx.doi.org/10.17713/ajs.v49i1.882.