



Article

Regional Development in Poland in Taxonomic Terms

Rafał Klóska[®], Elżbieta Ociepa-Kicińska *[®], Rafał Czyżycki[®] and Piotr Szklarz[®]

Institute of Spatial Management and Socio-Economic Geography, University of Szczecin, 70-453 Szczecin, Poland; rafal.kloska@usz.edu.pl (R.K.); rafal.czyzycki@usz.edu.pl (R.C.); piotr.szklarz@usz.edu.pl (P.S.)

* Correspondence: elzbieta.ociepa-kicinska@usz.edu.pl

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Abstract: Regional development is a complex economic category and a commonly used term today, yet it is vaguely defined and, therefore, interpreted implicitly and understood intuitively. From a statistical point of view, this concept, on account of its imprecision and ambiguity, is a kind of multidimensional characteristic which may be measured, though not conclusively. Due to the lack of a universal set of diagnostic variables adopted in taxonomic analyses, the quantitative approach to the examined research area, which is in most cases presented descriptively, poses the main problem. The objectives of the article are to rank the provinces of Poland in terms of regional development in the years 2006–2018 and to assess the similarity of results over time. The research study is based on linear ordering methods within the scope of multidimensional statistical analysis. The results of the conducted analyses allowed us to rank the provinces of Poland in terms of regional development in the years 2006–2018 and to assess the similarity of the results over time. The results of the analysis indicate a clear stabilization of high ranked positions during the examined period, last places are generally taken by the same regions. This situation may indicate an increase or at least strengthening of the disproportions between the most and least developed regions in Poland. Theoretical considerations presented in the article as well as the empirical results of our own research may provoke more detailed discussion on the subject.

Keywords: regional development; quantification; statistical analysis

1. Introduction

Regional development is a multi-faceted research topic and an interdisciplinary issue, lacking a complex theory to describe or even define it. In the academic literature, it is described as a process, mainly of an economic nature, where regional production factors are transformed into goods and services [1]. According to Regional Development Policy presented by Organisation for Economic Co-operation and Development (OECD), regional development may be perceived in most general terms as an effort made in order to decrease the regional disproportions via supporting business activity in those regions. The objective of a regional policy should be ensuring a possibility of development and high living standard to the inhabitants in various types of regions [2]. A. Pike, A. Rodriguez-Pose and J. Tomaney show that (historically dominant in defining development) the economic aspect is expanded, albeit very unevenly, by other aspects, including social, ecological, political or cultural [3]. It should be noted that the literature on the subject consistently differentiates between the concepts of economic growth and economic development. Development, in the simplest terms, is understood as a process of positive changes comprising both quantitative growth and qualitative progress, where the quantitative aspect encompasses the concept of economic growth, while the qualitative aspect regards transformation of socio-economic structures, as a result of which they acquire new characteristics [4]. Changes in the economic potential, economic structure, natural environment, infrastructural development, spatial

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order and spatial development allow identifying regional development with a permanent increase in the standard of living of the region's inhabitants [5]. The implementation of regional policy results in the development of regions. Currently, the development of the country based on the development of regions is an objective necessity resulting from participation in the global economy (with clear spatial polarization and diversified pace of development of individual areas) [6]. Differences in natural environment conditions as well as geographical and social development factors cause the individual regions to show different dynamics of development [7]. In addition, contemporary development mechanisms, including technological progress, development of the information society and globalization of the economy contribute to deepening development disparities [8].

As regional development is multidimensional by nature, it may be considered from different points of view. The components of this complex and ambiguous concept are development and region. The former of these two terms suggests an evolutionary and progressive nature of the concept associated with something new and improved [9]. The process-oriented overall changes, both quantitative and qualitative, are highlighted [10,11]. Due to its interdisciplinary nature, the term "region" is investigated by various scientific disciplines, however, it may be perceived differently by a geographer, political scientist, sociologist or economist. There is a general acceptance that the term refers to a specific space and, in this sense, it is used in many countries and languages. Attempts to define regional development in the source literature have been made on several occasions [1,5,12], however, it is difficult to provide a comprehensive definition, thus the term remains a kind of an abstract mental shortcut, commonly used, yet understood rather intuitively. It may be perceived as a complex process of continuous socio-economic change of specific spaces, including isolated regions, aimed at improving the existing situation in terms of the adopted criteria.

However, due to the lack of a single, generally accepted definition as well as the multitude of criteria which may be taken into account, the adopted sets of indicators to quantify this research area pose a methodological challenge. Due to the lack of a universal list of measures of regional development as well as the difficulties resulting from the limited availability of reliable and comparable statistical data, this issue is still examined in statistical terms, and the research and analysis undertaken should lead to a better understanding of this concept in the future. The aim of the study is, therefore, to present a quantification of regional development in Poland and its taxonomic analysis in the years 2006–2018 by means of selected methods of multidimensional comparative analysis.

2. Research Areas and Diagnostic Variables

The level of regional development may be measured, though inconclusively. Over the recent years, many studies addressed the theory and determinants of regional development, both in a broad perspective and in concrete areas comprising, inter alia, the financial aspects of development, educational conditions of development, impact of technical effectiveness on the individual socio-economic indicators, globalisation processes, innovativeness or methods and tools for managing the regional development (for more details please refer to [13–22]). The main problem is the selection of specific characteristics allowing the quantification of the research area. Regional development is generally analysed descriptively and, due to the multidimensionality of this economic category, the quantitative representation is not unequivocal and this issue may be considered from various perspectives. Abstract concepts and general expressions need to be specified by, first of all, identification and then application of a carefully selected set of measures, and there are no generally accepted, universal solutions in this area. In statistics and economic analyses, as indicated by C. Bywalec [23], an indicator, understood as a number, i.e., an absolute quantity reflecting the intensity (significance) of a phenomenon or the quotient of two different quantities, is frequently identified with a measure and generally both these terms are used interchangeably; however, the use of the former (indicator) is usually more adequate in theoretical and methodological considerations, and the latter (measure)—in empirical studies, already using specific indicator quantities (of a diagnostic feature). A comprehensive approach to these issues is complex and complicated, and the limited availability of comparable statistical data and the lack of generally

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accepted, universal solutions applicable to diagnostic features adopted hinders a reliable presentation of multidimensional quantitative and qualitative changes in regional terms.

The NUTS (Nomenclature des unités territoriales statistiques—Nomenclature of Territorial Units for Statistics in French) division itself is a meaningful expression of a purely economic approach to the region and proves that the territorial division across all EU Member States may not be standardised [24]. The Nomenclature of Territorial Units for Territorial Statistics (NTS) in force in Poland, compiled on the basis of the European Nomenclature of Units for Territorial Statistics (NUTS), divides our country into territorial, hierarchically related units on five levels, the first three of which are defined as regional levels and the last two as local levels. NUTS 1 corresponds to the level of macro-regions, NUTS 2 corresponds to the size of provinces, NUTS 3 covers sub-regions, NUTS 4 defines districts (poviats) and cities with powiat right and NUTS 5 covers communes (gminas). S. Korenik emphasises that the primary region is treated as a second-degree unit of administrative division of the country [25]. This opinion is shared by D. Strahl [26] and J. Paradysz [27]. Therefore, for the purposes of this study, the region in Poland is equated with each of the sixteen existing provinces (voivodeships) in 2006–2018.

The literature review is based on the analysis of methods used in the past to study the phenomenon of regional development in Poland and worldwide, with particular emphasis on the methodological deficiencies of these methods. The source literature identifies various indicators of socio-economic changes in the regions and their number in various research works usually varies from several to several dozen [26,28–30]. The main pillars of regional development include the social, economic and environmental aspects, and these three areas—as indicated by T. Borys [31]—in Polish literature are traditionally referred to as governances, however occasionally four planes are recognised: by separating the institutional and political governance from the social governance or separating the spatial governance from the environmental governance, and even five can be recognised when describing the most advanced form of the so-called integrated governance, including the institutional, political, social, economic, environmental and spatial governance [32]. In this context, the evolving concept of sustainable development aimed at ensuring the fulfilment of current needs, without compromising future generations may be treated as a frame of reference when identifying regional development [33]. Poland has undertaken to implement the principles of sustainable development and the structure of national indicators in this respect is presented by means of 76 indicators, 26 of which represent social governance (34%), 24—environmental governance (32%), 19—economic governance (25%) and 7—institutional and political governance (9%) [34]. In practice, only selected measures are usually analysed [35]. Such a wide representation of the observed socio-economic changes in the regions is additionally hindered by the limited and sometimes even lack of comparable statistical data not only in spatial but also in time terms. It is common to recognise different information opportunities in this respect, which has an adverse impact on the comprehensive description and assessment of individual areas of regional development.

Due to the complexity of the analysed issues, the proper selection and final choice of diagnostic variables always poses a methodological dilemma and a considerable challenge for researchers, especially since in practice analyses and diagnoses of multidimensional categories are usually carried out by means of compromise and consensus between the ambitions of the researcher and the information availability of databases. However, one should be aware that the final results of the comparative analyses are determined mainly by the list of variables adopted for the study, apart from the taxonomic methods used. The interpretation of the obtained analysis results should therefore always be made in reference to a specific set of characteristics. It should reflect the most important aspects of the analysed phenomenon, depending on the purpose of the study, taking into account the factual circumstances.

Taking into consideration the above raised dilemmas concerning the quantification of the research area, an attempt was made to specify the diagnostic variables of regional development in Poland. An in-depth examination of the subject [4,36] involving literature studies, review of studies conducted in this field with emphasis of expert opinions contained therein, as well as our own reflections in this respect, were the starting point for further analysis (inter alia: [12,26,28,29,37–40]). Several hundred

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different indicators were analysed in the public databases of the Central Statistical Office (including, inter alia: information contained in the STRATEG system created to facilitate the development policy programming and monitoring, Local Data Bank (LDB), Statistical Yearbooks, Statistical Yearbooks of Provinces and other documents) in terms of their content (descriptions of indicators and their methodological explanations) and level of territorial accessibility. On the basis of these premises and the available statistical data, a list of initial indicators (as of 6 September 2019, few data gaps have been bridged by extrapolation methods or data from the last available date have been used, which is a common practice in the EU nomenclature—e.g., [41]) was drawn up which identified regional development in Poland in three aspects: social, economic and environmental, referring to the previously established guidelines for component governance, i.e., the main areas of sustainable development in Poland, with similar proportions of this governances, i.e., the percentage share of the indicators of a given group in relation to all adopted measures. If necessary, conversion factors have been applied so that the proposed set of characteristics is expressed in relative rather than absolute units. This approach allows dissociation from the area and population of the regions, and the values obtained thereby indicate relatively the structure or scale of a given phenomenon. The substantive selection of variables, in the strict sense, was considered superior, and the selection of variables was based on statistical criteria of dispersion and correlation.

Taking into account the postulate of features discrimination, the classic coefficient of variation was applied to eliminate quasi-stable variables. The relatively strong correlations observed were each time subjected to a thorough substantive assessment with regard to the provision by the variables thus indicated of certain specific information ultimately affecting regional development. As a result of this approach, statistical data series were obtained for eighteen indicators adopted as the final set of diagnostic variables, which seem to describe regional development in Poland in 2006–2018 in a fairly comprehensive manner (cf. Table 1).

Table 1. Regional development indicators in Poland 2006–2018.

Indicator Symbol	DIMENSION/Regional Development Indicator				
Social Dimension					
X_1	Infant deaths per 1000 live births				
X_2	Relative at-risk-of-poverty rate (%)				
X_3	Number of university students per 10,000 inhabitants				
X_4	Registered unemployment rate (%)				
X_5	Number of fatalities in road accidents per 100,000 inhabitants				
X_6	Water consumption for the purposes of national economy and total population (hm³) per 10,000 inhabitants				
	Economic Dimension				
X ₇	GDP (current prices) per capita in PLN				
X_8	Share of business entities outlays in total outlays on R&D activity (%)				
X ₉	Number of newly registered entities of the national economy in the private sector per 10,000 inhabitants				
X_{10}	Porkers per 1000 people				
X ₁₁	Total capital expenditure (current prices) per capita in PLN				
11	Environmental Dimension				
X ₁₂	Percentage of population using wastewater treatment plants (%)				
X ₁₃	Level of forestation (%)				
X ₁₄	Recycling of packaging waste (%)				
X ₁₅	Share of devastated and degraded land requiring rehabilitation in total area (%)				
X ₁₆	Share of recovered waste (excluding municipal waste) in the amount of waste produced during the year (%)				
X ₁₇	Share of electricity production from renewable sources in total electricity production (%)				
X_{18}	Electricity consumption per 1 million PLN of GDP (GWh)				

Source: own elaboration based on: [4].

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3. Test Methodology

Quantitative methods are currently widely used in empirical research, including regional research, and their usefulness is not disputed. From a taxonomic point of view, the aim of regional studies is generally to describe and evaluate a set of objects in terms of a certain general criterion adopted which is the subject of analysis. In this study, it is the regional development in Poland and the examined objects include provinces in the years 2006–2018. One of the main research tasks is linear ordering, which boils down to establishing the order of the objects under consideration according to a specific criterion, which allows the establishment of a hierarchy, i.e., an order from "the best" to "the worst". For this purpose, an appropriate synthetic measure, the so-called synthetic development measure (SDM), i.e., adopted aggregation formula, is determined. In the Polish statistical literature, due to the significant achievements of Polish scientists in this field, a term for linear ordering has been coined—multidimensional comparative analysis (MCA) [42,43]. In order to underline the significant contribution of Polish statisticians to the development of the described methodology, it is worth noting the achievements of the following authors: Z. Hellwig [44], M. Cieślak [45], E. Nowak [46] T. Grabiński, A. Malina, A. Zeliaś [47], W. Tarczyński [48] and M. Markowska [49]. Equally important and interesting are scientific achievements in this field presented in the world literature and it is worth mentioning the works of the following authors: J. A. Hartigan [50], H. H. Bock [51] or B. S. Everit, S. Landau, M. Lees

For the purposes of this study, selected linear ordering methods included in the multidimensional comparative analysis (MCA) were used for taxonomic analysis of regional development in Poland in 2006–2018. First, the values of synthetic features were assessed in detail due to the adopted general criterion in selected units of time of the analysed range of study. As the synthetic development measure (SDM) was established separately for each year under consideration, the hierarchy of the objects (provinces in Poland) could be established on the scale of development separately for each analysed time unit (specific year).

A relative development coefficient was used as an SDM formula to rank the objects analysed by means of the diagnostic variables adopted in the study, which is as follows:

$$W_i = \frac{100}{k} \sum_{j=1}^k \alpha_j z_{ij} \tag{1}$$

where:

W_i—relative development coefficient;

k—number of variables used in the study;

 α_i —the weight of the j-th variable;

 z_{ij} —standardised by means of a zero unitarization of the statistical x_{ij} feature values included in the study.

This is an aggregate measure, which is the arithmetic mean of the diagnostic variables rendered comparable by zero unitarization multiplied with the following algorithm for the stimulants:

$$z_{ij} = \frac{x_{ij} - \min\{x_{ij}\}}{\max\{x_{ij}\} - \min\{x_{ij}\}}$$

$$(2)$$

and for the inhibitor:

$$z_{ij} = \frac{\max\{x_{ij}\} - x_{ij}}{\max\{x_{ij}\} - \min\{x_{ij}\}}$$
(3)

A higher value of the aggregate Formula (1) with values between 0 and 100 ensures a higher rank. The synthetic development measure (SDM) adopted for the study is methodically consistent

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with the Summary Innovation Index (SII) commonly used in the EU nomenclature [41]. The approach adopted is therefore generally recognised and often used in practice. A possible weighing of features poses a certain problem and methodical dilemma. The literature contains comments and proposals in this regard (e.g., [53]), moreover, experts may also be consulted. In the experience of the authors of this study, in many cases, the experts fail to reach a consensus and explicitly determine the system of weights for a specific analysis of various multidimensional phenomena. To date, however, this issue has not been resolved conclusively and no universal and generally accepted procedure has been developed. Therefore, for the purpose of this study—as is generally practised by researchers (Sokołowski 1984, p. 48)—each feature was assigned equal importance and equal weights were applied.

In identifying the nature of each of the 18 diagnostic variables adopted in the study, it was assumed, after a thorough substantive assessment, that the high values of most of them are desirable in view of the general criterion adopted, and that only 7 of the variables serve as inhibitors. These are designated the following symbols in Table 1: X_1 , X_2 , X_4 , X_5 , X_6 , X_{15} , X_{18} .

The values of synthetic features determined using Formula (1) allowed the assessment of the similarity of the set of objects (here: provinces in Poland) over time (here: in the years 2006–2018) in terms of regional development (here: described by a set of eighteen diagnostic variables X_1 , X_2 , ..., X_{18} from Table 1). For this purpose, the measure proposed by M. Walesiak was used [54]. It is methodically consistent with the H. Theil's ex post forecast accuracy coefficient (description and application of H. Theil's coefficient may be found, inter alia, in: [55]), and to apply it, it is necessary to assume that the values of the compared synthetic features M_r and M_s are indicated on a quotient or interval scale that allows the measurement of the interval distance of objects, whereby:

$$P^{2}(M_{r}, M_{s}) = P_{rs}^{2} = \frac{1}{n} \sum_{i=1}^{n} (p_{ir} - p_{is})^{2}$$
(4)

If there are no differences in the values of the compared synthetic features, the (4) measure will equal 0. Its square root indicates the average range of deviations of the features M_r and M_s from periods r and s. In addition, the value expressed in Formula (4) may be divided into the sum of three components, which allow the identification of reasons for the differences in the values of the compared synthetic features:

$$P_{rs}^2 = P_1^2 + P_2^2 + P_3^2 (5)$$

where:

$$P_1^2 = (\overline{p}_r - \overline{p}_s)^2 \tag{6}$$

$$P_2^2 = (S_r - S_s)^2 (7)$$

$$P_3^2 = 2S_r S_s (1 - \rho) \tag{8}$$

and $\overline{p}_{,r}$, $S_r(\overline{p}_{,s},S_s)$ constitutes the arithmetic mean and standard deviation of the r-th (s-th) value of the synthetic feature, respectively, whereas $\overline{p}_{,r}$, $S_r(\overline{p}_{,s},S_s)$ is the Pearson correlation coefficient between the vectors $p_{,s}=(p_{1s},p_{2s},\ldots,p_{ns})$ and $p_{,r}=(p_{1r},p_{2r},\ldots,p_{nr})$.

Partial measures P_1^2 , P_2^2 and P_3^2 provide information about the range of deviations of the compared synthetic features, resulting from, respectively:

the difference between the average values of the features M_r and M_s ; the difference in dispersion of the values of the features M_r i M_s ; inconsistencies in the changes in the values of the features M_r and M_s .

As part of the adopted approach, changes in regional development in Poland in the years 2006–2018 were analysed and the similarity of results over time was assessed.

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4. Results and Discussion

The primary values of the adopted SDM (1) are presented below in Table 2.

Table 2. Values of the W_i indicator of the regional development in Poland in the years 2006–2018.

Province	The Values of The W_i Indicator For Regional Development In Poland In The Year					
Tiovince	2006	2010	2014	2018		
Dolnośląskie	48	52	51	49		
Kujawsko-pomorskie	44	43	37	44		
Lubelskie	35	38	34	32		
Lubuskie	52	55	49	47		
Łódzkie	44	43	34	36		
Małopolskie	51	57	55	58		
Mazowieckie	60	64	65	61		
Opolskie	43	40	36	43		
Podkarpackie	41	50	48	48		
Podlaskie	44	46	46	43		
Pomorskie	61	62	63	61		
Śląskie	46	49	47	54		
Świętokrzyskie	31	26	24	22		
Warmińsko-Mazurskie	40	40	35	34		
Wielkopolskie	43	50	44	47		
Zachodniopomorskie	38	43	40	44		

Source: own elaboration based on CSO [56].

The results presented in Table 2 are directly comparable, as they concern the same research subject in terms of its substance (regional development in Poland) expressed each time by the same list of diagnostic variables $(X_1, X_2, \dots, X_{18})$ were taken from Table 1) and an identical aggregation formula (relative development coefficient determined using Formula (1)) was used in all the years analysed. The analysis of information included in Table 2 reveals that in 2018 the value of the applied measure for a given region was higher than in 2006 (the initial period of the study) in six provinces: Dolnośląskie, Małopolskie, Mazowieckie, Podkarpackie, Śląskie and Wielkopolskie, however, only in Małopolskie and Śląskie provinces no higher values of the aggregation formula were recorded at the same time. Moreover, in 2018, the lowest values of the measure used in the analysed years were recorded in as many as six provinces: Lubelskie, Lubuskie, Podlaskie, Pomorskie, Świętokrzyskie and Warmińsko-Mazurskie. From this perspective, the improvement of regional development in Poland in the examined years may not be proved. On the scoring scale from 0 to 100%, the difference in the W_i measure used for individual provinces in the analysed years varies approximately from 2% for Pomorskie province to 10% for Łódzkie province. A similar representation, but taking into account individual years of the study, demonstrates that the greatest interregional disparities occurred in 2014 (the difference between the then highest ranked Mazowieckie province and the lowest ranked Świętokrzyskie province was as much as 41%), and the smallest in 2006 (Pomorskie province scored 30% more than Świętokrzyskie province).

The assessment results concerning the similarity of object set over time based on the value of the synthetic feature in selected years of the analysed period are presented in Table 3.

Table 3. Results of the assessment of similarity of Polish provinces in terms of regional development on the basis of the value of the adopted SDM in the years 2005–2015.

Years Compared	The Values of Measure $P_{r\mathrm{s}}^2$ and Partial Measures P_1^2 , P_2^2 and P_3^2				
	P_{rs}^2	P_1^2	P_{2}^{2}	P_{3}^{2}	
2006 and 2010	17.7701	5.8112	2.0455	9.9134	
2010 and 2014	15.8707	9.3839	1.8203	4.6664	
2014 and 2018	13.5451	0.6337	0.1156	12.7958	

Source: own elaboration based on CSO [56].

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The values of the adopted SDM slightly change over time, as the average deviations of the compared synthetic features from two periods four years apart during the analysed period range from 3.68 to 4.22%, with the lowest value recorded for the years 2014 and 2018 and the highest for the years 2006 and 2010. The main reason for these differences between 2006 and 2010 as well as 2014 and 2018 was the inconsistency of the changes in the values of the synthetic features and, between 2010 and 2014, the insufficient consistency of the average values of the synthetic features.

Additionally, the similarity of the object set was assessed at the extreme moments of the study, i.e., in 2006 and 2018. The average deviation of the values of synthetic features in the compared years amounted to 5.0838% ($P_{rs}^2 = 25.8446$) and was mainly a consequence of the inconsistency of the changes of synthetic features ($P_1^2 = 0.0206$, $P_2^2 = 5.9506$ and $P_3^2 = 19.8735$).

On the basis of primary values of the synthetic development measure, the provinces in Poland were ranked according to their regional development in the years 2006–2018 and the received ranking places are presented in the Table 4.

Table 4. Ranking	positions with	regard to regiona	l development ir	Poland in the	vears 2006-2018.
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Province	Ranking Position In The Year				
Tiovince	2006	2010	2014	2018	
Dolnośląskie	5	5	4	5	
Kujawsko-pomorskie	8	12	11	9	
Lubelskie	15	15	15	15	
Lubuskie	3	4	5	8	
Łódzkie	7	10	14	13	
Małopolskie	4	3	3	3	
Mazowieckie	2	1	1	1	
Opolskie	11	13	12	12	
Podkarpackie	12	6	6	6	
Podlaskie	9	9	8	11	
Pomorskie	1	2	2	2	
Śląskie	6	8	7	4	
Świętokrzyskie	16	16	16	16	
Warmińsko-Mazurskie	13	14	13	14	
Wielkopolskie	10	7	9	7	
Zachodniopomorskie	14	11	10	10	

Source: own elaboration based on CSO [56].

The information contained in Table 4 indicates a clear stabilisation of high-ranking positions during the examined period. The leader of regional development is usually Mazowieckie province, followed closely by Pomorskie province, and Małopolskie province usually takes the third place. Last places are generally taken by the same regions. Świętokrzyskie province is rated lowest of all the provinces in Poland (Lubelskie province is rated slightly higher). This situation may indicate an increase or at least strengthening of the disproportions between the most and least developed regions in Poland. The most significant changes in the ranking position (range) concerned Łódzkie province (drop by seven positions), and to a slightly lesser extent, Podkarpackie province (leap by six positions).

5. Conclusions

The results of the conducted analyses allowed us to rank the provinces of Poland in terms of regional development in the years 2006–2018 and assessment of the similarity of the results over time. The fact that taxonomic methods may be successfully used in regional analyses is not without significance for this study. However, one should have in mind that each case has to be considered individually, as there is no single, generally applicable and universal research method; therefore, in order to select an appropriate method, the substantive and methodological knowledge of the phenomenon or socio-economic process consideration is necessary. The decision must be reasonable

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and well thought-out and taken individually by each researcher seeking guidance in extensive specialist literature. The main problem of a comprehensive analysis of regional development is its quantification, i.e., a quantitative approach to a phenomenon determined in a descriptive manner. As a result of a different set of diagnostic variables adopted, one may obtain completely different final results of multidimensional analyses even using the same test methodology. For that reason, it is particularly important that diagnostic variables are selected on a strictly substantive basis, and, additionally, based on statistical criteria. However, one must not rely only on indications of formal methods. Moreover, it is worth noting that the results of different studies on the same subject may be directly compared not only if the same list of diagnostic variables is used, but also if the same aggregation formula is adopted. In the context of diagnostic variables adopted, it is additionally worth mentioning a growing perspective of regional development which derives from the processes of urban regeneration, often dependent also on private capital [57]. Although the frames for these activities were defined within public-private partnership, it seems that there are still barriers significantly limiting them in Poland [58,59]. Despite the limitations recognised today (mainly related to the unavailability or limited availability of statistical data or still unrevealed potential of some development factors), regional development in Poland and related changes may be measured and assessed over time, as exemplified by the presented results of empirical research.

The presented considerations and research results allow for more accurate diagnosis of regional development and identification of its changes in recent years in Poland. In this study, some problems have been highlighted and may contribute to scientific discussions. The multidimensionality of the described issues makes it difficult to expect clear solutions, therefore, the research in this area should be continued. Correction or expansion of the list of indicators adopted may contribute to the further development of tools that allow for the diagnosis of the reality in the best and legible way, and at the same time, may enable us to improve the decision-making process. Using the appropriate indicators should affect monitoring of the implemented socio-economic policy, and the description and assessment of spatial diversity on the regional development map. This approach may be useful for central and local government authorities in preparing development strategies, as well as in obtaining and allocating funds, subsequently improving the development of individual regions.

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