

Romania in the European Educational Landscape: Skills, Opportunities, and Challenges

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Abstract. *Education and economic performance are key factors in the formation of individual and social development and directly influence the well-being and long-term prosperity of the country. In the context of the European Union, the member states have disparities on the main educational and economic indicators. While Romania made an important progress in the last decades regarding the alignment of workforce with education and economic performance at European standards, it's still facing major challenges. An ineffective management of human resources led to an imbalance between the active and inactive population. This shows a crucial need of adapting the higher education system to labor market's demand by raising the education quality, flexibility of university programs, introducing internships, and supporting the graduates transition to jobs appropriate to their training. These measures aim to reduce unemployment rate and reinforce the connection between education and economic performance. This paper uses hierarchical cluster analysis to determine Romania's position in the European educational field and highlight the similarities with the other member states. We found that Romania has a similar position in the EU as Bulgaria and Cyprus, among other countries, offering potential for growth in educational investment and the integration of graduates into the workforce. Also, this cluster analysis generally indicates notable differences among the educational systems in the European Union. It highlights Romania's potential for improvement in areas such as attracting international students and spending on tertiary education.*

Keywords: cluster analysis, education indicators, tertiary education, European Union, economic development and education.

Introduction

Education represents a main factor in Romania's economic and social growth, as it shapes a skilled workforce, and reduces social inequalities. A strong educational system contributes to productivity growth, attracts investments, and facilitates the transition to a modern economy, based on research and education. In the last 20 years, Romania had a significant growth of students number, supported by social and economical changes. Between 1998 and 2009, Romania has the biggest student population growth from the European Union, mostly determined by private universities development. The expansion of private universities led to more higher education access. By 2010, Romania had approximately one million students, ranking seventh in the EU after Germany, the UK, France, Poland, Italy, and Spain (Pavelescu, Vasile, 2014).

This paper uses cluster analysis on five relevant indicators for education and economic growth, to highlight Romania's position within the European Union. This method makes it possible to identify groups of countries with similar characteristics, to highlight areas of improvement for Romania's tertiary education. The hierarchical clustering results will provide a clear perspective on Romania's place in the European educational landscape and the challenges that the country faces and will contribute to the formulation of recommendations for alignment with EU standards.

The purpose of this article is to highlight the similarities and differences between Romania and other Member States in terms of relevant indicators such as investment in education, graduate employment rates and internationalization of universities. The results obtained will provide insights into the strengths and areas for improvement, thus contributing to a better understanding of Romania's position in the European educational landscape.

The research objectives include determining the Romania's position regarding higher education within European Union, by analyzing key performance indicators, and also assessing the employability of graduates and the effectiveness of higher education in preparing students for the labor market.

The structure of this paper is as follows: the next section is the literature review that will provide the present state of educational field in the EU, including an overview of Romania's educational system. In the methodology section we will describe the statistical and data analysis methods used on the collected data and the indicators that have been examined. The next section provides the main findings that we obtained by cluster analysis. The results and discussions are summarized in the last section.

Literature review

Student mobility and higher education attainment

An important factor for student mobility within EU is the expenditure per student, and there is an increased likelihood the students would choose a country where monetary compensation are granted, shows (Caruso et al., 2015). Also, the study indicates that the student mobility is shaped by the perception of safety, the forces of economic globalization, and the economic state of the host nation. Students typically opt for destinations that provide a safe environment, are integrated into the global economy, and offer expanded job prospects both during their education and upon graduation.

In terms of attainment, in Romania the individuals having higher education are more likely to gain high levels of satisfaction and income later in life, compared to only secondary level graduates, that report significantly lower chances of achieving moderate or high levels of both satisfaction and income in the long run. Higher education positively influences financial well-being, as people with tertiary education are more likely to be highly satisfied with their financial situation compared to those with lower education levels (Zamfir et al., 2022).

Between 2000 and 2020, the population aged 25-64 with tertiary education increased in all EU countries, reaching 32.8% in 2020. The highest enrolment rates are in Ireland, Finland, Luxembourg, and Sweden, while the lowest are in Romania, Italia, Czechia and Croatia. In European Union, the enrolment rate is 9.2% with Finland and Sweden at the top. In 2019, over four million students graduated university, mostly in business, law, and administration.

France, Germany and Spain have the highest graduation rates, and Romania is in this top as well (Profiroiu et al., 2022). Turk (2019) states that students coming from disadvantaged backgrounds, mostly male, are less influenced by the quality of universities, while female students mobility is influenced by social and economical factors.

Geographical barriers are important too, with universities in central Italy attracting more students, while those in Sicily and Sardinia do not attract as many. Policy recommendations include financial support for disadvantaged students, reducing geographic barriers, and strategically expanding higher education institutions to improve accessibility, in particular for female students from families with a low income.

Higher education and social development

Higher education and social development are strongly connected, and the European Union's role in education has generated many discussions. The complex bureaucracy and a language difficult to understand of the Bologna Process has made the gap between the desired goals and the real problems of universities even wider, such as job insecurity for teachers and the constant competitiveness. Brexit has highlighted its own contradiction, because even if the United Kingdom has contributed to the educational reforms, it did not fully respect the Process standards. After the exit of the United Kingdom from the European Union, non UE countries as Iceland and Norway started a more important role in higher education administration, forcing other states to maintain these standards (Dakowska, 2019).

The Bologna Process was created to help students to study easier in other countries, and to support Europe to become an economy based on education. Because every country has its own educational system, organisational problems have appeared. European Union has become the leader of this process and each country engages to contribute and benefit from common standards of education. Due to globalisation, universities become more competitive, and the Bologna Process offers rules and standards that are used even outside Europe. By including this process, the European Union become a major leader in education, influencing how higher education develops globally (Zahavi, Friedman, 2020).

The research of Mariana (2015) reveals that in Romania there is a persistent connection between higher education and economic growth. The study realised in period 1980-2012, using variables as GDP per capita and number of students, indicates that higher education has a positive and significant impact for economic development. Although a cointegrated relationship was not found between the analysed variables, including public spending on education, the results confirm the importance of university education in sustaining a stable economic growth.

The study of Lilles and Rõigas (2015) shows that there is a strong link between the number of enrolled students and regional economic growth in Europe, between 1998 and 2008. The study reveals that investment in research and development contribute to economic development, but with a time lag, as it takes time for the human capital to contribute to this growth, because they have to graduate the university first, and then they will have an impact to the society.

Young graduates employability

Pavlin and Svetlik (2014) shows that higher education graduates employability is an important subject in the context of globalisation, that puts pressure on the educational systems in Europe. The main competitive advantage of Europe consists in the formation of skilled human capital through higher education, supported by reforms such as Bologna Process. The study highlights aspects such as transition from education to labor market, the discrepancy between students training and labor market demands, and skill development.

The study of Stiwnne and Alves (2010) shows that in Portugal and Sweden, after the implementation of Bologna Process in 2007, there is a strong connection between higher education, graduates employability, and students satisfaction. The authors indicate that the main challenges

depend on how to meet the expectations of young people who invested in tertiary education and how to manage the differences between those with advanced and those with lower education.

The research of Pelinescu and Simionescu (2019) reveals that recent policies of tertiary education adopted by the member states influence the rate of students' employment. Using hierarchical linear models and data from 2010 and 2015, the authors analyse the impact of measures such as the requirement that teachers have higher education, the existence of educational recommendation of formal and informal learning. The results indicate that these policies have positive effects on the integration of young people into the labor market, especially in older member states. The article's main idea is the importance of public investment in education and the need to modernise education.

Andrews and Higson (2008) found that business graduates need both specialised knowledge and soft skills to be employable. Employers from different countries especially value critical thinking and communication skills. While graduates show strong technical knowledge, they often need to improve their presentation and speaking abilities, which are important for career success.

Korotaj et al. (2024) show that Bulgaria, Hungary, and Romania have high student dropout rates, suggesting the urgent need to reform their education systems. The study also explains how geographic location influences the labor market, and future studies should combine clustering with supervised methods like regression to better predict labor market outcomes and understand how education and training affect the employment rates.

The study of Garcia-Selva et al. (2024) shows that emotional intelligence affects how people see their chances to get a job more than digital skills do, important in understanding and managing emotions. People good at recognising and controlling their feelings tend to perform better and handle work challenges more confidently.

The indicators used for this article help to evaluate the higher education system, this approach being similar to Korotaj et al. (2024), but it focuses more on educational outcomes and how investment and international connections affect how people see job opportunities. The research method gives better understanding of the variety and complexity of education in Europe and supports creating public policies that solve the current problems.

Methodology

For data description, we will use summary statistics as they provide a clear overview of key indicators of the dataset. The data is analysed using hierarchical clustering, which allows the identification of similar characteristics countries, highlighting Romania's position in European Union educational landscape, using R statistical software. For cluster analysis, we used information from (Wei, 2019).

The data used for this paper was collected from Eurostat, from year 2021, so we could collect data for all EU countries, and it includes 5 indicators relevant for education. The variables are: *Graduates*, as number of tertiary education graduates per 1,000 individuals aged 20-29 in the population; *Employment Rate*, for individuals aged 20-34 with tertiary education, not in school or training, and graduated within the last 3 years; *International Students*, number of enrolled students from abroad; *Enrolled Students*, percentage of individuals aged 20-24 in the population, who are enrolled in tertiary education; and *GDP percent*, as public expenditure on higher education, as percent of GDP.

We chose hierarchical clustering over k-means, because there is no need to specify the number of groups initially, and it produces a dendrogram that clearly shows how groups are

connected. It is also more flexible than k-means since it can identify clusters of different shapes, making it better for more complex data.

Results and discussions

Before applying any data analysis algorithm, it is important to examine the descriptive statistics, for a better understanding of the data's distribution, variability, and consistency.

Table 1. Descriptive statistics

	Graduates	Employment Rate	International Students	Enrolled Students	GDP percent
Mean	59,57	84,38	56255,00	35,30	1,15
Standard Error	3,47	1,55	15897,53	1,51	0,08
Standard Deviation	18,01	8,07	82605,99	7,82	0,43
Kurtosis	1,02	2,19	9,21	3,77	0,96
Skewness	0,61	-1,49	2,92	-1,38	1,04
Range	83,60	32,30	373340,00	38,00	1,90
Minimum	18,60	61,90	3019,00	9,00	0,46
Maximum	102,20	94,20	376359,00	47,00	2,36
Coefficient of variance	30%	10%	147%	22%	38%

Source: Generated by the authors using Excel.

Graduates, International Students, and GDP percent have high variability, as reflected by the large range, indicating significant differences between countries, and the standard deviation has also high values, suggesting extensive dispersion around the mean. The indicators Employment Rate and Enrolled Students have reduced values for standard deviation, reflecting a lower variability and a more consistent distribution of data in the observed countries.

The indicators Graduates, International Students, and GDP Percent have a positive skewness, suggesting that most countries report lower values for these variables, while a small number with high results skew the distribution to the right. This reflects variation in educational achievements, international student flows, and education investment, suggesting that even if many countries achieve moderate results, and a few values are much higher than the average. For Employment Rate and Enrolled Students the values of skewness are similar, both having negative asymmetry, meaning that in the distribution predominate high values for these indicators, and some countries report substantially low rates of employment and number of enrolled students.

The kurtosis is greater than 3 for International Students and Enrolled Students, meaning that the distributions are leptokurtic, have higher peaks and fatter tails compared to a normal distribution. The values are more concentrated around the mean, especially for International Students, where the kurtosis has the greatest value out of all variables. For the other indicators, the kurtosis is below 3, which means the distributions are flatter and have fewer extreme values.

The coefficient of variance shows that the number of international students is not a homogenous indicator, and the mean is not a representative value for the data. Also, for public expenditure on tertiary education, the value of this coefficient is greater than 30%, so the mean is not representative. For the other indicators, the coefficient has values less or equal to 30%, so the data is homogenous, and the values are concentrated around the mean.

Cluster analysis

Before applying the cluster algorithm, the data has been scaled, so that the influence of unit of measurement is removed, the comparability of the variables is ensured, and the clustering accuracy is increased.

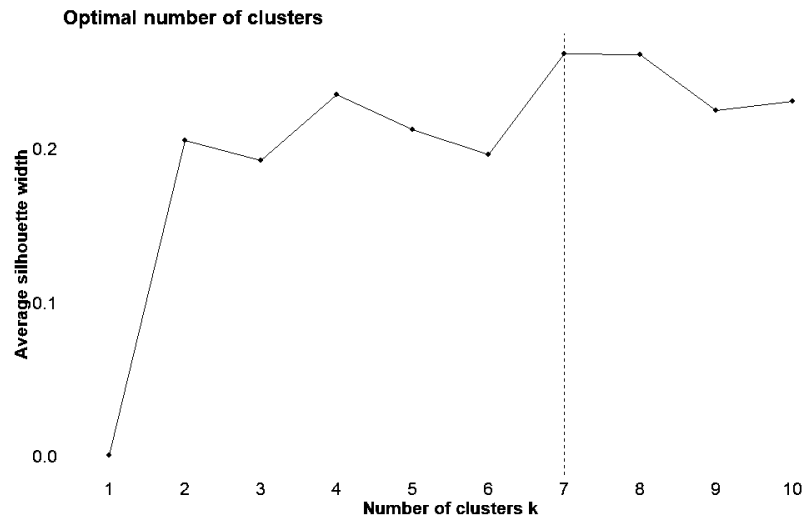


Figure 1. Finding the optimal number of clusters using the Silhouette method

Source: Generated by the authors using R statistical software.

In Figure 1, the Silhouette method is plotted in order to decide which is the optimum number of clusters to use in this analysis, and the method indicates a number of 7 clusters, as the mean of silhouette coefficient reaches the maximum value in that point. The increase in silhouette values to $k=7$, followed by a decreasing, suggests that choosing a greater number of clusters doesn't lead to a notable improvement in the quality of analysis.

But at this stage, the specific composition of each cluster is not determined. In the next step, a hierarchical clustering dendrogram is used to determine how countries, including Romania, are grouped based on their educational characteristics. This allows for a detailed comparison of Romania's position relative to other member countries.

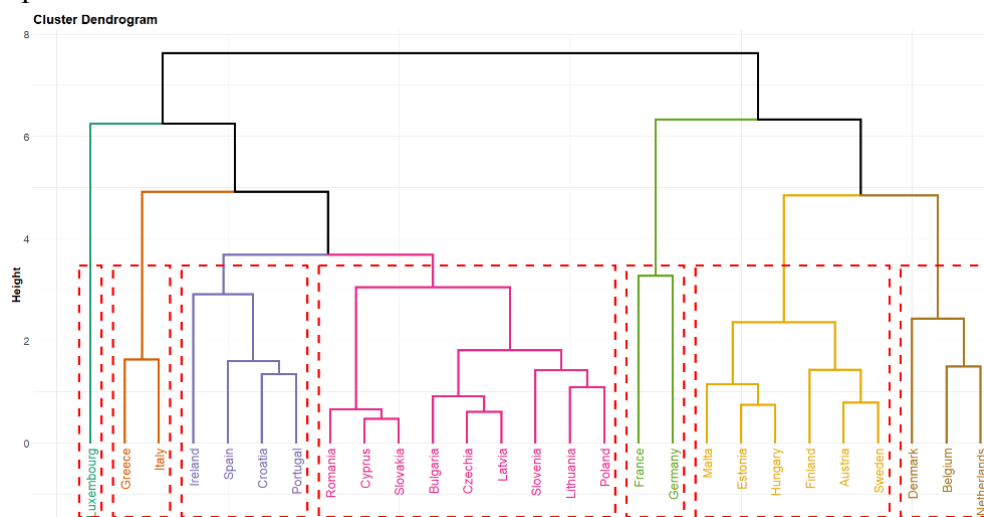


Figure 2. Hierarchical clustering

Source: Generated by the authors using R statistical software.

Figure 2 illustrates the results of the clustering analysis applied to the 27 European Union Member States based on the five selected indicators. We found that the countries have been grouped into different distinct clusters, with specific characteristics. Within the European Union, Romania shares similar characteristics with Cyprus, Slovakia, Bulgaria, Czechia, Latvia, Slovenia, Lithuania, and Poland, these countries belonging to the same cluster. This result reflects the similarities and differences between the European economies in terms of the selected variables. The number of clusters has been determined using the Silhouette method, showing that there are seven significant groups of countries that have common characteristics. This indicates a clear segmentation of the EU countries, with some falling into homogeneous clusters, while others show greater variation relative to the rest of the countries. We can identify similarities and differences between Romania and other Member States by examining the characteristics of each cluster and highlight possible gaps and opportunities for development.

Table 2. Clusters means

Cluster	Graduates	EmplRate	International	EnrolledStd	GDPpercent	Country
1	48,4	90,32	30914	30,18	1,5	Austria, Estonia, Finland, Hungary, Malta, Sweden
2	79,2	88,9	73128	40,97	1,87	Belgium, Denmark, Netherlands
3	54	85,06	25503	37,06	0,91	Bulgaria, Cyprus, Czechia, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia
4	78,67	79,5	38855	39	0,9	Croatia, Ireland, Portugal, Spain
5	75,7	87,45	314602	34,25	1,29	France, Germany
6	54,8	62,8	48038	41,05	0,77	Greece, Italy
7	18,6	85,6	3779	9	0,46	Luxembourg

Source: Generated by the authors using R statistical software.

The first cluster includes Austria, Estonia, Finland, Hungary, Malta, and Sweden. These countries have a very high employment rate of 90.32%, which indicates an efficient integration of graduates in the labour market, that is sustained by the high GDP percentage invested on higher education. A lower value for the enrolled students may indicate a more selective educational system or a labor market that quickly absorbs young people without necessarily requesting university studies.

Belgium, Netherlands, and Denmark form the second cluster, and these countries present a high rate of graduates and an employment rate of 88.9%, similar to the one in the first cluster. The high number of international students shows that these countries are educational centers at European level. Also, the increased GDP allocation suggests a considerable investment in the tertiary educational field, which can contribute to the international quality and recognition of higher education.

Romania belongs to the third cluster, along with countries as Bulgaria, Cyprus, and Poland, and it is characterized by a lower employment rate compared to the first clusters, of 85.5%. The number of relatively reduced international students (25503 individuals) indicates that universities

in these countries are less attractive for international mobility. The percentage of only 0.91% of public expenditure on higher education, suggests a more modest investment in tertiary education, facing similar challenges to the other Central and Eastern European countries from the cluster with difficulties in aligning education with labor market requirements and increasing the international competitiveness of its university system. Romania occupies an intermediate position, with potential for improvement in terms of both educational attractiveness and integration of graduates into the labor market.

The fourth cluster is formed by Croatia, Ireland, Portugal, and Spain. It has a high amount of graduates, but the employment rate is lower 79.5%, compared to other groups. The average number of international students 38855 suggests a moderate attractiveness of the education system, while education funding is relatively low 0.9% of GDP. This may reflect difficulties in integrating graduates into the labor market, even if the percentage of graduates is high.

France and Germany represent the fifth cluster, and they stand out with high number of international students of 314602, confirming the prestige of the universities in these two countries, which attract a significant number of people from all over the world. The percentage of GDP allocated to education is 1.29%, and it indicates a substantial investment, in comparison to the other clusters, which contributes to maintaining the quality of education and facilitating the transition of graduates into the labor market.

Cluster six is formed by Greece and Italy, and it has a relatively low rate of graduates 54.8‰ and the lowest employment rate 62.8% of all clusters. Although the number of international students is moderate, of 48038 students, the low allocation of GDP to education, 0.77%, suggests a possible under-funding of the education system.

In 2003, Luxembourg established the University of Luxembourg, a globally competitive research-focused university, to diversify its economy, reduce dependence on financial services. The University emphasizes multilingualism, internationalization and inter-disciplinary work and attracts students from all over the world. Although Luxembourg's research and development spending is lower than in neighbouring countries, it continues to invest in research and innovation, and cooperates with global partners to strengthen education. Graduates from the University and other specialized institutions often obtain jobs in finance, governance and technology in line with the country's economic priorities (Harmsen et al., 2018). Similar to this study, we identified that Luxemburg has a lower tertiary education expenditure, compared to other EU countries, and it reports low rates of graduates and enrolled students.

Conclusions

Education and economic results play an important role in the development of individual and society growth, directly influencing national competitiveness and long-term prosperity.

At a European Union level, Romania is similar to Bulgaria, Cyprus, and Poland, and is remarked for a lower employment rate of 85.5, compared to Austria or Sweden. The relatively small population of international students suggests that universities in these regions are less attractive for international student exchanges. With only 0.91% of public expenditure dedicated to higher education, there is a modest investment for higher education. It faces similar challenges as other Central and Eastern European nations in the cluster, such as aligning education with labor market needs and enhancing the global competitiveness of the university system.

Romania has an intermediary position, offering potential for growth in educational appeal and the integration of graduates into the workforce. Countries with a higher number of graduates and rate of employment such as France and Germany tend to invest more in tertiary education,

which suggests that Romania could benefit of a better funded educational policies. Generally, this cluster analysis shows the existence of significant differences between the educational systems within EU, and Romania has improvement potential regarding tertiary education expenditure, integrating the graduates into the workforce, and attract international students.

To enhance Romania's higher education system, a recommendation is increasing public investment in tertiary education to improve infrastructure, teaching quality, and research. Aligning curricula with labor market demands through stronger university-business partnerships, vocational training, and internships can boost graduate employability.

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