Regional Development in Poland

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Abstract:

Purpose: The multidimensionality of regional development allows its issues to be viewed from various perspectives. The article aims to quantify the research area named in the title and to classify the voivodeships in Poland; that is, to segment the studied regions into subsets where development similarity is preserved.

Design/Methodology/Approach: For this research, which showcases the current level of regional development in Poland, Ward's hierarchical agglomeration method was employed. As the EU regional policy primarily hinges on the NUTS 2 level, this study equates a region in Poland with each of its sixteen voivodeships.

Findings: The intricacies and vagueness of measuring regional development present challenges in its identification. The need for a theoretical description and actual measurement of the contemplated process of continuous socio-economic transformation in the regions, the limited availability of complete satistical data and non-uniform criteria for evaluating the improvement of the existing state necessitate the individual selection of a specific set of tools. Quantifying the research area and employing the right classification method allowed for segmenting the voivodeships in Poland into groups of similar development, effectively presenting a statistical snapshot of this multifaceted phenomenon.

Practical Implications: Taxonomic methods can are effective for regional development studies. The outlined theoretical considerations and analysis results enhance the understanding of the economic category in the title, offer insights into Poland's current state,, and can guide socio-economic decisions and future development strategy planning.

Originality/Value: The article highlights that the different levels of generalization, dynamic or spatial approaches, as well as the plurality of regional changes, mean that, taking into account the specific factors of regional development, it is examined from a variety of aspects. However, descriptions are attainable, and multivariate statistical analysis techniques prove beneficial for empirical studies.

Keywords: Regional development, quantification, multivariate statistical analysis.

JEL codes: O18, C19, R59.

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1. Introduction

Regional development has been frequently endeavored to be defined in the source literature, but a unanimous definition remains elusive. This term, often perceived as a cognitive shortcut, is intrinsically interpreted and intuitively understood. Regardless of its inherent ambiguity, it frequently serves as a multifaceted descriptor in both theory and practice due to a broad consensus on its meaning.

A consistent aspect in endeavors to clarify this term is the socio-economic enhancement of certain factors (Brol, 2006, p. 16). M. Markowska actually identifies regional development with socio-economic development taking place in the region improving its potential (Markowska, 2002, p. 20). T. Kudłacz believes that visible shifts in economic potential, structure, environment, infrastructure, spatial organization, or the residents' living standards permit equating regional development with a sustained improvement in living standards and regional economic potential (Kudłacz, 1999, p. 15).

S. Korenik posits that regional development predominantly operates as an economic process (Korenik, 2004, p. 108). A. Ziomek describes it as an intricate procedure of continuous adaptation of the complete socio-economic structure to environmental prerequisites.

Considering the aforementioned viewpoints, literary analyses, and personal reflections, regional development can be perceived as a multifaceted economic category. At the basic regional level it typically delves into the continuous socio-economic evolution in designated zones, spanning distinct regions, with the intention of ameliorating the prevailing state based on selected criteria (Klóska, 2015, p. 19).

The multifaceted nature of regional development leads to a vast spectrum of criteria understanding. Transformations in regions arise from diverse conditions, encompassing myriad sectors and phenomena. This necessitates the recognition of an array of factors and the imperative to discern pivotal ones. The absence of a universal factor classification, thereby lacking a unanimous agreement on evaluation criteria, further accentuates regional development's intricacy and indeterminacy.

2. Factors of Regional Development

Regional development signifies continuous modifications perceived as socio-economic metamorphoses in the regional expanse. This results from the interplay of multifarious factors. These elements vary in nature and influence and are frequently analyzed to pinpoint regional development determinants. In this study's perspective, not every development factor is determinant, but every determinant is a factor — so pivotal that it can be regarded as a key factor.

In the economic literature, there is no such classification of development factors that is universal and recognized by most researchers (Flejterski, 2003, p. 80). Attempts to identify and determine the relationship between endogenous and exogenous factors lead to the search for "locomotives", "vehicles", "flywheels" or "growth poles" stimulating development, due to which some researchers pay special attention to internal factors, while others emphasize the role of macro- and megaeconomic conditions (Flejterski, Jaźwiński, and Klóska, 2010, p. 80).

D. Rynio draws attention to the proportional relationship between the size and quality of endogenous resources and the socio-economic development of a territorial unit (Rynio, 2010, p. 61-69; Brol, 2006, p. 16-17) also attributes the main driving force in regional development to endogenous factors, which include:

- in the area of demographic resources: structure of the population by age and level of education, living conditions, professional qualifications and skills of residents, degree of social integration and social activity in the activities of local governments and social organizations,
- in the sphere of the regional ecosystem: components and resources of the natural environment, the state of pollution and devastation of the natural environment, and ecological awareness of the inhabitants,
- in the field of infrastructure: its technical condition and development potential, infrastructural investments, and the size of the regional budget,
- covering the space of the region: spatial accessibility, physiographic conditions, relief and value of space as well as the effectiveness of regional marketing,
- in the regional economy: the economic base of the region, entrepreneurship and competitiveness, and the ability to innovate - revealing and developing new techniques and technologies, as well as the scale and structure of the regional market.

The role of exogenous factors in regional development should also be emphasized. Since they reflect changes in the macro-environment, they serve as a positive or negative impulse for individual areas of regional development. These factors contribute to the development and innovative transformation of endogenous factors, create new resources and institutions related to the location of new devices, technologies, and jobs in the region. These often positively influence the dynamics of development, structural transformations and social changes (Brol, 2006, p. 17).

In addition to the aforementioned division of factors into endogenous and exogenous, factors are often categorized in specific dimensions of regional development in the literature (Korenik, 2011, p. 78-79; Markowska, 2002, p. 25; Głuszczuk, 2011, p. 75). These dimensions can include spatial, economic, social, technical, technological, ecological, or political aspects. However, it's important to note that attributing significance to these classified conditions varies, and therefore approaches to this problem differ.

Not every factor influences observed changes equally; some factors have a positive impact while others act as barriers to development. The hierarchy of considered factors depends on the individual characteristics of the region, its resources, the current direction of changes, established priorities, and the strategy being implemented. Each region should highlight its uniqueness, define its operational profile, and to achieve its developmental goals, identify its determinants, understand their intrinsic value, and then utilize them effectively.

3. Data and Methods

The multidimensionality of regional development, as previously pointed out, and the intuitive understanding of the concept, making its generally formulated identifiers need to be made more specific. A significant challenge, made more complex by the limited availability of statistical data, is the selection of specific characteristics that allow the quantification of the research area. In regional research of this type, certain simplifications and generalizations are made.

Consequently, using the same list of diagnostic variables for all regions implies that each analyzed region possesses the same development specificity, regardless of varying conditions. As with most researchers, a substantive selection, in the strictest sense, was considered to be superior. The source literature encompasses various indicators of socio-economic changes in regions.

They range from a few to several dozen, with common ones being gross domestic product per capita, unemployment rate, employment structure, and research and development expenditure (Strahl, 2005, p. 18; Sobczak, 2006, p. 126-132; Pawełs, 2010, p. 674-675; Diang, de Vries, Han, 2014, p. 134; Xinjian, Junhai, 2011, p. 902-905). As a result of the applied approach, a set of ten diagnostic variables of regional development in Poland in 2021 was finally adopted (Table 1).

Table 1. *Regional development indicators in Poland in 2021*

Indicator symbol	**Dimension** / indicator of regional developmen
I. Economic dimension	
X_1	Gross domestic product per capita [PLN/capita]
X_2	Percentage of the unemployed with higher education [%]
X_3	Total internal R&D expenditures in relation to GDP [%]
X_4	Number of newly registered entities of the national economy in the private sector per 1,000 people of working age [per 1,000 people of working age]
X_5	Master's degree graduates per 1,000 people of working age [per 1,000 people of working age]

II. Social dimension	
X₆	Average monthly disposable household income [PLN/person]
X₇	Physicians working by primary place of work per 10,000 population [person/10 thousand people]
X₈	Population per bed in hospitals [person/bed]
X₉	Beneficiaries of community social assistance per 10,000 population [person/10 thousand people]
X₁₀	Natural increase per 1000 population [per 1000 population]

Source: *Own study based on data from the Central Statistical Office (www.strateg.stat.gov.pl; 20.07.2023).*

Cluster analysis of voivodeships in Poland in 2021 in terms of regional development characterized by the variables listed in Tab. 1, was conducted using Ward's agglomeration method, deemed the most effective (Miligan, 1996, p. 358). The study employed the traditional approach, namely the square of the Euclidean distance (Ward, 1963, p. 236-244) Diagnostic variables underwent normalization by standardization. In an attempt to verify the obtained grouping results, a one-way analysis of variance (ANOVA) was utilized. This technique determines which of the diagnostic variables significantly influenced the differentiation of groups. Tthe significance level was assumed, as most researchers commonly do, at 0.05.
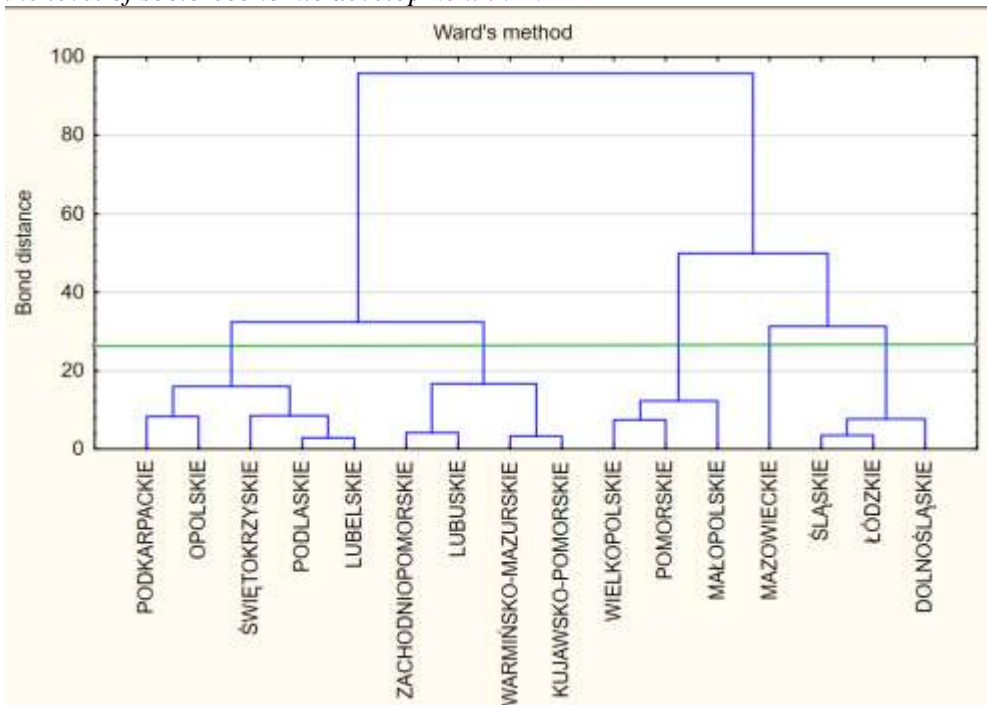
4. Results

To classify the voivodeships in Poland based on socio-economic development in 2021, the Ward method with the square of the Euclidean distance was applied to the ten variables X1-X10, all normalized using the standardization method (cf. Fig. 1).

Upon analyzing the dendrogram in Fig. 1, multiple division variants were considered. Given the lack of a universally accepted rule for halting the agglomeration process, the logical approach was to truncate the dendrogram's longest branches. This led to the distinction of five groups of voivodeships through cluster analysis:

I – Podkarpackie, Opolskie, Świętokrzyskie, Podlaskie and Lubelskie,
II - Zachodniopomorskie, Lubuskie, Warmińsko-mazurskie, and Kuyavian-Pomeranian,
III - Wielkopolskie, Pomorskie, and Małopolskie,
IV – Mazowieckie,
V – Śląskie, Łódzkie, and Dolnośląskie.

The subsequent one-way analysis of variance (ANOVA, see Table 2) confirmed the significant impact of all ten diagnostic variables (with a p-value of 0.045391) when segregated into five clusters, reinforcing the appropriatness of this decision.

Figure 1. *The results of the classification of the voivodships in Poland according to the level of socio-economic development in 2021*

Table 2. *Results of grouping voivodships in Poland in terms of regional development in 2021*

	ANOVA p < 0,05000							
Zmienna	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
X1	3,343936E+09	4	835984035	211956102	11	19268737	43,38551	0,000001
X2	6,586783E+01	4	16	25	11	2	7,33876	0,003929
X3	2,962528E+00	4	1	2	11	0	3,47856	0,045391
X4	3,599128E+01	4	9	20	11	2	4,90841	0,016188
X5	3,184307E+01	4	8	19	11	2	4,65836	0,019144
X6	4,429580E+05	4	110740	124349	11	11304	9,79610	0,001254
X7	3,031632E+02	4	76	221	11	20	3,77263	0,036166
X8	8,156654E+03	4	2039	2663	11	242	8,42224	0,002307
X9	1,013955E+05	4	25349	70950	11	6450	3,93005	0,032135
X10	4,233984E+01	4	11	12	11	1	9,91535	0,001193

Note: The columns of Table 2 show the symbol of the variable, the values of the sums of squares, the number of degrees of freedom and the mean sums of squares for effect and error, respectively, as well as the value of the F-test and the corresponding probability level p (Stanisz, 2007, p. 271-306).

The mean feature values within the revealed that the fourth group is the most advanced, which is expected since it comprises solely the capital voivodship – typically the leader in such rankgings. The fifth and third groups follow closely, while the first and second groups are comparatively less developed. Nonetheless, within each group, there is a notable similarity in the socio-economic development of the included regions.

5. Conclusions

Socio-economic shifts in the region are influenced, which was emphasized, by a plethora of factors. A recurrent topic of discussion is the identification of determinants of the development of a specific space, pinpointing the primary causative forces at play. The meticulous selection of diagnostic variables remains a paramount methodological concern for researchers and poses a significant challenge.

The final roster of regional development indicators often strikes a balance between substantive considerations and available data. A notable constraint of public statistics is the delay in data availability; the most recent data currently accessible pertain to the end of 2021, resulting in several-month time lag. In spite of these challenges, the methodological deliberations culminated in the utilization of measures that adeptly categorized the voivodeships in Poland based on regional development.

The insights shared in this study, coupled with the findings from the research, sucessfully met the study's objectives. Five groups of regions were distinguished in which similarity is maintained (regions belonging to the same cluster are similar to each other in terms of regional development), and all variables included in the study had a statistically significant impact on the obtained classification results.

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