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## SUSTAINABLE DEVELOPMENT OF INVESTMENT-ATTRACTIVE OF WARMINSKO-MAZURSKIE PROVINCE

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**ABSTRACT:** The objective of this paper is to demonstrate the relationships between the level of potential investment attractiveness of municipalities and their development proceeding in a sustainable manner. The study involved municipalities located in Warmińsko-Mazurskie province. In order to determine the level of their potential investment attractiveness, Z. Hellwig's method of development pattern was employed, while in order to develop a synthetic index of development based on the index of sustainable development, the absolute measure of development was applied. The obtained results enabled a conclusion to be drawn that the most investment-attractive municipalities are those developing in a sustainable manner.

**KEY WORDS:** potential investment attractiveness, sustainable development, Warmińsko-Mazurskie province

## Introduction

Each region is characterised by a certain level of territorial attractiveness understood as the region's ability to attract new entities i.e. investors, tourists, and inhabitants. The level of this attractiveness is determined by how well a particular region is endowed with economic, social, and environmental values. One of the elements of territorial attractiveness is investment attractiveness understood as the ability to persuade investors to locate investments within a particular area. As regards investment attractiveness, both real and potential investment attractiveness is distinguished. Real investment attractiveness is "a region's ability to satisfy an investor, and to induce absorption of financial and physical capital in the form of investments. It may be measured by assessing the effectiveness of incurred financial, physical, human, and natural capital expenditures" (Godlewska-Majkowska). Potential investment attractiveness is "a set of regional location advantages that contribute to the achievement of an investor's objectives" (Godlewska-Majkowska). According to the methodology of the Institute of Enterprise at the Warsaw School of Economics, an index of potential investment attractiveness for municipalities (PAI1) is calculated based on five so-called microclimates: labour resources, social infrastructure, technical infrastructure, market, and administration (Godlewska-Majkowska). This study investigates the level of potential investment attractiveness, which may be considered equivalent to the potential present in a region.

As already mentioned, investment attractiveness is one of the elements of territorial attractiveness of a particular area. The elements, which determine the level of investment attractiveness, are a combination of a variety of values. These values may be equated with particular orders distinguished within the framework of sustainable development: economic values – economic order; social values – social order; and environmental values – environmental order.

The objective of this paper is to demonstrate the relationships between the level of potential investment attractiveness of municipalities and their development proceeding in a sustainable manner.

## Subject of the study

The study involved municipalities of Warmińsko-Mazurskie province, which account for 14% of all *gminas* (both urban and rural) of the province. The municipality with the highest population density is the municipality of Ełk, while the one with the lowest population density is the municipality of

Lubawa. The municipality with the largest area and population is the municipality of Olsztyn, while the municipality with the smallest area and population is the municipality of Górowo Iławeckie (table 1).

Table 1. Characteristics of the municipalities under study

Municipality	area [ha]	population [people]	population density [people per km <sup>2</sup> ]
Braniewo	1 241	17 161	1430
Działdowo	1 147	21 402	1946
Iława	2 188	33 174	1508
Lubawa	1 684	10 083	593
Nowe Miasto Lubawskie	1 137	11 101	1009
Ostróda	1 415	33 517	2394
Elbląg	7 982	121 642	1521
Elk	2 105	60 462	2879
Giżycko	1 372	29 726	2123
Bartoszyce	1 179	24 196	2200
Górowo Iławeckie	332	4 140	1380
Kętrzyn	1 035	27 732	2773
Lidzbark Warmiński	1 435	16 200	1157
Mrągowo	1 481	22 005	1467
Szczytno	1 062	23 992	2181
Olsztyn	8 833	173 444	1971

Source: author's own work based on (Bank of Local Data, 2015).

The average area of the municipalities under study is 2227 ha, the population is 39374 people, and the population density is 1783 people per km<sup>2</sup>. The areas of only two municipalities (Olsztyn and Elbląg) exceed the average area. The smallest municipality (Górowo Iławeckie) occupies an area accounting for only 15% of the largest municipality's area.

## Materials and research methods

In order to determine the level of potential investment attractiveness of municipalities of Warmińsko-Mazurskie province, indices were distinguished for particular microclimates determining its level, and then divided into

stimulants and depressants. The indices whose higher values indicate a higher level of development should be considered as stimulants, while the indices whose lower value indicates a higher level of development should be considered as depressants (Sławińska, 2014, p. 117). For the five microclimates, namely labour resources, technical infrastructure, social infrastructure, market, and administration, a total of 39 indices were distinguished, of which 32 are stimulants, and 7 are depressants (table 2).

**Table 2.** Indices of potential investment attractiveness of municipalities

Microclimate	Index	S/D
Labour resources microclimate	number of persons employed per 1000 people	S
	percentage of persons employed in the working age population	S
	nett migration rate per 1000 people	S
	nett international migration rate per 1000 people	S
	expenditures from the municipality budget on schooling and education per person	S
	expenditures from the municipality budget on culture and national heritage protection per person	S
	percentage of the working age population in the total population	S
	percentage of the registered unemployed in the working age population	D
	non-working age population per 100 people of working age	D
	retirement age population per 100 people of pre-working age	D
Technical infrastructure microclimate	retirement age population per 100 people of working age	D
	surface area of roads' proportion in the municipality area	S
	surface area of railways' proportion in the municipality area	S
	percentage of people using water supply network in the total population	S
	percentage of people using the sewerage network	S
	percentage of people using the gas supply network in the total population	S
	water supply distribution network per 100 km <sup>2</sup>	S
	sewerage distribution network per 100 km <sup>2</sup>	S
	gas supply distribution network per 100 km <sup>2</sup>	S
	expenditures from the municipality budget for transport and communication per person	S

Microclimate	Index	S/D
Social infrastructure microclimate	average floor space of 1 flat	S
	average floor space of a flat per person	S
	number of flats per 1000 inhabitants	S
	expenditures from the municipality budget on schooling and education per person	S
	expenditures from the municipality budget on culture and national heritage protection per person	S
	expenditures from the municipality budget on health care per person	S
	percentage of primary schools equipped with computers with Internet access for schoolchildren	S
	libraries' book collection per 1000 people	S
	children aged 3-5 years old per one place in an institution of pre-school education	D
	population per 1 library	D
Market microclimate	population density	S
	own income – share in taxes constituting the income of the State budget, personal income tax	S
	own income – share in taxes constituting the income of the State budget, corporate income tax per one employed person	S
	percentage of the area of special economic zones in the municipality area	S
Administration microclimate	percentage of the area of legally protected areas in the municipality area	D
	share of own income in the total income of the municipality budget	S
	percentage of the area included in the area development plan in the municipality area	S
	European Union funds for financing EU programmes and projects per person	S
	funds for co-financing own tasks, acquired from other sources, per inhabitant	S

Source: author's own work based on (Nowicki, 2014; Godlewska-Majkowska, 2009; Godlewska-Majkowska, 2010).

In order to develop a synthetic index of the level of potential investment attractiveness of municipalities of Warmińsko-Mazurskie province, Z. Hellwig's method of development pattern was employed. The first step to developing a synthetic index of the level of potential investment attractiveness of municipalities of Warmińsko-Mazurskie province was to generate an observation matrix. The next steps were as follows (Stec, 2011, p. 232-251):

1. standardisation of the characteristics' values  $x_j$ , according to the following formula:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{S_j},$$

where:

$z_{ij}$  – standardised values

$x_{ij}$  – output value of the characteristic

$\bar{x}_j$  – arithmetic mean of the characteristic

$S_j$  – standard deviation of the characteristic

2. determination of maximum values (for stimulants) and minimum values (for depressants) of the analysed characteristics:

$z_{oj} = \max_i z_{ij}$ , for the variables, which are stimulants

$z_{oj} = \min_i z_{ij}$ , for the variables, which are depressants

3. calculation of Euclidean distances  $D_{io}$ :

$$D_{io} = \sqrt{\sum_{j=1}^m (z_{ij} - z_{oj})^2}$$

4. calculation of the arithmetic mean ( $\bar{D}_o$ ) and standard deviation ( $S_o$ ) for the sequence of values  $D_{io}$
5. calculation of the value  $\bar{D}_o = \bar{D}_o + 2S_o$
6. determination of the value of the measure of development

$$d_i = 1 - \frac{D_{io}}{\bar{D}_o}$$

The values obtained by Z. Hellwig's method fall within the range of [0–1], with the values closer to 1 indicating a higher level of development, and the values closer to 0 indicating a lower level of development (Pomianek, Chrzanowska, Bórawski, 2013, p. 442-456).

**Table 3.** Indices of sustainable development of municipalities

Order	Index
Environmental order	forest ratio
	percentage of naturally restocked and afforested areas in the total area of forests
	total water consumption in households per 1 inhabitant
	percentage of people using water supply network in the municipality population
	percentage of people using the sewerage network in the municipality population
	percentage of people using sewage treatment plants in the municipality population
	water supply network per 100 km <sup>2</sup>
	sewerage network per 100 km <sup>2</sup>
	gas supply network per 100 km <sup>2</sup>
	economic operators per 1000 inhabitants of working age
Economic order	own income of the municipality budget per 1 inhabitant
	expenditures from the municipality budget per 1 inhabitant
	proportion of investment expenditures in total expenditures of the municipality budget
	proportion of agricultural land in the municipality area
	proportion of arable land in the area of agricultural land
Social order	non-working age population per 100 people of working age
	natural population growth
	average floor space of a flat per person
	average number of people per 1 habitable room
	number of persons employed per 1000 inhabitants
	percentage of the registered unemployed in the working age population
	percentage of persons employed in the total population
	expenditures from the municipality budget on schooling and education per 1 inhabitant

Source: author's own work based on (Borys, 2005; Adamowicz, Smarzewska, 2009).

The next step of the study was to distinguish indices of sustainable development for environmental, economic, and social orders. A total of 23 indices were distinguished (table 3).

In order to determine the level of development of municipalities of Warmińsko-Mazurskie province based on indices of sustainable development, M. Cieślak's absolute measure of development ( $m_{it}$ ) was applied, which is calculated as follows (Krakowiak-Bal, 2005, p. 7-82):

$$m_{it} = \sum_{j=1}^m y_{ij}^t,$$

( $i=1,2,\dots,k; t=1,2,\dots,T$ ),

where  $y'_{ij}^t$  is a normalised value of the characteristic

$$y'_{ij} = \frac{y_{ij}}{S_j},$$

where:

$y_{ij}$  – value of the characteristic

$S_j$  – standard deviation of the characteristic

This method lacks a pattern of any kind, and the place of the studied municipality is determined by the value of characteristics and their standard deviation indicating the average variation of the characteristics' values (Krakowiak-Bal, 2005, p. 7-82).

## Results of the research

The data accepted for the study originated from the Central Statistical Office Bank of Local Data, and relate to the year 2015.

Prior to the study, the variables were subjected to statistical verification due to the obtained value of the coefficient of variation. Only those variables for which the value of the coefficient of variation was higher than 10% were accepted for analysis. Consequently, three indices were excluded from the study of the level of potential investment attractiveness of municipalities of Warmińsko-Mazurskie province, namely: the percentage of the working age population in the total population, non-working age population per 100 people of working age, and retired age population per 100 people of pre-working age. In turn, in the study into the level of development of municipalities based on the indices of sustainable development, 6 indices were omitted, namely: the percentage of people using water supply network in the municipality population, the percentage of people using the sewerage network in the municipality population, the percentage of people using sewage treatment plants in the municipality population, average floor space of a flat per person, average number of people per one habitable room, and non-working age population per 100 people of working age.



**Table 4.** A synthetic index of the level of potential investment attractiveness of municipalities of Warmińsko-Mazurskie province

municipality	$d_i$	municipality	$d_i$	municipality	$d_i$	municipality	$d_i$
Bartoszyce	0.14	Elk	0.16	Kętrzyn	0.21	Nowe Miasto Lubawskie	0.00
Braniewo	0.07	Giżycko	0.15	Lidzbark Warmiński	0.15	Olsztyn	0.36
Działdowo	0.24	Górowo Iławeckie	0.05	Lubawa	0.18	Ostróda	0.20
Elbląg	0.17	Iława	0.17	Mrągowo	0.20	Szczytno	0.18

Source: own work based on the (Bank of Local Data, 2015).

The application of Z. Hellwig's method of development pattern enabled the development of a synthetic index of the level of potential investment attractiveness for each municipality of the Warmińsko-Mazurskie province (table 4). The most potentially investment-attractive municipality among those involved in the study is the municipality of Olsztyn, and the least potentially investment-attractive one is the municipality of Nowe Miasto Lubawskie.

The application of the absolute measure of development enabled the development of a synthetic measure of development for each municipality of Warmińsko-Mazurskie province (table 5). Based on the indices of sustainable development accepted for analysis, the most developed municipality of Warmińsko-Mazurskie province is the municipality of Olsztyn, and the least developed one is the municipality of Braniewo.

**Table 5.** Synthetic measure of development of municipalities of Warmińsko-Mazurskie province

municipality	$m_{it}$	municipality	$m_{it}$	municipality	$m_{it}$	municipality	$m_{it}$
Bartoszyce	54.68	Elk	52.80	Kętrzyn	58.98	Nowe Miasto Lubawskie	53.89
Braniewo	49.40	Giżycko	51.08	Lidzbark Warmiński	57.30	Olsztyn	76.23
Działdowo	60.97	Górowo Iławeckie	54.03	Lubawa	59.81	Ostróda	53.37
Elbląg	58.39	Iława	53.32	Mrągowo	59.48	Szczytno	56.87

Source: own work based on the (Bank of Local Data, 2015).

The Pearson product-moment coefficient of correlation between the index of potential investment attractiveness and the index of development of municipalities of Warmińsko-Mazurskie province indicates a strong positive correlation ( $r=0.79$ ) – municipalities at a high level of development are, at the same time, potentially investment-attractive municipalities, and municipalities at a low level of development are municipalities of little potential investment attractiveness.

The calculated indices enabled the municipalities of Warmińsko-Mazurskie province to be ranked in terms of their potential investment attractiveness and the level of development (table 6). Figure 1 presents the places taken by particular municipalities.

**Table 6.** Rankings of municipalities of Warmińsko-Mazurskie province in terms of the level of potential investment attractiveness and the level of development

Municipality	d <sub>i</sub> ranks	m <sub>i</sub> ranks	Municipality	d <sub>i</sub> ranks	m <sub>i</sub> ranks
Bartoszyce	13	9	Kętrzyn	3	5
Braniewo	14	16	Lidzbark Warmiński	11	7
Działdowo	2	2	Lubawa	6	3
Elbląg	9	6	Mrągowo	5	4
Elk	10	14	Nowe Miasto Lubawskie	16	11
Giżycko	12	15	Olsztyn	1	1
Górowo Iławeckie	15	10	Ostróda	4	12
Iława	8	13	Szczytno	7	8

Source: author's own work.

Based on the obtained ranks, the strength and direction of the interdependence between the potential investment attractiveness of municipalities of Warmińsko-Mazurskie province and the level of their development were determined. To this end, Spearman's rank correlation coefficient was applied, the result of which  $r_s=0.67$  indicates the occurrence of a strong positive correlation.

## Summary

There is an apparent strong relationship between the level of potential investment attractiveness of municipalities of Warmińsko-Mazurskie province and the level of their development, determined on the basis of indices of sustainable development. The two most developed municipalities, namely Olsztyn and Działdowo, are also municipalities with the highest level of

potential investment attractiveness. The greatest difference between the ranks of the two presented indices amounts to 8 and relates to the municipality of Ostródawhich only takes the 12th place in terms of the level of development, and the 4th place in terms of the level of potential investment attractiveness.

Based on the obtained results, a conclusion may be drawn that the investment-attractive municipalities are those characterised by a high level of socio-economic development.

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