

HAS SERBIA REACHED THE QUALITY OF EDUCATION OF EU COUNTRIES? MULTI-CRITERIA EVALUATION

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Abstract: *The aim of the paper is to analyse the position of the Republic of Serbia in relation to the performance of education in the countries of the European Union (EU), which was evaluated based on a multi-criteria analysis. For that purpose, the following criteria from the Eurostat database were used: Tertiary educational attainment (age group 25-34), Participation in early childhood education, Adult participation in learning, Share of individuals having at least basic digital skills and Early leavers from education and training. In the ranking of countries, the Grey Relational Analysis (GRA) was applied, while the weighting coefficients were calculated using the equal weighting method. Research shows that Serbia lags far behind EU countries in terms of the quality of education, so educational policy makers must improve that quality in the coming period, especially when it comes to the indicator - Participation in early childhood education. In addition, the hypothesis that highly developed countries (based on GDP per capita) have higher values of the composite index of education was confirmed. The best results are achieved by the countries of Northern Europe, so in improving the level of education, the practice of these countries must be followed and adopted by policy makers.*

Keywords: education, socio-economic sustainability, multi-criteria analysis, Grey Relational Analysis (GRA), composite index.

JEL classification: C44, I25.

1. Introduction

In recent decades, the concept of sustainable development has increasingly become the occupation of many researchers. The original goal of sustainable development was to balance economic growth and environmental protection. Nowadays, the social dimension of sustainable development is a subject of wide interest. This segment of sustainable development implies: reduction and/or eradication of poverty, good health, high quality education, reduction of inequality in society, social inclusion. Quality education is one of the drivers of sustainable development (SDG 4), whereby the availability of education for all groups and strata of the population is highlighted (United Nations Development Programme, 2022). Special emphasis is placed on children who should complete primary and secondary education free of charge. This paper deals with measuring the quality of education in Serbia and the countries of the European Union (EU) using multi-criteria analysis method based on a combination of selected indicators.

A quality education system achieves positive effects on the individual and the entire society. An individual with a better education will more easily find a suitable job and ensure a better socio-economic status for himself and his family members. On the other hand, education is

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part of human capital, which is a factor of economic growth and development (Madžar, 2022; Marjanović and Marković, 2022). In addition, there are also non-economic effects that are reflected in social inclusion, improved access to health and other services, as well as the possibility of higher income, which contributes to the reduction of poverty.

The originality of this study consists in the construction of a unique aggregate index that will include indicators from the Eurostat database related to the quality of education and through which the performance of any country can be measured. An additional contribution is looking at the position of Serbia, as a candidate country, in relation to the EU countries, bearing in mind the current process of European integration. The aim of the paper is to use scientific methodology to inform the academic community and the creators of economic and development policies about the state and quality of education in Serbia compared to EU countries.

After the introduction, the paper explains the applied methodology and the development of the composite index (as a synthetic measure of the quality of education) through a multi-criteria model. Then, the results of the research are presented and the main observations are discussed. The last section deals with concluding considerations of the main results, an overview of recommendations for public policy makers and directions for future research.

2. Literature review

Education plays a significant role in the socio-economic development of any country, especially because it increases the level of employment, encourages innovation, research and development, as well as social cohesion. In light of this, the quality of the labour force on the market largely depends on the quality of education. As a goal, improving the quality of education is outlined in strategies and documents at the EU level (for example, The Europe 2020 strategy and Lisbon strategy). These strategies are based on sustainable, inclusive and smart growth, which can only be achieved through the development of an economy based on knowledge and innovation (Roszkowska and Filipowicz-Chomko, 2020). Quality (higher) education will create ideal conditions for smart growth based on the development of science and technology. That is why it is necessary to include children in the process of preschool education from early childhood. Education until starting school aims at both education and socialization of children. During education, the main challenge is to achieve the lowest possible percentage of those who leave school early. In this sense, there are various programs to prevent dropping out of schools, where poverty is one of the leading factors. Another goal that should be achieved is to have a tertiary diploma, but also to continue permanent training and lifelong learning, considering the constant changes in the way of performing activities. From the point of view of the individual, in this way the problem of low wages is overcome, while at the level of the national economy conditions are created for the construction of a high-tech society in which social costs will be as low as possible. As a special part of the quality education in modern society where the service sector dominates, the acquisition of digital skills and literacy is emphasized. That is why the authors chose the following criteria in the process of measuring education performance and multi-criteria ranking of countries: *Tertiary educational attainment (age group 25-34)*, *Participation in early childhood education*, *Adult participation in learning*, *Share of individuals having at least basic digital skills* and *Early leavers from education and training*.

The Eurostat database is the basis for assessing sustainability in various areas, including the quality of education (Roszkowska and Filipowicz-Chomko, 2020). There are not many works that consider this problem using synthetic indicators. One of the few studies that uses similar indicators in measuring the quality of education at the EU level applies the extended TOPSIS framework (Roszkowska and Filipowicz-Chomko, 2020). Their research, combining

the following indicators (*Early leavers from education and training, Tertiary education, Early childhood education, Underachievement in reading, maths, science, Employment rates of recent graduates and Adult participation in learning*), emphasizes that Northern European countries show the best educational performance, while the worst placed countries are Bulgaria and Romania. Certain authors are only concerned with measuring the performance of higher education and in developing a composite performance index they apply the following indicators: *Research, Teaching, Service and Finance* (Asif and Searcy, 2014). There are also several papers that consider similar performance related to the achievement of sustainable development goals in the EU using multi-criteria analysis. Thus, Ture, Dogan and Kocak (2019) in their study evaluate the achievement of the goals of the Europe 2020 strategy based on various economic, demographic, innovation and educational criteria. Corrales-Herrero and Rodriguez-Prado (2021) measure the living conditions of the younger population in the EU using a composite indicator that, in addition to indicators of education and training, also includes indicators of social inclusion and employment. They conclude that there has been an improvement in the quality of education and estimate that the best conditions for this have the countries of Northern and Central, bearing in mind all the analysed criteria, Europe. There is almost no study that evaluates people's quality of life and social and economic sustainability using a multi-criteria procedure, which does not include indicators of education (Beslerová and Dzuričková, 2014). Marković et al. (2022) in assessing the social dimension of sustainable development, in addition to the economic components, use certain criteria related to early school leaving and youth education. In determining social development and economic and social disparities, economic, educational, health and living standard indicators are indispensable (Pîrvu et al. 2018). As innovation and digitalization are the foundation of modern society, current research on the quality of education often includes digital competencies (Zakrajšek et al., 2021), so the author applies this type of criteria in his work as well.

3. Research methodology

Grey Relational Analysis (GRA) is a multiple-criteria decision-making method created by Deng Julong in 1982 (Ju-Long, 1982; Lin and Lin, 2002). As a method of multi-criteria analysis, it is applied in almost all sciences: construction, medicine, informatics, social sciences, agriculture (Patil, Walke Gaurish and Mahesh, 2019). Using this technique, it is possible to optimize and rank alternatives based on many, often conflicting criteria. Before carrying out the analysis, it is necessary to select the indicators that will best represent the problem, and then collect data from the relevant databases. After that, decision makers can process the data. Composite indices are obtained by applying this method as follows (Tosun, 2006; Kuo, Yang and Huang, 2008; Jožić, Bajić and Celent, 2015; Maksimović et al., 2016; Patil, Walke Gaurish and Mahesh, 2019; Grdinić-Rakonjac et al., 2021; Kehinde and Chukwuka, 2022):

a. At the beginning, it is necessary to normalize the data depending on the type of criteria:
i) for benefit criteria ('larger is the better'):

$$x_{ij} = \left(\frac{y_{ij} - \min(y_{ij})}{\max(y_{ij}) - \min(y_{ij})} \right) \quad (1)$$

ii) for cost criteria ('smaller is the better'):

$$x_{ij} = \left(\frac{\max(y_{ij}) - y_{ij}}{\max(y_{ij}) - \min(y_{ij})} \right) \quad (2)$$

where:

y_{ij} are the original values of the criteria.

b. Then, by applying the following formula, the Grey relational coefficient is determined:

$$\gamma(X_{0j}, X_{ij}) = \frac{(\Delta_{min} + \xi \Delta_{max})}{(\Delta_{ij} + \xi \Delta_{max})} \quad (3)$$

where:

$$\Delta_{ij} = |X_{0j} - X_{ij}| \quad (4)$$

$$\Delta_{min} = \min\{\Delta_{ij}, i = 1, 2, \dots, m; j = 1, 2, \dots, n\} \quad (5)$$

$$\Delta_{max} = \max\{\Delta_{ij}, i = 1, 2, \dots, m; j = 1, 2, \dots, n\} \quad (6)$$

ξ - is the distinguishing coefficient [0,1] that has an initial and most commonly used value of 0.5.

c. Finally, the value of the composite index (Grey relational grade) is calculated and a certain method is applied to determine the weight of the criteria.

$$\Gamma(X_0, X_i) = \sum_{j=1}^n w_{j\gamma}(x_{0j}, x_{ij}) \quad (7)$$

where:

$$\sum_{j=1}^n w_{ij} = 1 \quad (8)$$

d. The alternatives are ranked according to the decreasing values of the obtained index.

The last segment of the methodological explanation presents a description of the criteria used in the previously defined multi-criteria model (Table 1). Data for all criteria refer to 2021, except for the second indicator (*Participation in early childhood education*) where data from 2020 were used, as the last available values from the database. In this paper, the author chose the equal weighting method, so that all indicators will have equal relative importance in the formation of the aggregate measure of the quality of education (1/5 = 0.20).

Table 1: Description of criteria of the quality of education

Criteria name	Definition
<i>Tertiary educational attainment, age group 25-34 (in %)</i>	This indicator was obtained as a percentage of the population aged 25 to 34 who have university or similar higher education.
<i>Participation in early childhood education (in %)</i>	Participation in early childhood education means the share of children from the age of 3 until starting school who were involved in early education and training.
<i>Adult participation in learning (in %)</i>	This indicator measures the share of the population aged 20 to 64 (according to the total population of the same group of people) who stated that they had received formal or non-formal education or training in the 4 weeks prior to the survey.
<i>Share of individuals having at least basic digital skills (in %)</i>	The indicator represents the percentage of people (age group 16–74) who possess basic digital skills, which include the following areas: communication, information, problem solving, software and security.
<i>Early leavers from education and training (in %)</i>	This indicator shows the percentage of the population aged 18 to 24 with at most lower secondary education who were not in training or in the education system in the period of 4 weeks before the survey.

Source: Eurostat, 2022.

4. Results and Discussion

Table 2 provides descriptive statistics of the criteria values. The minimum, maximum and mean values are shown, as well as the standard deviation and the coefficient of variation as measures of dispersion. EU countries differ widely when it comes to education performance; the highest deviation from the mean value is present in the criterion - *Share of individuals having at least basic digital skills*, while the greatest data variability is recorded in the criterion - *Adult participation in learning*.

Table 2: Descriptive statistics of education quality criteria

Criteria name	Max	Min	Mean	St. Deviation	CV
<i>Tertiary educational attainment, age group 25-34 (in %), 2021</i>	62.6 (Luxembourg)	23.3 (Romania)	44.13	9.92	0.22
<i>Participation in early childhood education (in %), 2020</i>	100.0 (Ireland, France)	69.1 (Serbia)	89.53	8.17	0.09
<i>Adult participation in learning (in %), 2021</i>	34.7 (Sweden)	1.8 (Bulgaria)	12.37	8.32	0.67
<i>Share of individuals having at least basic digital skills (in %), 2021</i>	79.0 (Netherlands, Finland)	28.0 (Romania)	55.71	12.19	0.22
<i>Early leavers from education and training (in %), 2021</i>	15.3 (Romania)	2.4 (Croatia)	8.17	3.36	0.41

Source: author's calculation based on data from the Eurostat database

Romania and Italy have less than 30% of the population who have completed tertiary education. On the other hand, Luxembourg is at the top in terms of the percentage of those with a tertiary degree. Ireland and France have achieved that all children from three years to school age are included in education and training programs, in contrast to Serbia, where this participation is at the lowest level. Sweden and Finland stand out as countries with the highest percentage of adults involved in some kind of education. On the contrary, Bulgaria is in the biggest problem in this matter. The best knowledge of basic digital skills is present in the Netherlands and Finland, while at the other end is Romania. Based on the Europe 2020 strategy, the maximum rate of early school leaving should be 10% (European Commission, 2010). Romania, Spain, Italy, Bulgaria, Hungary, Germany, Malta and Cyprus have not reached the stated target by 2021, which significantly increases the risk of a vicious cycle of poverty and social exclusion in the mentioned countries.

Based on the combination of criteria that show the quality of education, Table 3 is presented. It summarizes the values of the composite index and shows the position of the analysed countries. Very similar results were shown by other studies that perform a multi-criteria ranking of EU countries according to education performance (Roszkowska and Filipowicz-Chomko, 2020). According to the research results, the best education performance is achieved by all countries of Northern and Western Europe, except Austria and Germany. Serbia has a higher value of the composite index than only two EU countries - Romania and Bulgaria. Germany, as a highly developed country, unexpectedly took 22nd

place. The key reasons for this are the high number of people who leave education early, as well as the small percentage of the population that has completed university education.

Table 3: Ranking of countries according to the composite performance indices of the quality of education

Rank	Country	Composite index value	Rank	Country	Composite index value
1	Ireland	0.5568	15	Latvia	0.3344
2	Netherlands	0.5332	16	Estonia	0.3295
3	Sweden	0.5167	17	Malta	0.3012
4	Finland	0.4832	18	Croatia	0.2964
5	Denmark	0.4418	19	Poland	0.2932
6	Luxembourg	0.4403	20	Czechia	0.2903
7	France	0.4325	21	Greece	0.2699
8	Belgium	0.4033	22	Germany	0.2645
9	Slovenia	0.3761	23	Slovakia	0.2562
10	Lithuania	0.3753	24	Hungary	0.2484
11	Portugal	0.3578	25	Italy	0.2454
12	Cyprus	0.3523	26	SERBIA	0.2158
13	Spain	0.3492	27	Bulgaria	0.1692
14	Austria	0.3377	28	Romania	0.0874

Source: author's calculation based on data from the Eurostat database

It is interesting that the first six ranked countries are those EU countries that have the highest amount of GDP per capita (World Bank, 2021), so there is obviously a nexus between the quality of education and the level of economic development of the countries. In order to statistically confirm such a relationship, the author used Spearman's correlation coefficient according to which there is a very high and statistically significant correlation between these variables, as the coefficient is 0.78, while the correlation is statistically significant at the level of 0.01. There are other studies that have examined the interdependence of education and economic development and found a high level of association (Panagiotis, 2019).

The study shows significant differences between EU countries in education performance, which may be the result of differences in institutional configurations (Corrales-Herrero and Rodriguez-Prado, 2021). The Republic of Serbia still does not achieve an adequate quality education. It is at the very bottom of the analysed European countries. The biggest obstacle to achieving high performance is low *Participation in early childhood education*. However, taking into account other indicators of education, Serbia also has a very poor performance.

5. Conclusion

The paper showed significant differences among the EU member states, taking into account the values of the indicators per country, as evidenced by other studies dealing with education and socio-economic sustainability. The results obtained on the basis of the composite index of the quality of education clearly show that the countries of Northern and Western Europe have significantly better performance than the countries of Southern and Eastern Europe. This is in accordance with the results of the research of other authors who looked at the quality of education, but also social sustainability, socio-economic development, assessment of people's quality of life and the degree of achieved sustainable development. Quality education is significantly related to the level of economic development of the country, which the study confirmed based on the correlation analysis.

The aim of the paper was to propose one of the methodological approaches in the construction of composite indexes of the quality of education. The second goal was to assess Serbia's lagging behind EU countries, as well as to compare EU countries according to the degree of success in the implementation of educational public policies. The ultimate goal is to achieve high-quality and inclusive education, which is also the goal of the Europe 2030 agenda (European Commission, 2019). Serbia should make additional efforts in the transition period. International cooperation with universities in the EU through various programs (for example, ERASMUS+) can help in this sense. A special role should be played by schools that will constantly improve cooperation with parents in order to solve various problems related to learning and absenteeism. Increasing the speed, availability and coverage of the Internet, especially in rural areas, is necessary to increase the percentage of digitally literate population.

The work fulfilled its original objective - to present the position and place of Serbia in relation to the quality of education in the EU using a multi-criteria framework in order to assess Serbia's readiness to integrate into the European education system in the future. Although the paper is primarily aimed at policy makers in Serbia, the information obtained from the research results can be used by a wide range of stakeholders, including but not limited to practitioners, scientists and the general public.

Determining the relationship between educational performance and employment rates can be a guideline for future research. In this way, in addition to the evaluation of the quality of education, it is possible to determine the compatibility of the educational policy and the labour market. In addition, determining the directions of education reforms and the education system in the Republic of Serbia can be the subject of new research, as well as performance analysis over time. Continuous monitoring of Serbia's place in relation to EU countries will be the best indicator of the success of public policy makers in the field of education.

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Bio-note

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