DOI 10.2478/vjes-2022-0009

Tertiary Education in Europe. What is Romania's place?

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Abstract

In the context of the internationalization of the labor market, the countries around the world have begun to focus on developing and implementing education policies that ensure the quality, coherence and equity of tertiary education. The main objective of this study is to identify and analyze the place of Romania between 35 European countries and Turkey, in terms of tertiary education. Cluster analysis has been used to achieve this goal, and the results indicate similarities and disparities between the countries analyzed. This article can be a reflection for decision-makers in the development of a skilled workforce..

Keywords: tertiary education, cluster analysis, European states, Turkey, Romania

Classification JEL: C38, I20, I25

Introduction

Tertiary education is a basic pillar for the stimulating economic and social development and competitiveness due to its major objective, namely to provide human capital with skills relevant and adaptable to the constantly evolving economic environment, and on the other hand in training students as active members of the communities they belong to. Therefore, great attention must be paid to the tertiary education that produces the future workforce, and governments must make access to and progress in tertiary education a priority in their national macro-strategies and policies.

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This paper aims to identify the place of tertiary education in Romania among 35 European countries, including Turkey in terms of the share of its levels (Bachelor, Master and Doctoral), and on the other hand in terms of distribution of tertiary education.The results of the research undertaken suggest that in terms of the share of students enrolled in tertiary education as a percentage of the population aged 20-24, Romania was in 2019 on the 26th place out of the 35 states included in the analysis. Romania's gap with the EU average remains the same as in 2015, even increasing by 0.1 percentage points. However, these overviews hide significant differences between the included states that can only be identified by analyzing each of the four levels of education included in tertiary education, and the research undertaken aimed precisely at identifying and analyzing these differences. This article is structured around three main sections (Data and methodology, Results and discussions, Conclusions) and two complementary sections (Introduction and References).

1. Data and methodology

In order to achieve the research objectives, data sets on the characteristics of tertiary education in 35 European countries, including Turkey, were selected. In order to ensure comparability, the use of absolute values was avoided, the research being based on relative data series (percentages) based, on the one hand, 20-24 years old in the population of each state included, and on the other hand total students enrolled at tertiary education levels. These data sets refer to Students in tertiary education - as% of 20-24 years old in the population (STE, 2022), as well as to the Distribution of students enrolled at tertiary education levels by field of education (DSE, 2022). Based on these, fifteen variables were selected (Table 1).

Table 1.

The meanings and units of measurement of the analyzed variables*

Variables	Significance of variables	Remarks	Unit
TE14	Tertiary education (levels 5-8) 2014	Students per 20-24 years old in the population	%
TE19	Tertiary education (levels 5-8) 2019		%
BCR	Bachelor's or equivalent level		%
MST	Master's or equivalent level		%
DCT	Doctoral or equivalent level		%
EDU	Education	Distribution of students enrolled at tertiary education levels by field of education	%
ATH	Arts and humanities		%
SJI	Social sciences, journalism and information		%
BAL	Business, administration and law		%
NMS	Natural sciences, mathematics and statistics		%
ICT	Information and Communication Technologies		%
EMC	Engineering, manufacturing and construction		%
HTW	Health and welfare		%
SRV	Services		%
PMTE	Percentage of males in total stutents enrolled at tertiary education levels		%

**With the exception of TE14, the values of all the other variables correspond to 2019*

In order to identify and analyze Romania's place among European states in terms of tertiary education, the cluster methodology was used. It was used in two variants corresponding to the two main objectives of the paper.

In both cases, the proximity matrix was obtained using Euclidian distance, and for generating clusters Ward's method was used (Marinoiu, 2016):

$$\Delta(A,B) = \sum_{i\in A\cup B}\left\|x_i - m_{A\cup B}\right\|^2 - \sum_{i\in A}\left\|x_i - m_A\right\|^2 - \sum_{i\in B}\left\|x_i - m_{\mathbf{B}}\right\|^2 - \frac{n_{A\cap B}}{n_{A\cup B}}\left\|m_A - m_B\right\|^2 \quad (1)$$

In (1), A and B are two clusters, m_i is the centroid, n_i is the number of elements from cluster i. and x_i an item. To test the statistical significance of the variables belonging to clusters, it was based on testing two null hypotheses:

$$H_{0_1}: \sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \ldots = \sigma_r^2 \quad (2)$$

$$H_{0_2}: m_1 = m_2 = m_3 = \ldots = m_r \quad (3)$$

The condition for accepting each of the two hypotheses is: $Sig.F > \alpha$.

The first null hypothesis H0_1 corresponds to Levene's Test and, if accepted, the ANOVA methodology is still used (Gogonea & Zaharia, 2008).

If hypothesis H0_1 is rejected, Robust Tests of Equality of Means are used, whose null hypothesis is H0_2. The test is applied to each variable. If hypothesis H0_2 is rejected then that variable is included in the cluster analysis, and if H0_2 is accepted, that variable is removed.

For the validation of statistical hypothesis, the Confidence level of 95% (α=0.05) was used.

For the variables to be included in the cluster analyzes, the main characteristics of their value distributions were determined. Given that the individual values of the variables are expressed as a percentage at the level of each analyzed state (with specific bases for each), in their case only the indicators of the shape of the distribution, the variation intervals and the median value and modulus corresponding to each variable were analyzed (Table 2).

Table 2

The main characteristics of used variables in clusters analysis

	EDU	ATH	SJI	BAL	NMS	ICT	EMC	HTW	SRV	BCR	MST	PHD
Median	8.05	10.25	9.15	22.55	5.15	5.05	15.05	14.35	4.80	23.70	7.00	0.10
Mode	9.50	13.30	9.30	21.10	5.10	5.00	21.00	13.50	3.90	19.30	6.80	0.10
Kurtosis	-0.13	2.16	3.48	14.14	2.52	0.66	-0.83	-0.24	-0.60	1.50	-0.42	9.33
Skewness	0.25	-0.57	-0.70	3.35	1.03	0.31	0.05	0.17	0.00	0.14	0.26	2.50
Max	0.0	1.1	0.0	13.5	0.0	0.0	7.6	6.9	0.0	5.1	0.6	0
Min	16.6	16.6	15.7	68.3	14.7	12	23.7	24.8	9.4	44.4	16.3	0.6

The values of the main characteristics of the data series used in the two cluster analyzes (Table 2) show that in the case of five of them (ATH, SJI, BAL, NMS and PHD) the distributions differ significantly from the normal distribution. At the same time, the amplitudes of the variation intervals (the difference between the extreme values) is also large (54.8 for BAL, 39.3 for BCR etc). Last but not least, for most data series, the values of the median and the modulus differ quite a bit from the middle of the variation range. All this leads to the conclusion that the most appropriate way to work to achieve the research objectives is the methodology of hierarchical clusters.

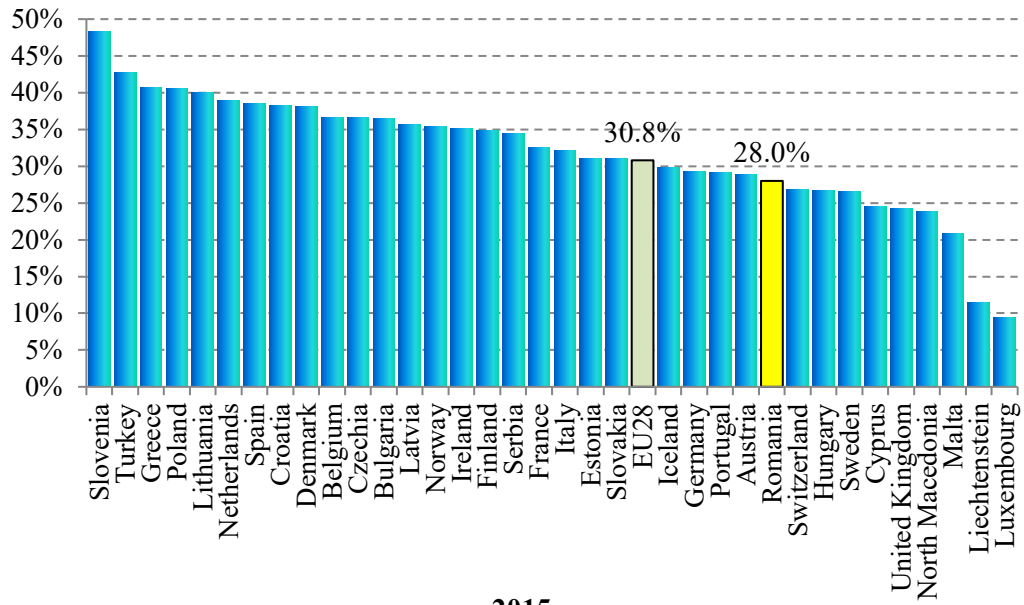
2. Results and discussion

At a glance, the share of students enrolled in tertiary education (levels 5-8, ISCED11) as a percentage of the population aged 20-24 in 2015 was between 9.4% in Luxembourg and 48.3% in Slovenia , while in 2019, the lowest share of 8.4% was recorded in Luxembourg, and the highest in Greece, 46.2%.

At the level of 2015 (Figure 1), in terms of the share of students enrolled in tertiary education compared to the population aged 20-24, Romania was on the 26th place out of the 35 states included in the analysis, with 2.8 points less than the European Union average.

Figure 1

Distribution of the analyzed states from the point of view of the share of tertiary education students compared to the population aged 20-24, in 2015



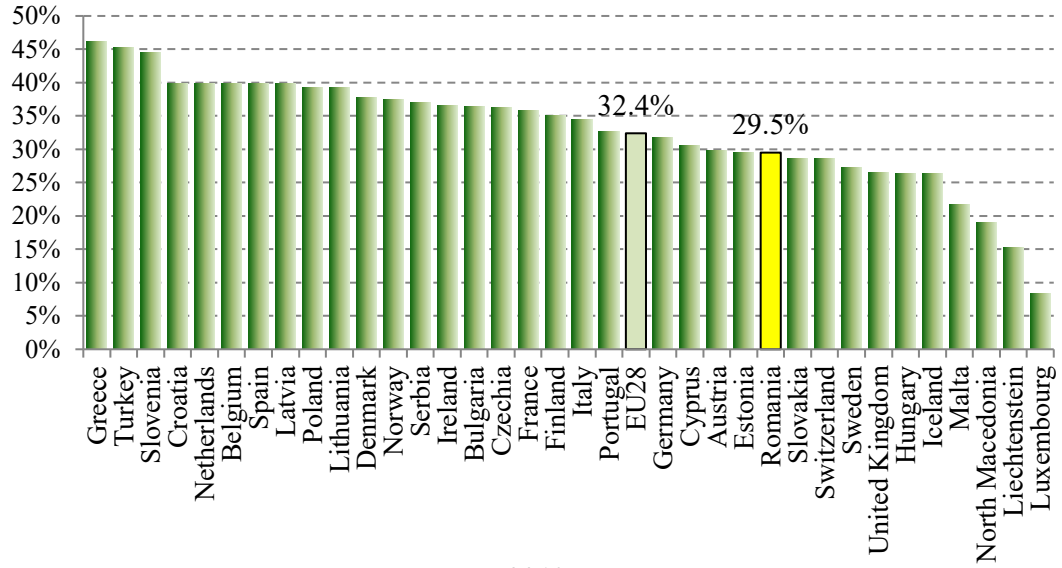
Of the 21 countries with weights above the European Union average, in six states, of which five EU Member States (Slovenia, Greece, Poland, Lithuania and the Netherlands) and one non-EU state (Turkey) had values above 39% .

Above the value of the average weight registered at the level of the European Union (30.8%), in the range between the weights of 35.1% -38.5% there were nine states (eight EU member states, plus Norway), and in the range 31, 1% -34.8% were six other EU Member States.

Below the EU average were nine EU member states, including Romania, as well as five other non-EU member states.

Figure 2

Distribution of the analyzed states from the point of view of the share of tertiary education students compared to the population aged 20-24, in 2019



2019

In the period 2015-2019, due to the characteristics of demographic developments as well as the availability of young people regarding the enrollment in tertiary education in the hierarchy of the analyzed states, some changes occur (Figure 2).

Of these, the largest increases in the share of students enrolled in tertiary education as a percentage of the population aged 20-24 were recorded in Cyprus (6.1 percentage points), followed by Greece (5.5 percentage points), Latvia (4 percentage points) , 1 percentage point) and Liechtenstein (3.8 percentage points).

On the other hand, the largest reductions in these weights were recorded in North Macedonia (-4.9 percentage points), Slovenia (-3.8 percentage points), Iceland (-3.5 percentage points) and Slovakia (-2 , 5 percentage points).

In Romania, in 2019 the share of students enrolled in tertiary education as a percentage of the population aged 20-24 was 29.5%, 1.5 percentage points more than in 2015, which placed it on the 25th place of the 35 states analyzed. On the other hand, the gap with the EU average remains, even increasing by 0.1 percentage points (from 2.9 percentage points in 2015 to 2.9 percentage points in 2019).

However, these overviews hide significant differences between the included states that can only be identified by analyzing each of the five levels of education included in tertiary education (ISCED 4-8). The research undertaken, through its objectives specified above, aimed precisely at identifying and analyzing these differences.

In order to fulfill the first main objective of the undertaken research, namely the determination and analysis of Romania's place in terms of the share of tertiary education levels 20-24 years old in the population of each state, 35 states were included in the analysis. The classification was based on Bachelor's or equivalent level (BCR) data series. Master's or equivalent level (MST) and Doctoral's or equivalent level (PHD).

The tests and analyzes performed resulted in a 6-cluster structure (Table 3).

Table 3

Cluster membership

Cluster	Cluster members
A	Belgium, Bulgaria, Czechia, Germany, Croatia, Italy, Poland, Slovenia, Norway
B	Denmark, Greece, Latvia, Lithuania, Netherlands, Finland, Serbia
C	Estonia, France, Cyprus, Hungary, Austria, Portugal, Romania, Slovakia, Sweden
D	Ireland, Spain, Switzerland,
E	Luxemburg, Malta, Iceland, Liechtenstein, North Macedonia, Turkey
F	United Kingdom

Initially, Levene's Test was used to test the statistical significance of the variables belonging to clusters (Table 4). Taking into account the values of Sig.F, it results that, for the variable BCR, the null hypothesis H0_1 is rejected, which means that the ANOVA methodology cannot be applied further.

Table 4

Test of Homogeneity of Variances

Variables	Levene Statistic	df1	df2	Sig.F
BCR	3.211	4	29	.027
MST	1.076	4	29	.386
PHD	1.018	4	29	.415

Robust Tests of Equality of Means were then used. The results obtained by both the Weich's Test and the Brown-Forsythe's Test (Table 5) lead to the conclusion that, for all three variables, the null hypothesis H0_2 is rejected and the alternative hypothesis is accepted: the average values recorded at the cluster level are significant statistical.

Table 5

Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.F
BCHR	Welch	13.402	4	9.120	.001
	Brown-Forsythe	10.986	4	13.138	.000
MSTR	Welch	20.658	4	11.641	.000
	Brown-Forsythe	20.158	4	25.747	.000
DCTR	Welch	9.838	4	9.985	.002
	Brown-Forsythe	10.493	4	17.393	.000

a. Asymptotically F distributed.

The results obtained (table 6), through the determined descriptive indicators, represent landmarks in highlighting the ranking of states on clusters, in relation to the three variables (BCR, MST, PHD) included in the analysis. At the same time, it is given back to Romania in terms of the share of tertiary education levels 20-24 years old in the population of each state, both at the level of cluster C of which it is part, and in relation to the component countries of the other clusters.

Table 6

Descriptive statistics of clusters

Cluster	Variable	Mean	Std. Dev.	Std. Error	Min	Max
A	BCR	25.41	2.0739	0.6913	22.40	28.50
	MST	11.21	1.9554	0.6518	9.10	15.30
	PHD	0.08	0.0667	0.0222	0.00	.20
B	BCR	32.36	5.7189	2.1616	27.10	44.40
	MST	5.57	2.0910	0.7903	1.70	7.70
	PHD	0.04	0.0535	0.0202	0.00	.10
C	BCR	18.47	2.5612	0.8537	14.10	22.60
	MST	9.63	3.1682	1.0561	6.80	16.30
	PHD	0.12	0.0441	0.0147	.10	.20
D	BCR	26.93	4.1405	2.3905	23.70	31.60
	MST	4.60	1.1533	0.6658	3.50	5.80
	PHD	0.23	0.0577	0.0333	.20	.30
E	BCR	16.63	8.0294	3.2780	5.10	27.00
	MST	2.70	1.8111	0.7394	.60	5.70
	PHD	0.02	0.0408	0.0167	0.00	.10

At the level of the first cluster (A) the most significant share of Bachelor's or equivalent level of 28.50% is held by Belgium, followed by Slovenia with 27.3% and Norway with 26.8% in the total tertiary education students - as% of 20-24 years of the population.

Compared to the average of 25.41%, Germany with 22.5% and Italy with 22.4%, are the countries that occupy the last places.

Ponderea cea mai mare pentru indicatorul Master's or equivalent level aparține Croației (15.30%), urmată de Poland (13,1%) și Italy cu 11.6%, în timp ce ultimele locuri aparțin Norway cu 9.5% și Germany cu doar 9.1%, având în vedere media de 11.21%. Pentru indicatorul Doctoral or equivalent level (PHD), față de media 0.08%, se poate preciza că Belgium cu 0.2% este în fruntea clasamentului, urmată de Czechia, Germany, Croatia, Poland și Slovenia cu 0.1%.

The highest share for the Master's or equivalent level indicator belongs to Croatia (15.30%), followed by Poland (13.1%) and Italy with 11.6%, while the last places belong to Norway with 9.5% and Germany with only 9.1%, having considering the average of 11.21%. For the Doctoral or equivalent level (PHD) indicator, compared to the average of 0.08%, it can be stated that Belgium with 0.2% is at the top of the ranking, followed by the Czech Republic, Germany, Croatia, Poland and Slovenia with 0.1%.

For the other three countries (Bulgaria, Italy and Norway) the weights are subunit, insignificant, highlighted by the percentage of 0%.

Regarding the countries of cluster B, it can be specified that Greece, which occupies the first place at Bachelor's or equivalent level with 44.4%, will be on the last place for Master's or equivalent level with 1.7%. Taking into account the averages of 32.36% (BCR) and 5.57% (MST), the Netherlands with 33.5% is in second place compared to the component countries of cluster B for BCR and three for MST with 6.3%. The maximum percentage of 7.7% for the Master's or equivalent level indicator is registered in Lithuania, which, in terms of Bachelor's or equivalent level, with 31.5%, ranks third. Latvia with 27.1% represents the country with the lowest share (27.1%) of the Bachelor's variable or equivalent level. The other three countries (Denmark, Findland, Serbia) have intermediate values of

maximum and minimum percentages, for both indicators analyzed. The average weight of 0.04% of the Doctoral or equivalent level (PHD) indicator divides the countries of cluster B into two categories: countries with a percentage of 0.1% (Greece, Netherlands, Serbia) and those with subunit, insignificant percentages encountered with 0% (Denmark, Latvia, Lithuania, Findland).

With a number of 9 countries, as well as cluster A, the cluster C is presented in the analysis. Estonia with 22.6% is on the first place at Bachelor's or equivalent level (BCR) and the last with 6.8% at Master's or equivalent level (MST) . In a reverse situation, France is on the last hierarchical step at BCR with 14.1% and on the first at MST with 16.3%. At the same time, with the same percentage of 6.8% at MST, Austria is at the end of the ranking compared to the other component countries of the cluster, but is on the second place at BCR with 20.4%. On the second hierarchical step in terms of the Master's or equivalent level indicator is Portugal with 11.8%. The third place in the ranking of the countries of cluster C is occupied by Cyprus at BCR with 19.8% and Slovakia with 10.8% at MST. Hungary and Sweden are the countries with corresponding weights of the two indicators between the highs and lows presented for this cluster. Regarding the Doctoral or equivalent level (PHD) indicator, it is possible to mention for this cluster C a classification of the countries only in two categories: two countries with a weight of 0.2% (France and Slovakia) and the rest of the states with only 0.1% (Estonia, Cyprus, Hungary, Austria, Portugal, Romania and Sweden).

Romania, compared to the other component countries of cluster C, presents a rather favorable situation in terms of the share of tertiary education levels 20-24 years old in the population of each state. The statement is justified by the weights recorded for both indicators (BCR and MST) which place it in the middle of the ranking compared to the other eight countries. Thus, with 10.2%, Romania ranks fourth in the MST, being over 0.57 percentage points above the average of the indicator. Analyzing Romania's position on the hierarchical level of C cluster countries in terms of Bachelor's or equivalent level (BCR) indicator, the same previous statement is confirmed by the 19.3% (like Portugal) which are 0.83 percentage points above the average of this indicator.

Cluster D has three component countries: Ireland, Spain, Switzerland. Ireland with 31.6% at BCR and 0.3% at PHD, is ranked first compared to the other two countries and last at PHD with 3.5%. The 0.2% of the PHD indicator are registered for both Spain and Switzerland, which occupy this second place and the other two variables (23.7% for BCR and 4.5% for MST). Spain with 5.8% is at the top of the ranking for Bachelor's or equivalent level and on the third place with 25.5% for Master's or equivalent level.

Of the six components of cluster E, Turkey is at the top of the Bachelor's or equivalent level ranking with 27% and the last at Master's or equivalent level with 2.4%. Second place at BCR is occupied by Iceland (23.5%) and Liechtenstein at MST with 3.8%. North Macedonia is the country with 18.3% for BCR, ranking third and 0.6% for MST, which places it in last place. Luxembourg with 5.1% is on the last place at BCR and with 1.5% on the penultimate place at MST. With regard to the PHD indicator, there is a special situation in the sense that, compared to the average of 0.02%, only Luxembourg is above 0.1%, the rest of the countries have insignificant, subunit weights presented as 0%.

United Kingdom, the only component of cluster F, accounts for 19.3% for BCR, 4.8% for MST and 0.6% for the PHD indicator.

In order to fulfill the second main objective of the research, namely the determination and analysis of Romania's place in terms of distribution of students enrolled at tertiary education levels by field of education, 36 states were included in the analysis.

Although nine variables were initially selected for research on this issue (Table 1), after testing the statistical significance of their inclusion in the classification algorithm (tests performed with Levene's Test, Welch's Test and Brown-Forsythe's Test), three of them (EDU, ATH and EMC) have not been included in the classification algorithm). Under these conditions, the classification was made according to the data series on Social sciences, journalism and information (SJI), Business, administration and law (BAL), Natural sciences, mathematics and statistics (NMS), Information and Communication Technologies (ICT), Health and Welfare (HTW) and Services (SRV). The tests and analyzes performed resulted in a structure with 7 clusters (Table 7).

Table 7

Cluster membership

Cluster	Cluster members
A	Belgium, Denmark, Lithuania, Malta,
B	Bulgaria, Czechia, Spain, France, Croatia, Latvia, Poland , Slovenia, Serbia
C	Germany, Ireland, Luxemburg, Austria, United Kingdom
D	Estonia, Hungary, Romania, Finland, North Macedonia
E	Greece, Italy, Iceland
F	Cyprus, Turkey
G	Netherlands, Portugal, Slovakia, Sweden, Norway, Switzerland, Bosnia and Herzegovina

Testing the statistical significance of the variables belonging to clusters was performed with Levene's Test (Table 8). Given that for the variables HTW and SRV the values of Sig.F are higher than the significance threshold ($\alpha = 0.05$), the null hypothesis H0_1 is rejected, which means that even in this case the ANOVA methodology cannot be applied.

Table 8

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
SJI	2.210	6	28	.072
BAL	1.186	6	28	.342
ICT	.211	6	28	.970
HTW	5.385	6	28	.001
SRV	2.648	6	28	.037
NMS	1.309	6	28	.286

On the other hand, the results obtained by both the Weich's Test and the Brown-Forsythe's Test (Table 9) lead to the conclusion that, for all six variables, the null hypothesis H0_2 is rejected and, consequently, the hypothesis is accepted. alternative: the average values recorded at the cluster level are statistically significant.

Table 9

Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
SJI	Welch	5.563	6	7.211	.019
	Brown-Forsythe	6.028	6	8.340	.011
BAL	Welch	80.797	6	9.766	.000
	Brown-Forsythe	15.046	6	23.002	.000
ICT	Welch	4.015	6	7.463	.041
	Brown-Forsythe	6.847	6	14.562	.001
HTW	Welch	24.930	6	10.014	.000
	Brown-Forsythe	6.771	6	13.772	.002
SRV	Welch	21.239	6	10.324	.000
	Brown-Forsythe	19.982	6	17.008	.000
NMS	Welch	10.215	6	9.607	.001
	Brown-Forsythe	9.114	6	12.427	.001

a. Asymptotically F distributed.

The determination of the main descriptive indicators (mean, standard deviation, standard error) allowed to obtain some results (table 10) through which the countries can be ranked on clusters in relation to the 6 variables (SJI, BAL, ICT, HTW, SRV, NMS). In this context, Romania's position is shown in terms of the share of the distribution of students enrolled in tertiary education levels by field of education, both at the level of cluster C of which it is part, and in relation to the component countries of the other clusters.

Table 10

Descriptive statistics of clusters

CLS		SJI	BAL	ICT	HTW	SRV	NMS
A	Mean	9.100	24.600	5.275	21.425	2.475	4.350
	Std. Dev	0.245	2.858	1.515	2.944	0.866	0.810
	Std. Error	0.122	1.429	0.758	1.472	0.433	0.405
B	Mean	8.989	21.800	5.644	13.578	7.933	5.178
	Std. Dev	1.617	3.597	1.605	1.599	1.134	1.663
	Std. Error	0.539	1.199	0.535	0.533	0.378	0.554
C	Mean	8.920	24.360	6.360	11.240	2.100	10.040
	Std. Dev	2.376	4.016	1.270	4.403	1.883	2.719
	Std. Error	1.063	1.796	0.568	1.969	0.842	1.216
D	Mean	7.380	21.960	9.180	14.820	5.140	4.340
	Std. Dev	1.221	2.460	1.980	3.459	0.885	1.152
	Std. Error	0.546	1.100	0.886	1.547	0.396	0.515
E	Mean	14.000	19.333	3.700	12.367	3.167	7.633
	Std. Dev	1.539	1.305	1.967	3.873	0.379	2.139
	Std. Error	0.889	0.754	1.136	2.236	0.219	1.235
F	Mean	8.350	40.300	2.250	9.550	5.150	2.550
	Std. Dev	2.192	0.849	1.626	0.212	0.212	0.354
	Std. Error	1.550	0.600	1.150	0.150	0.150	0.250
G	Mean	10.314	19.600	4.400	17.214	4.671	5.586
	Std. Dev	1.085	3.913	1.348	2.184	1.684	1.316
	Std. Error	0.410	1.479	0.509	0.826	0.636	0.497

At the level of the first cluster A (Belgium, Denmark, Lithuania, Malta) the maximum weights of the distribution of students enrolled in tertiary education by field of education are recorded for Social sciences, journalism and information (9.3% SJI), Business, administration and law (27.6% BAL), Information and Communication Technologies (7.1% ICT) and Services (3.6% SRV) in Malta. Denmark ranks first among SJIs (9.3%) and Natural Sciences, Mathematics and Statistics (NMS) with 5.5%. The Health and welfare indicator registers the highest share of 24.8% in Belgium. The least favorable situations, with the lowest weights, are distributed at the level of countries and variables as follows: Belgium to BAL (21.1%), ICT (3.5%), SRV (1.5%) and NMS (3.6%), then Lithuania to SJI (8.8%) and HIW (18.2%).

In the case of cluster B (Bulgaria, Czechia, Spain, France, Croatia, Latvia, Poland, Slovenia, Serbia), the percentage changes in the six indicators are quite significant. Thus, the weights for SJI range between 6.3% (Croatia) and 11.4% (Serbia), and for BAL between 16.4% (Serbia) and 27.1% (Latvia). For ICT the percentages are reduced between 3.1% (France) and 8.9% (Serbia), while for HTW the percentage values of the countries are between the minimum of 10.6% (Serbia) and 15.7% (Spain). In the case of the other two variables SRV and NMS, the percentage fluctuations are between 6% and 9.4% for Spain and Croatia, respectively between 2.7% and 7.5% reported in Latvia and France.

Cluster C, which includes Germany, Ireland, Luxembourg, Austria, the United Kingdom, faces fluctuations from one country to another, from one indicator to another. Thus, between Luxembourg (first in the ranking) and Ireland (last in the hierarchy), an amplitude of 5.6 percentage points was determined at the level of the SJI indicator and 10.2 percentage points for BAL. Austria and the United Kingdom with 5% and Luxembourg with 7.7% are the countries with the highest weights obtained for the ICT indicator. With an amplitude of 9.1% for HTW Ireland holds the supremacy, and Germany finishes the ranking. Only 3.8% are determined by the length of the variation interval for SRV, Ireland, Austria being in the first places while United Kingdom occupies the last place. At the other end of the table is the United Kingdom which ranks first with 14.7% for NMS, while with 8% Luxembourg is at the bottom of the rankings.

Estonia, Hungary, Romania, Finland and North Macedonia represent the component countries of the D cluster. 3.2% (NMS) ranks last. By 18.5%, Finland dominates the country hierarchy at HTW, and at 17.7% and 4.2% it is at the end of them for the BAL and SRV indicators. Hungary has only a minimum percentage in the country ranking for the NMS indicator of 3.2%. Estonia registers two percentage minimums with 9.5% for ICT and 12.4% for HTW, while on the first hierarchical step it will be placed on the NMS indicator.

Romania, by the registered values, from the point of view of the share of the distribution of students enrolled at tertiary education levels by fields of education at SJI and BAL, is placed at the top of the ranking with 8.8%, respectively 24%. For the other four variables, the results show that the country is placed in the middle of the ranking of the components of cluster D, without occupying extreme places of minimum or maximum. Thus, Romania, compared to the other countries included in cluster D, presents a rather favorable situation, through the middle position it occupies through the percentage values of 13.8% for HTW, 7% for ICT, 4.4% for NMS and 4.3% for SRV.

The three countries of cluster E are: Greece, Italy, Iceland. Greece occupies top positions with 20.7% in BAL and 9.5% in NMS, while at the end of the ranking it is observed with 12.7% for SJI, 7.9% for HTW and 2.9% corresponding to SRV. Italy is the country with the most middle percentages in the ranking, only for BAL and ICT being the lowest, of

18.1% and 1.9%. For most variables, Iceland recorded maximum shares of 15.7% for SJI, 14.8% for HTW, 5.8% for ICT and 3.6% for SRV. Only a minimum percentage will be reported to the NMS of 5.3%.

Because cluster F comprises only two countries, it has a clear hierarchy in the sense that the maximum share belonging to one country implies a minimum share for the other. Thus, the maximum percentage is recorded in Cyprus for BAL (40.9%), HTW (9.7%), ICT (3.4%) and NMS (2.8%), and for Turkey for the other two indicators SJI (9.9%) and SRV (5.3%).

With regard to the last G cluster (Netherlands, Portugal, Slovakia, Sweden, Norway, Switzerland, Bosnia and Herzegovina), the percentage developments of the six indicators can be summarized. Thus, the length of the variation interval for the SJI is 3.1 percentage points, the percentages fluctuating between the Swedish maximum and the Swiss minimum. At the BAL indicator, the two countries change their extreme positions in the sense that Switzerland with 25.1% is on the first place, and Sweden on the last with 13.5%. The percentage values of the ICT indicator vary between 6.8% for Bosnia and Herzegovina and 2.7% for Portugal. A rather small amplitude of 6.1 percentage points is also recorded for HTW, given that the maximum belongs to Slovakia and the minimum to the Netherlands. Another difference of 4.3 percentage points for SRV is determined between the Swedish percentage maximum and the Portuguese minimum. The last indicator, NMS faces a variation over a range of 4 percentage points calculated between the maximum percentage belonging to Switzerland and the minimum in Bosnia and Herzegovina.

3. Conclusions

Tertiary education is essential to creating a smart economy.

The research aimed to identify the place of tertiary education in Romania among European countries, including Turkey. In order to achieve this goal, the weights of the levels of tertiary education (Bachelor, Master and Doctoral) as well as the distribution of the fields of tertiary education (Social sciences, journalism and information, Business, administration and law, Natural sciences, mathematics and statistics, Information) were identified and used. and Communication Technologies, Health and Welfare, Services).

The clearer highlighting of the hierarchical situation of the 35 European states, including Turkey and especially Romania, depending on the variables included in the analysis is justified on the one hand by the use of data related to Students in tertiary education - as% of 20-24 years old in the population and the distribution of students enrolled at tertiary education levels by field of education, and on the other hand by applying the cluster methodology was used.

As a result of applying the cluster methodology was used, seven clusters were obtained, the last one including only one country (United Kingdom). The results obtained, summarized by cluster, show that, in terms of the weights of tertiary education levels, the most significant were determined in cluster B (Denmark, Greece, Latvia, Lithuania, Netherlands, Finland, Serbia) by an average weight of 32.36%, with regard to Bachelor's or equivalent level, at cluster A (Belgium, Bulgaria, Czech Republic, Germany, Croatia, Italy, Poland, Slovenia, Norway) with 11.21% regarding Master's or equivalent level and at cluster D (Ireland, Spain, Switzerland) for Doctoral or equivalent level by 0.23%.

The analysis of the results regarding the weights of the distribution of students enrolled at tertiary education levels by fields of education show the dominant position of

cluster F by the weight of 40.3% determined as an average for Cyprus, Turkey in terms of Business, administration and law. With 21.43% in Health and welfare, the first cluster formed by Belgium, Denmark, Lithuania, Malta is also in first place in the context of the comparative analysis of the percentage values of the indicator obtained by the other clusters. Dominant positions are registered at Natural sciences, mathematics and statistics with an average percentage of 10.04% for cluster C (Germany, Ireland, Luxembourg, Austria, United Kingdom) and at Social sciences, journalism and information with 10.31% for cluster G (Netherlands, Portugal, Slovakia, Sweden, Norway, Switzerland, Bosnia and Herzegovina). With lower percentages, 9.18% and 7.93% for Information and Communication Technologies (ICT) and Services (SRV) are the maximums determined for cluster D (Estonia, Hungary, Romania, Finland, North Macedonia) and cluster B (Bulgaria, Czech Republic, Spain, France, Croatia, Latvia, Poland, Slovenia, Serbia).

More about this source textAs a summary of Romania's position in relation to other countries, taking into account the two criteria (levels of tertiary education and areas of tertiary education) we can mention the existence of two situations. In the first situation, when the share of tertiary education levels was analyzed 20-24 years old in the population of each state, in the cluster with 9 countries, Romania occupies a middle position for each of the three indicators included in the analysis: BCR, MST and PHD. The second situation, when the share of the distribution of students enrolled in tertiary education by fields in the cluster with five countries was analyzed, reflects the dominant position of Romania for two fields: Social sciences, journalism and information (SJI) and Business, administration and law BAL. Regarding the other variables (ICT, HTW, SRV, NMS), the results show that the percentage level with central values is characteristic of Romania in the hierarchical ranking achieved.

Limitations and future research: Research can be complemented by a comparative investigation of education policies with strict reference to tertiary education. This could capture governments' views on tertiary education and their correlation with national economic and social goals, as well as the identification of potential non-correlations that would provide information and proposals for future directions of educational policies.

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