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AN ANALYSIS OF THE INSTITUTIONAL DEVELOPMENT OF POLISH VOIVODESHIPS BETWEEN 2010 AND 2014 IN THE CONTEXT OF IMPLEMENTING THE CONCEPT OF SUSTAINABLE DEVELOPMENT

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OCENA POZIOMU ROZWOJU INSTYTUCJONALNEGO WOJEWÓDZTW POLSKI W LATACH 2010–2014 W KONTEKŚCIE REALIZACJI KONCEPCJI ZRÓWNOWAŻONEGO ROZWOJU

STRESZCZENIE. Celem badania była ocena zróżnicowania rozwoju instytucjonalnego województw Polski w latach 2010–2014 w kontekście realizacji koncepcji zrównoważonego rozwoju. Do analizy badanego zjawiska oraz uporządkowania regionów pod względem poziomu rozwoju instytucjonalnego zastosowano syntetyczny miernik rozwoju oparty na wspólnym wzorcu i antywzorcu wyznaczony metodą TOPSIS. Zbadano także wpływ doboru wektora wag na końcowy wynik analizy. W opracowaniu wykorzystano dane Banku Danych Lokalnych GUS.

SŁOWA KLUCZOWE: zrównoważony rozwój, rozwój instytucjonalny, wielowymiarowa analiza porównawcza, wektor wag, wspólny wzorzec rozwoju, TOPSIS

Introduction

As defined in the Report of the World Commission on Environment and Development in 1987, 'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'¹. The vision of growth embraced by this definition assumes the improvement in the quality of life for people worldwide while protecting and respecting global natural resources. This aim can only be achieved through integrated activities within the key areas which in the literature dealing with this subject are termed social, economic, environmental, institutional and political order². Analyses of the level of sustainable development for the regions of Poland in the context of these key areas have been the subject of many studies and qualitative surveys³.

This paper presents a multi-dimensional comparative analysis of the development of Polish voivodeships in the context of good governance based on the rankings of voivodeships for 2010–2014 as determined by the TOPSIS method with the common development pattern. Additionally, the influence of the selection of a weight vector on the final result was studied. The research was based on data from the Central Statistical Office of Poland (GUS).

¹ Report of the World Commission on Environment and Development: Our Common Future, (Brundtland Report), 1987, <http://www.un-documents.net/wced-ocf.htm> [21/06/2016].

² M. Burchard-Dziubińska, *Idea zrównoważonego rozwoju*, in: M. Burchard-Dziubińska, A. Rzeńca, D. Drzazga (eds.), *Zrównoważony rozwój – naturalny wybór*, Łódź 2014, pp. 9–34; T. Borys, *Wybrane problemy metodologii pomiaru nowego paradygmatu rozwoju – polskie doświadczenia*, „Optimum. Studia Ekonomiczne” 2014 No. 3(69), pp. 3–21; T. Borys, *Wskaźniki zrównoważonego rozwoju*, Białystok 2005; *Wskaźniki zrównoważonego rozwoju Polski*, Katowice 2011.

³ E. Roszkowska, E.I. Misiewicz, R. Karwowska, *Analiza poziomu zrównoważonego rozwoju województw Polski w 2010*, „Ekonomia i Środowisko” 2014 No. 2(49); B. Bal-Domańska, J. Wilk, *Gospodarcze aspekty zrównoważonego rozwoju województw – wielowymiarowa analiza porównawcza*, „Przegląd Statystyczny” 2011 LVIII, b. 3–4; B. Kryk, *Wybrane instytucjonalno-administracyjne uwarunkowania jakości życia w województwie zachodniopomorskim*, „Optimum. Studia Ekonomiczne” 2015 No. 3(75); E. Roszkowska, M. Filipowicz-Chomko, *Analiza wskaźnikowa różnicowania rozwoju społecznego województw Polski w latach 2005–2013 w kontekście realizacji koncepcji zrównoważonego rozwoju*, „Ekonomia i Środowisko” 2016 No. 1(56); E. Kusideł, *Zbieżność poziomu rozwoju województw Polski w kontekście kształtowania ładu instytucjonalnego*, „Optimum. Studia Ekonomiczne” 2014 No. 3(69).

Research methodology

The level of the sustainable development of voivodeships is a complex economic phenomenon⁴. Because of the analysed problem, rankings of regions are designed using a multidimensional comparative analysis, in which two approaches are used to create a synthetic measure of development, i.e. not based on a pattern, and based on a pattern of development⁵. In this study the level of the institutional development of Polish voivodeships in 2010–2014 was analysed using the TOPSIS method with a common pattern and anti-pattern of development.

At the first stage of the multidimensional comparative analysis diagnostic criteria were chosen in line with the relevant statistics and subject of the study. The substantive stage consisted in choosing features that 'in the light of the knowledge relevant to the analysed subject are the most important for the comparative analysis of the tested elements'⁶, with indicators grouped to those whose greater values prove a better position of the region in terms of the investigated problem (stimulants) and those for which a lower value is required (destimulants). In terms of statistics, criteria were selected by eliminating those with a low diagnostic value, i.e. characterised by a low level of variability and a high degree of correlation⁷.

In the next stage a synthetic measure of the institutional development was designed based on the TOPSIS method, which included the following steps⁸:

1. Construction of an evaluation matrix:

$$X = [x_{ikt}], \quad (1)$$

where:

x_{ikt} – is the value of k -indicator ($k = 1, 2, \dots, m$) for i -voivodeship ($i = 1, 2, \dots, 16$) in t -year ($t = 2010, \dots, 2014$).

⁴ T. Borys, *Zrównoważony rozwój – jak rozpoznać ład zintegrowany*, „Problemy Ekoro-zwoju – Problems of Sustainable Development” 2011 Vol. 6, No. 2, pp. 75–81.

⁵ A. Młodak, *Analiza taksonomiczna w statystyce regionalnej*, Warszawa 2006.

⁶ T. Panek, *Statystyczne metody wielowymiarowej analizy porównawczej*, Warszawa 2009, p. 17.

⁷ A. Młodak, op. cit.

⁸ C.L. Hwang, K. Yoon, *Multiple Attribute Decision Making: Methods and Applications*, New York 1981; B. Bal-Domańska, J. Wilk, op. cit.; E. Roszkowska, M. Filipowicz-Chomko, *Ocena rozwoju społecznego województw Polski w latach 2005–2013 w kontekście realizacji koncepcji zrównoważonego rozwoju z wykorzystaniem metody TOP-SIS*, „Ekonomia i Środowisko” 2016 No. 2(57).

2. Normalization of the values of the indicators in order to achieve their comparability:

- for stimulants:
$$\tilde{z}_{ikt} = \frac{x_{ikt} - \min_i \{x_{ikt}\}}{\max_i \{x_{ikt}\} - \min_i \{x_{ikt}\}} \quad (2)$$
- for destimulants:
$$\tilde{z}_{ikt} = \frac{\max_i \{x_{ikt}\} - x_{ikt}}{\max_i \{x_{ikt}\} - \min_i \{x_{ikt}\}},$$

where:

i – is the number of the voivodeship ($i = 1, 2, \dots, n = 16$); k – is the number of the indicator ($k = 1, 2, \dots, m$); t – year ($t = 2010, \dots, 2014$).

$\max_i \{x_{ikt}\}$ – maximum value of k -indicator in years 2010–2014;

$\min_i \{x_{ikt}\}$ – minimum value of k -indicator in years 2010–2014.

3. The weight factors are calculated for indicators, where:

$$\sum_{k=1}^m w_k = 1. \quad (3)$$

In order to constructing a syntetic measure of development the weighting schemes calculated in three statistical procedures were used. Their usefulness and impact on the result of the analysis were discussed⁹.

W1 System: equal weights were adopted for all variables¹⁰, i.e.

$$w_k = \frac{1}{m} \quad (4)$$

where:

k – number of indicator ($k = 1, 2, \dots, m$).

W2 System: weights were calculated based on the coefficients of variation:

$$w_k = \frac{\sum_{t=2010}^{2014} |w_{kt}|}{5} \quad (5)$$

where:

$$w_{kt} = \frac{|v_{kt}|}{\sum_{k=1}^m |v_{kt}|}, \quad (6)$$

⁹ F. Wysocki, *Metody taksonomiczne w rozpoznawaniu typów ekonomicznych rolnictwa i obszarów wiejskich*, Poznań 2010.

¹⁰ T. Grabiński, S. Wydymus, A. Zeliaś, *Metody taksonomii numerycznej w modelowaniu zjawisk społeczno-gospodarczych*, Warszawa 1989.

v_{kt} – coefficient of variation for the indicator ($k = 1, 2, \dots, m$) in a year $t = 2010, \dots, 2014$.

W3 System: weights were calculated based on the correlation coefficients:

$$w_k = \frac{\sum_{t=2010}^{2014} |w_{kt}|}{5}, \quad (7)$$

where:

$$w_{kt} = \frac{\sum_{i=1}^m |r_{ikt}|}{\sum_{i=1}^m \sum_{k=1}^m |r_{ikt}|}, \quad (8)$$

r_{ikt} – elements of the correlation matrix R for individual variables ($k = 1, 2, \dots, m$) in a year $t = 2010, \dots, 2014$.

A higher weighting factor corresponds to the indicator whose values have an average or higher coefficient of variation (case W2) or the indicator whose values are more strongly correlated with the values of other indicators (case W3).

4. Calculation of the Euclidean distance of every voivodeship the pattern (z_{kt}^+) and anti-pattern (z_{kt}^-) of development taking into account the weight vector according to the formulas:

$$d_{it}^+ = \sqrt{\sum_{k=1}^m (w_k z_{ikt} - w_k z_{kt}^+)^2}, \quad d_{it}^- = \sqrt{\sum_{k=1}^m (w_k z_{ikt} - w_k z_{kt}^-)^2} \quad (9)$$

where: $z_{kt}^+ = (1, 1, \dots, 1)$ – development pattern, $z_{kt}^- = (0, 0, \dots, 0)$ – development anti-pattern, $i = 1, 2, \dots, n = 16$; $k = 1, 2, \dots, m$; $t = 2010, \dots, 2014$.

5. Determination of synthetic measure for i -th voivodeship and t -th year:

$$q_{it} = \frac{d_{it}^-}{d_{it}^- + d_{it}^+}, \quad (10)$$

where: $i = 1, 2, \dots, n = 16$; $t = 2010, \dots, 2014$.

It should be noted that $0 \leq q_{it} \leq 1$. Higher values of the q_{it} measure indicate a higher position of i -voivodeship in the ranking.

6. Linear ordering of voivodeships in terms of the value of the synthetic measure of the institutional development, with consideration of different approaches to the determination of weighting factors.

Analysis of the results describing the level of institutional development carried out in terms of the time-space. The values of the synthetic measure were calculated, and rankings of voivodeships for 2010–2014 were created considering three statistical procedures for the construction of weighting factors. We analysed the impact of adopted weights on the values of synthetic measures and rankings. The progress of voivodeships towards 2014 against 2010.

Selection of diagnostic indicators for the analysis of the institutional development of Polish voivodeships

To carry out the analysis of the institutional development of Polish voivodeships in 2010–2014 8 indicators¹¹ were preselected. The indicators were proposed by the Central Statistical Office and included in the subject area: *Good governance*, in two domains: *Openness and participation* (3 variables) and *Economic instruments* (5 variables)¹². The initial list of diagnostic indicators divided into areas and taking into account the nature of the variable included:

1. Domain: *Openness and participation*

Z1: Foundations, associations and social organizations per 10 thous. population (S);

Z2: Structure of councilors in the legislative organs of local government units (female) [%] (S);

Z3: Structure of councilors in the legislative organs of local government units (people with tertiary education) [%] (S);

Variables Z1-Z3 characterizing the domain *Openness and participation* indicate the importance of non-governmental organizations and the accessibility of various social groups to public functions. The activity of non-governmental organizations has a huge impact on social, cultural and environmental policies, and is an important factor in shaping reliance and creating bonds in the community. Good governance is aimed at creating equal opportunities for men and women for their participation in local government units, and the increased involvement of citizens with tertiary education whose experience

¹¹ The study did not consider *Voting turnout*.

¹² Local Data Bank, www.wskaznikizrp.stat.gov.pl [10/05/2016].

and specialist knowledge can be helpful in making decisions on economic and social issues.

2. Domain: *Economic instruments*

Z4: Fees of the environment and other revenues on the funds for environmental protection and water management per capita [PLN] (D);

Z5: Revenue to gminas budgets from service charges in division 756 per capita [PLN] (D);

Z6: European Union funds to finance programs and EU projects collected by local governments per capita [PLN] (S);

Z7: Expenditure on handling public debt of local governments at all levels to 1000 PLN local governments budget revenue [PLN] (D);

Z8: Investment expenditures of self-governement units in percentage of their total expenditure [%] (S).

The second group of indicators of good governance in domain: *Economic instruments* includes variables Z4-Z8. According to the patterns of sustainable development, environmental protection and the adjustment of the burden to it is an important aspect, while socio-economic development should lead to improved quality of life. Revenues from environmental taxes concerning the emissions of gases and dust into the air, sewage into the ground and water bodies, water extraction (from tax-payers' own intake), and waste disposal are among the instruments supporting sustainable development and are fully allocated to environmental protection. EU funds and expenditure on investments are of key importance in reducing regional differences in socio-economic development. An important task of the local government units is to earmark funds for projects that are most needed by citizens.

In the next step, diagnostic indicators were verified for their variability and correlation. Coefficients of variation for diagnostic indicators in the analysed years are presented in Figure 1.

None of the Z1-Z8 indicators was rejected because of their high variation. Coefficients of variation lower than 10% were obtained only for the indicator Z1 in 2010 (9.96%), Z3 in 2014 (9.66%) and Z8 in 2010 (8.08%). The lowest variation between voivodeships in the analysed period was recorded for *Foundations, associations and social organizations per 10 thous. population* (Z1), and the highest for *Revenue to gminas budgets from service charges in division 756 per capita*. The most significant difference was observed in 2014, when the highest value of the Z5 indicator for Dolnośląskie voivodeship was 36-fold greater than the smallest value recorded that year, for Mazowieckie. These voivodeships were also characterised by large variation in terms *Euro-*

pean Union funds to finance programs and EU projects collected by local governments per capita (Z6). The largest change was found for 2011. For Małopolskie voivodeship the value of the Z6 indicator was over 5-fold greater than that for Łódzkie voivodeship. An increasing disproportion between voivodeships in terms of most indicators is a negative trend. The analysis revealed a declining disproportion between voivodeships in the studied years only for variables Z2 and Z3.

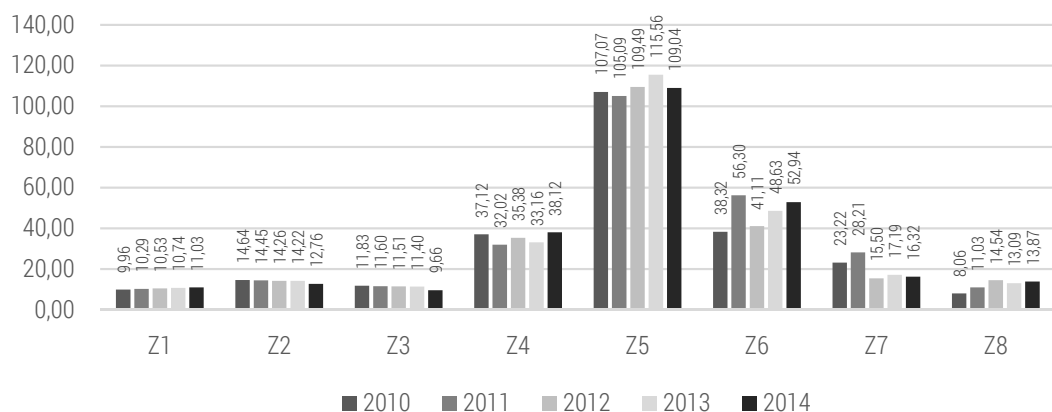


Figure 1. Coefficients of variation for diagnostic indicators [%]

Source: authors' own analysis based on data from GUS.

The correlation between selected indicators was analysed using the inverted correlation matrix¹³. Further analysis included all indicators due to the low values of diagonal elements of the inverted correlation matrix for the analysed years.

¹³ A. Młodak, op. cit.

Analysis of differentiation of the level of institutional development of Polish voivodeships in 2010–2014

After substantive and statistical verification the synthetic measure of development was designed using 8 indicators (Z1-Z8). Weights of variables obtained using three weighting systems are presented in Table 1.

Table 1. Weights of variables depending on different weighting systems

Weighting system	Variables							
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8
System W1	0,125	0,125	0,125	0,125	0,125	0,125	0,125	0,125
System W2	0,040	0,054	0,043	0,136	0,421	0,182	0,077	0,047
System W3	0,119	0,151	0,116	0,132	0,102	0,101	0,146	0,133

W1 – equal weights (formula 4), W2 – weighting system based on the coefficient of variation (formulas 5–6), W3 – weighting system based on the correlation coefficient (formulas 7–8).

Source: authors' own analysis based on data from GUS.

The values of the weighting factors obtained using the coefficient of variation (system W2) are characterized by great differentiation. The weighting system W3 based on the correlation coefficient is comparable to the W1 system. In the W2 approach variable Z5 was the most important for the design of the synthetic measure, while as many as five variables (Z1, Z2, Z3, Z7, Z8) had a marginal role. Such a weighting system seems to be inappropriate. The substantive analysis of the importance of indicators suggested that further analysis should either employ the weighting system based on the correlation between variables, or that equal weights should be adopted. A further part of the study compares rankings obtained based on each approach, which will allow for a more detailed assessment of the effect of a statistical procedure for the choice of weights on the final ranking.

At the next stage of analysis indicators were normalized in accordance with formula (2). Using the system of weights and normalized values of indicators the synthetic measures were calculated and regions were linear ordered depending on these measures. The values of the synthetic measure of the institutional development of the voivodeships determined by the TOPSIS method and ranks of voivodeships in 2010–2014 depending on different weighting procedures are presented in Table 2.

Table 2 Values of the synthetic measure of institutional development of Polish voivodeships and rankings of voivodeships for 2010–2014 determined using the TOPSIS method and different weighting systems

Voivodeships	Synthetic measure TOPSIS (position) (System W1)					Synthetic measure TOPSIS (position) (System W2)					Synthetic measure TOPSIS (position) (System W3)				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Dolnośląskie	0,563(13)	0,499(13)	0,529(6)	0,557(7)	0,549(13)	0,320(16)	0,217(16)	0,353(16)	0,290(16)	0,229(16)	0,608(7)	0,544(6)	0,548(4)	0,588(6)	0,597(8)
Kujawsko-pomorskie	0,606(5)	0,531(10)	0,526(7)	0,574(6)	0,611(4)	0,841(1)	0,740(5)	0,783(2)	0,832(1)	0,821(1)	0,601(8)	0,528(12)	0,504(8)	0,556(8)	0,606(7)
Lubelskie	0,532(14)	0,484(14)	0,442(14)	0,496(14)	0,551(12)	0,757(6)	0,703(8)	0,682(12)	0,700(11)	0,692(10)	0,536(14)	0,486(14)	0,434(15)	0,499(15)	0,568(13)
Lubuskie	0,676(2)	0,566(5)	0,535(5)	0,584(3)	0,655(2)	0,786(4)	0,790(2)	0,786(1)	0,778(2)	0,766(2)	0,691(2)	0,534(9)	0,509(7)	0,573(6)	0,661(2)
Łódzkie	0,492(16)	0,390(16)	0,373(16)	0,436(16)	0,419(16)	0,523(15)	0,424(15)	0,456(15)	0,348(15)	0,322(15)	0,529(16)	0,421(16)	0,393(16)	0,478(16)	0,453(16)
Małopolskie	0,526(15)	0,581(3)	0,492(9)	0,517(13)	0,584(9)	0,701(11)	0,809(1)	0,755(3)	0,740(3)	0,761(3)	0,534(15)	0,554(5)	0,465(11)	0,507(13)	0,576(11)
Mazowieckie	0,597(7)	0,519(12)	0,514(8)	0,554(8)	0,593(6)	0,743(7)	0,691(10)	0,690(9)	0,703(10)	0,701(8)	0,610(6)	0,519(13)	0,511(6)	0,558(7)	0,609(5)
Opolskie	0,625(4)	0,532(9)	0,485(10)	0,543(9)	0,567(10)	0,729(8)	0,657(11)	0,666(13)	0,682(12)	0,667(11)	0,638(4)	0,534(10)	0,478(10)	0,550(9)	0,577(10)
Podkarpackie	0,579(9)	0,560(6)	0,478(13)	0,531(10)	0,589(7)	0,793(3)	0,769(3)	0,722(6)	0,718(6)	0,743(4)	0,563(13)	0,531(11)	0,451(13)	0,515(12)	0,572(12)
Podlaskie	0,576(11)	0,528(11)	0,484(12)	0,524(11)	0,562(11)	0,771(5)	0,719(6)	0,711(7)	0,718(7)	0,709(6)	0,584(12)	0,537(8)	0,482(9)	0,530(10)	0,580(9)
Pomorskie	0,602(6)	0,578(4)	0,555(3)	0,579(4)	0,603(5)	0,709(10)	0,696(9)	0,698(8)	0,724(5)	0,707(7)	0,628(5)	0,598(3)	0,561(3)	0,598(4)	0,624(4)
Śląskie	0,572(12)	0,550(7)	0,546(4)	0,576(5)	0,585(8)	0,728(9)	0,714(7)	0,737(5)	0,708(8)	0,696(9)	0,585(11)	0,560(4)	0,546(5)	0,595(3)	0,606(6)
Świętokrzyskie	0,585(8)	0,462(15)	0,438(15)	0,488(15)	0,483(15)	0,634(14)	0,447(14)	0,547(14)	0,530(14)	0,466(14)	0,591(9)	0,477(15)	0,437(14)	0,500(14)	0,505(15)
Warmińsko-mazurskie	0,717(1)	0,639(1)	0,597(1)	0,633(1)	0,676(1)	0,825(2)	0,753(4)	0,747(4)	0,739(4)	0,734(5)	0,737(1)	0,656(1)	0,602(1)	0,652(1)	0,706(1)
Wielkopolskie	0,577(10)	0,534(8)	0,485(11)	0,519(12)	0,507(14)	0,682(12)	0,643(12)	0,688(10)	0,643(13)	0,592(13)	0,588(10)	0,537(7)	0,465(12)	0,520(11)	0,517(14)
Zachodniopomorskie	0,629(3)	0,593(2)	0,583(2)	0,622(2)	0,615(3)	0,657(13)	0,639(13)	0,683(11)	0,704(9)	0,655(12)	0,666(3)	0,614(2)	0,589(2)	0,629(2)	0,639(3)

Source: authors' own analysis based on data from GUS, www.wskaznikizrp.stat.gov.pl [10-05-2016].

Data in Table 2 show that there is no voivodeship that in 2010–2014 would consistently improve its situation in terms of institutional development. In the case of weighting system W1 and limit years, the analysis of the synthetic measure of development shows that in 2014 the value increased slightly compared to 2010 for 6 voivodeships: Kujawsko-Pomorskie, Lubelskie, Małopolskie, Podkarpackie, Pomorskie and Śląskie. For all these voivodeships positive changes in their ranking positions were also observed. In these voivodeships the level of sustainable development also improved slightly. The ranking of voivodeships created using the TOPSIS method and equal weights shows that in all the analyzed years Warmińsko-Mazurskie voivodeship was a strong leader in good governance. The second and third positions were taken by Zachodniopomorskie and Lubuskie voivodeships, respectively. The last in the ranking is Łódzkie voivodeship, holding its position for the whole analysed period. The scatter for the synthetic measure of development determined for equal weights of indicators, as well as the number of voivodeships per category in 2010–2014 is presented in Figure 2.

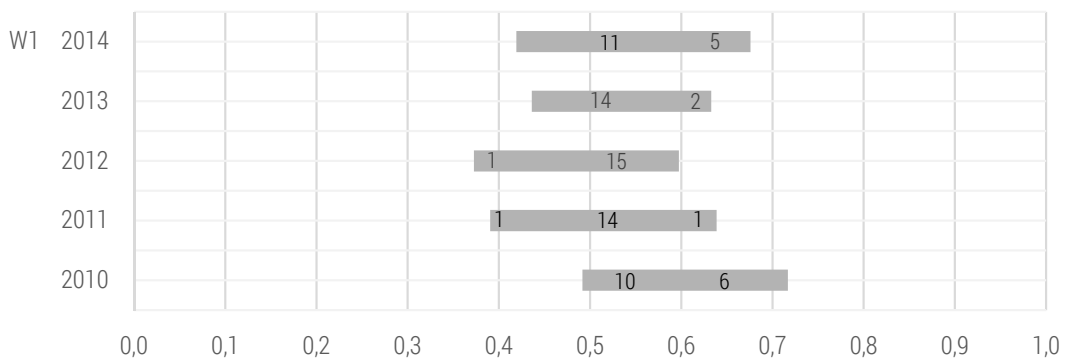


Figure 2. Dispersion of values q_{it} and number of voivodeships per category in 2010–2014 for the weighting system W1

Source: authors' own analysis based on Table 2.

The analysis focused on the increment in q_{it} showed that none of the voivodeships achieved clear progress in sustainable development.

The analysis of the synthetic measure of development and rankings of voivodeships obtained using the TOPSIS method and weighting system based on the coefficients of variation (weighting system W2) shows substantial differences both in the values of the synthetic measure and rankings of voivodeships with respect to results obtained for the system of equal weights. In this case the leader in the ranking of institutional development was Kujawsko-Pomorskie voivodeship, followed by Lubuskie and Warmińsko-Mazurskie

voivodeships. The ranking was closed in all years between 2010 and 2014 by Dolnośląskie voivodeship, slightly outdistanced (15th position) by Łódzkie voivodeship. Also in this case there was no voivodeship that would consistently improve its situation between 2010 and 2014. Comparing 2014 and 2010, the value of the synthetic measure of development increased only for Małopolskie voivodeship. The most significant increase in the position was also found for Małopolskie, as it moved from position 11 to 3. Dispersion of values q_{it} and number of voivodeships per category in 2010–2014 for the weighting system W2 is presented in Figure 3.

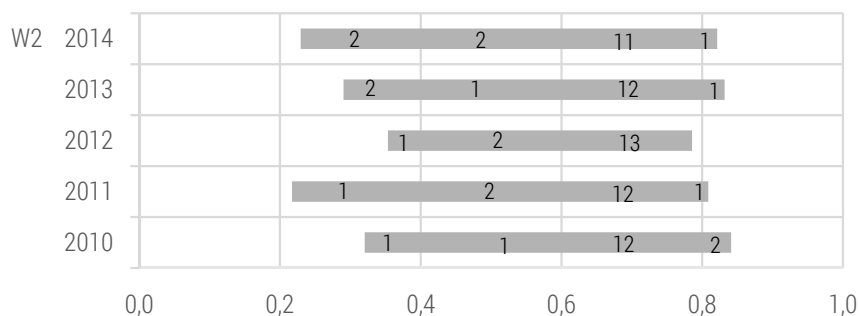


Figure 3. Dispersion of values q_{it} and number of voivodeships per category in 2010–2014 for the weighting system W2

Source: authors' own analysis based on Table 2.

The analysis of data from Table 2 shows that results obtained using the TOPSIS method and weighting system W3 are comparable to those obtained when equal weights were adopted. This is also confirmed by the ranking of voivodeships. In this case, as with the system of equal weights, the leading position in 2010–2014 in terms of good governance was taken by Warmińsko-Mazurskie voivodeship, and the last position by Łódzkie voivodeship. The second and third positions were held by Zachodniopomorskie voivodeship and Pomorskie, respectively. The comparison of 2010 versus 2014 shows that the value of q_{it} increased slightly for 5 voivodeships: Kujawsko-Pomorskie, Lubelskie, Małopolskie, Podkarpackie, and Śląskie. For all these voivodeships positive changes in their positions in the ranking were also observed. The level of good governance in the context of sustainable development improved slightly in these voivodeships. The scatter for the synthetic measure of development determined based on the weighting system incorporating correlation coefficients as well as the number of voivodeships per individual category in 2010–2014 is presented in Figure 4.

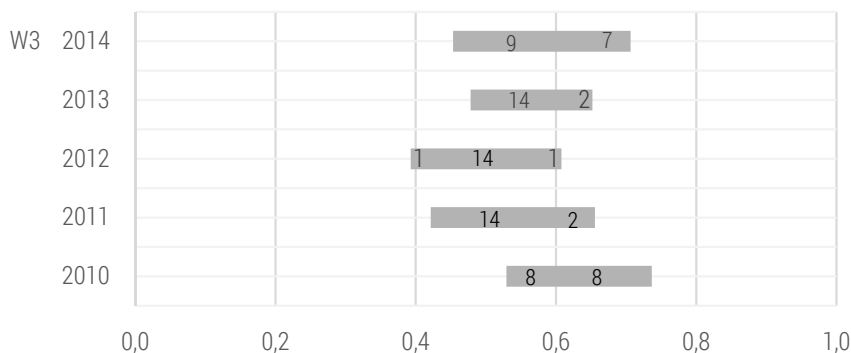


Figure 4. Dispersion of values q_{it} for voivodeships and number of voivodeships per category in 2010–2014 for the weighting system W3

Source: authors' own analysis based on Table 2.

Distance of voivodeships from the development pattern and anti-pattern in 2010 and 2014 determined by the TOPSIS method and different weighting systems are presented in Figures 5 and 6.

Figures 5 and 6 illustrate the scale of discrepancies of obtained rankings in the analysed years¹⁴. Rankings obtained using the weighting systems W1 and W3 are comparable but significantly different from the ranking obtained with the weighting system W2. A significant decrease in the value of the indicator (as compared to other rankings) was observed for Dolnośląskie, Łódzkie and Świętokrzyskie voivodeships. The obtained ranking was strongly influenced by the diagnostic variable Z5, i.e. a weighting factor assigned to this variable, its nature (destimulant) and outliers for these three voivodeships. The compatibility of rankings of voivodeships prepared using the TOPSIS method for 2010–2014 and the adopted weights W1–W3 were compared using Pearson's correlation coefficient (Table 3). For the weighting system W2 there was the largest differentiation of voivodeships in terms of good governance in the study period. For example, in 2010 the measure of development determined using the TOPSIS method was in the range of [0.492; 0.717] for the W1 system, [0.320; 0.841] for the W2 system, and [0.529; 0.737] for the W3 system.

¹⁴ Data in Table 2 show similar relationships between the values of the synthetic measure and different weighting systems for other analysed years.

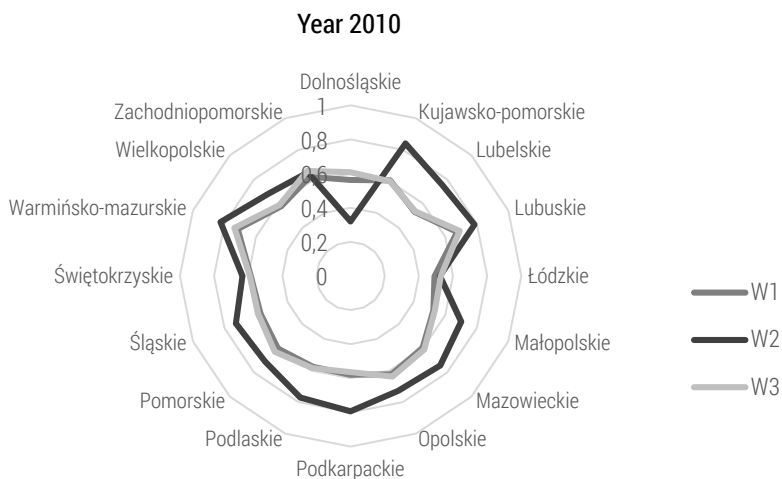


Figure 5. Distance of voivodeships from development pattern and anti-pattern in 2010 determined by the TOPSIS method and different weighting systems.

Source: authors' own analysis based on data from Table 2.



Figure 6. Distance of voivodeships from development pattern and anti-pattern in 2014 determined using the TOPSIS method and different weighting systems.

Source: authors' own analysis based on data from Table 2.

Tabela 3 Values of Pearson's correlation coefficient determined for q_{it} depending on the adopted weights W1-W3 for voivodeships in 2010–2014

Pearson's correlation coefficient	Years				
	2010	2011	2012	2013	2014
W1-W2	0,450	0,630	0,420	0,497	0,707
W2-W3	0,233	0,375	0,222	0,246	0,542
W3-W1	0,962	0,932	0,966	0,947	0,966

Source: authors' own analysis based on Table 2.

The values of Pearson's correlation coefficient confirm previous observations that the ranking obtained using equal weights, and the weights taking into account the correlation coefficients, are very similar, but different from the ranking obtained using the system of weights W2.

Conclusions

Comparative analysis of the level of good governance in the context of the sustainable development of Polish voivodeships covered the timeframe 2010 to 2014. Based on data from the Central Statistical Office 8 variables defining the level of good governance were used to construct a synthetic measure of development determined with the TOPSIS method. The study indicated persistent disproportions in the level of the institutional development of voivodeships in 2010–2014. In addition, slow progress and diversified trends were observed regarding changes in the development of voivodeships and their good governance. None of the voivodeships in 2010–2014 steadily and significantly improved its situation in the context of institutional development. Changes were not radical, but considering the fact that sustainable development is a long-term process aimed at improving sustainability and quality of life, it is important to determine whether there has been progress or regression. It is worth noting that in 2014 compared to 2010 the vast majority of voivodeships made significant progress in the domain *Openness and participation*, but a significant regression was found for most of the voivodeships in the domain *Economic instruments*. The leading position of Warmińsko-Mazurskie voivodeship in the implementation of good governance and sustainable development patterns was strongly determined by the low value of the Z4 variable and high values of the Z1 and Z2 variables. The study demonstrated that slight overall progress in both domains of good governance was observed in five voivodeships: Kujawsko-Pomorskie, Lubelskie,

Małopolskie, Podkarpackie and Śląskie. Their position reflects a pursuit to introduce sustainable patterns of governance. However, the situation in other voivodeships is alarming, because in the analysed period of 2010–2014 they showed an overall regression in the overall level of good governance.

The study was also focused on the impact of a particular weighting system on the final ranking of voivodeships. Three weighting systems based on different statistical procedures were considered. The analysis demonstrated that the choice of a weighting system should be strongly focused on the substantive correctness of the obtained results. In this study the adoption of the weighting system based on the coefficient of variation caused an overestimation of the importance of destimulant Z5, which significantly affected the final ranking.

Authors' contributions to this article

prof. Ewa Roszkowska, PhD – devised the study concept, carried out the study and processed data

Marzena Filipowicz-Chomko, PhD – gathered data, carried out the study, and processed data; the study has been conducted under project No. S/WI/1/2014 and financed from the science fund of MNiSW

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