A PROPOSAL OF VERIFICATION OF THE INDICATOR METHOD FOR EVALUATION OF SUSTAINABLE DEVELOPMENT

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A b s t r a c t

Sustainable development should be viewed in the context of environmental, social and economic order. The objective of the present study has been to evaluate to what extent the development occurring in the Province of Warmia and Mazury is sustainable in terms of the environment, society and economy, and to suggest some improvements to the evaluation method applied so far. The theoretical, empirical and competence research was conducted in 2006–2010. The empirical part of the research was performed in 2008–2009, based on the data of 2007 obtained from the Regional Data Bank. Applying the comparative indicator method, 70 indicators were developed of opposite preference orientation. It has been suggested that the area covered by forests, waters, etc., i.e. the land where people cannot be settled, should be omitted from calculations of the population density indicator. Furthermore, the forest cover indicator in the present study was used without making a distinction between private and public woodlands. The author's analysis of the social and economic order has demonstrated that the local society is poor, which entails low comfort of living and underfinanced health care and education. The evaluation of environmental order has yielded more positive results.

PROPOZYCJA WERYFIKACJI WSKAŹNIKOWEJ METODY OCENY ZRÓWNOWAŻONEGO ROZWOJU

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Abstrakt

Rozwój zrównoważony należy rozpatrywać, uwzględniając: ład środowiskowy, społeczny i gospodarczy. Celem badań było określenie stopnia zrównoważenia rozwoju w aspektach środowiskowym, społecznym i gospodarczym województwa warmińsko-mazurskiego oraz propozycja wprowadzenia poprawek w stosowanej dotychczas metodzie. Badania teoretyczne i kompetencyjne prowadzono w latach 2006–2010, empiryczne w latach 2008–2009 na podstawie danych z 2007 r., zebranych z zasobów Banku Danych Regionalnych (BDR). Wskaźnikową metodą porównawczą opracowano 70 wskaźników o różnych kierunkach preferencji. W badaniach zastosowano klasyfikację dziedzinową wskaźników. Zaproponowano, aby w obliczaniu wskaźnika gęstości zaludnienia pomijać przestrzenie, na których nie można osiedlić ludzi, np. wód i lasów. Ponadto w badaniach zastosowano wskaźnik dotyczący lesistości województwa bez podziału na lasy prywatne i publiczne.

Introduction

Sustainable development discussed in the literature (*Wskaźniki ekorozwoju* 1999, *Wskaźniki zrównoważonego rozwoju* 2005), in practice should be evaluated on different levels, including the regional one (*Zrównoważony rozwój regionów uprzemysłowionych* 2009), which means that it should be included into regional and local planning. Sustainable development is not a measurable goal to attain, but is a time dynamic phenomenon. It should take many years or even generations to proceed. Sustainable development needs to be monitored and objectively evaluated. The evaluation can be aided by adequately selected indicators. When working out the indicator method for monitoring the attainment of sustainable development goals, it is essential to answer the question what sustainable development actually means in the sense of constructing indicators and what indicators can be applied to monitor its progress on the regional level. The selected regional measures, theoretically adjusted to describe the environmental, social and economic order, will enable us to develop a model of sustainable development for the whole province. For some of the indicators, it is difficult to determine the preference orientation, e.g. the share of privately-owned forests in the total woodland cover (a stimulant or destimulant?). Some problems arise when dealing with issues which pertain to more than one order. Some indicators can appear in evaluation of two orders and may have opposite preference orientation, e.g. number of passenger cars per 1000 residents. With respect to the environmental order, this is a destimulant, but in the social and economic order – this indicator acts as a stimulant. The elaborated model may serve to evaluate the status of the examined orders and to assess the progress of sustainable development in the future. Thus, it is suggested to apply indices rather than indicators in order to examine this development in time.

The purpose of this study has been to determine the degree of sustainability of development in the Province of Warmia and Mazury in the context of environmental, social and economic order, and to propose some improvements in the method applied so far.

The current indicator method for evaluation of the sustainability of development in regions

Back in the mid-1990s, the Polish Ministry for the Environment (then the Ministry for Protection of Natural Resources and Forestry) initiated the establishment of a team of researchers from scientific centres in Warsaw, Wrocław and Jelenia Góra to work on sustainable development indicators. Once the researchers became acquainted with analogous research in the world and in Poland, they presented the results of their investigations in the book *Wskaźniki ekorozwoju* (Indicators of Eco-development), published in 1999 (Borys 1999). Another book, which came out in 2005 under the title *Wskaźniki zrównoważonego rozwoju* (Indicators of Sustainable Development), was written to popularize the results of previous studies, including the following levels of management: local, regional and countrywide (Borys 2005, pp. 9–13). The book contained a presentation of the indicator method with a comprehensive commentary on the subject. A few hundred indicators were suggested, grouped according to different criteria (*Wskaźniki zrównoważonego rozwoju* 2005, pp. 62–321). Such measures need to be created and improved mainly because it is necessary to monitor the implementation of various planning and strategic documents.

The selection of environmental indicators was guided by the principle of causality, which states that every human activity produces some effect on the environment and can be a cause of positive and negative changes. These indicators are associated with groups of goals as specified in the Ecological Policy of the Polish State. They show the current status, major sources of problems and neutralization or alleviation of effects of man-made pressure. In the social context, the indicators were predominantly concerned with demography, poverty, health, education and culture, that is the level of living. Their selection, analogously to economic indicators, was subjected to the strategic and operational aims.

For each of the indicators, the so-called indicating value was computed, which showed the percentage by which the indicator was better or worse than the average for comparable provinces in Poland (Rogala 2005, pp. 237–246). This evaluation took into consideration the uniform preference, hence the higher the evaluation indicator, the better the status of the analyzed unit, with the average value for the other units being 100%. The study took advantage of the zero unitarization method to refer 'unitarized' indicators to the means by

employing the following formulas (BORYS, ROGALA 2004, pp. 601–608, ROGALA 2005, pp. 237–246):

– for stimulants

$$O_P = [(W_i - W_{\min.})/(W_{\max} - W_{\min.})] \times 100\%;$$

– for destimulants

$$O_R = [(W_{\max} - W_i)/(W_{\max} - W_{\min.})] \times 100\%;$$

– for the mean of a stimulant

$$O_{P-\text{mean}} = [(W_{\text{mean}} - W_{\min.})/(W_{\max} - W_{\min.})] \times 100\%;$$

– for the mean of a destimulant

$$O_{R-\text{mean}} = [(W_{\max} - W_{\text{mean}})/(W_{\max} - W_{\min.})] \times 100\%;$$

where:

O_P or O_R – point valuation of indicator W for the province,

$O_{P-\text{mean}}$ or $O_{R-\text{mean}}$ – point valuation of the average of indicators for a comparable group of units (provinces); this value depends on the distribution of the level of an indicator:

W_i – level of the indicator of the evaluated unit,

$W_{\min.}$ – minimum level of the indicator for a given sample,

$W_{\max}$ – maximum level of the indicator for a given sample,

W_{mean} – mean of the indicator for a given sample.

– The calculated indicators were referred to the average level in a comparable group of units, according to the formula:

$$[(OP/OP\text{-mean}) \times 100\%] - 100\% \text{ or } [(OR/OR\text{-mean}) \times 100\%] - 100\%$$

Evaluation of the degree of sustainability of the development of the Province of Warmia and Mazury in the environmental, social and economic context

The Province of Warmia and Mazury is one of the 16 provinces distinguished in Poland by the latest administration reform, which took place at the end of the 20th century. On 1 January 1999, by virtue of law (Ustawa z dnia 24 lipca 1998 roku o wprowadzeniu zasadniczego trójstopniowego podziału terytorialnego państwa, DzU nr 96, poz. 603), a new, three-tier division of the territory of Poland was introduced, in which – above communes with local governments, there are districts and provinces with local governments as well as 'state government' provinces. The Province of Warmia and Mazury incorporated the whole Province of Olsztyn (as existed in 1975–1998), half of the Provinces of Suwałki and Elbląg) and single communes from the provinces of

Toruń, Ciechanów and Ostrołęka. To a large extent, the current boundaries of the Province of Warmia and Mazury coincide with the borders of former East Prussia except in the north (ŁAGUNA, WITKOWSKA-DĄBROWSKA 2008, pp. 92–102).

The area of the Province of Warmia and Mazury is 24 203 km², which corresponds to 7.7% of the territory of Poland and makes it the fourth largest province in our country. The province has a highly varied landscape relief and is characterized by diverse natural resources, with a large percentage of inland surface waters (over 6% of the area). The forest cover equals 30% and is close to the country's average. Over 54% of the total area belongs to farmland. The population of the province in 1.4 million. The population density is the lowest in Poland, i.e. 59 persons per 1 km² (Cf. ŁAGUNA, WITKOWSKA-DĄBROWSKA 2008, pp. 92–102; WITKOWSKA-DĄBROWSKA 2009, pp. 61–71; WITKOWSKA--DĄBROWSKA, BĄCZKOWSKI 2010, pp. 258–268). The population is ethnically varied and relatively young: 23.2% are people in the pre-working age,

Table 1

Orders and domains as well as the number of indicators chosen for the present study on the sustainable development of the Province of Warmia and Mazury

Orders					
Environmental		social		economic	
Domains	number of indicators	domains	number of indicators	domains	number of indicators
Environment and landscape protection	6	demography	3	consumption of raw materials and production of industrial waste	5
Forest protection and sustainable development	4	education and development	6	employment	5
Wastewater and sewage management	5	poverty and social exclusion	5	investment outlays	2
Water management	5	level and quality of life	6	entrepreneurship	4
In total	20	lifestyle and public health	5	agriculture	3
x	x	in total	25	availability of goods and services	6
x	x	x	x	in total	25
In total	70				

Source: the author, based on *Wskaźniki zrównoważonego rozwoju*. 2005. s. 62–321.

13.3% are in the post-working age and 63.5% are people in the working age. The province is among one of the least polluted in Poland. The major branches of industry are food processing and furniture making. The tourism industry and fisheries are developing well owing to the favourable natural conditions. The REGON system in 2007 had 113 058 registered business enterprises, i.e. 0.08 per capita (WITKOWSKA-DĄBROWSKA, BĄCZKOWSKI 2010, pp. 258–268).

For the present study on the sustainable development of the Province of Warmia and Mazury, the author chose these indicators which can be calculated from the statistical data available from the Regional Data Bank (the RDB). The domain classification of indicators was applied, with which it is possible to construct the so-called pyramids of indicators. Within each order, several domains were distinguished. In total, 70 indicators of different preference orientation (stimulants and destimulants), grouped in three order: environmental, social and economic ones, were chosen (Tab. 1).

Table 2 contains collected data for particular domains in 2007, which was the last year included in the study. Particular indicators have been discussed in detail in the authors' earlier publications. However, the indicators suggested previously have undergone some modifications and transfer as well as adjustment to different domains during the study. As a result, the domain structure shown in Table 2 has been achieved.

Among the several examined domains, just one, namely agriculture, scored a higher value than the average from other comparable provinces in Poland during the whole analyzed period. The high score was mainly attributable to a high level of purchased agricultural produce per 1 ha of arable land and an increase in the use of fertilizers per 1 ha of arable land. The assessed value for the use of raw resources and materials was lower than the average for the other provinces (but gradually approximating it) and ranged within 90.85–00.11%, mainly due to the poorly developing infrastructure in the environmental protection sector (gas pipelines, sewerages, wastewater treatment plants). The general value attained for the domain employment was similar. The fact that it was below the country's average was mainly due to the demographic load indicator. In the domain goods and services availability, the value kept increasing in the analyzed years but it never exceeded 59% of the country's average. The low degree of availability of sewerages and gas pipelines in the province was a lasting obstacle.

The lowest values versus the country's average were obtained by the Province of Warmia and Mazury in the domains entrepreneurship and investment outlays. In the former domain, the province scored the lowest in the whole country due to the low participation of the private sector business entities and the number of the REGON registered business per 10 000 people. The value scored in comparison to the country was very low during the whole analyzed period.

Table 2

Evaluation of the sustainability of the Province of Warmia and Mazury versus the country's average in 2007

Orders					
Environmental		social		economic	
Domains	indicator %	domains	indicator %	domains	indicator %
Environment and landscape protection	99.48	demography	108.21	consumption of resources and industrial waste generation	96.53
Forest protection and sustainable development	379.50	education and development	46.37	employment	105.14
Wastewater and sewage management	46.18	poverty and social exclusion	21.18	investment outlays	22.10
Water management	54.13	level and quality of life	61.07	entrepreneurship	61.02
Sustainability of development	144.82	lifestyle and public health	78.82	agriculture	112.85
		sustainability of development	63.13	availability of goods and services	58.77
				sustainability of development	77.30

Source: the author, based on data from the RDB in 2007.

The general value of the sustainability of the economic development fell below the country's average, compared to the other provinces in Poland, and varied from 72.18 to 78.88% in the analyzed years. The dynamics of changes in the analyzed years, however, confirms some increase of the general value of economic sustainability. Similar results were yielded by the author's analysis of the sustainable development in the social and environmental context. Among the social order indicators, very few scored below the country's average for comparable provinces. These were the indicators which belonged to the domain demography and the indicator showing the number of housing units built per 1000 residents. The indicator which informs us about the number of pupils per 1 teacher in primary schools reached the value equal to the average for the compared provinces. The remaining indicators were below the average values. The lowest values were scored by the indicators from the domains poverty and social exclusion and public health, especially the sums allocated to health care and the number of residents per 1 physician.

The social order was characterized by low mean values in as many as four domains out of the five ones submitted to analysis. Demography was the exception in that it scored above the country's average. As the study demon-

strates, the Province of Warmia and Mazury is a region inhabited by a poor population, as a result of which the level of living is low and the health care or education are underfinanced. This conclusion is confirmed by such findings as a low number of college and university students per 10,000 people, i.e. 421.70 versus the average of 474.2 for the other provinces, as well as a high number of people per 1 physician, i.e. 617 versus the country's average of 514.

The evaluation of the environmental order was more favourable, although no more than two domains, water management as well as wastewater and sewage management scored above the average. Forest protection and sustainable development reached a high score owing to the forest regeneration and afforestation projects carried out in the province, as well as the forest cover above 30%.

Many of the problems encountered in the province are persistent. These include low employment activity of residents or a high long-term unemployment rate. The province used to have a large share (compared to other regions in Poland) of arable land managed by the State Farms, which – when liquidated – caused a drastic increase in the number of unemployed people. Further, the level of education among the population of our province is lower than the country's average. Individuals with primary and incomplete primary education make up 39% of the total population of the province (Poland's average is 33%). Just 8% of the province's residents hold higher education diplomas (Poland's average is 10%). As a result, finding employment is much more difficult. Consequently, the problem of poverty and social exclusion is growing. The high share of agriculture in the economic structure of the province as well as the specific natural conditions favour the development of organic farming, tourism and agri-tourism. Obviously, a short tourist season is a barrier. What is needed here is more investment in the tourist industry facilities, as well as monitoring the demands and preferences of incoming and potential tourists. Among the economic factors that could stimulate the province's development are large areas left for possible investment. Their development, however, often collides with the priorities of nature conservation (BARTKIEWICZ et al. 2010, pp. 9–116).

Suggested changes in the method for evaluation of sustainable development

The present study relied on the domain classification of indicators. This approach enabled the author to construct the so-called pyramids of indicators, because within each order several domains had been distinguished. A similar domain classification is used by the RDB. Thus, using their data was feasible.

However, not all the RDB's indicators adequately decipher the sustainable development, e.g. population density, which is calculated based on the total area (Tab. 3).

Table 3

Suggested changes in sustainable development indicators

Orders	Currently used indicators	Indicators proposed for evauation of sustainable development of the Province of Warmia and Mazury
Environmental	share of area of private forests in total area of forests [%]	forest cover [%]
Social	population density (number of people per 1 km^2)	population density (number of people per 1 km^2 of land excluding forests and surface waters)
Economic	number of cars per 1000 residents	number of cars manufactured after the year per 1000 residents

Source: the author, based on the studies carried out in 2006–2010, Province of Warmia and Mazury.

It is rather difficult to expect high population density rates in areas with a high share of surface waters and forests, i.e. the land where people cannot be settled. In the Province of Warmia and Mazury, the population density is on average 59 persons per 1 km^2. It is therefore suggested to exclude the land covered by forest or surface water from calculations of a population density rate, as the respective rate for Warmia and Mazury would then reach 92 persons per km^2. However, additional calculations would be needed then, because the official statistics do not contain such data. In turn, for some of the indicators it is difficult to state a preferences orientation. This is an important issue because different formulas are applied to calculations concerning stimulants than their opposites, e.g. the share of privately-owned forests to total forests – is it a stimulant or destimulant? Both types of ownership rights – private and public – are governed by the same forest management regulations, therefore the forestry production output in similar in both types of woodlands. In this study, the author used the indicator expressing the total forest cover in the Province of Warmia and Mazury.

Another problem appears where two orders overlap. Some of the indicators can be assigned to two orders and, to make matters more complicated, they can have opposite preferences orientation, e.g. number of passenger cars per 1000 residents. For the environmental order, this is a destimulant, but for the social and economic orders, this factor acts as a stimulant. Possessing a car is no

longer a determinant of the social status. Some other attributes, such as the car make and year of production should be considered.

Beside changing some of the indicators, it is also suggested to apply indices rather than indicators in the future because when discussing development we more often think about a dynamic process, changing in time, and not a static phenomenon.

Summary

The Province of Warmia and Mazury is not a uniform area due to some differences in the history of two regions: Warmia and Mazury, which make up most of the province's territory. Despite such differences, the Province of Warmia and Mazury appears as a very distinct part of Poland. The present study on the social order in this part of Poland has demonstrated that the local communities are poor, which entails a low level of living and underfinanced health care and education. The evaluation of the environmental order yielded better results. The region is characterized by good quality of the environment, which is extremely important for maintaining high natural assets in the whole province, including various forms of nature conservation. The general evaluation of the sustainability of the economic development generated results below the country's average.

During this investigation, the author has suggested several changes in the selection of indicators, e.g. forest cover, number of passenger cars per 1,000 residents or the way of calculating population density. Further, the concept of using indices rather than indicators should allow us to examine sustainable development as a time-dependent process.

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References

BARTKIEWICZ P., KRAJEWSKA A., MAGDA I., NAZARCZUK J.M., PELLE D. 2010. *Warmia i Mazury 2020. Jaka droga do rozwoju*. Instytut Badań Strukturalnych, Warszawa–Olsztyn, pp. 9–116.

BORYS T., ROGALA P. 2004. *Moduł wskaźnikowy w audytach zrównoważonego rozwoju*. In: *Taksonomia – klasyfikacja i analiza danych – teoria i zastosowania*. Eds. I. Jajuga, M. Walesiak. Wyd. Akademii Ekonomicznej we Wrocławiu, 11: 601–608.

BORYS T. 2005. *Wstęp – wartość pytań retorycznych. Wskaźniki zrównoważonego rozwoju*. Wyd. Ekonomia i Środowisko. Białystok, pp. 9–13.

ŁAGUNA T.M., WITKOWSKA-DĄBROWSKA M. 2008. *Równoważenie rozwoju w regionie nieuprze-mysłowionym (uprzemysłowionym inaczej)*. In: *Zrównoważony rozwój regionów uprze-mysłowionych*. Ed. E. Lorek. Wyd. AE w Katowicach, pp. 92–102.

Rogala P. 2005. *Moduł wskaźnikowy w lokalnym audycie zrównoważonego rozwoju*. In: *Wskaźniki zrównoważonego rozwoju*. Red. T. Borys. Wyd. Ekonomia i Środowisko. Warszawa – Białystok, pp. 237–246.

Witkowska-Dąbrowska M. 2009. *Evaluation of environmental order in Warmia and Mazury voivodship*. Olsztyn Economic Journal, 4(1): 61–71.

Witkowska-Dąbrowska M., Bączkowski T. 2010. *Indicators of Warmińsko-Mazurskie voivodship sustainable development in the economic aspect*. Olsztyn Economic Journal, 5(2): 258–268.

Wskaźniki zrównoważonego rozwoju. 2005. Red. T. Borys. Wyd. Ekonomia i Środowisko. Warszawa–Białystok, pp. 62–321.