THE SPATIAL DIVERSITY OF SOCIO-ECONOMIC DEVELOPMENT IN UKRAINE

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Purpose: The processes of socio-economic development always take place in a specific space and are not uniform. The modern conditions of regional development vary a lot with regard to the socio-economic development of the particular territorial entities. This is also true for Ukraine, the subject of this study and a current candidate for the European Union. This paper will assess the diversity of socio-economic development of the Ukrainian regions in 2020 and rank these entities according to the level of their development.

Methodology: Z. Hellwig's method of development pattern, which helps to order the regions in terms of their development, is applied to the evaluation of socio-economic development of the Ukrainian entities. The indicators adopted are systematised by the following areas: Demographics and job market, Structure of regional economies, Innovation, research and development activities, Technical infrastructure, Social infrastructure, and Condition and protection of the natural environment.

Findings: The analysis helps to identify the levels of socio-economic development of Ukrainian regions and the region groups of the highest, high, low, and very low standards of development. The results suggest a great diversity of socio-economic development of these regions. Dnipropetrovsk, Zaporizhzhya, and Kharkiv experience the maximum, while Donetsk and Luhansk the minimum levels of development.

Research limitations/implications: The data published by the State Statistics Service of Ukraine for 2020 are used, excluding those for the temporarily occupied area of the Autonomous Republic of Crimea, the city of Sevastopol, and parts of the temporarily occupied areas of Donetsk and Luhansk regions. Further comparative research should estimate the effects of the changes on socio-economic development following the end of the Russian Federation's aggression against Ukraine. Continuing studies may also identify factors with a decisive impact on the regions' attribution to the particular groupings.

Social implications: The evaluation of the regional development levels may provide foundations for some strategies of socio-economic development, an explication of causes of regional variations, and a determination of potential for and ways of levelling down the existing inequalities. The diversity of development of the individual Ukrainian regions is important to its status of a candidate to the EU, granted on 23 June 2022. In connection with a closer cooperation between Ukraine and the EU, the results can provide knowledge about where to channel the EU funding aimed at the socio-economic development of the particular regions.

Originality/value: The determination of the diversity of socio-economic development and positioning of the Ukrainian regions in this respect. The study can also be seen as a contribution to the existing research and serve the purpose of comparative analysis.

Keywords: region; regional development; regional diversity; socio-economic development of regions; Hellwig's method.

Category of the paper: research paper.

1. Introduction

Socioeconomic development is a highly complex and multi-faceted phenomenon. It's not measurable directly and comprises a series of elements associated with both economic and societal development. The latter itself should be seen as a sequence of directed and irreversible changes in the structures of objects, i.e., systems (Krajewski, 1977).

The dynamics and nature of contemporary socio-economic development processes are determined by spatial and structural diversities. They are not barriers to that development, however, excessive imbalances of socio-economic development standards are problematic (Dominiak, Churski, 2012). Large differences among regions may have adverse effects on the development of a whole country. Supporting socio-economic development on a regional scale is an important issue, therefore, particularly in countries classed as 'emerging and developing economies'. Ukraine is one such country, which, faced with the aggression of the Russian Federation, applied for the membership of the European Union on 28 February 2022 and, on 23 June 2022, the European Council awarded it the status of a candidate country. In regional terms, Ukraine, in spite of efforts taken after it regained its independence in 1991, is characterised by a sharp spatial West-East dichotomy (Kallioras, Tsiapa, 2015).

This paper will assess the diversity of socio-economic development of the Ukrainian regions in 2020 and rank these entities according to the level of their development. Generally available data, chiefly those published by the State Statistics Service of Ukraine for 2020, are used. They fail to include any figures for the areas of the Autonomous Republic of Crimea, the city of Sevastopol, and some parts of Donetsk and Luhansk regions, occupied by the Russian Federation since 2014.

2. Literature review

Economic development comprises some structural as well as other changes that accompany economic growth (Kemerschen, McKenzie, Nardinelli, 1991). It's a process of quantitative and qualitative change in an economy (Gondek, 2016). The former are expressed with the rate of

economic growth, while the latter relate to the quality of goods and services produced, the structures of product ranges, labour, improvements to technology, management or human capital growth, among other things. Thus, an economy may exhibit growth without development, but not the other way round (Kemerschen, McKenzie, Nardinelli, 1991). Economic development defines overall changes in an economy in the long term (Bąkiewicz, Czaplicka, 2011). It's broader in scope than economic growth. Economic development is a 'historical (long-range) process of a country's internal economic and social change that produces a society looking for ways of improving its economic position and organised in ways allowing and encouraging citizens to invest in material, human, and intellectual capitals necessary for their uninterrupted accumulation' (Nasiłowski, 2004).

Social development, in turn, denotes a 'change in a system of societal relations, the structure of a society, its preferences, social criteria and rules of conduct, patterns of behaviour, attitudes, and awareness that serve to improve the coexistence and collaboration of people and their adequate participation in the effects of economic development' (Marciniak, 2005). This is therefore a process of important and irreversible transformations in social structures that has its dynamics and direction and is conditioned by, inter alia, specific natural, demographic, social, economic, and political factors (Dzieciuchowicz, 2011). The major elements of social development encompass: a diversity of scientific and cultural heritage, the quality and dynamics of its expansion, the availability of economic development effects, some changes in individual and group models, attitudes, and awareness (Marciniak, 2005).

An exploration of the development of a given country or region cannot be restricted to economic or social factors only. Both the aspects need to be addressed (Milenkovic et al., 2014). Socio-economic development offers a wider view of the development of an economy and society. It has already been mentioned this is a highly complex and multidimensional phenomenon. It's regarded as 'a systematic improvement to a population's living conditions, rising welfare and cultural benefits based on a comprehensive societal progress and a universal and equal access to social facilities, the provision of optimum conditions for individual and societal development as the forms and principles of societal living improve' (Piontek, 2006). The socio-economic development is a process of quantitative, qualitative, and structural changes as a result of actions undertaken as part of societal (economic) practice. These changes affect: material living conditions, economic structure and entrepreneurship, access to public goods and services, relations within a social system, the condition of the natural environment, and life satisfaction (Litwiński, 2017). Thus, the socio-economic development can generally be defined as a process of changes or improvement to social and economic conditions that affect an individual, organisation, or an entire country (Roztocki, Weistroffer, 2016).

In spatial terms, the socio-economic development can refer to a variety of territorial levels like local, subregional, regional or national. It should be stressed regions are integral parts of a country, thus the latter's socio-economic development is to a substantial extent determined by the development of its particular regions.

Regional development means a continued growth of economic potential and living standards on the scale of a given territorial unit (Szymla, 1994). It can also be treated as a set of changes in a given territorial unit resulting in an enrichment of its internal structural elements as well as relations among these elements. In other words, these changes bring social and economic progress to that area (Kocurek, 2013). It's also regarded as irreversible quantitative and qualitative changes which tend to produce a permanent growth of socio-economic and cultural potential of a region (Kudełko, 2005). In turn, T. Kudłacz defines regional development as a 'permanent growth of living standards and economic potential on the scale of a give territorial unit' (Kudłacz, 1999). A. Klasik (Klasik, 1997) expands on the above definition by pointing to the factor of competitiveness. In his view, regional development is a continuing growth of three elements: the economic potential of regions, their competitive power, the living standards and quality of life of residents that contribute to the socio-economic development of a country. The foregoing definitions identify the so-called components of regional development which can serve to determine the following areas of regional development (Strahl, 2006):

- The residents of a region.
- Regional ecosystem.
- Infrastructure.
- Regional economy.
- Space – the territory of a region.

The regional development comprises changes taking place at the same time in a number of overlapping and interacting areas. It's normally defined from the perspective of changes in its following components: economic potential and structure, natural environment, infrastructure, spatial order, living standard, and landscape planning. Therefore, the assessment of progress on the processes of socio-economic development of regions consists in the identification and measurement of changes in its component parts (Bell, Morse, 2008; Ginevičius, Gedvilaitė, Bruzgė, 2015).

3. Research method

The methods of linear ordering are among the ways of classifying or establishing an order of multidimensional objects. The methods, a branch of taxonometry, are largely achievements of the Polish econometric and statistical thought (Pociecha, 2008; Bąk, 2017).

Z. Hellwig's taxonomic method, also known as multidimensional comparative analysis (MCA) (Hellwig, 1968, 1981), is employed in the assessment of Ukrainian regions' socio-economic development. It helps to rank certain objects in a multidimensional space of characteristics (Pociecha, 2008). Such a ranking is based on a synthetic variable (indicator) (Hellwig, 1981). There are two groups of methods to estimate the synthetic variables, namely,

non-model and model methods (Bąk, 2017). The MCA is a model method as it relies on the design of an abstract object P_0, referred to as the development model (in particular, it may be a real object). The objects studied are ordered according to their distance from the development model, which allows to identify the level of their development (from 'the best' to 'the worst').

The taxonomic study consists of several stages. The first is designed to determine the goal and scope of the research. This paper aims to assess the diversity of socio-economic development of the Ukrainian regions in 2020 and identify some groups of regions with comparable levels of development.

The next, important stage is the selection of characteristics. To be precise, it's divided in two steps: a choice of characteristics on their merits and a formal application of the variation coefficient (Tarka, 2012). The characteristics (variables) chosen should (Tarka, 2012; Bąk, 2017):

- Well discriminate objects.
- Be weakly correlated with one another.
- Be strongly correlated with rejected characteristics.

Therefore, the study begins with a rejection of characteristics that are neither evidently or hypothetically related to a phenomenon examined, the so-called redundant characteristics, from a list of potential characteristics (the choice on merits). Based on the coefficient of variation, characteristics of a low variability are eliminated (the formal selection). Those for which the coefficient is below the threshold value of 0.1 are treated as quasi-constant and removed from the list (Hellwig, 1981). The coefficient of variation is calculated as follows:

$$V_j = \frac{s_j}{\bar{x}_j} \tag{1}$$

where:
s_j – the standard deviation of jth characteristic,
$\bar{x}_j$ – the arithmetic mean of jth characteristic.

It should be stressed the socio-economic development is a multidimensional category and the final results of comparative analyses, beside the methods applied, are first of all determined by a list of diagnostic variables adopted for the purpose of study. With this in mind, a final list of characteristics is a compromise between the desire to represent the key aspects of a phenomenon under analysis, their overall consistency with the characteristics discussed by specialist literature and an author's experience of an aspect studied, and the availability of databases. An initial list for the study of the socio-economic development of Ukrainian regions comprises 51 characteristics. On the removal of those redundant and quasi-constant, 46 characteristics remain, grouped into six areas that reflect the following major aspects of:

- Demographics and job market.
- Structure of regional economy.
- Innovation and research and development activities.
- Development standard of technical infrastructure.
- Development standard of social infrastructure.

Condition and protection of the natural environment.

In the group describing the demographics and job market, the following characteristics are distinguished: X1 – population per 1 km^2, X2 – urban population as a % of total population (the level of urbanisation), X3 – the balance of migration per 1,000 population, X4 – professionally active population aged 15-70 per 1,000 inhabitants, X5 – disposable income per capita, X6 – the rate of unemployment as a % of working age population to the workforce of a given age, X7 – the working age unemployed, X8 – informal employment of population as a percentage of employed population aged 15-70. The group describing the structure of regional economy comprises the following research characteristics: X9 – the number of businesses per 1,000 population aged 15-70, X10 – industry and construction workers aged 15-70 per 1,000 population, X11 – a share in the national sold production, X12 – sold industrial production, X13 – industrial investment expenditure per 1 industrial worker aged 15-70, X14 – the proportion of industrial and construction investment expenditure to total investment expenditure, X15 – the share of agricultural plantation to the total area, X16 – the yields of cereals and leguminous crops, X17 – the yields of sunflower, X18 – per capita revenue of regional budgets. The characteristics of innovation and research and development activities include: X19 – R&D employment per 1,000 professionally active people aged 15-70, X20 – the innovation spending of industrial enterprises (employing more than 49) as a percentage (a region's share nationally), X21 – R&D expenditure per capita, X22 – the proportion of R&D expenditure to GNP, X 23 – innovative industrial enterprises per 10,000 population. The following are specified among the variables defining the development standard of technical infrastructure: X24 – the geographical density of hard surface public roads [km/100 km^2]; X25 – the demographic density of hard surface public roads [km/10,000 population], X26 – the geographical density of railroads [km/100 km^2], X27 – the demographic density of railroads [km/10,000 population], X28 – the percentage of population using water supply systems, X29 – the percentage of population using sewage systems, X30 – inhabitants of collective accommodation facilities per 1,000 population, X31 – transport accident casualties per 100,000 population, X32 – m^2 of housing resources per capita. The analysis of social infrastructure provision is conducted in consideration of the following characteristics: X33 – the mortality of infants below 1 per 1,000 of live births, X34 – the number of doctors (except dentists) per 10,000 population, X35 – the number of hospital beds per 10,000 population, X36 – nursing home places for the elderly and disabled per 1 disabled pensioner, X37 – the number of children in pre-school education (aged 1-6) as a % of children of the same ages, X38 – pupils at secondary educational institutions per 10 000 population, X39 – students

at universities per 1000 population, X40 – libraries and community centres per 1000 population. The following characteristics are utilised to analyse the condition and protection of the natural environment: X41 – air emissions from means of transport per 1 km^2, X42 – CO2 emissions per 1 km^2, X43 – the recovery of recycled polluted water, m^3 per capita, X44 – the disposal of recycled polluted water into surface water facilities relative to the yield of sewage treatment plants, X45 – the share of waste incineration and reused or recycled waste in the total amount of waste generation, X46 – investment expenditure on the environment protection per capita.

The procedure continues to remove the characteristics which don't contain sufficient information, since the similarity of some characteristics causes them to potentially carry the same information and form clusters, or subsets including a central and some satellite characteristics. A cluster consists of a central and a minimum of one satellite characteristic. Diagnostic variables not included in clusters are named isolated characteristics. A final list of characteristics to be analysed is constituted by central and isolated characteristics (Hellwig, 1981).

Hellwig's parametric method of classifying the variables serves to determine the base variables (the final list of characteristics). Its algorithm encompasses (Hellwig, 1981; Bąk, 2017):

- The creation of a correlation matrix R$_{mxm}$,

$$R = [r_{ij}] \begin{bmatrix} 1 & \cdots & r_{1m} \\ \vdots & \ddots & \vdots \\ r_{m1} & \cdots & 1 \end{bmatrix},$$ (2)

where:

i, j = 1,2, ….m,

m – the number of variables (characteristics).

- The calculation of total coefficients of correlation for each column of R out of their absolute values:

$$R_j = \sum_{i=1}^{m} |r_{ij}|,$$ (3)

- Finding a column (k) with a maximum R$_j$:

$$R_k = max_j\{R_j\},$$ (4)

- The identification of a central variable numbered (k) and of satellite variables, for which:

$$|r_{ij}| > r^*,$$ (5)

where:

r* – the threshold coefficient of correlation.

- The removal from matrix R of columns and lines corresponding to the identified central variable and satellite characteristics to arrive at a reduced square matrix.

- The repetition of the foregoing steps until the last reduced matrix is liquidated; the variables not included in any cluster are isolated characteristics.

Since the test applies to an entire set, not a random sample, the boundary coefficient of linear correlation r*= 0.8 is adopted. Statistics textbooks treat this value as strong. The variables: X1, X4, X7, X9, X12, X13, X16, X18, X19, X20, X21, X27, X29, X30, X39, X41, and X42 are considered satellite characteristics. The remaining 29 characteristics are central or isolated and constitute the set of base characteristics (the final list of characteristics).

The procedure leading to the establishment of Z. Hellwig's synthetic measure of development proceeds to divide the characteristics into stimulants and destimulants. The former's growth is deemed positive and decline negative from the perspective of a system, phenomenon, or process studied. A characteristic whose absolute rise is found adverse and a reduction is found positive is termed a destimulant, on the other hand (Hellwig, 1981).

Stimulants prevail among the base variables adopted for the purposes of study. Only 4 out of 29 characteristics are destimulants, namely, the rate of unemployment as a % of working age population to the workforce of a given age, informal employment of population as a percentage of employed population aged 15-70, transport accident casualties per 100,000 population, and the mortality of infants below 1 per 1,000 of live births. The base characteristics adopted seem to provide the foundations for an accurate analysis of the diversity of socio-economic development of the Ukrainian regions.

The base variables are unit quantities. The variety of units and measures and the different natures of stimulants and destimulants cause characteristics to be normalised (standardised). The transformation follows the formula (Hellwig, 1981; Brzozowska-Rup, Czaja, Piotrowska-Piątek, 2020):

$$Z_{ik} = \frac{x_{ik} - \bar{x}_k}{S_k},$$ (6)

where:

Z_{ik} – the standardised value of characteristic k for region I,

x_{ik} – the value of characteristic k in region I,

$\bar{x}_k$ – the arithmetic mean of variable k,

S_k – the standard deviation of variable k.

The subsequent stage consists in determining a development model defined as an abstract object P_0 characterised by the maximum values of stimulants and minimum values of destimulants and having standardised coordinates:

$$P_0 = [z_{01}, z_{02}, \ldots, z_{0k}],$$ (7)

where:

$z_{0k} = \max\{z_{ik}\}$ – where x_k is a stimulant,

$z_{0k} = \min\{z_{ik}\}$ – where x_k is a destimulant.

Taxonomic (Euclidean) distances between the particular objects and the adopted model P_0 are then computed as follows:

$$c_{i0} = \sqrt{\sum_{k=1}^{m}(z_{ik} - z_{0k})^2}, \tag{8}$$

where:

i = 1, 2, 3, ..., n.

The final stage of linear ordering involves the calculation of the synthetic indicator. To normalise the values of di, a relative taxonomic measure of development is built and computed as:

$$d_i = 1 - \frac{c_{i0}}{c_0}, \tag{9}$$

where:

i = 1, 2, 3, ..., n,

$$c_0 = \overline{c_0} + 2 * s_0, \tag{10}$$

$\overline{c_0}, s_0$ − the arithmetic mean and standard deviation of the sequence c_{io} (i = 1, 2, 3, ..., n), respectively.

The calculated synthetic measure of development d_i (9) equals [0;1]. The higher it is, the less distant a given object (region) is from the model and the greater its socio-economic development. The above approach helps to identify the levels of socio-economic development of Ukrainian regions and to divide them into four groups:

Group I: the regions of the highest indicator of development level ($d_i \geq \overline{d_i} + S_{di}$).

Group II: the regions of a high indicator of development level ($\overline{d_i} \leq d_i < \overline{d_i} + S_{di}$).

Group III: the regions of a low indicator of development level ($\overline{d_i} - S_{di} \leq d_i < \overline{d_i}$).

Group IV: the regions of the lowest indicator of development level ($d_i < \overline{d_i} - S_{di}$).

where:

d_i − the value of the synthetic indicator,

$\overline{d_i}$- the arithmetic mean of the synthetic indicator,

S_{di} − the standard deviation of the synthetic indicator.

The study is based on the statistics provided chiefly by the statistical publication Regions of Ukraine 2020 Part I ('Статистичний збірник «Регіони України» 2020 Частина I', 2021) and Part II ('Статистичний збірник «Регіони України» 2020 Частина II', 2021), as well as the website of State Statistics Service of Ukraine (*Державна Служба Статистики України*, 2022).

4. Results and discussion

The Ukrainian regions are classified by means of a synthetic measure based on 46 characteristics adopted. The measure is designed to order the regions in respect of their socio-economic development. Thus ordered, the units are then grouped into four principal classes of similar development levels.

The Dnipropetrovsk region ranks first with an indicator of 0.444 (Table 1 and Figure 1). It's followed by Zaporizhzhya (0.405) and Kharkiv (0.384). The regions of a high development standard constitute the largest grouping. The regions of Donetsk and Luhansk, on the other hand, come last with Hellwig's indicators of (-0.081) and (-0.166), respectively.

Table 1.
The levels of socio-economic development of Ukrainian regions in 2020 based on Hellwig's taxonomic measure of development

| No.	Region	d_i
Group I $di \geq 0.464$		
1.	Dnipropetrovsk	0.444
2.	Zaporizhzhya	0.405
3.	Kharkiv	0.384
Group II $0.256 \leq di < 0.464$		
4.	Kyiv	0.354
5.	Poltava	0.340
6.	Lviv	0.320
7.	Khmelnytskiy	0.318
8.	Sumy	0.314
9.	Cherkasy	0.291
10.	Vinnytsya	0.285
11.	Ternopil	0.281
12.	Mikolayiv	0.278
13.	Chernivtsi	0.273
14.	Ivano-Frankivsk	0.266
15.	Kirovohrad	0.266
16.	Odesa	0.264
17.	Zhytomyr	0.258
Group III $0.128 \leq di < 0.256$		
18.	Chernihiv	0.249
19.	City of Kyiv	0.245
20.	Rivne	0.233
21.	Kherson	0.206
22.	Volyn	0.195
23.	Zakarpattya	0.182
Group IV $di < 0.128$		
24.	Donetsk	-0.081
25.	Luhansk	-0.166

Source: The authors' own compilation.
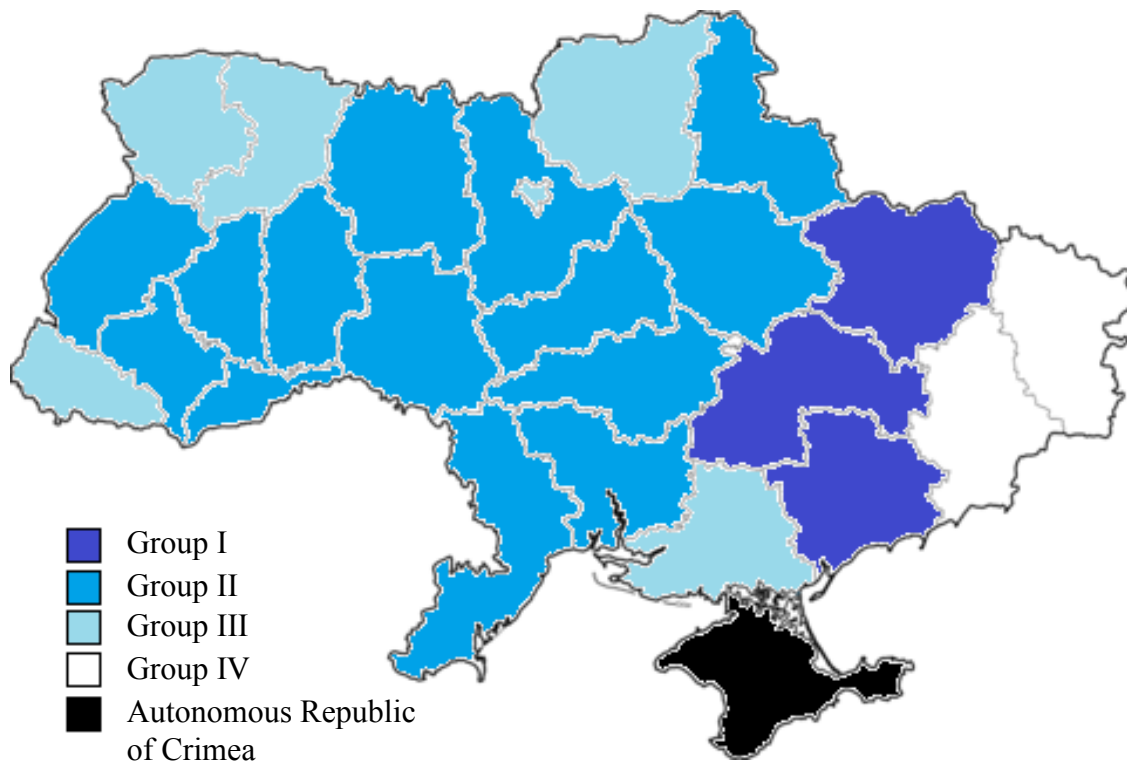
Figure 1. The socio-economic development of the Ukrainian regions in 2020.

Source: The authors' own compilation.

Dnipropetrovsk, Zaporizhzhya, and Kharkiv formed the group of maximum development in 2020. The distance between the region of Dnipropetrovsk and the leader is 0.03. The latter owes its position to the strongly developed metallurgy, chemical, and space rocket production industries as well as a number of natural raw material deposits and a key Ukrainian financial centre located there. The second, most numerous grouping (14 units) consists of the following regions: Kyiv, Poltava, Lviv, Khmelnytskiy, Sumy, Cherkasy, Vinnytsya, Ternopil, Mikolayiv, Chernivtsi, Ivano-Frankivsk, Kirovohrad, Odesa, and Zhytomyr. Its Hellwig's indicator is in the range $0.256 \leq d_i < 0.464$. It needs to be pointed out its leading region of Kyiv leaves its follower, Kharkiv, behind by 0.03 points. The third group of a low standard of development comprises six regions: Chernihiv, City of Kyiv, Rivne, Kherson, Volyn, and Zakarpattya. The group of minimum standard of development encompasses just two regions, Donetsk and Luhansk, in the year studied. They show negative synthetic indicators, denoting an extremely low level of development.

The classification of regions according to Hellwig's synthetic indicator points to large differences in the standards of socio-economic development. The gap between the maximum of 0.444 (Dnipropetrovsk) and minimum of -0.166 (Luhansk) is 0.610. The numbers of territorial units are well structured, that is, the regions of the highest and high development prevail (17), whereas barely 8 are in the groups of low and minimum levels of development.

Each region strives for economic growth, possible by effectively utilising competitive advantages and thus improving the level of socio-economic development. Any imbalances of economic and macroeconomic policies and decisions at the national level can also be felt on the regional scale (Chirinko, Wilson, 2008; Andrusiv et al., 2020).

Comparative analyses among the Ukrainian regions with regard to the levels of their socio-economic development serve to identify those most similar as far as the adopted assessment criteria are concerned. A number of publications corroborate differences in the development of territorial units, while the rankings of regions from the viewpoint of selected variables help to precisely designate those best developed (Kozyreva, Sagaidak-Nikituk, Demchenko, 2017; Kozyreva et al., 2017; Miłek, 2018; Tiulkina, 2019; Andrusiv et al., 2020; Пошивалова and Прошкіна, 2020). The results are comparable, except for position variables for some regions.

Some authors draw attention to connections between regional digital divides and the levels of socio-economic development, a problem for sustainable development, particularly in the 'backward' regions of Ukraine (Deineko et al., 2022). The paper analyses the international practices of digital divide management and offers recommendations for public policy to overcome digital inequalities. K.Tiulkina (Tiulkina, 2019) discusses the socio-economic development of Ukrainian regions considering sustainable development. Her results affirm the presence of the groups of leaders, medium, and low development level regions similar to the results generated in this article.

O. Kozyreva et al. (Kozyreva et al., 2017) corroborate our results. The transformation processes in Ukraine affect regional development in different ways. Some regions have mobilised the potential in place and gradually adapted to hard economic realities, whereas others are in a state of stagnation, which widens regional disproportions. The leaders in light of the synthetic social development indicator in 2014 included Kharkiv, Dnipropetrovsk, Zaporizhzhya, Odesa, and the City of Kyiv. The City of Kyiv, Dnipropetrovsk, Kyiv, Poltava, and Kharkiv scored best on economic development.

In general, the processes of socio-economic development are not homogeneous in terms of space. Due to a variety of historical conditions and the changes of internal and external factors, the development processes do not take place with the same intensity in every area. In order to remove the development disparities, the European Union pursues its cohesion policy, whose instruments are to prevent the differences from widening and to help reduce the disproportions in the socio-economic development of countries (Gawlikowska-Hueckel, Szlachta, 2014; Michoń, 2017). The potential joining of the EU by Ukraine offers an opportunity for bridging development gaps using the EU funds. In the situation of growing inter-regional disparities and seeking some ways of minimising the adverse effects of territorial disparities, therefore, an urgent need arises of assessing the levels of socio-economic development of Ukrainian regions in order to identify the development potential and improve the effectiveness of economic activity.

5. Conclusions

The level of socio-economic development of regions is of interest to economic and macroeconomic policies. Our results may serve the management of the Ukrainian regions' development. This study offers the following conclusions:

1. The Ukrainian regions exhibit some varied levels of development. The distance between the leader (Dnipropetrovsk) and the bottom region (Luhansk) suggests a considerable spatial differentiation (the divergence is 0.610). The level of development estimated by means of the synthetic indicator shows a nearly 3:1 distance between the ranking leader and the bottom region.

2. Most Ukrainian regions demonstrated the highest and high levels of socio-economic development in 2020. They are led by Dnipropetrovsk, which founds its advantage on a well-developed economy (including the industry) and innovation, research, and development activities. Kharkiv likewise generates high values for the characteristics of economy, innovation and R&D, though it comes second on the indicators of: R&D expenditure per capita in hry. – 1093.94 (the City of Kyiv is first with 2 844.00). Zaporizhzhya is in the first group with its high values of the following variables: X10, X14, X15, X22, and X23. The results fail to demonstrate a clear-cut split into the eastern and western Ukraine, but most region in groups I and II are situated in the eastern part of the country (with the exception of Donetsk and Luhansk). However, Kallioras and Tsiapa (Kallioras, Tsiapa, 2015) point out the spatial division into the eastern and western areas is profound, with some large divergences of their economic and production structures, although the dichotomy cannot be seen as unidimensional, purely economic or social; it is multidimensional.

3. The results of statistical analysis of socio-economic development levels in the Ukrainian regions provide national decision-makers with substantive knowledge needed to make decisions and finance actions to improve the development of Ukrainian regions and thus to improve the quality of life. They may also assist with decisions concerning financial support, i.e., EU funding to the particular countries. The development of Ukrainian regions is of importance to foreign investors' decisions associated with capital allocations. They are after all dependent on investment attractiveness, which consists in the development standard and innovativeness of an economy, human capital resources, the accessibility of economic and social (including telecommunications) infrastructure, the environment condition, the regions' attitudes to investors, and the standards of public security.

4. This paper makes contributions of two types to the discussion of its subject matter. First, it provides a theoretical framework to socio-economic development. Second, it offers an empirical verification of the spatial diversity of the socio-economic development of Ukrainian regions. The assessment is based on the adopted characteristics using the multidimensional statistical analysis. The availability of data is a limitation of this study.

5. This project identifies several areas for further research. It should aim to compare the development of Ukrainian regions to that of the European Union countries. A more in-depth analysis of the impact of the adopted factors on the socio-economic development of Ukraine is welcome. Since this study addressed data for 2020, the research may continue to determine the effects of the pandemic on the regional development of Ukraine in the context of its development potential, as well as the Russian Federation's aggression of 24 February 2022. The research should continue to identify any change tendencies of selected indicators following the start of military operations in February 2022, with a special focus on the balance of migration. Therefore, a comparative analysis of selected variables will be undertaken, in particular of the balance of population migrations in 2020-2022.

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