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SUSTAINABLE DEVELOPMENT. CASE STUDY: NORD-EST REGION

ABSTRACT

The study presents the results of the evaluation of sustainable development in the six component counties of the Nord-Est Region of Romania; the evaluation was carried out on the basis of the Sustainable Development Index (SDI). The developed index was based on 5 criteria, which included 15 indicators in their structure, considered representative for this approach. The component counties of the Nord-Est Region were analyzed and ranked on the basis of SDI. Iași county ranked first in the hierarchy, while Botoșani county ranked last. The differences between the SDI values in the six component counties of the Nord-Est Region reveal different degrees of sustainable development across counties.

Key words: Sustainable Development Index, Nord-Est Region, sustainable development.

JEL Classification: R10, O10, Q01.

1. INTRODUCTION

Each community in Romania has “highly differentiated social, economic and cultural situations” (Dumitru Sandu, 2011), each of them having its own modernization and sustainable development pattern, adapted to its specific needs and requirements.

In the broad context of sustainable development, the area of investigation of the present study focused on the counties from the Nord-Est Region of Romania. The aim was to establish a hierarchy of their degree of sustainable development, having in view the diversity of problems they are facing. For this purpose, the Sustainable Development index (SDI) was developed, and the values obtained by each county made it possible to analyze and rank the counties in terms of sustainable development.

One of the main objectives of regional development policies, and not only, is to reduce the existing disparities across regions, by stimulating balanced development and accelerating the recovery of areas lagging behind in terms of development, due to historical, geographical, economic and political conjunctures, as well as to prevent the emergence of new regional disparities and disequilibria.

2. STATE OF KNOWLEDGE

There are several indices and aggregated indicators by which the different degrees and levels of poverty are measured, and the present study focused on only two of them.

The first is the *Local Social Development Index (LSDI)* by which “the main structural lines of local and regional disparities of social type” have been identified (Dumitru Sandu, 2011). The index was calculated by aggregating seven primary indicators on the basis of a factor score and was “intended for comparative analyses of social development” (Dumitru Sandu, 2011). The indicators used to calculate this index were the following: education stock at community level, average age of persons over 14 years, life expectancy at birth, cars per 1000 inhabitants, average area per dwelling, natural gas consumption per inhabitant and size of locality. LSDI was used to identify the main disparities in Romania’s social development, at the level of historical regions, at the level of development regions and at county level. At the level of historical regions, minimum and equal values were obtained for three historical regions, namely: Moldova, Muntenia and Oltenia and maximum values for Bucureşti-Ilfov Region, followed by Banat and Transilvania Regions, with no significant differences between them. At the level of development regions, the results of the study were not different, so that “the development regions retain, to a great extent, the essential characteristics of historical regions” (Dumitru Sandu, 2011).

At the lower territorial level i.e., at county level, the poorest counties in social terms “are not found in Moldova, but in the southern part of the county”; the counties with “medium-low development level are mainly located in the western part of Moldova, in the area that starts from Suceava and continues to Vrancea, extending to the southern regions” (Dumitru Sandu, 2011).

The analysis also focused on the intra-county rural-urban disparities. Thus, the study showed that at the level of the six component counties of the Nord-Est Region, the social development index in the urban area had the highest values in Iaşi county (LSDI=93), followed by the counties Neamţ and Bacău (LSDI=84), while Botoşani county (LSDI=78) ranked last; the social development index in the rural area had the highest values in Neamţ county (51 points) and the lowest values in Vaslui county (38 points). The most significant urban-rural disparities were found in Iaşi county, followed by Vaslui county, while Suceava county had the lowest urban-rural disparities.

Table 1

Local Social Development Index in the counties from the Nord-Est Region, by residence areas

County	Urban	Rural	Difference
Bacău	84	47	37
Botoşani	78	39	39
Iaşi	93	48	45
Neamţ	84	51	33
Suceava	77	54	23
Vaslui	79	38	41

Source: Dumitru Sandu, 2011.

The conclusions of the study highlight that the regional disparities are structured by four axes: urban-rural housing, residential concentration, accessibility to services and infrastructure and employment. These add to education quality, health condition, consumption and social relations, which together “represent basic components of the space of social development inequalities manifested at regional level” (Dumitru Sandu, 2011).

The second index, Local Human Development Index (LHDI), was developed to estimate the development level of localities in Romania, its first form with data from 2002 and subsequently with data from 2011. For the calculation of this index, indicators referring to human capital, material capital (measured by three indicators), health capital and vital capital have been used. The index values were updated in the year 2020, with data from 2018, using the same indicators for the three types of capital, except for the last type i.e., vital capital. This implied a complex methodology, based on the aggregation of indicators, logarithmation of certain indicators values and factor analysis.

The conclusions of the latest update of LHDI, at regional level, emphasized that “local development decreasing trends are manifested mainly in the context of Nord-Est and Sud-Vest regions”, while at local level “there is a strong, significant inertial trend of local development”, so that the “administrative territorial units that were highly developed/poor in the year 2011 have continued to be developed or poor in 2018, beyond the effects of distance, regional development or appurtenance to a particular region” (Dumitru Sandu, 2020).

The above-mentioned indices rather measure the poverty level of local communities in Romania than the development potential of these communities. The Sustainable Development Index (SDI) was intended to measure the degree of development at the level of all counties in Romania, but in the present study it was mainly used to measure the degree of development of the counties from the Nord-Est Region.

3. MATERIAL AND METHOD

Starting from the previously mentioned study, but with the intention to measure the degree of development of all counties in Romania, an index was developed to enable this approach. Thus, the main purpose of the study was to develop the *Sustainable Development Index (SDI)* to assess the degree of sustainable development at county level. The main objectives were to calculate the SDI for all counties in Romania, and then to extract only the component counties of the Nord-Est Region for analysis and ranking.

The proposed index had a set of 15 indicators in its structure, grouped by 5 criteria. The indicators proposed for the construction of SDI were selected *according to their relevance* in describing the current state of sustainable development, *according to their availability* in the official statistical source, as

well as *according to their compatibility* with other indicators that are important to describe the sustainable development level.

The data used were extracted from the official statistics, from the National Institute of Statistics, from the Tempo-online and e-Demos databases (Table 2).

For SDI calculation, data were normalized in a first stage, considering the expression of indicators in different units of measurement, as well as their nature, de maximum or de minimum respectively. For data normalization, the available indicators for each county in part (I1, 2...15) and the 42 county territorial units (J1, 2...42) were considered. The normalization method that we chose was based on amplitude, taking into consideration maximum and minimum values of each indicator; the calculation formula was: $v_1 = (v - v_{min}) / aa$, where: v_1 – normalized value; v – indicator value; v_{min} – minimum value taken by each indicator; aa – absolute amplitude of each indicator.

Table 2

Data source of indicators used for the construction of Sustainable Development Index (SDI) and unit of measurement for each indicator

Criterion 1 – Human resource	
1. Number of inhabitants – no.	Tempo-online – POP107D
2. Population density – inhabitants/km ²	Tempo-online, population – POP107D and total area - AGR101B
3. Share of population aged 0-14 years in total population – %	Tempo-online – POP107D
4. Share of population aged 15-64 years in total population – %	Tempo-online – POP107D
Criterion 2 – Economy of the primary sector	
1. Agricultural area – ha	Tempo-online, AGR101B
2. Number of active enterprises in the primary sector – no.	Tempo-online – INT101O
3. Turnover rate in the primary sector – million RON	e-demos
Criterion 3 – Economy of the secondary and tertiary sectors	
1. Number of active enterprises in the secondary and tertiary sectors – no.	Tempo-online – INT101O
2. Turnover rate in the secondary and tertiary sectors – million RON	e-demos
Criterion 4 – Social and dwelling	
1. Number of inhabitants /physicians – number	Tempo-online, inhabitants – POP107D and no. of physicians - SAN104B
2. Number of pupils /teachers – number	Tempo-online, no. of pupils – SCL103D and no. of teachers – SCL104D
3. Number of newly built dwellings – number	Tempo-online – LOC104B
Criterion 5 – Environment	
1. Length of drinking water supply network – km	Tempo-online, GOS 106B
2. Length of sewerage pipelines – km	Tempo-online, GOS 110A
3. Length of gas distribution pipelines – km	Tempo-online GOS 116A

Source: author's own elaboration

Thus, normalized values were obtained for all component indicators of each criterion. By summing up the normalized values of indicators for each county, we obtained the position of each county within each criterion. Summing up the values obtained in each criterion, a single value was obtained i.e., the Sustainable Development Index (SDI) for each county, and the analysis made at this territorial level was the object of another publication (Roşu, E, 2021).

The study, initially carried out for all the counties of Romania, focused only on the component counties of the Nord-Est Region. Finally, a hierarchy of counties in terms of sustainable development level was established, based on the SDI values obtained. 5 analysis criteria and a set of 15 indicators were taken into consideration for the development of the theoretical model for the analysis of the current sustainable development stage of the counties in Romania.

The first criterion of the analysis, *human resource*, is the most important resource of a community and it is a factor with maximum influence in the economic development process of the respective community. The following indicators were included in this criterion: number of inhabitants (number of populations by domicile), population density, share of population aged 0–14 years in total population of the county and share of population aged 15–65 years in total population of the county.

The following indicators were selected for the analysis of *the economy of the primary sector*: agricultural area, number of active enterprises in the primary sector and turnover rate in the primary sector.

For the analysis of the *economy of the secondary and tertiary sectors*, which included all the other economic activities, the following indicators were selected: number of active enterprises in the secondary and tertiary sectors and turnover rate in the secondary and tertiary sectors.

The *social and dwelling criterion* included indicators referring to population's access to healthcare, education and housing. These were the following: number of inhabitants/physicians, number of pupils/teacher (de minimum indicators) and number of newly built dwellings.

The last criterion of the analysis, the *environment* criterion, includes indicators considered the most relevant indicators available in the official statistics. Thus, the indicators selected under this criterion, even though at first sight pertain to the technical infrastructure, are extremely important for environmental protection; these were the following: length of drinking water supply network, length of sewerage pipelines and length of gas distribution pipelines.

4. RESULTS AND DISCUSSIONS

The indicators proposed and used for SDI try to avoid using data from surveys or censuses conducted every few years, and rather use data from official statistics, calculated and reported on yearly basis. Thus, the indicators needed for

the development of the Sustainable Development Index were extracted from NIS official database, the most numerous indicators being available for the year 2020, except for the agricultural area, for which the latest available year was 2014.

The value of each criterion was calculated for each county, and by summing up the values obtained for each criterion, a single SDI value at the level of each county was obtained (Annex 1). The component counties of the Nord-Est Region were extracted, as only these counties are the object of the analysis of the present study (Table 3).

Table 3
Sustainable Development Index at county level

County	Criterion					SDI
	Human resources	Economy of the primary sector	Economy of the secondary and tertiary sectors	Social and dwelling	Environment	
Bacău	1.610	0.877	0.110	1.160	1.496	5.253
Botoşani	1.327	0.886	0.009	1.020	0.263	3.505
Iaşi	2.051	1.181	0.198	1.197	2.153	6.780
Neamţ	1.187	0.851	0.067	1.325	0.886	4.316
Suceava	1.764	1.124	0.121	1.602	0.964	5.575
Vaslui	1.646	0.966	0.038	1.157	0.576	4.383

Source: author's own calculations.

For the *human resource criterion*, Iaşi county ranked first and Neamţ county ranked last. Iaşi county had high values in terms of share of population aged 0–14 years in total population of the county and share of population aged 15–65 years in total population; this means that, on the one hand, the human resource of the county consists of the young population that will enter the labour market in the near future, and will actively contribute to economic development, and on the other hand, it consists of the active population of working age that is currently contributing to the economic development of the country. Three other counties had quite close values for this criterion (Suceava, Vaslui şi Bacău). Neamţ county, on the last position in terms of this criterion, had low values in all indicators, except for the indicator share of population aged 15–65 years in total population of the county (Table 4).

In the *economy of the primary sector criterion*, Iaşi county ranked first, followed at short distance by Suceava county, while Neamţ county ranked last in the hierarchy. It can be noticed that the values obtained for this criterion are relatively homogenous, with not very great differences across the six component counties, which means that the primary sector – agriculture has a similar importance in the economy of the six counties. The counties with high scores for this criterion had larger agricultural areas compared to the other component counties of the region (Table 5).

Table 4

Criterion 1 – Human resources (normalized values)

County	Inhabitants – number	Population density	% pop. aged 0–14 years in total	% pop. aged 15–65 years in total	Total
Bacău	0.270	0.009	0.577	0.754	1.610
Botoșani	0.120	0.007	0.615	0.585	1.327
Iași	0.381	0.016	0.885	0.769	2.051
Neamț	0.180	0.008	0.385	0.615	1.187
Suceava	0.281	0.007	1.000	0.477	1.764
Vaslui	0.142	0.007	0.712	0.785	1.646

Source: author's own calculations.

Table 5

Criterion 2 – Economy of the primary sector (normalized values)

County	Agricultural area	No. of active enterprises in the primary sector	Turnover rate in the primary sector	Total
Bacău	0.462	0.258	0.158	0.877
Botoșani	0.566	0.201	0.119	0.886
Iași	0.550	0.345	0.286	1.181
Neamț	0.405	0.310	0.136	0.851
Suceava	0.501	0.487	0.136	1.124
Vaslui	0.578	0.099	0.289	0.966

Source: author's own calculations.

In the *economy of secondary and tertiary sectors criterion*, Iași county also ranked first, while Botoșani county ranked last. Iași county had the highest values of the two indicators of this criterion: number of active enterprises in the secondary and tertiary sectors and turnover rate in the secondary and tertiary sectors, compared to the other counties in the region (Table 6).

Table 6

Criterion 3 – Economy of the secondary and tertiary sectors (normalized values)

County	No. of active enterprises in the secondary and tertiary sectors	Turnover rate in the secondary and tertiary sectors	Total
Bacău	0.074	0.036	0.110
Botoșani	0.007	0.002	0.009
Iași	0.128	0.070	0.198
Neamț	0.047	0.021	0.067
Suceava	0.079	0.043	0.121
Vaslui	0.038	0.000	0.038

Source: author's own calculations.

In the *social and dwelling criterion*, all the counties had values greater than one and relatively homogenous. Suceava and Vaslui had high values of the number of inhabitants/physicians, which means low access to healthcare system; Neamţ and Suceava had high values in the number of pupils/teachers, which can be explained by the high pressure on the education system. Iaşi county had higher values of the indicator number of newly built dwellings, compared to the other five counties in the region (Table 7).

Table 7

Criterion 4 – Social and dwelling (normalized values)

County	No. of inhabitants /physician	No. of pupils /teacher	No. of newly built dwellings	Total
Bacău	0.519	0.545	0.096	1.160
Botoşani	0.570	0.382	0.068	1.020
Iaşi	0.053	0.764	0.381	1.197
Neamţ	0.637	0.618	0.070	1.325
Suceava	0.749	0.655	0.199	1.602
Vaslui	0.763	0.364	0.031	1.157

Source: author's own calculations

In the *environment criterion*, Iaşi county ranked first, with the highest values of the drinking water supply network and length of gas distribution pipelines, compared to the other counties of the region. The county with the lowest scores obtained for this criterion was Botoşani, with low values in all component indicators of the criterion, compared to the other counties of the region (Table 8).

Table 8

Criterion 5 – Environment (normalized values)

County	Length of drinking water distribution network	Length of sewerage pipelines	Length of gas distribution pipelines	Total
Bacău	0.774	0.220	0.501	1.496
Botoşani	0.150	0.007	0.106	0.263
Iaşi	1.142	0.308	0.702	2.153
Neamţ	0.500	0.095	0.291	0.886
Suceava	0.443	0.228	0.294	0.964
Vaslui	0.314	0.074	0.189	0.576

Source: author's own calculations.

According to the SDI values, Iaşi county obtained the highest value (SDI=6.780), ranking first in the hierarchy of the six counties of the Nord-Est Region, at great distance from the other counties. Suceava county ranked second,

followed by Bacău, Vaslui and Neamț counties. Botoșani county ranked last, with the lowest SDI value (SDI=3.505). Thus, the obtained SDI values show that Iași county has the highest development level, while Botoșani county has the lowest development level.

5. CONCLUSIONS

On the basis of the Sustainable Development Index (SDI) that was developed, based on 5 criteria and 15 indicators, each county was assigned a final score. In the present study, the analysis focused only on the component counties of the Nord-Est Region. Thus, the highest score was obtained by Iași county (SDI=6.780), and the lowest score by Botoșani county (SDI=3.505). Thus, Iași county has the highest development level, and Botoșani county has the lowest development level, compared to the other counties in the Nord-Est Region. The six component counties, by their SDI values, can be ranked as follows: Iași is the county with the highest development level, Suceava and Bacău have a high development level (SDI values > 5), Vaslui and Neamț have a medium development level (SDI values > 4), while Botoșani has a low development level. This conclusion refers only to the 6 component counties of the Nord-Est Region. At an overall analysis, it can be noticed that, except for Bucharest Municipality, the county with the highest development level is Timiș (SDI=8.659), followed by the counties Constanța, Cluj, Ilfov and Prahova. In the hierarchy of all the counties of Romania, Iași ranks 7th. Among the counties with the lowest development level, Covasna ranks first (SDI=2.388), followed by Mehedinți, Caraș-Severin and Teleorman. The counties with the lowest development levels are not found in the Nord-Est Region, but in the south and south-west of Romania.

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Annex 1
Sustainable Rural Development Index by counties

County	Criterion					SDI
	Human resources	Economy of the primary sector	Economy of the secondary and tertiary sectors	Social and dwelling	Environment	
Alba	0.963	1.095	0.094	0.820	1.553	4.525
Arad	1.109	1.625	0.155	0.934	2.231	6.054
Argeş	1.061	1.132	0.259	1.293	2.657	6.402
Bacău	1.610	0.877	0.110	1.160	1.496	5.253
Bihor	1.369	1.837	0.214	0.649	1.997	6.066
Bistriţa-Năsăud	1.476	0.749	0.050	1.070	0.948	4.293
Botoşani	1.327	0.886	0.009	1.020	0.263	3.505
Braşov	1.394	1.130	0.147	1.492	1.848	6.011
Brăila	0.698	1.325	0.161	1.193	0.735	4.112
Buzău	0.789	0.580	0.080	1.273	1.362	4.084
Caraş-Severin	0.784	0.728	0.015	0.512	0.657	2.696
Călăraşi	1.024	1.802	0.016	1.629	0.532	5.003
Cluj	1.163	1.184	0.423	1.472	3.021	7.263
Constanţa	1.507	2.143	0.289	1.602	2.320	7.861
Covasna	1.204	0.453	0.006	0.534	0.191	2.388
Damboviţa	1.185	0.590	0.072	1.593	1.579	5.019
Dolj	1.047	1.675	0.181	0.705	1.583	5.191
Galaţi	1.350	1.044	0.123	1.125	1.543	5.185
Giurgiu	0.760	0.838	0.020	1.258	0.210	3.086
Gorj	1.208	0.404	0.036	0.630	1.113	3.391
Harghita	1.115	0.860	0.047	0.438	0.958	3.418
Hunedoara	0.883	0.690	0.072	0.894	1.337	3.876
Ialomiţa	1.086	1.333	0.012	1.544	0.642	4.617
Iaşi	2.051	1.181	0.198	1.197	2.153	6.78
Ilfov	1.869	0.681	0.412	2.656	1.636	7.254
Maramureş	1.396	0.824	0.102	0.942	1.832	5.096
Mehedinţi	0.874	0.422	0.001	0.888	0.245	2.43
Mureş	1.229	1.143	0.163	0.375	2.889	5.799
Neamţ	1.187	0.851	0.067	1.325	0.886	4.316
Olt	0.797	1.117	0.057	1.027	1.011	4.009
Prahova	1.071	0.948	0.323	1.433	3.229	7.004
Satu Mare	1.526	1.081	0.039	0.889	1.212	4.747
Salaj	1.087	0.796	0.044	0.812	0.675	3.414
Sibiu	1.360	0.718	0.155	1.045	1.575	4.853
Suceava	1.764	1.124	0.121	1.602	0.964	5.575
Teleorman	0.100	1.472	0.012	0.924	0.459	2.967
Timiş	1.453	2.772	0.365	1.103	2.966	8.659
Tulcea	1.113	1.230	0.014	1.125	0.646	4.128
Vaslui	1.646	0.966	0.038	1.157	0.576	4.383
Vâlcea	0.540	0.692	0.038	0.730	1.447	3.447
Vrancea	1.105	1.024	0.033	1.172	0.693	4.027
Bucharest Municipality	2.896	1.602	2.000	2.005	3.000	11.503

Source: author's own calculations