

Does Romania Meet the Targets for Recovery and Resilience?

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Abstract. *The Recovery and Resilience Mechanism represents the European Union's response to the devastating effects of the COVID-19 pandemic, designed to help EU's members built more resilient and sustainable societies capable of transitioning to digitalization and a green economy. This initiative consists of six pillars that were analyzed in the current study through six indicators associated with the Sustainable Development Goals. The examined indicators cover green transition pillar, specifically looking at artificial forest regeneration; digital transformation with a focus on IT equipment in schools; health and economic and social resilience pillar measured by the number of doctors per 10,000 inhabitants; inclusive growth – presented as the average pension levels in Romania; social and territorial cohesion measured by the share of agrotourism accommodations in the total of guesthouses in each county and education through the number of professional units in total school units. The results section presents the county-level situation of the six variables highlighted by six detailed visual maps. A second analysis was conducted for NUTS2 regions which also resulted in six overview maps. To assess regional resilience, the authors conducted a TOPSIS analysis to rank these regions based on how well they meet the Sustainable Development Goals. The findings of the current study reveal a pattern observed over time in many researches - southern regions consistently show lower performance compared to their northern counterparts across most indicators.*

Keywords: resilience, recovery, sustainable development, TOPSIS.

Introduction

The Recovery and Resilience Facility is the cornerstone of the NextGenerationEU project, which provides loans and funds to support reforms and investments in Member States to recover from the disruption caused by the pandemic and create digital, green and resilient economies (European Commission, 2021a). In order to achieve these objectives, six pillars have been formed that underpin this mechanism, the aim of the current research being to determine the most resilient regions of Romania by analysing a number of six indicators intended to present the regional situation through association with the six pillars, but also with certain Sustainable Development Goals.

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The concept of sustainability and its achievement represent the aspects to be aspired to in order to form resilient communities, the connection between it and the elements that define the recovery and resilience mechanism being investigated in numerous studies on institutional quality (Hunjra et al., 2023), green technologies (Yan et al., 2024), ecological planning (Kim et al., 2024) and sustainability of cities (Mori & Christodoulou, 2012), education and work (Batrancea, 2023) as well as health (Liu et al., 2016).

The research begins by presenting a study of the specialized literature in which the elements defined in the previous paragraph are deepened, but not limited to them. The methodology defines the indicators used in the current study, as well as the method of their collection, together with the technique used to classify the regions of Romania. TOPSIS analysis is a multi-attribute decision method through which scores are associated to the proposed alternatives based on the distance between the alternatives and the positive and negative ideal solutions, this being one of the most used decision support techniques, noting an increase in the use of this method in recent years (Pandey et al., 2023). The section dedicated to the results describes at an early stage, the county performances obtained in 2022 for the six indicators analyzed, the results recorded by the development regions were also defined, so that finally, a ranking of the NUTS2 regions can be achieved by applying the TOPSIS method.

Literature review

The recovery and resilience mechanism is based on six pillars, the first of which refers to the green transition, which aims at energy efficiency and increasing the share of energy from renewable sources, as well as the focus on green technologies, aimed at helping biodiversity, the circular economy and adaptation to climate change. The second pillar addresses policies for future generations, which advocate for access to quality education, encouraging vocational education, digital education to support the inclusion of young people in the workforce. The next pillar addresses smart, sustainable and inclusive growth, which promotes entrepreneurship, competition, improving the business environment, encouraging research, innovation and development to support small and medium-sized companies. Digital transformation represents the fourth pillar, which aims to digitize the public sector, as well as the private sector by developing basic and advanced skills of staff. Social and territorial cohesion refers to improving infrastructure and services, the inclusion of vulnerable groups and social protection, as well as supporting the development of work skills and the creation of stable jobs. The last pillar defines institutional and social resilience, as well as health and the economy, which aims to increase resilience, accessibility, and the quality of healthcare, along with the efficiency of the public administrative sector (European Commission, 2021b).

In the case of the EU, discrepancies are noted between the states that constituted the Union, compared to the new ones, which is why regional policies are implemented aimed at reducing socio-economic differences. As economic growth is an element by which sustainable development can be measured, in a study that integrated 62 NUTS2 regions from central and eastern EU, including Romania, it is observed that the introduction of young people into the labor market is a factor that supports this growth (Batrancea, 2023). Also, discrepancies are noted not only between countries, but also within them, with the delimitation between urban and rural areas, for which, according to a study on Bulgaria, Germany, the Netherlands, Poland and Romania, the two countries located in the southeast of the EU need significant measures to achieve rural sustainability. One of the identified problems is found in the education sector, with the percentage of educated people decreasing in these countries, making digitalization and improving school infrastructure urgently needed (Memo & Pieńkowski, 2023). Another way to develop the

sustainability of rural areas is through agrotourism because people are becoming increasingly interested and eager for authentic experiences and products from the area where they grew up; thus, the development of this type of tourism leads to an increase in incomes obtained in rural areas (Ammirato & Felicetti, 2014).

Since the current study also aimed to present county performances, it is worth mentioning that the results obtained by Romania, through the analysis of indicators other than those defined in the current research, position Bucharest in a leading position, categorically delimiting it from the other counties (Ciucu (Durnoi) et al., 2024), a fact that can be noted even within this analysis.

A study on the development regions in Romania, which took into account 26 indicators designed to describe the three major components of sustainable development, shows that the Bucharest-Ilfov region has by far the best results for the period that the authors set out to analyze, followed by the North-West region (Botha et al., 2020). Also, in another study on the development regions in Romania and Bulgaria regarding education, poverty and decent work, their ranking also being achieved by applying the TOPSIS method, it is noted that the Bucharest-Ilfov region occupies a leading position, also in second place being the North-West region, while the regions in southern Romania occupied lower spots in the ranking (Ciucu-Durnoi et al., 2024)

In a study on regional environmental sustainability, which presents the EU development regions, it is found that in terms of the regional indicator of sustainability of the competitive environment, the regions of Romania had among the most significant increases, a sign that Romanian employees are located in sectors where both competitiveness and environmental sustainability are increased. However, it is found that the high values of the indicator are due, mainly, to the regional competitiveness indicator, rather than to that of environmental sustainability, for which only the Center and West regions show positive changes (Santos et al., 2022).

In terms of greenhouse gas emissions, regarding the evolution from 1990 to 2022, two of Romania's regions, Bucharest-Ilfov and Center, are among the top 10 countries that had the largest decreases in these emissions, while two other regions, South-East and West, are among the top 14 EU NUTS2 regions that managed to reduce 55% of emissions in the period described above. Surprisingly, with very few exceptions, Romania's counties do not excel at all in terms of renewable energy sources based on solar or wind panels (European Commission. Statistical Office of the European Union., 2024).

The following two sections to be presented are intended to detail the methods used, as well as the indicators selected to study the issues of Romania's counties and development regions viewed through the lens of the six pillars of the recovery and resilience mechanism.

This research contributes to the specialized literature by considering some relevant indicators for the pillars of the Recovery and Resilience Mechanism, presenting the results obtained with the help of the TOPSIS method and proposing some policies adapted to the level of counties and development regions. Although researchers have frequently used multicriteria methods in the assessment of sustainability and regional development, there are not many studies that have analyzed territorial resilience in Romania by considering socio-economic, educational and environmental indicators in a comparative analysis at the regional level. Therefore, the current study provides insight into territorial differences in resilience and contributes to the existing literature by highlighting directions for intervention to reduce regional inequalities.

Methodology

The current section is dedicated to presenting the data that was collected, as well as the methods used to create the current research. The investigated indicators were obtained after querying the database provided by the National Institute of Statistics; the data analyzed for the study were those from 2022.

Table 1 presents the link of the chosen indicators to the six pillars of the EU Recovery and Resilience Mechanism, as well as to the Sustainable Development Goals, explaining how each indicator is calculated.

Table 1. Indicators

Pillar	Indicator	Calculation method	SDG	References
Green transition	Artificial regeneration	Total artificial regeneration/forest area*100 (%)	15	Hardalau et al.(2025), Buzatu et al. (2023)
Digital transformation	IT equipment in schools	Computers/students*100 (%)	4	Grigorescu et al. (2025), Barna and Epure (2020)
Smart, sustainable and inclusive growth	Average pension	State social insurance (lei)	1	Spinu et al. (2023) Sorici et al. (2022)
Health and economic and social resilience	Medics	Medics/inhabitants * 10000	3	Ciucu (Durnoi) et al., (2024) Apostu et al. (2022)
Social and territorial cohesion	Agrotourism pensions	Agrotourism guesthouses/total guesthouses* 100 (%)	8	Ammirato and Felicetti (2014) Micula et al. (2024)
Next generation	Vocational education	Professional units/total school units*100 (%)	4	(Batrancea, 2023), Popescu and Roman (2018)

Source: Authors' own research.

In the case of Green transition, the indicator considered was Artificial regeneration, this indicator representing one of the targets of SDG 15 „Life on Land”. A study on forest sustainability shows that in areas where artificial cuts have been made there is a higher probability of browsing, the species found being red deer, fallow deer and roe deer (Hardalau et al., 2025). Moreover, in another paper on biodiversity conservation, it is noted that between 2018-2022 there was a decrease of approximately 10% in the area on which artificial regenerations were carried out (Buzatu et al., 2023). Agritourism, as a target of SDG 8 Decent Work and Economic Growth, was chosen to define Social and territorial cohesion, Ammirato and Felicetti (2014) stating that agritourism helps increase incomes in rural areas, Micula et al. (2024) noting the upward trend of this type of tourist accommodations in Romania.

SDG 4 „Quality Education” targets have been assigned to the Digital Transformation and Next Generation pillars. According to a study conducted by Grigorescu et al. (2025), giving the European Commission directives, by 2030, the digital gap for secondary school graduates is to be reduced to 15%. Moreover, 72% of Romanians lack basic digital skills. In their paper on digital transformation, Barna and Epure (2020) discuss these two concepts related to this research, youth unemployment and digital literacy skills, offering a series of recommendations and initiatives to integrate young people into the labor market. The role of youth inclusion in the labor market was also discussed by Batrancea (2020), noting in the study the positive effect on economic growth. Moreover, according to Popescu and Roman (2018), vocational training participation increases the chance of employment by 15%.

The Health and economic and social resilience pillar was covered through SDG 3 "Good Health and Well-being", the exodus of doctors from Romania being a known phenomenon (Apostu et al., 2022). Although Bulgaria is facing a migration of medical professionals, approximately two-thirds of Romania's counties have fewer doctors than any other county in Bulgaria (Ciucu (Durnoi)

et al., 2024). State social insurance, related to SDG 1 „No Poverty”, was included in the Smart, sustainable and inclusive growth pillar, Spinu et al. (2023), comparing social insurance benefits in Romania and the Republic of Moldova, noted an improvement in the public social security system. Sorici et al. (2022) also investigated the social insurance budget, calculating an index meant to offer a higher level of social protection, given the social vulnerabilities that can arise during times of crisis.

The technique for preference of order by similarity to the ideal solution, also known by the acronym TOPSIS, is a multi-attribute decision-making method (Hwang & Yoon, 1981) by which the ranking of alternatives is achieved by choosing the method that has the shortest distance from the positive ideal solution, but also the greatest distance from the negative ideal solution (Lai et al., 1994). The application of different multi-attribute decision-making methods leads to different results in terms of the ranking of alternatives (Yeh, 2002). Among the advantages of the method are the simplicity of the application of the method, the mathematics behind it being easy to implement, and the procedure being intuitive. Also, other advantages are related to rationality, understanding, efficiency and the ability to associate weights in the decision-making process (Galik et al., 2022).

The method starts by creating a matrix $X_{m \times n}$, with m defining the number of alternatives, while n presents the number of criteria. The first stage in the application of the method is the normalization of the previously defined matrix (Yoon & Hwang, 1995):

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}, i=\overline{1, m}, j=\overline{1, n} \quad (1)$$

The next step is to assign weights (w) to the criteria according to their degree of importance, then calculating the ideal positive (v^+) and negative (v^-) solutions.

$$v_{ij} = w_j r_{ij}, i=\overline{1, m}, j=\overline{1, n} \quad (2)$$

In the case of the current research, the weights assigned were equal, because one criterion cannot be considered more important than another. Moreover, there are studies that attest to the fact that there are no significant differences in the ranking when the weights are changed, especially when there are similarities and interdependencies between the indicators (Bánhidi & Dobos, 2024; Einhorn & Hogarth, 1975).

The ideal negative or positive solutions are chosen according to the specifics of the criterion; if the criterion involves obtaining a maximum value, then the positive ideal solution will be represented by the maximum value of the criterion, while the negative ideal solution will represent the minimum value, the situation being reversed in the case of criteria in which a minimum value is desired.

$$v_j^+ = \begin{cases} \max_i v_{ij} \\ \min_i v_{ij} \end{cases}, v_j^- = \begin{cases} \min_i v_{ij} \\ \max_i v_{ij} \end{cases}, j=\overline{1, n} \quad (3)$$

After these solutions are calculated, the aim is to determine the distance between the alternatives and the ideal solutions:

$$S_i^+ = \sqrt{\sum_{j=1}^n (v_i^+ - v_{ij})^2}, S_i^- = \sqrt{\sum_{j=1}^n (v_i^- - v_{ij})^2}, i=\overline{1, m} \quad (4)$$

The final step is to calculate a performance score of each alternative.

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-}, i=\overline{1, m} \quad (5)$$

After obtaining this score, a ranking of the alternatives is made for which the highest value of the performance score is associated with the best alternative.

Results and discussions

This part of the paper is intended to present, in a first stage, the context in which the counties of Romania find themselves, with regard to the resilience indicators presented in the methodology, and subsequently, to highlight the context concerning the eight development regions. At the end of this section, the results obtained following the implementation of a multi-attribute decision method are illustrated to achieve a ranking of these regions in terms of the performances recorded through the six analysed indicators.

Resilience in the county context

The subsection dedicated to the county context presents the results obtained by the 42 counties of Romania regarding the six indicators analysed by illustrating maps created with the aim of highlighting the geographical effects.

Figure 1 presents the values recorded by each county for the year 2022 regarding the number of doctors per 10,000 inhabitants. As can be seen, their number varies from 12.03 doctors in Giurgiu to 99.32 in Bucharest, but the preponderance of red color is highlighted, indicating a relatively small number of doctors, counties such as Timiș, Iași, Cluj, Dolj or Mureș being at the opposite pole, for which the number of doctors exceeds 50 per 10,000 inhabitants.

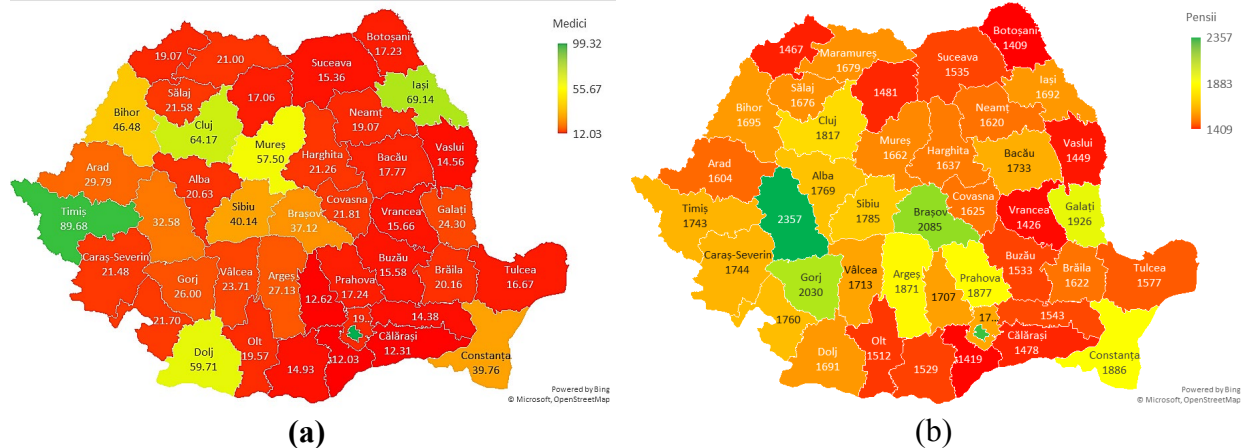


Figure 1. Medics per 10000 inhabitants (a), Average pension (b)

Source: Authors' own research.

Regarding the average pension in the form of state social insurance, a minimum value of 1,409 lei is noted in Botoșani county; there are six other counties for which the amount of this pension does not reach 1,500 lei (Satu Mare, Bistrița-Năsăud, Vaslui, Vrancea, Giurgiu and Călărași) while pensions over 2,000 lei are found in four counties (Hunedoara, Brașov, Gorj and Bucharest). The highest amount of money of the average pension is in Hunedoara County, with a value of 2,357 lei.

Figure 2 illustrates the values held by counties in terms of the number of computers per 100 students. Thus, the highest value is recorded in Cluj County with 55.42%, while the lowest, 11.15, was reported in Olt County. In this case too, the preponderance of low values is noted, Bucharest being the only one that exceeds 40 computers per 100 students; in the rest of the counties the values do not exceed 32%. In the case of vocational education, a considerable number of counties are noted in which there are no such high schools, for instance Bihor, Alba, Argeș, Vâlcea, etc. Also, the counties that record the highest percentages are Maramureș, Iași, Sălaj, Ialomița and Botoșani, with values ranging between 3.79% and 6.04%. Other counties with average percentages are

Tulcea, Bistrița-Năsăud, Sibiu, Prahova and Buzău, where the percentages vary between 2.03% and 2.50%. All other counties have less than 2 vocational high schools per 100 educational units.

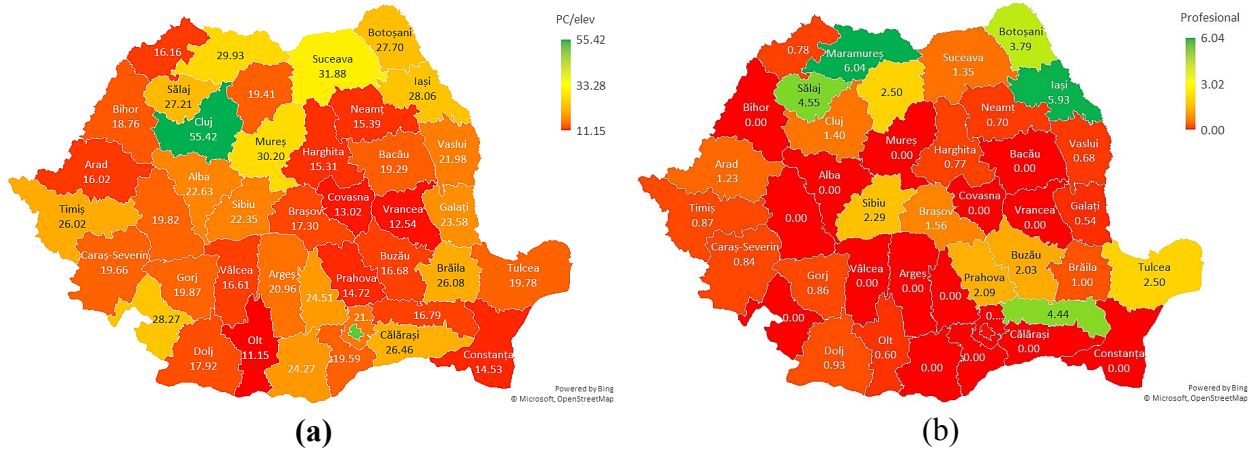


Figure 2. Computer/ student (a), Vocational education (b)

Source: Authors' own research.

Agrotourism guesthouses account for over 30% of the total number of guesthouses in more than half of Romania's counties, with the highest percentage being reached in Bistrița-Năsăud, a county where 59.78% of guesthouses are classified as agrotourism (Figure 3).

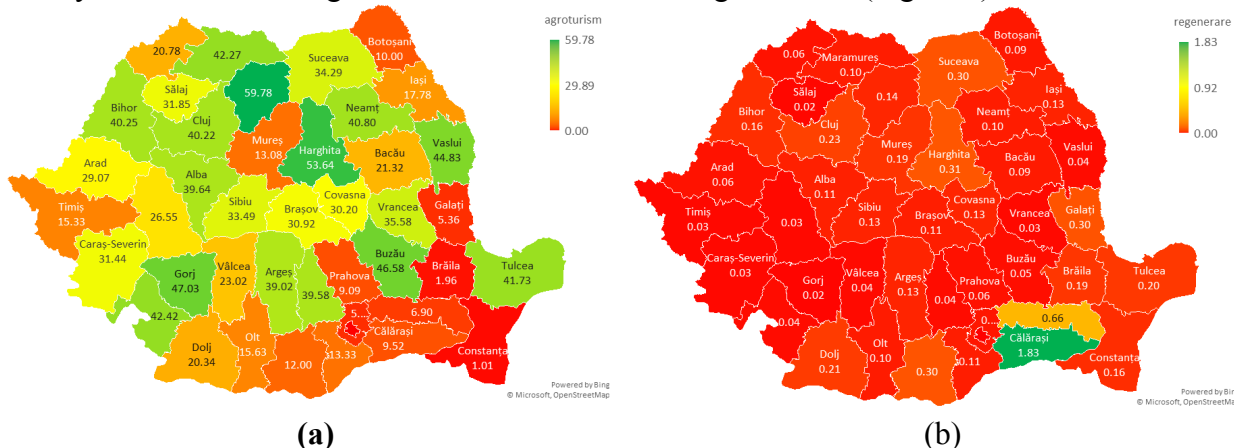


Figure 3. Agrotourism guesthouses (a), Artificial regeneration (b)

Source: Authors' own research.

Additionally, it is noted that the regions in the south and southeast of the country seem to have much lower values compared to the other regions. Also, in Bucharest, the percentage of this time as guesthouses is zero because, being a city, the implementation of such tourism cannot be discussed. Including in the case of Constanța county, which has the lowest percentage after the capital, this value can be explained by the preference of tourists to relax at the beach, in resorts designed for the specifics of the area; in contrast to Tulcea County, which, although it has the same opening to the Black Sea, is not as popular for seaside relaxation, with people visiting that area to visit the Danube Delta and to have different activities than those established in Constanța.

Artificial regenerations were calculated as the ratio between the number of hectares in which these regeneration procedures were carried out and the total hectares of forest land. As can be seen, only in Călărași does their percentage exceed 1%, reaching the value of 1.83%, the next

ranked being Ialomița, which in 2022 artificially regenerated 0.66% of the total forest area. Bucharest is the only region for which the percentage of regenerated area is 0% because, being a city, that is, an urban area, deforestation is not carried out so that it is necessary to repopulate certain areas with trees. Also, approximately 40% of the counties have values that do not even reach 0.1%.

NUTS2 resilience

The visualization of all counties may be somewhat deficient because it is difficult to follow a number of 42 different regions and to note the results recorded by each from one indicator to another. In order to simplify the tracking of performances at the level of each indicator, the results of the development regions were highlighted. In the regional analysis, the data were divided into four intervals, depending on the reporting to the quartiles. Thus, red is presented values that are below the first quartile, orange those between quartile 1 and the median, yellow is reserved for values greater than or equal to the median, but lower compared to quartile 3, while green illustrates the highest 25% of the values.

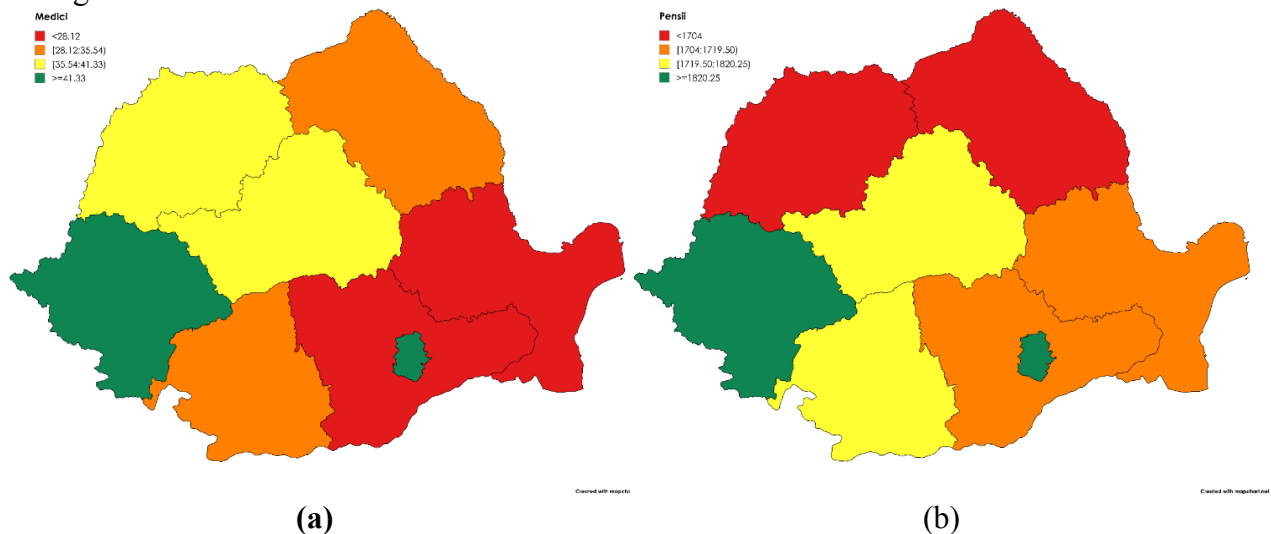


Figure 4. Medics per 10000 inhabitants (a), Average pension (b) NUTS2 regions

Source: Authors' own research.

In the case of doctors, except for the capital, all other regions in the South of the country are faced with low values of their number compared to the number of inhabitants; more precisely, in the South-East and South-Muntenia regions the rate of these doctors does not reach 28.12 per 10,000 inhabitants, followed by South-West Oltenia and North-East, where the values fall between 28.12 and 35.53 doctors per 10,000 inhabitants (Figure 4(a)). The North-West and Center regions are characterized by values greater than or equal to 35.54, but lower than 41.33, while Bucharest-Ilfov and West stand out with rates of doctors at least equal to 41.33 doctors per 10,000 inhabitants.

Regarding the average pension, small differences are observed between the values in the reference intervals of the quartiles. Thus, a quarter of the regions have average pension values lower than 1,704 lei (North-West and North-East regions), while half of them do not reach the amount of 1719.50 lei (South-East and South-Muntenia). Pensions between 1,719.50 and 1,820.24 lei are found in the Center and South-West Oltenia regions, and values reaching or exceeding 1,830.25 lei are observed in Bucharest and West (Figure 4(b)).

Concerning the number of computers per 100 students, with the exception of the Bucharest-Ilfov, the regions in the South stand out for their low percentages for this indicator. Thus, the regions with the lowest shares are South-East and South-West Oltenia, with values below 19.80%, followed by South-Muntenia and Center, where the values are below 21.25%. The regions where the percentages fall between 21.35% and 26.49% are North-East and West, while values of at least 26.50% are noted in Bucharest-Ilfov and North-West (Figure 5(a)).

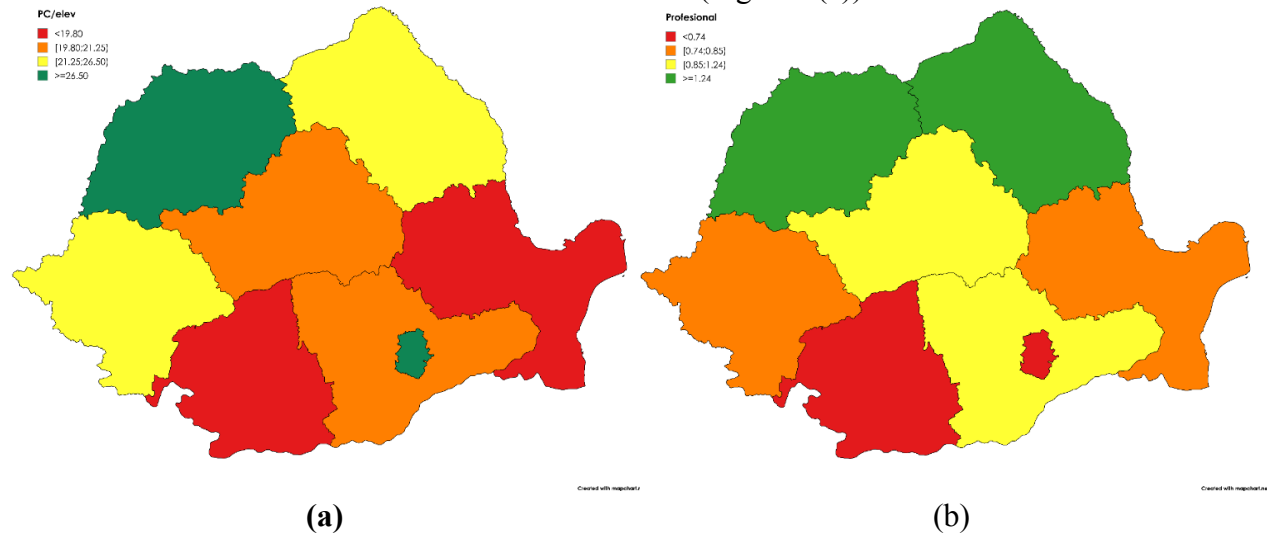


Figure 5. Computer/ student (a), Vocational education (b) NUTS2 regions

Source: Authors' own research.

The next indicator that studies education refers to the share of vocational education units in the total number of school units, for which, once again, the regions in the South seem less prepared compared to those in the North. According to what is illustrated in Figure 5(b), it is found that the regions where the percentage of these high schools is less than 0.74% of the total number of school units are Bucharest-Ilfov and South-West Oltenia, followed by South-East and West, with values that fall between 0.74% and 0.84%. The Center and South-Muntenia are characterized by percentages greater than or equal to 0.85%, but that do not exceed 1.24%, while the regions in the North present shares greater than or equal to 1.24%.

As was also noted in the case of the county analysis, the regions in the South and South-East are the ones with the lowest percentages of agrotourism guesthouses in the total number of guesthouses (Figure 6). Thus, the Bucharest-Ilfov area, as well as the South-East, are faced with percentages lower than 20.58%, while the South-Muntenia and West regions present values ranging from over 20.58%, but lower than 29.54%. Moreover, the South-West Oltenia and North-West regions present shares ranging from 29.54% to 33.16%, while the Center and North-East regions seem to give the greatest importance to agrotourism, with shares associated with this type of guesthouses exceeding, or at least equal to, 33.16%.

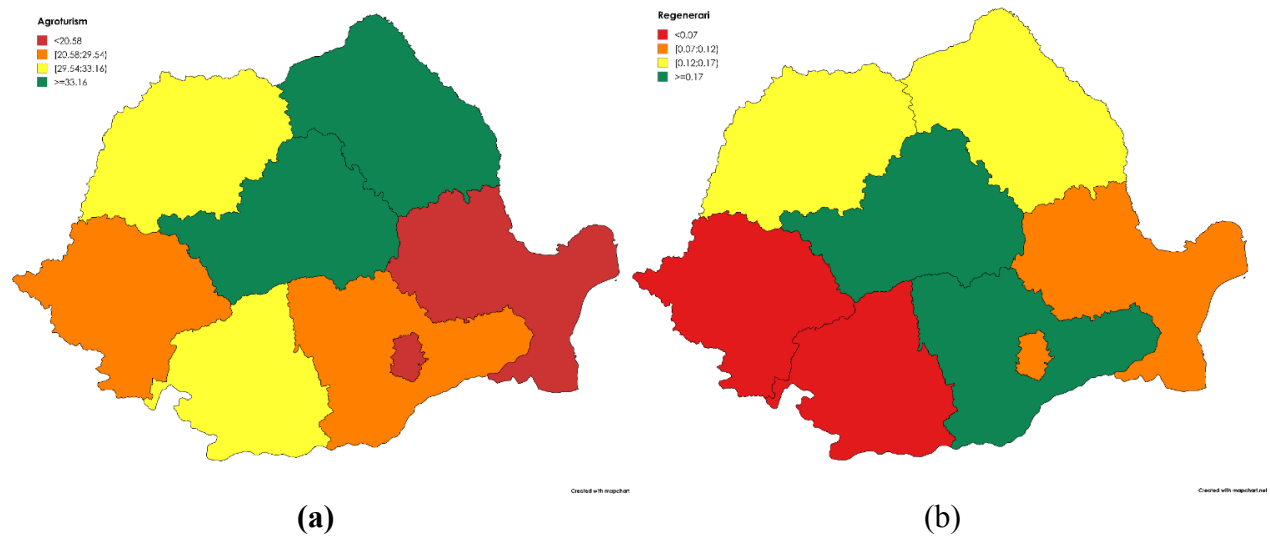


Figure 6. Agrotourism guesthouses (a), Artificial regeneration (b) NUTS2 regions

Source: Authors' own research.

Regarding artificial regenerations, low regeneration values at the country level were also observed in the county analysis. According to the regional analysis in Figure 6(b), the South-West Oltenia and West regions present the lowest values, below 0.07%. The Bucharest-Ilfov and South-East regions are those characterized by shares greater than or equal to 0.07%, but less than 0.12%, while the development regions in the North (North-West and North-East) present values ranging between 0.12% and 0.17%. The regions characterized by shares greater than or equal to 0.17% are Center and South-Muntenia.

TOPSIS analysis

According to the results presented above, it was noted that in terms of regional averages, Bucharest-Ilfov occupied a leading position for three indicators, while, for the other indicators, this region was exactly at the other extreme. In order to be able to achieve a ranking of the regions analysed, data made available by the National Institute of Statistics were collected, this time for the development regions, the values being those presented in Table 2.

Table 2. Initial values

Region	Agrotourism	Average pension	Artificial regeneration	PC/student	Vocational education	Medics
BUCHAREST - ILFOV	0.33	2178.00	0.08	43.13	0.13	80.03
CENTER	33.37	1800.00	0.17	21.14	0.88	36.54
NORTH-EAST	33.09	1598.00	0.17	25.00	2.37	29.24
NORTH-WEST	41.29	1677.00	0.13	30.99	2.32	37.59
SOUTH-EAST	15.22	1713.00	0.10	18.18	0.81	24.77
SOUTH-MUNTIANIA	22.37	1713.00	0.18	20.34	0.88	16.95
SOUTH-WEST OLTENIA	32.18	1726.00	0.05	17.96	0.55	34.54
WEST	26.91	1881.00	0.04	21.36	0.80	52.56

Source: Authors' own research.

The TOPSIS analysis begins with the normalization of the matrix, while the second step in calculating the scores for each region is to assign degrees of importance to the indicators to weight the values; in this case, all indicators having equal degrees. After these operations were performed, the data illustrated in Table 3 written in blue font emerged. For each criterion (indicator), the best alternative is chosen, as well as the weakest, presented at the end of the table. Based on these, the distances to the ideal positive and negative solution (SI+, SI-) are calculated, the final score being calculated as the ratio between SI- and the sum of the two distances.

Table 3. TOPSIS analysis results

Region	Agroturism	Average pension	Artificial regeneration	PC/student	Vocational education	Medics	SI+	SI-	P
Bucharest - Ilfov	0.004	0.43	0.22	0.59	0.03	0.66	0.84	0.64	0.43
Center	0.42	0.35	0.47	0.29	0.23	0.30	0.62	0.61	0.50
North-East	0.41	0.31	0.47	0.34	0.63	0.24	0.51	0.82	0.62
North-West	0.52	0.33	0.37	0.42	0.62	0.31	0.42	0.86	0.67
South-East	0.19	0.34	0.29	0.25	0.22	0.20	0.81	0.33	0.29
South-Muntiania	0.28	0.34	0.51	0.28	0.24	0.14	0.76	0.53	0.41
South-West Oltenia	0.40	0.34	0.15	0.24	0.15	0.28	0.80	0.44	0.36
West	0.34	0.37	0.10	0.29	0.21	0.43	0.71	0.48	0.40
Best Alternative	0.52	0.43	0.51	0.59	0.63	0.66			
Worst Alternative	0.004	0.31	0.10	0.24	0.03	0.14			

Source: Authors' own research.

Based on the scores obtained, the ranking presented in Table 4 was created, for which the highest value achieved is recorded by the North-West region, closely followed by the North-East region, at the opposite pole being the regions of the South, South-West Oltenia and South-East.

Table 4. NUTS2 regions ranking

Region	P
North-West	0.67
North-East	0.62
Center	0.50
Bucharest - Ilfov	0.43
South-Muntiania	0.41
West	0.40
South-West Oltenia	0.36
South-East	0.29

Source: Authors' own research.

The Bucharest-Ilfov region is in fourth place, given the specifics of the capital, such a result is not surprising because the presence of agrotourism guesthouses and operations specific to artificial regeneration are not elements that can be integrated into an urban county. However, excluding the area containing the capital would have implied an incomplete analysis, as Romania cannot be studied without one of its most important regions, this being the most developed region.

The results obtained by applying the TOPSIS method highlight significant territorial discrepancies between the development regions of Romania in terms of the level of resilience and sustainability. The final ranking indicates superior performance for the regions in the north and west of the country (North-West, North-East and Centre), while the regions in the south (South-Muntenia, South-West Oltenia and South-East) occupy the last positions. These results reflect an unequally distributed economic capital and the social and institutional discrepancy between

regions. In specialized literature, regional resilience represents the ability of a territory to absorb economic and social shocks, to adapt and continue the development process (Bartolini & Sarracino, 2014; Martin & Sunley, 2015). In this research, the indicators used – health system capacity, educational infrastructure, digitization and elements associated with environmental sustainability – can be interpreted as structural factors of territorial resilience.

The higher performances of the regions in the north and west of Romania can be explained by a combination of favorable socio-economic factors. These regions benefit from a greater concentration of human capital, the presence of important university centers and a more developed economic infrastructure and numerous investments from the private sector. Studies on regional resilience highlight the fact that regions characterized by higher levels of human capital and more developed educational systems have a greater capacity to adapt to economic and technological changes (Crescenzi et al., 2016; Faggian et al., 2017). Also, access to a developed digital infrastructure and educational resources contributes to increasing regional competitiveness and innovation capacity (Capello et al., 2015). In the case of Romania, these elements are more pronounced in the North-West and Center regions, where the presence of large university centers (Babeş-Bolyai University, Lucian Blaga University, Transilvania University of Brasov, University of Bucharest, National University of Science and Technology POLITEHNICA Bucharest, Academy of Economic Studies in Bucharest) contributes to the development of regional ecosystems adapted to the constant evolution of recent years. On the other hand, the lower performances of the regions in the south of the country can be associated with a series of structural vulnerabilities, such as limited access to medical services, insufficiently developed digital infrastructure or the lower level of private investment. While in the north and center of Romania, investors have concentrated their investments in the field of production, thus specializing the existing workforce, offering competitive salaries and opportunities for professional development, investments in the south of the country have been concentrated in the development of solutions for the storage of goods and merchandise, an economic activity that does not significantly develop the specialization of the workforce or encourage professional development. The literature on regional development shows that such characteristics can determine a territory's ability to manage economic or social shocks and slow down recovery after periods of crisis (Di Caro, 2017; Giannakis & Bruggeman, 2017). Research at the level of the European Union shows the existence of discrepancies between developed and less developed regions, these differences are often associated with the level of investments in infrastructure, education and innovation (European Investment Bank, 2022). The research results confirm these differences and highlight the fact that in the southern regions of Romania these limitations negatively influence the level of regional resilience. The Bucharest-Ilfov region differs from the other areas, being centered around the capital, it registers high values for indicators such as the number of doctors or the level of educational infrastructure, the predominantly urban character of the area reduces the relevance of some indicators specific to the rural environment, such as agritourism or forest regeneration. This region confirms the difficulty of building a set of indicators for comparing regions with different economic and geographic structures (Briguglio et al., 2009; Martin & Sunley, 2015). Thus, the results highlight the need to adapt comparative analyzes to the particularities of each region.

Regarding public policies, the results highlight the need to implement policies adapted to the needs of each region. For the regions in the south of the country with lower performances, public policies should aim at improving the medical infrastructure, developing the digital infrastructure in the educational system and stimulating sustainable economic activities, including rural tourism in areas of public interest. Also, increased investment in human capital and

educational infrastructure could contribute to increasing the resilience of these areas. These possible solutions are consistent with the objectives of the Recovery and Resilience Mechanism of the European Union, which aims to strengthen the capacity of member states to face economic and social crises through investments in education, digitalization and public services (European Commission, 2025).

Conclusion

The purpose of the current research was to establish a ranking of Romania's development regions, illustrated through the prism of a number of six indicators related to the six pillars of the recovery and resilience mechanism. Thus, the study began by presenting the results recorded by the counties of this country for the year 2022, each indicator being assigned a map intended to highlight the discrepancies as well as the zonal similarities, noting, in the case of several indicators, the predisposition of the southern areas to present lower values compared to the north and west of the country. The next step consisted in presenting the situation of the development regions, the intervals in which the values fell being between the minimum and maximum values and the quartiles. Through the regional context, the preponderance of low values in the south of the country is better observed, in some cases the Bucharest-Ilfov area representing an exception to this trend. Another element that stands out is the position of the Bucharest-Ilfov region in the individual rankings of the indicators; in the sense that for the average situation of the two counties, for three indicators this region occupies the leading position, while for the other three indicators, the situation is diametrically opposite. In the case of agrotourism guesthouses, but also of artificial regenerations, it is understandable that the values in Bucharest are null, because the urban specifics of the capital are to some extent contradictory with these concepts, thus, in the case of the Bucharest-Ilfov region, the low values associated with the region are explained.

The final stage of the research consisted in creating a ranking of the regions by incorporating all the indicators, in this case, giving equal degrees of importance to the six indicators. Thus, based on the values recorded by the indicators in 2022, the best performing region was the North-West, followed by the North-East and the Center, the Bucharest-Ilfov region ranked fourth, this position being expected based on the results presented in the study. Also, as anticipated, the southern regions occupy the last places in the ranking, given the poor performances illustrated throughout the research.

It is also worth mentioning the limitations of the current study, in the sense that these results can only be applied to the chosen indicators, any addition or elimination or replacement of any indicator leading to different conclusions. Thus, as observed, for the Bucharest-Ilfov region, some indicators did not lend themselves to the specifics of the capital, which led to the alteration of the results of the region, which is why an extrapolation of the results regarding zonal resilience cannot be achieved, because the choice of other indicators would have led to different effects. Another limitation refers to the method chosen to achieve the ranking, in the sense that choosing another multi-criteria decision analysis technique could bring about slightly different results than those presented in the current study, but, being one of the most used methods, as well as its specificity of calculating the distances from the best and the worst decision, lead to the idea of obtaining correct effects. This fact was supported by the ranking obtained, because throughout the research, the southern regions presented lower values compared to those in the north, which is why they were located in lower positions in the ranking obtained by applying this method.

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References

- Ammirato, S., & Felicetti, A. M. (2014). The Agritourism as a Means of Sustainable Development for Rural Communities: A Research from the Field. *The International Journal of Interdisciplinary Environmental Studies*, 8(1), 17–29. <https://doi.org/10.18848/2329-1621/CGP/v08i01/53305>
- Apostu, S. A., Vasile, V., Marin, E., & Bunduchi, E. (2022). Factors Influencing Physicians Migration—A Case Study from Romania. *Mathematics*, 10(3), 505. <https://doi.org/10.3390/math10030505>
- Bánhidi, Z., & Dobos, I. (2024). Sensitivity of TOPSIS ranks to data normalization and objective weights on the example of digital development. *Central European Journal of Operations Research*, 32(1), 29–44. <https://doi.org/10.1007/s10100-023-00876-y>
- Barna, C., & Epure, M. (2020). Analyzing youth unemployment and digital literacy skills in Romania in the context of the current digital transformation. *Review of Applied Socio-Economic Research*, 20(2).
- Bartolini, S., & Sarracino, F. (2014). *It's not the economy, stupid! How social capital and GDP relate to happiness over time* (arXiv:1411.2138). arXiv. <https://doi.org/10.48550/arXiv.1411.2138>
- Batrancea, L. M. (2023). The Hard Worker, the Hard Earner, the Young and the Educated: Empirical Study on Economic Growth across 11 CEE Countries. *Sustainability*, 15(22), 15996. <https://doi.org/10.3390/su152215996>
- Botha, I., Botezatu, M. A., & Coanca, M. (2020). Innovative Calculation Model for Evaluating Regional Sustainable Development. *ECONOMIC COMPUTATION AND ECONOMIC CYBERNETICS STUDIES AND RESEARCH*, 54(3/2020), 5–24. <https://doi.org/10.24818/18423264/54.3.20.01>
- Briguglio, L., Cordina, G., Farrugia, N., & Vella, S. (2009). Economic Vulnerability and Resilience: Concepts and Measurements. *Oxford Development Studies*, 37, 229–247. <https://doi.org/10.1080/13600810903089893>
- Buzatu, C. S., Ghiuleanu, I. V., Tudor, V. C., & Panait, R. (2023). EDUCATION, AWARENESS AND CONSERVATION OF ROMANIA'S BIODIVERSITY. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 23(4), 157–165.
- Ciucu (Durnoi), A.-N., Delcea, C., & Stoychev, K. (2024). *A County-Level Analysis of the Economic Performance in Ro-mania and Bulgaria Using Hierarchical Algorithms*.
- Ciucu-Durnoi, A.-N., Stoychev, K., Delcea, C., Vargas, V. M., & Pauna, C. (2024). Regional SDG Performance in Bulgaria and Romania: Poverty, Education, and Decent Work. *Amfiteatru Economic*, 26(Special 18), 1208. <https://doi.org/10.24818/EA/2024/S18/1208>
- Crescenzi, R., Luca, D., & Milio, S. (2016). The geography of the economic crisis in Europe: National macroeconomic conditions, regional structural factors and short-term economic performance. *Cambridge Journal of Regions Economy and Society*, 9. <https://doi.org/10.1093/cjres/rsv031>

- Di Caro, P. (2017). Testing and explaining economic resilience with an application to Italian regions*. *Papers in Regional Science*, 96(1), 93–114. <https://doi.org/10.1111/pirs.12168>
- Einhorn, H. J., & Hogarth, R. M. (1975). Unit weighting schemes for decision making. *Organizational Behavior and Human Performance*, 13(2), 171–192. [https://doi.org/10.1016/0030-5073\(75\)90044-6](https://doi.org/10.1016/0030-5073(75)90044-6)
- European Commission. (2025). *Recovery and Resilience Facility—Reforms and Investments*. https://reforms-investments.ec.europa.eu/recovery-and-resilience-facility-1_en
- European Commission. (2021a). *NextGenerationEU*. https://commission.europa.eu/strategy-and-policy/eu-budget/eu-borrower-investor-relations/nextgenerationeu_en.
- European Commission. (2021b). *The Recovery and Resilience Facility*. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en
- European Commission. Statistical Office of the European Union. (2024). *Eurostat regional yearbook: 2024 edition*. Publications Office. <https://data.europa.eu/doi/10.2785/174221>
- European Investment Bank. (2022). *Regional Cohesion in Europe 2021-2022*. European Investment Bank. <https://www.eib.org/eibis-cohesion-report-2021-2022>
- Faggian, A., Partridge, M., & Malecki, E. J. (2017). Creating an Environment for Economic Growth: Creativity, Entrepreneurship or Human Capital? *International Journal of Urban and Regional Research*, 41(6), 997–1009. <https://doi.org/10.1111/1468-2427.12555>
- Galik, A., Båk, M., Baładynowicz-Panfil, K., & Cirella, G. T. (2022). Evaluating Labour Market Flexibility Using the TOPSIS Method: Sustainable Industrial Relations. *Sustainability*, 14(1), 526. <https://doi.org/10.3390/su14010526>
- Giannakis, E., & Bruggeman, A. (2017). Economic crisis and regional resilience: Evidence from Greece. *Papers in Regional Science*, 96(3), 451–477. <https://doi.org/10.1111/pirs.12206>
- Grigorescu, A., Fontanella, B., Pasnicu, D., Uleia, M. C., Lincaru, C., & Tudose, G. (2025). Basic Education and Basic Digital Skills Insights for Romania & Italy. In A. M. Dima & C. Badarinza (Eds.), *Innovative Approaches in Economics, Leadership, and Technology* (pp. 85–100). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-86989-1_7
- Hardalau, D., Fedorca, M., Popovici, D.-C., Ionescu, G., Fedorca, A., Mirea, I., Daniel, I., & Ionescu, O. (2025). Insights in Managing Ungulates Population and Forest Sustainability in Romania. *Diversity*, 17(3), 194. <https://doi.org/10.3390/d17030194>
- Hunjra, A. I., Azam, M., Bruna, M. G., & Bouri, E. (2023). A cross-regional investigation of institutional quality and sustainable development. *Journal of International Financial Markets, Institutions and Money*, 84, 101758. <https://doi.org/10.1016/j.intfin.2023.101758>
- Hwang, C.-L., & Yoon, K. (1981). *Multiple Attribute Decision Making* (Vol. 186). Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-642-48318-9>
- Kim, E. S., Yun, S. H., Kim, J. Y., Thorne, J. H., Hyun, J. H., & Lee, D. K. (2024). Sequential action-based dynamic decision-support model for urban ecological planning. *Sustainable Cities and Society*, 101, 105092. <https://doi.org/10.1016/j.scs.2023.105092>
- Lai, Y.-J., Liu, T.-Y., & Hwang, C.-L. (1994). TOPSIS for MODM. *European Journal of Operational Research*, 76(3), 486–500. [https://doi.org/10.1016/0377-2217\(94\)90282-8](https://doi.org/10.1016/0377-2217(94)90282-8)
- Liu, L., Oza, S., Hogan, D., Chu, Y., Perin, J., Zhu, J., Lawn, J. E., Cousens, S., Mathers, C., & Black, R. E. (2016). Global, regional, and national causes of under-5 mortality in 2000–15: An updated systematic analysis with implications for the Sustainable Development Goals. *The Lancet*, 388(10063), 3027–3035. [https://doi.org/10.1016/S0140-6736\(16\)31593-8](https://doi.org/10.1016/S0140-6736(16)31593-8)

- Martin, R., & Sunley, P. (2015). On the notion of regional economic resilience: Conceptualization and explanation. *Journal of Economic Geography*, 15(1), 1–42. <https://doi.org/10.1093/jeg/lbu015>
- Memo, U., & Pieńkowski, D. (2023). Sustainable rural development indicators in Bulgaria, Germany, Poland, Romania and the Netherlands: A review of data. *Frontiers in Environmental Science*, 11, 1323688. <https://doi.org/10.3389/fenvs.2023.1323688>
- Micula, I. A., Zob, T. M., Oancea, A. T., Costinar, N. P., Gherdan, E., & Bacter, R. (2024). CONSIDERATIONS REGARDING THE EVOLUTION OF AGROTOURISM IN ROMANIA. *Scientific Research. Agricultural Management*, 26.
- Mori, K., & Christodoulou, A. (2012). Review of sustainability indices and indicators: Towards a new City Sustainability Index (CSI). *Environmental Impact Assessment Review*, 32(1), 94–106. <https://doi.org/10.1016/j.eiar.2011.06.001>
- Pandey, V., Komal, & Dincer, H. (2023). A review on TOPSIS method and its extensions for different applications with recent development. *Soft Computing*, 27(23), 18011–18039. <https://doi.org/10.1007/s00500-023-09011-0>
- Popescu, M. E., & Roman, M. (2018). Vocational training and employability: Evaluation evidence from Romania. *Evaluation and Program Planning*, 67, 38–46. <https://doi.org/10.1016/j.evalprogplan.2017.11.001>
- Santos, A. M., Barbero Jimenez, J., Salotti, S., Diukanova, O., & Pontikakis, D. (2022). *On the road to regional 'Competitive Environmental Sustainability': The role of the European structural funds* (JRC TECHNICAL REPORT No. 07/2022). JRC Working Papers on Territorial Modelling and Analysis. https://ec.europa.eu/economy_finance/arc2022/documents/papers/on_the_road_to_regional_competitive.pdf
- Sorici, M.-L., Mihaila, S., & Grosu, V. (2022). APPROACHES TO THE EVOLUTION OF THE SOCIAL CONTEXT THROUGH THE LENS OF THE SOCIAL INSURANCE BUDGET EFFORT IN ROMANIA. REALITIES AND PERSPECTIVES. *Journal of Social Sciences*, 5(3), 7–16. [https://doi.org/10.52326/jss.utm.2022.5\(3\).01](https://doi.org/10.52326/jss.utm.2022.5(3).01)
- Spinu, A., Roman, A.-M., & Dogotari, I. (2023). COMPARATIVE ASPECTS IN FINANCING OF SOCIAL INSURANCE BENEFITS IN ROMANIA AND THE REPUBLIC OF MOLDOVA. *Journal of Social Sciences*, 5(4), 75–82. [https://doi.org/10.52326/jss.utm.2022.5\(4\).09](https://doi.org/10.52326/jss.utm.2022.5(4).09)
- Yan, X., Han, Z., Zou, C., & Cheng, C. (2024). Assessing the role of emerging green technology transfer in sustainable development and identification of key regions in Yangtze River Delta region. *Technological Forecasting and Social Change*, 200, 123099. <https://doi.org/10.1016/j.techfore.2023.123099>
- Yeh, C. (2002). A Problem-based Selection of Multi- attribute Decision- making Methods. *International Transactions in Operational Research*, 9(2), 169–181. <https://doi.org/10.1111/1475-3995.00348>
- Yoon, K.-S. P., & Hwang, C.-L. (1995). *Multiple attribute decision making: An introduction*. Sage Publications.