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THE ROLE OF BUSINESS ENVIRONMENT INSTITUTIONS IN CREATING SUSTAINABLE DEVELOPMENT. AN ANALYSIS BASED ON EASTERN POLAND DISTRICTS

Abstract. The purpose of this paper is to identify the (spatial) relationships between the level of sustainable development and the saturation level of business environment institutions based on 2016 data collected at district level. This study covered 101 districts in the Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie and Warmińsko-Mazurskie voivodeships. The first part of this paper presents some problems involved in defining business environment institutions and sustainable development processes. Because of the multidimensionality of economic categories covered by the analysis, this study used the TOPSIS method to assess the development level of business environment institutions and the level of sustainable development. The Spearman's rank correlation analysis was performed for the constructed synthetic indicators. As shown by research, the phenomena addressed in this paper are strongly correlated. The value of the global Moran's *I* was –0.0685 for sustainable development and –0.0713 for business environment institutions.

Keywords: synthetic indicators, entrepreneurship, spatial dependencies

INTRODUCTION

Studies on the impact of geographic aspects of the conduct, efficiency, and competitiveness of business operators have gained importance in recent years as a result of the achievements of the new economic geography and industrial economics addressing the problems of location, theory of company development, and production concentration. It is difficult to not agree with R. Domański who claims that the "economic theory assertions that ignore the geographic aspects are incomplete and reflect reality in an overly simplified way" (Domański, 2007, p. 17). In economic studies on spatial units, interactions between particular geographic areas should be taken into account. Each area develops as an integral part of the entire national economy rather than as an isolated element. What happens in one territorial unit can affect what is happening in another (neighboring) spatial unit. This is particularly important in the context of spreading the idea of sustainable development. This is due to the fact that the structural elements of individual territorial units (such as natural resources, infrastructure) form a specific set of interrelated and interdependent components going beyond administrative boundaries. Note also that atmospheric pollution is of a cross-border nature, too. A spatial analysis will allow

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to identify the similarities (differences) between individual territorial units, both in general and individual terms.

The main purpose of this paper is to determine the relationship between synthetic indicators of sustainable development level and of the development level of business environment institutions in Eastern Poland districts, taking spatial interactions into consideration. The TOPSIS method was used in order to determine the development level of aspects covered by this analysis. To determine the strength of spatial relationships between the development levels of business environment institutions and the level of sustainable development in different districts, an analysis of spatial autocorrelation was carried out. This study covered 101 districts in the Lubelskie, Podlaskie, Podkarpackie, Świętokrzyskie and Warmińsko-Mazurskie voivodeships. The variables were selected based on substantive, statistical and formal criteria.

BUSINESS ENVIRONMENT INSTITUTIONS AND SUSTAINABLE DEVELOPMENT

The definition of "sustainable development" has evolved along with the changing economic reality. Because of the wide spectrum of definition components, the relevant literature fails to provide an unambiguous, universal definition of this economic category. The definition most frequently referred to by the authors is the one formulated for the purposes of the "Our Common Future" 1987 UN report prepared under the direction of G.H. Brundlant, Prime Minister of Norway. Accordingly, sustainable development is described as a development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (United Nations, 1986). Also, Turner and Pearce (1992) note that the concept of sustainable development is directly related to that of inter-generative justice. They believe sustainable development means that the next generation should not be "worse off" in development terms than the current one. This means leaving the next generation with a stock of capital assets that provide them with the capability to generate at least as much development as is achieved by the current generation. According to International Institute for Sustainable Development (IISD), sustainable development "requires the maintenance of the capital stocks that make up the comprehensive wealth portfolio, as they are the basis for the consumption that leads to well-being. Since well-being is fundamentally an individual concept, it is not just the overall size of asset stocks that matters but the assets available per capita; therefore, sustainability must be assessed in terms of maintenance of per capita rather than aggregate capital stocks" (IISD, 2018, p. 9). P. Dasgupta (2007) defines sustainable development as "an economic program where the average prosperity of present and future generations, taken together, does not decrease over time." As defined in the Environmental Protection Law Act of April 27, 2001 (Ustawa, 2001), sustainable development means "social and economic development which integrates political, economic and social activities while maintaining natural balance and permanence of basic natural processes in order to guarantee the ability to satisfy basic needs of particular communities or citizens of both the existing and future generations". In the first decades of shaping the concept of sustainable development, it functioned as a macroeconomic idea. However, the effectiveness of the practical implementation of sustainable development assumptions depends on the effectiveness of tools used at local and regional level.

Representatives of various fields of science – including economic, sociological or technical sciences – deal with issues of sustainable development and have developed hundreds of different definitions of this concept. Gajdzik i Wyciślik (2010, pp. 28–34) delivered a catalog of nearly 40 definitions of sustainable development. In turn, 44 definitions were reported by B. Piontek (2002, pp. 11–16). It is difficult to disagree with W.J. Varey (2004, p. 7) who claims that the concept of sustainable development has "lost itself in the maze of terms". The author emphasizes that at least 500 definitions of this concept can be identified.

Events of particular importance for sustainable development in the last decade include: The Report of the Commission for the Measurement of Economic Performance and Social Progress of 2009[1] (commonly referred to as the Stiglitz Report, it includes recommendations for the measurement of well-being and sustainable development), the 2012 "Rio+20" conference and The Future We Want[2] (the final conference document which includes references to the institutional foundations of sustainable development), or the *Road to Dignity by 2030: Ending*

[1] For a broader description see: Stiglitz et al., 2009.

[2] For a broader description see: United Nations, 2012.

Poverty, Transforming All Lives and Protecting the Planet[3] (a UN Report which defines 6 main goals of sustainable development, i.e. [1] dignity: to end poverty and fight inequalities; [2] people: to ensure healthy lives, knowledge and the inclusion of women and children; [3] prosperity: to grow a strong, inclusive and transformative economy; [4] planet: to protect our ecosystems for all societies and our children; [5] justice: to promote safe and peaceful societies, and strong institutions; [6] partnership: to catalyze global solidarity for sustainable development), Agenda for Sustainable Development 2030 Transforming Our World[4] (a 2015 document setting out 17 sustainable development goals, including providing patterns of sustainable consumption and production, and promoting a sustainable use of ecosystems).

In the OECD approach, local development is not seen solely as a series of different micro-initiatives at the local level or as a set of policies governing the exploitation of indigenous resources. It is also a way to integrate various policies and programs at the local level, which will consequently allow for synergy and improvement of coordination, as well as a tool to improve local management by involving local residents and cooperation networks in the process of policy formulation and implementation (OECD, 2001, p. 9). In turn, the definition of local development presented by R. Brol (1998, p. 9–10) fundamentally corresponds with the idea of sustainable development. According to the author, local development is a "harmonized and systematic operation of the local community, local authorities and other municipal operators, aimed at creating new and improving existing utility values of the municipality, creating favorable conditions for the local economy and ensuring spatial and ecological governance."

Sustainable development at the local level means, in particular: matching local skills and needs to the availability of employment; protecting the environment based on an ecosystem-based approach to minimize the consumption of natural resources; meeting local needs at a local level; participation of all local community sectors in local planning and decision-making; high quality of and universal access to basic services; and high quality of cultural heritage (Borys, 2005). Therefore, local sustainable development cannot be limited to environmental protection aspects only; ensuring social and economic security for the residents also plays an important role.

In the process of accelerated development, Business Environment Institutions (BEI) play a special role, since the success of other market operators depends on the effectiveness of their operations. In the relevant literature, terms such as enterprise support bodies, enterprise and innovativeness support centers, or business-related organizations, are also used interchangeably to describe this type of organizations. However, these terms often differ in the scope of institution groups equated with business environment institutions. K. B. Matusiak defines BEI as an organizationally diverse group of non-commercial institutions committed to support entrepreneurship. These institutions undertake activities in the field of enterprise support; self-employment; support for start-ups; promoting and improving competitiveness; creating conditions for the transfer of new technologies and implementation of innovative projects; improving the quality of human resources; resource management and implementation of infrastructural projects; creating a cooperation and partnership network of various operators committed to accelerating the development and increasing the prosperity and wealth of the population (Matusiak, 2011, p. 126–127).

In the nomenclature used by the Polish Business and Innovation Centers Association, business environment institutions are often referred to as innovation and entrepreneurship centers. They are classified into three groups: entrepreneurship centers (training and consultancy centers, business incubators); innovation centers (technology transfer centers, pre-incubators, academic business incubators, technology incubators, technology parks) and non-banking financial institutions (regional/local loan funds, credit guarantee funds, micro-lending funds, seed capital funds, business angels networks) (Matusiak, 2010, p. 116–117). A very extensive list of this type of institutions was presented by M. Górzyński et al. who distinguished ten types, namely (Górzyński et al., 2006, p. 13–16): central administration units (including the Polish Agency for Enterprise Development); local government units; regional development agencies; R&D facilities (e.g. units of the Polish Academy of Sciences); employers' and employees' organizations (e.g. trade unions); producer chambers and associations; training and consultancy institutions; the tertiary education sector; enterprise support bodies; enterprise and innovation support networks.

[3] For a broader description see: United Nations, 2014.

[4] For a broader description see: United Nations, 2015.

In the era of worldwide globalization and growing competition, the increasing importance of innovation as a factor determining many processes at the micro- and the macroeconomic level is characteristic of modern economies. Meanwhile, an important condition for attaining the sustainable development goals is to create and absorb innovations (especially eco-innovations). Such innovations contribute to sustainable development by "improving the efficiency of natural resources used in the economy, reducing the adverse environmental impact of human activities or making the economy more resistant to environmental pressures" (Szpor and Śniegocki, 2012, p. 3). A well-developed network of business environment institutions, together with an extended range of services, are the very factors that may contribute to the increased absorption of state-of-the-art technologies, to the creation of environmentally-friendly and other innovations, to the facilitation of the knowledge flow, and to the creation of new competition forms. Also, it may result in the development of many economic operators. This is because the wide adoption of innovation becomes "one of the main conditions for strengthening the development drivers and improving their effectiveness" (Brzeziński, 2001, p. 26). C. Longhi points out that BEIs even determine the process of collective learning (Longhi, 1999, p. 333–342).

Business environment institutions also play a major role in identifying the entrepreneurs' demand for environmentally-friendly and other innovations; assess the commercial potential of new (technological, organizational, product) solutions; provide support in searching for state-of-the-art technologies or direct contacts with technology producers who are able to implement such technologies as per the buyer's requirements. Also, they participate in searching for buyers of state-of-the-art technologies by taking measures to promote state-of-the-art solutions (e.g. the activity of technology transfer centers), which includes organizing conferences and direct meetings. Furthermore, they develop procedures which enable assessing and applying for legal protection of innovations (e.g. R&D centers, universities). Business environment institutions also provide financial support to operators interested in deploying innovative solutions in their operations (e.g. local loan funds), and support the process of putting innovation into commercial practice (including training and consultancy centers), for instance by checking the operator's adaptability.

DATA TYPE AND EMPIRICAL RESEARCH METHODOLOGY

Obviously, the developments in specific territorial units are determined by a series of (spatial) factors which are at the origin of various links and impacts. Therefore, the analysis of socio-economic events based on cross-sectional data should cover the impact of the spatial structure of objects (e.g. districts) on the phenomenon considered. This is because the spatial structure is usually impacted by specific factors, mostly historic, cultural or sociological in nature (Zeliaś, 1991). As a consequence, spatial relationships (referred to as spatial autocorrelation) may exist between neighboring units.

This study covered 101 districts[5] in 5 voivodeships (Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie and Warmińsko-Mazurskie). As at the end of 2016[6], that territory had a population of 8,136,888 and an area of 99,039 km^2 (over 31% of the country's total area). In the territory under consideration, the Sejny district (with a population of 20,417) and the city of Lublin (340,466) are the last and the first district by population, respectively. The Białystok district (2,975 km^2) and the city of Zamość (30 km^2) have the largest and smallest area, respectively.

In order to determine the degree of availability of infrastructural elements in individual Eastern Poland districts, the weighted average index of spot density was used, taking into account both the population and the area of the geographic unit considered (Grzywacz, 1982, p. 221):

$$g_{aw} = \frac{l}{p \cdot m} \quad (1)$$

where:

- g – weighted average index of saturation
- l – number of objects
- p – surface area (100 km^2)
- m – population of a given territorial unit (10,000 people).

[5] In Poland, districts are administrative units extending over a part of the voivodeship territory. Smaller local government units (municipalities) also exist. German and Austrian *kreis* and the Czech and Slovak *okres* are the equivalent of the Polish district (*powiat*).

[6] Data from the Local Data Bank of the Central Statistical Office (www.stat.gov.pl).

To build the synthetic indicator of BEI development levels in the districts, the following set of diagnostic variables was used. I1: weighted average density (WAD) of universities; I2: WAD of remote units of universities; I3: WAD of technology transfer centers; I4: WAD of innovation centers; I5: WAD of seed capital funds; I6: WAD of loan funds; I7: WAD of business incubators; I8: WAD of technology incubators; I9: WAD of technology parks; I10: WAD of training and consultancy centers.

In turn, to build the synthetic indicator of sustainable development levels (SMRZ), 35 sub-indicators were proposed, split into 3 dimensions (cf. Borys, 1999; Central Statistical Office, 2011):

- the environmental dimension: OS1: wastewater treated vs. total volume of wastewater; OS2: share of population served by treatment plants in the total population; OS3: forest cover; OS4: particulate matter emissions by particularly noxious plants per km^2; OS5: emission of gaseous pollutants by particularly noxious plants per km^2; OS6: area of walking and leisure parks per km^2; OS7: share of green areas in the total area; OS8: water consumption per inhabitant;
- the social dimension: S1: population density; S2: population growth rate per 1000 population; S3: infant deaths per 1000 live births; S4: graduates of junior high schools per 1000 population; S5: share of dwellings equipped with central heating; S6: share of dwellings served by gas networks; S7: number of books per 1000 population; S8: library members per 1000 population; S9: population per library; S10: population per cinema seat; S11: doctors per 10000 population; S12: hospital beds per 1000 population; S13: apartments per 1000 population; S14: number of kindergarten pupils per 1000 children aged 3 to 5; S15: number of passenger cars per 1000 population; S16: traffic accidents per 100000 population;
- the economic dimension: G1: employees per 1000 population; G2: share of employees in the working-age population; G3: hard-surfaced municipal roads in the district per km^2; G4: sewage network length per km^2; G5: water supply network length per km^2; G6: share of commercial enterprises in the total number of operators registered in the REGON system; G7: permanent marketplaces per 1000 population; G8: hotel beds per 1000 population; G9: social foundations, organizations and associations per 1000 population; G10: industrial output sold per capita; G11: CAPEX in enterprises per inhabitant.

The choice of variables was largely determined by the availability of complete, up-to-date data for all objects. The discriminating capacity of variables and their capacity, i.e. the degree of correlation with other variables, was examined in order to obtain the final set of diagnostic variables. It was assumed that the set of potential variables reflecting the sustainable development and the condition of BEIs in the districts under consideration would exclude the characteristics which demonstrate a coefficient of variation below a critical threshold arbitrarily set at 10% (such characteristics are considered to be *quasi-fixed*). OS1 was the only variable to be eliminated based on the above criterion. To assess the information value, the inverse correlation matrix[7] was used. In the case of variables related to sustainable development levels, the inverse correlation matrix was calculated for each thematic sub-group of variables. Next, the variable with the highest diagonal entry, above the threshold set at $r^*=10$[8], was eliminated. In this way, OS7 and G1 were eliminated from the set of potential decision variables describing the level of sustainable development. For each variable referring to the saturation level of BEI in districts, diagonal values not exceeding the established threshold were recorded.

The nature of each of them was specified (stimulating effect, inhibiting effect or neutral effect). As regards business environment institutions, all analyzed variables were included in the set of variables with a stimulating effect (high values are desirable in the context of the characteristics of the phenomenon under consideration). Conversely, in the case of variables illustrating the sustainable development level, OS4, OS5, OS8, S3, S9, S10, S16 were included in the set of variables with an inhibiting effect. Other variables have a stimulating effect.

With a view to ensure the comparability of characteristics expressed with different units and of different orders of magnitude, a standardization-based normalization procedure was performed.

When analyzing the spatial differentiation of districts by sustainable development level, it is necessary to compare many research fields described with a broad set of variables. The same applies to the concentration of institutional infrastructure in specific areas. Therefore, to quantify the sustainable development levels of

[7] For a broader description, see Młodak, 2006, p. 30–31.

[8] If other diagonal entries of the correlation matrix exceeded the threshold values, they were also eliminated.

Eastern Poland districts (and the development levels of business environment institutions), TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution), a multidimensional statistical analysis method based on synthetic development measures, was used. In this case, the synthetic indicator is based on Euclidean distance both from the pattern (positive ideal solution) and from the anti-pattern (negative ideal solution), whereas the Hellwig's method (commonly used by scientists) takes only the distance from the pattern into account. The smaller is the distance from the positive ideal solution (and the greater is the distance from the negative ideal solution), the higher is the value of the synthetic variable (for a broader description, see Hwang and Yoon, 1981).

To analyze the interactions between the values of synthetic indicators of sustainable development and business environment institutions in specific districts, on one side, and the corresponding values recorded in neighboring districts, on the other, the global Moran's *I* statistic was calculated. It enables determining the strength and nature of correlations throughout the study area, and is calculated as follows (Kopczewska, 2007):

$$I = \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \cdot \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(x_i - \overline{x})(x_j - \overline{x})}{\frac{1}{n}\sum_{i=1}^{n}(x_i - \overline{x})^2} \quad (2)$$

where:

- x_i, x_j – values observed in locations i and j ($i, j = 1, 2, \dots, n$)
- $\overline{x}$ – average value in all areas under consideration
- w_{ij} – entries of the spatial weight matrix.

The global Moran's *I* statistic calculated for the synthetic indicator of sustainable development of Eastern Poland districts was less than zero (–0.0685) and not statistically significant. An in-depth analysis makes it possible to determine the local Moran's *I* statistics; for non-standardized variable values and for a weight matrix standardized by rows; it is expressed as follows (Kopczewska, 2007):

$$I_{i(w)} = \frac{(x_i - \overline{x})\sum_{j=1}^{n} w_{ij}(x_j - \overline{x})}{\sum_{i=1}^{n}(x_i - \overline{x})^2 / n} \quad (3)$$

SPATIAL AUTOCORRELATION BETWEEN SYNTHETIC INDICATORS OF SUSTAINABLE DEVELOPMENT AND OF BEI DEVELOPMENT LEVEL IN EASTERN POLAND DISTRICTS

The calculations show that sustainable development levels vary moderately across the districts considered. As at 2016, the maximum-to-minimum ratio for the synthetic indicator of sustainable development was 2.09 while the coefficient of variation was above 12.26%. Also, the synthetic indicator demonstrated right-side asymmetry which means the values equal to or below the arithmetic mean (as calculated for this indicator) were dominant; an asymmetry coefficient of 1.85 reflects a strong (and positive) asymmetry of the distribution. Eight out of ten districts with the highest levels of synthetic indicator of sustainable development were urban districts (the highest values were identified in Lublin, Zamość and Olsztyn). Note also the very low ranking of the Olsztyn district (ranked 93rd by value of the synthetic indicator of sustainable development), Kielce district (95th), Białystok district (100th) and Biała Podlaska district (101st), located in the immediate vicinity of former or current capitals of voivodeships. This could be caused by the phenomenon referred to as "big city shadow". Municipal districts (Olsztyn, Kielce, Biała Podlaska and Białystok) accumulate a significant part of the voivodeship's social and economic potential (enterprises, cultural and educational facilities). This contributes to understating the indicators of living standards and economic development in the corresponding land districts.

In the case of the synthetic indicator of development of business environment institutions, the coefficient of variation exceeded 140%. In three quarters of districts, it did not go beyond 0.0591, reaching a minimum of 0 (Białystok district) and a maximum of 0.4398 (city of Łomża). Urban districts ranked 1st to 14th by value of the indicator. High levels recorded in district capitals may result from a fairly high selectivity of investments in the physical institutional infrastructure. Indeed, the development and modernization policy for this part of the socioeconomic system is somehow discriminatory to some districts (mainly due to demographic factors and the related population structure). The indicator of development level of business environment institutions reached the highest level in the Świdnica district (due to a high weighted average indicator of technology parks' density).

Table 1. Values of the synthetic indicator of sustainable development and of development levels of business environment institutions in Eastern Poland districts; local Moran's *I* values

Districts	Synthetic indicator		Local Moran's *I* values	
	I	II	I	II
1	2	3	4	5
Augustowski	0.43	0.02	−0.23*	0.22
Bartoszycki	0.39	0.03	0.24	0.20
Bialski	0.29	0.01	−0.44	−0.05
Biała podlaska	0.51	0.38	−4.49**	−1.88*
Białostocki	0.34	0.00	0.42	0.10
Białystok	0.45	0.34	−1.09*	−1.70***
Bielski	0.40	0.02	0.11	0.25
Bieszczadzki	0.48	0.07	0.54	0.02
Biłgorajski	0.36	0.02	0.43	0.22
Braniewski	0.38	0.03	0.24	0.20
Brzozowski	0.42	0.04	−0.10	0.17
Buski	0.40	0.02	0.04	0.20
Chełm	0.51	0.22	−1.12	−0.81
Chełmski	0.38	0.01	−0.11	0.07
Dębicki	0.41	0.03	−0.01	0.09
Działdowski	0.39	0.04	0.10	0.11
Elbląg	0.41	0.23	−0.03	−0.59
Elbląski	0.39	0.03	0.07	−0.01
Ełcki	0.36	0.07	0.25	0.03
Giżycki	0.4	0.04	0.11	0.09
Gołdapski	0.38	0.07	0.16	0.03
Grajewski	0.37	0.04	0.51*	0.17
Hajnowski	0.42	0.03	−0.10	0.21
Hrubieszowski	0.37	0.02	0.30	0.32**
Iławski	0.39	0.03	0.08	0.17
Janowski	0.37	0.04	0.26	0.13
Jarosławski	0.41	0.02	−0.03	0.27
Jasielski	0.39	0.03	0.14	0.19
Jędrzejowski	0.38	0.04	0.18	0.12
Kazimierski	0.39	0.04	0.04	0.13
Kętrzyński	0.39	0.04	0.17	0.16
Kielce	0.46	0.32	−0.88	−0.91

Table 1 – cont.

1	2	3	4	5
Kielecki	0.36	0.03	0.09	0.04
Kolbuszowski	0.41	0.04	0.00	0.06
Kolneński	0.36	0.03	0.67	0.23
Konecki	0.39	0.04	0.16	0.14
Krasnostawski	0.39	0.02	0.15	0.23
Kraśnicki	0.38	0.02	0.12	0.18
Krosno	0.52	0.39	−1.37	−1.73
Krośnieński	0.38	0.01	−0.23	−0.21
Leski	0.49	0.04	1.21	0.02
Leżajski	0.39	0.06	0.16	0.07
Lidzbarski	0.39	0.03	0.14	0.21*
Lubaczowski	0.40	0.02	0.09	0.23
Lubartowski	0.39	0.01	0.09	0.23
Lubelski	0.40	0.00	−0.02	0.03
Lublin	0.62	0.34	0.18	−0.43
Łańcucki	0.40	0.05	0.06	0.12
Łęczyński	0.43	0.04	−0.02	0.14
Łomża	0.47	0.44	−0.89	−1.94
Łomżyński	0.37	0.01	0.50*	−0.08
Łukowski	0.35	0.02	0.99**	0.29*
Mielecki	0.45	0.11	−0.08	−0.12
Moniecki	0.36	0.02	0.51*	0.29**
Mrągowski	0.40	0.02	0.11	0.24
Nidzicki	0.39	0.06	0.17	0.09
Niżański	0.39	0.07	0.11	0.01
Nowomiejski	0.39	0.05	0.15	0.10
Olecki	0.39	0.05	0.18	0.05
Olsztyn	0.56	0.36	−2.71	−1.75*
Olsztyński	0.36	0.01	−0.10	0.03
Opatowski	0.41	0.03	0.01	0.15
Opolski	0.39	0.03	0.06	0.16
Ostrowiecki	0.40	0.07	0.11	0.01
Ostródzki	0.42	0.02	−0.07	0.20
Parczewski	0.41	0.03	−0.02	0.24*
Pińczowski	0.40	0.05	0.05	0.11
Piski	0.40	0.03	0.14*	0.18
Przemyski	0.38	0.01	−0.26	0.04

Table 1 – cont.

1	2	3	4	5
Przemyśl	0.53	0.25	–1.41	–0.96
Przeworski	0.37	0.04	0.3	0.18*
Puławski	0.42	0.08	–0.07	–0.03
Radzyński	0.40	0.02	0.18**	0.32**
Ropcz.–Ędz.	0.39	0.04	–0.02	0.10
Rycki	0.39	0.05	0.18	0.08
Rzeszowski	0.39	0.01	–0.01	0.01
Rzeszów	0.55	0.37	–0.99	–1.75*
Sandomierski	0.39	0.06	–0.06	–0.01
Sanocki	0.42	0.07	0.08	0.01
Sejneński	0.40	0.04	–0.01	0.18
Siemiatycki	0.41	0.04	–0.04*	0.18*
Skarżyski	0.39	0.05	0.18	0.07
Sokólski	0.40	0.02	0.17	0.34*
Stalowowolski	0.44	0.09	–0.25	–0.02
Starachowicki	0.40	0.07	0.11	0.02
Staszowski	0.41	0.02	0.00	0.14
Strzyżowski	0.39	0.04	0.08	0.15
Suwalski	0.40	0.03	0.06	–0.12
Suwałki	0.44	0.41	–0.14	–1.25
Szczycieński	0.39	0.02	0.19	0.25
Świdnicki	0.42	0.11	0.19	0.02
Tarnobrzeg	0.47	0.33	–0.41	–0.63
Tarnobrzeski	0.39	0.04	–0.11	–0.10
Tomaszowski	0.41	0.03	0.02	0.26*
Węgorzewski	0.40	0.05	0.04	0.07
Włodawski	0.43	0.03	–0.28*	0.23*
Włoszczowski	0.41	0.03	0.04	0.16
Wysokomazowiecki	0.38	0.02	0.34	0.26
Zambrowski	0.37	0.04	0.68*	0.23**
Zamojski	0.38	0.00	–0.06	0.08
Zamość	0.57	0.29	–2.02	–1.36*

I – synthetic indicator of sustainable development levels.
II – synthetic indicator of development of business environment institutions.
*, **, *** – statistically significant at $p < 0.05$, $p < 0.01$, $p < 0.001$, respectively.
Source: own elaboration based on Central Statistical Office data and on Bąkowski and Mażewska, 2015.

To verify the relationship between the concentration of business environment institutions in Eastern Poland districts and the levels of sustainable development, a correlation analysis was performed. In order to eliminate the negative impact of outliers, if any, on the results of the correlation analysis, the Spearman rank correlation coefficient was used. The calculated value was 0.5487, which suggests a strong relationship between the aspects covered by the analysis, and allows to conclude that the correlation coefficient was significant at $p < 0.05$.

The analysis of spatial autocorrelation was the next stage of the research. Spatial autocorrelation is defined as the correlation degree between the identified value of a variable in a specific location and the value of the same variable in another location.

In such analyses, a major problem is to define the neighborhood structure expressed with the connectivity matrix. The approach used in this paper considers a shared border to be the proximity criterion.

The global Moran's I statistic was used to calculate the strength and nature of autocorrelation across the entire study area. Positive and significant I values indicate the existence of positive autocorrelation (i.e. similarity of objects examined). Conversely, negative I values mean negative autocorrelation (i.e. diversity of objects examined). Positive autocorrelation means that objects with similar values are grouped into clusters, while negative autocorrelation is interpreted as "hot spots," i.e. isolated areas where distinctly different values are recorded (Kopczewska, 2007, p. 72).

Later on, the local statistics of Moran I was used, which is included in the so-called LISA (Local Indicator of Spatial Association).

These statistics allow to identify clusters of areas with similar levels of the feature under consideration and areas characterized by different values of the synthetic indicator of sustainable development level and development level of Business Environment Institutions. The results of the analysis of local Moran's I_i statistics can be visualized on a map which shows clusters of areas at similar levels of the indicator considered and outliers (areas characterized by a different value of synthetic indicators).

When it comes to synthetic indicators of sustainable development level, 7 low-low areas (with low values of the variable considered) were identified based on local Moran's I statistics. These were two neighboring districts (Radzyń and Łuków) in the Lubelskie voivodeship, and the vast compact cluster in the north-eastern part

Synthetic indicator of sustainable development levels	Synthetic indicator of development of business environment institutions

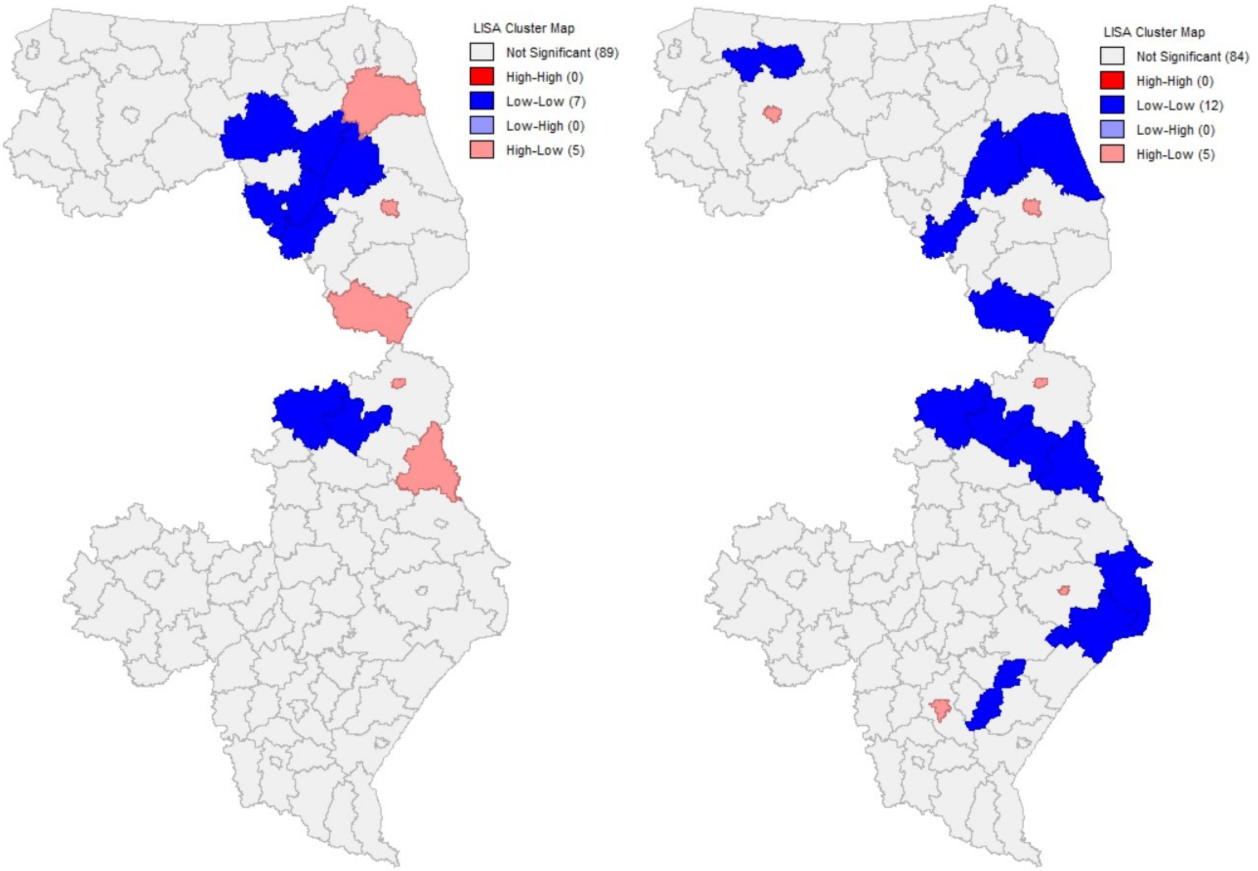

Fig. 1. Maps of local Moran's *I* statistics by cluster type
Source: own elaboration.

of the study area, including 1 district in the Warmińsko--Mazurskie voivodeship (Pisz district) and 4 districts in the Podlaskie voivodeship, namely Grajewo, Monki, Łomża and Zambrów districts. The structure of the analyzed districts also included 5 high-low areas (a high value of the indicator surrounded by low values in the neighborhood): Augustów district, Siemiatycze district and the city of Białystok in the Podlaskie voivodeship, and the city of Biała Podlaska and Włodawa district in the Lubelskie voivodeship. Based on the maps of local Moran's *I* statistics created for synthetic indicators of the development level of business environment institutions, 12 low-low areas were identified (Lidzbark district in the Warmińsko-Mazurskie voivodeship, Sokółka, Mońki, Siemiatycze and Zambrów districts in the Podlaskie voivodeship, and 6 districts in the Lubelskie voivodeship: Łuków, Radzyń, Parczew, Włodawa, Hrubieszów, and Tomaszów districts; and one district, Przeworsk, in the Podkarpackie voivodeship). Also, 5 high–low areas were indicated (urban districts: Olsztyn, Białystok, Biała Podlaska, Zamość and Rzeszów).

When analyzing the local Moran's I_i statistics for the synthetic indicator of sustainable development, it may be concluded that positive, statistically significant values are identified in 7 districts. This means these districts are adjacent to areas with similar values of the sustainable development indicator, and therefore represent a kind of sustainable development clusters. In 5 districts, negative and statistically significant values of local statistics were identified. These districts are surrounded by relatively low values of the synthetic indicator of sustainable development and can be treated as local outliers. As regards other districts, values of the local Moran's I_i statistics calculated for the variable under consideration were positive in 55 cases and negative in 34 cases. However, as the negative values were not statistically significant, no particular attention should be paid to these results. In turn, as regards the calculated synthetic indicators of BEI development level, the local Moran's I_i statistics were positive and statistically significant for 12 districts (statistically significant negative values were recorded in 5 districts). In other districts, most (64) of the local statistics were positive but statistically insignificant. Only in four districts (Łukowski, Radzyński, Zambrowski, Moniecki), both in the case of the level of sustainable development and the level of development of business environment institutions, areas of the same low-low type were identified. Therefore, it is difficult to say that business environment institutions are conducive to the concentration of districts at similar levels of sustainable development.

CONCLUSION

The importance of the institutional environment in the context of economic processes stimulation is increasingly analyzed. However, the authors usually focus on institutional disparities between countries and on relationships between the institutional structure and economic performance of specific countries (including the research by D. Acemoglu, R. Kormendi, P. Meguire, or R. Levine and D. Renelt). In turn, relationships between the institutional environment and the level of sustainable development of local government units (e.g. districts) are often of secondary interest. In the era of the knowledge economy, and in the context of the growing importance of institutions which support the absorption and development of innovations, an important problem is posed by regional disparities in the development of institutional infrastructure supporting the creation of suitable conditions for initiating and developing innovative undertakings. In the study area, nearly 49% of innovation and enterprise centers are concentrated in urban districts. Technology parks act as comprehensive business support centers and are particularly important among innovation and entrepreneurship institutions. In 2016, only 11 such centers existed in Eastern Poland, including 6 based in urban districts. The most widespread innovation and entrepreneurship institutions are training and consultancy centers (57 were identified). They are non–profit advisory and information units which support the development of entrepreneurship and facilitate the transfer of new technologies.

As shown by the results, a negative but statistically insignificant spatial relationship exists between the synthetic measures of the features under consideration. The value of the global Moran's I was –0.0685 for sustainable development and –0.0713 for business environment institutions. For both of these economic aspects, positive values of the local Moran's I statistics were much more frequent: 62 occurrences for the synthetic indicator of sustainable development (including 7 statistically significant ones) and 76 occurrences for the synthetic indicator of BEI development (including 12 statistically significant ones).

Spatial analyses can be a source of knowledge for central and local government authorities dealing with spatial and economic issues. It seems that the awareness of spatial relationships between individual territorial units facilitates the implementation of development policies at both local and regional level. The identification of spatial structures for such an important economic category as sustainable development may support the initiation of development efforts (including measures taken by local authorities to establish local strategies for sustainable development) towards achieving the highest possible standards of living for the population while respecting the natural environment in specific geographic areas. In further research, other spatial statistics could be used, including both global (i.e. join–count) and local ones (i.e. Getis-Ord statistics). Alternatively, another spatial neighborhood structure could be employed (i.e. higher order neighborhood). Also, it could be useful to develop a system of partial weights so that the variables covered by the analysis are not treated as equivalent.

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ROLA INSTYTUCJI OTOCZENIA BIZNESU W KREOWANIU ZRÓWNOWAŻONEGO ROZWOJU – ANALIZA NA PODSTAWIE POWIATÓW POLSKI WSCHODNIEJ

Abstrakt. Celem artykułu jest określenie zależności (przestrzennych) między poziomem rozwoju zrównoważonego a nasyceniem powiatów w instytucje otoczenia biznesu dla danych z 2016 r. Badaniem objęto 101 powiatów w województwach lubelskim, podkarpackim, podlaskim, świętokrzyskim i warmińsko-mazurskim. Ze względu na wielowymiarowość analizowanych kategorii ekonomicznych do oceny poziomu rozwoju instytucji otoczenia biznesu i poziomu rozwoju zrównoważonego wykorzystano metodę TOPSIS. Dla skonstruowanych syntetycznych mierników dokonano analizy korelacji rang Spearmana. Ponadto przeprowadzono analizę autokorelacji przestrzennej w oparciu o statystyki Morana *I* (lokalne i globalne), aby wyznaczyć skupienia powiatów o podobnym poziomie analizowanych zjawisk. Przeprowadzone badania pokazują, że istnieje silna zależność korelacyjna między analizowanymi zjawiskami. Wartość globalnej statystyki Morana *I* dla syntetycznego miernika zrównoważonego rozwoju wynosiła –0.0685, a dla instytucji otoczenia biznesu –0.0713.

Słowa kluczowe: rozwój zrównoważony, instytucje otoczenia biznesu, zależności przestrzenne