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Spatial-Temporal Analysis of Selected Socio-Economic Problems Related to Sustainable Development in the Pressure-State-Response Framework

Abstract: The problems related to sustainable development (SD) cover changes over time and space, as well as the interpenetrating relationships in economic, social, environmental, institutional and spatial spheres. The development, in line with the concept of sustainable development, takes place when all changes occurring in the environment are focused on improving the quality of life of the Earth's population, following the principles of environment resources' protection at the level allowing the development of future generations. SD concept remains one of the goals underlying developmental policies conducted at the global, EU, national and regional level. Therefore, the question arises how the developmental changes in one area manifest in others in the space of territorial units. The research was conducted for socio –economic areas, where through improvements in economic activity conditions, positive effects in areas of unemployment and poverty are expected. The analysed phenomena, described using indicators, are structured in accordance with the principle: from a problem to its solution, *PSR* (*pressure-state-response*). Methodology of the SD evaluation in the PSR framework is based on aggregate measures, correlation analysis, spatial statistics and macro evaluation of changes using `change matrix'. The analysis was carried out for the panel of data referring to the poviats in Poland in the period 2009–2014.

Keywords: sustainable development, spatial analysis, PSR model

JEL: O18, Q56, R11, R12

1. Introduction

Sustainable Development (SD) is a process directed towards achieving a high quality of life of inhabitants in the long term, with consideration given to natural resources and the environment, taking into account social, economic and spatial progress. It does not describe a state to be achieved, but rather a process of change to be implemented. Through analysis and monitoring it is possible to coordinate certain events or phenomena, which, being left unattended, could generate highly adverse side-effects with negative influence on quality of life on a global scale. Quantitative expression of assumptions and goals of SD makes it easier to evaluate their initial and final levels and allows to monitor progress.

One of the more important tasks in evaluating development processes is to design tools which will allow to monitor processes of change and results of actions taken. A desirable quality of monitoring tools is simplicity of interpretation, availability of information at the initial stage, high informative value and clarity of results obtained. These features can be achieved by using sets of indicators with the assistance of graphic presentation techniques and statistical analysis tools. In the case of regional development analysis it is also important to consider interrelations between analysed elements – here it is helpful to use indicators grouped according to areas outlined by *cause-effect* framework. As is pointed out in (Borys, 2005) the *cause-effect* sets of indicators are indeed a formation of a holistic theory of a phenomenon together with a logic series of interrelated indicative information, that is easily translated into a string of strategic goals and actions and largely explains the mechanism of the phenomenon'.

This article analyses the evaluation of processes of change in areas that are of interest from SD perspective, using sets of indicators. The research was conducted for socio-economic areas, where through improvements in economic activity conditions, positive effects in areas of unemployment and poverty are expected. The analysis was conducted with compliance to SD monitoring procedure, in the *Pressure-State-Response* (*PSR*) process framework, which was put forward by the author in (Bal-Domańska, 2016a). The PSR model has initially been developed by the OECD for structuring work on environmental policies and reporting, then also by European Environment Agency (Smeets, Weterings, 1999). It states that: "human activities exert pressures on the environment and affect its quality and the quantity of natural resources ("state"); society responds to these changes through environmental, general economic and sectoral policies and through changes in awareness and behaviour ("societal response")" (OECD, 2013). In the literature PSR model is also suggested as the general framework for a wide range of phenomena (Eurostat, 2014; Borys, 2003; Ptak, 2003; Borys, 2005; Kusterka, 2005; Bal-Domańska, 2015b).

This is a modified and extended version of the research on *unemployment-poverty-economic activity* presented in (Bal-Domańska, 2016b). The modification involved considerable increase of time scope of the research and introduction of extended unemployment rate (aggregate measure for unemployment) as well as aggregate measure of economic growth for *response* area. The use of aggregate measures allowed for in-depth analysis of unemployment and cumulative effects of economic activity.

The main research objective was to evaluate the level of SD of Polish poviats based on the spatial-temporal analysis, using *PSR* framework for socio-economic areas. Subject to analysis were 380 poviats (including city-poviats) in the period of 2009–2014. The research was conducted under the hypothesis that the PSR model supported with statistical correlation and dynamic and spatial methods is a good tool for obtaining the macro-picture and understanding the spatial dependence between economic activity and unemployment, assessed as one of the key factors of poverty.

2. The procedure of evaluation of Sustainable Development of poviats in the *pressure – state – response* framework and the definition of the research problem for *unemployment – poverty – economic activity* spheres

Methodology of the SD evaluation in the *PSR* framework consists of 5 steps:

1. Choice of indicators for areas in *PSR* framework and construction of aggregate measures of a phenomenon in each area.
2. Evaluation of relations between *PSR* areas using correlation analysis.
3. Evaluation of spatial dependency and clustering tendencies using spatial statistics.
4. Macro evaluation of changes using `change matrix'.

Each of the stages of the research is described below.

2.1. Choice of indicators for areas in *PSR* framework

Fundamental to the research is the assumption that economic activity of entities is able to influence labour market and the level of unemployment. High level of unemployment, particularly long-term, results in formation of poverty areas. The assumptions called for a design of a series of measures that would describe access

to labour market (*pressure*) affecting poverty levels (*state*) and factors that favour labour and economic growth (*response*). For evaluations in the areas of *pressure* and *response* aggregate measures were used (Fig. 1).

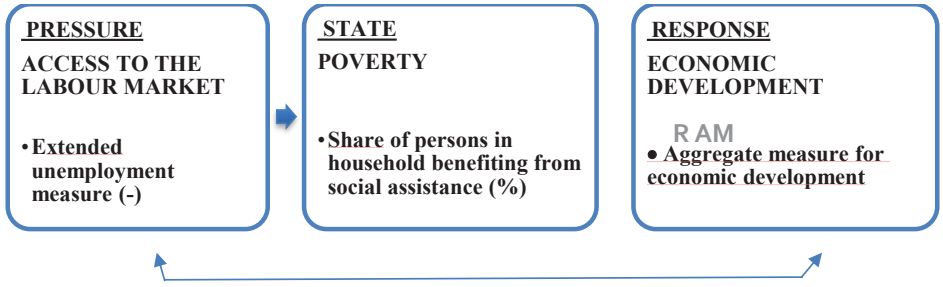

Figure 1. Indicators and relationships in '*unemployment-poverty-economic activity*' framework

Source: own work

Aggregate measures (*AM*) were designed according to the following guidelines:

– The method of averaged standardized sum was used as the aggregating function for normalized values.
– Normalisation with zero minimum and common development pattern for the period of 2009–2014 (normalised data over the whole time period take values in the range of [0, 1]).
– Defining of weights – w_j ($\Sigma\, w_j = 1$) for each indicator, that reflect its influence on SD.
– Substitution of depressants with stimulants, so that each *AM* is of stimulant nature.

How this approach to defining aggregate measures could be beneficial was presented in Bal-Domańska (2016a).

For the description of the *access to labour market* area the concept of Extended Unemployment Measure (*P AM*) was used – presented in (Bal-Domańska, 2015a). The use of the Extended Unemployment Measure gives the possibility of overall evaluation of the situation in this area in various local administrative units (LAUs), in terms of its level of development as well as structure. This makes the measure useful not only for evaluation of the level of workplace scarcity, but it also describes the nature of the problem. In the formula of extended unemployment rate – aside from unemployment rate (registered) % (*P UR*) – two variables were considered, that define the nature of unemployment: share of long-term unemployment (over 12 months) % (*P LT*), and surplus of unemployed women (men) over unemployed men (women) (*P FM*). To rationalize the influence of each of the *P AM* compo-

nents on unemployment in LAUs weights $w_{i,,}$ were introduced. Weights were defined considering the author's assessment that their proportions *should* allow for the number of the unemployed to maintain the decisive role in the evaluation of the phenomenon *P UR* (the most influential factor w_1= 0.6) and assign value to the role of the long-term unemployment (particularly influential kind of unemployment for poverty *P AM* w_2= 0.3) and gender – based on structural unemployment of men/women (minor revision for poviats with big disproportion of unemployed women and men w_3= 0.1). All the components of *P AM* are inherently depressant. The structure of extended unemployment measure *P AM* is presented as:

$$P\,AM_{it} = 0.6P\_UR_{it} + 0.3P\_LT_{it} + 0.1P\_FM_{it}. \quad (1)$$

Long-term unemployment is usually associated with the problems of poverty and social exclusion. From an individual's point of view, it contributes to qualification erosion, which is followed by lower self-esteem, and that again decreases the possibility of re-entering the labour market. Structural unemployment is another threat, which is caused by maladjustment in supply and demand for labour in relation to some occupations depending on required qualifications. A particular example of such structural unemployment is the unemployment of men or women, who exhibit preference for certain occupations that are associated either with men or women, in a local labour market with defined industry structure; their access to regional labour markets is also hindered (Bal-Domańska, 2015a). One can assume, that there is a degree of disproportion in the unemployment of men/women that poses no threat to the local labour market. In this article it is set at 10%. In the poviats where the disproportion in the number of unemployed men/women amounted to less than 10%, it was assumed, that the problem of gender-specific structural unemployment does not occur and the measure was given the value of 0. In other cases: the higher the measure the more difficult the described situation.

In order to introduce the problem of poverty and to consider the availability and usefulness of data for the analysis, a single indicator was used: the share of people in households relying on social transfers/benefits in the overall number of people (%) (*S HB*). Social services offer assistance in the form of money transfers, or goods and services obtained via officials. People defined as the clients of social services are members of households who receive a form of assistance as well as all other members of such households, with no regard to whether or not, or what kind of assistance they received. Information on the share of households benefitting from social assistance allows to monitor the susceptibility to the risk of poverty, which is followed by social exclusion. It can be assumed that individuals who receive these forms of social assistance are members of households affected by poverty. The reason for this is the fact, that when the claim is being decided, the financial situation of all the members of a household is taken into account.

An aggregate measure of development was also proposed for the evaluation of the level of economic growth of poviats. Factors responsible for economic development were taken into consideration within the structure of the aggregate measure of economic development (*R AM*), i.e.:

$$R\,AM_{it} = 0.4R\_ET_{it} + 0.1R\_BG_{it} + 0.5R\_IN_{it}, \tag{2}$$

where: *R_ET* – Balance of newly-registered and removed entities of the national economy recorded in the REGON register per 10,000 inhabitants, *R_BG* – Share of entities employing 10 or more persons in total number of entities, *R_IN* – Investment outlays in enterprises employing 10 and more persons per 1 inhabitant at working age.

As factors in economic development the following were pointed out: investment outlays, the balance of entities recorded in REGON register and the share of economic entities employing 10 or more persons (10+). The importance for local economic development was evenly distributed between investment activity (*R_IN*: $w_3 = 0.5$) and the activity and structure of economic entities (*R_ET R_BG*: $w_1 + w_2 = 0.4 + 0.1 = 0.5$). It was assumed that an increase in the number of economic entities per 10,000 inhabitants favours job creation and adjustment of the labour market to the needs of a competitive economy. 10% of variability in *R AM* was ascribed to the structure of economic entities (*R_BG*: $w_3 = 0.1$), favouring the ones that create the most workplaces, i.e. employing 10 or more persons. It can be assumed, that in the poviats with high unemployment the inclination to set up new businesses is low, and so opportunities to increase employment should be sought in creating enterprises that offer new workplaces. All the factors are considered as stimulants for economic development.

While interpreting measurements for phenomena occurring in different problem spheres, one has to consider the relationships between aggregate measures (*AM*) and the components. As was indicated in the assumptions, an increase in economic activity positively influences reduction in unemployment, which in turn favours poverty reduction. It has to be mentioned though, that economic activity (as defined above) directly influences unemployment rate (*P UR*) but has limited effect on the aggregate measure (*P AM*). This is why in the following part of the research the *P AM* measure will be used as a measure for the level of unemployment in a LAU (local administrative unit), which directly influences poverty levels. For the evaluation of the effectiveness of activities stimulating development and their influence on local labour market situation, standard unemployment rate will be used (*P UR*).

2.2. Evaluation of relations between *PSR* areas using correlation analysis

The measurement of dependencies between indicators defined for problem areas in the *PSR* framework was conducted with the application of correlation analysis (Pearson's linear correlation coefficients). It was assumed that indicators for *Pressure* (*Pp*, $p = 1, 2, \ldots, P$) and *State* (*SS*, $s = 1, 2, \ldots, S$) are expected to show high correlation ($r_{PpSs} \rightarrow 1$) which would confirm that there exist relationships between causes and components of the quality of life, which intrinsically result from the situation, events and phenomena in the *Pressure* area. Strong relationships should also occur between factors in the areas of *Response* (*Rr*, $r = 1, 2, \ldots, R$) and *Pressure* (r_{PpRp}), so that it would be possible to effectively influence the problem situation and to use phenomena from the area of *Response* as instruments of improvement of the situation.

When evaluating the relationships between groups of phenomena (indicators), their dynamics should be taken into consideration, which means that their influence on the situation could be deferred in time.

2.3. Evaluation of relations between *PSR* areas using spatial statistics

The aim of the spatial analysis is to evaluate the susceptibility of poviats for the creation of clusters of either crisis (negative) or growth (positive). The occurrence of growth clusters with a favourable situation provides opportunities for the development of the whole region and for positive spill-over effects. Likewise, the occurrence of problem areas with unfavourable situation signalise the existence of crisis clusters which are in need of profound structural changes and restoration processes. A different aspect is represented by LAU's whose situation does not correspond in the slightest with the situation of neighbouring units (outliers – *hot spots*). This occurs for example for metropolitan units, for which resources and phenomena appear in ripple effects, forming from the centre towards the peripheries. In the context of SD indicators in the *PSR* framework, attention is paid to focusing the restoration processes (*response*) on the units with unfavourable situation within the *pressure* area (Bal-Domańska, 2016a).

The simplest method of observing spatial dependencies is visual assessment – the evaluation of the distribution of a phenomenon on the map. The initial visual assessment ought to be followed by in-depth spatial statistics analysis. While presenting the phenomena on the map it is important to pay attention to the method of classifying data. To observe the distribution of a phenomenon in a section with similar values for indicators, it is worth using the method of natural breaks, which is common in spatial analysis programs. In this research, to establish the classes of poviats for which the indicators would be presented on the

map, the quantile method was used, with the division of poviats into 5 classes, so that each class contains 20% of poviats. The advantage of this approach is a set method of division of poviats for each feature, that shows 20% of units with the least and the most favourable situation. The disadvantage here is the fact that the method allows to include poviats with significantly different values in one class. This is encountered particularly in the case of outliers, which are of course classified in the extreme classes (top or bottom). This imperfection can be eliminated by using spatial statistics to evaluate clustering tendencies of poviats with similar values of indicators.

To identify spatial dependence Moran's Global and Moran's Local Statistics were used. Moran's Global I describes tendency across subjects to form groups of poviats – clusters – with similar (favourable or unfavourable) situation (Moran, 1947; Cliff, Ord, 1981; Arbia, 2006; Suchecki, 2010). To identify clusters of units with extremely different situation from neighbouring units (outliers – *hotspots*) and also clusters with similar values of a phenomenon Moran's local was used. To calculate spatial statistics standardised weight matrix was used with a first-order neighbors – it takes into consideration spatial relationships between neighbouring poviats. R program was used to perform the calculations (Kopczewska, 2006).

2.4. Macro evaluation of changes using 'change matrix'

The last stage of the analysis is the evaluation of changes over time with consideration to global and local changes in the situation. Change matrix was used for this; improvement in the situation is deduced on the basis of dynamics of changes in values for a higher unit (here: Poland) and the share of local units (here: poviats) that observed improvement in the situation (Bal-Domańska, 2016a). It was assumed that overall improvement of the situation can be stated if the improvement at the country scale exceeded 5% and was noted in at least 70% of poviats. Overall deterioration can be stated if the deterioration at the country scale amounted to at least 5% and the improvement was observed for less than 15% of poviats.

3. Evaluation of Sustainable Development of poviats in relation to *unemployment-poverty-economic activity*

3.1. Evaluation of relationships in the areas of *Pressure – State* and *Response – Pressure*

The conducted autocorrelation analysis – a linear correlation of the level of a phenomenon in period t and its values in period $t - 1$ – showed that there exist strong relationships for the majority of the analysed variables (Tab. 1), in particular for the variables from the areas of *pressure* and *state*. It can be identified as somewhat disturbing, as it implies stability of a phenomenon in its spatial distribution, and suggests the persistence of crisis situations characterised by high unemployment, a large proportion of the long-term unemployed with the prevalence of individuals of certain gender and at risk of poverty. In such case, policies of lifting out of poverty and social inclusion encounter established, unfavourable trends (but also favourable ones in the areas with low aggregate unemployment rate and its components together with low levels of poverty). In the case of economic development, two of the phenomena manifested persistence: investment outlays and share of entities employing over 10 persons. Little stability over time was observed in poviats for the balance of newly registered and removed entities. The fluctuations in the number of economic entities show certain spontaneity across poviats.

Table 1. Pearson *r* correlation coefficients in the year *t* with the $t - 1$ ($r_{t,t-1}$)

	2010	2011	2012	2013	2014
P AM	**0,971**	**0,979**	**0,986**	**0,985**	**0,981**
P UR	0,980	0,987	0,993	0,990	0,988
P LT	0,885	0,912	0,947	0,934	0,940
P FM	0,933	0,939	0,948	0,948	0,951
S HB	**0,974**	**0,982**	**0,991**	**0,995**	**0,994**
R AM	**0,689**	**0,789**	**0,819**	**0,814**	**0,800**
R IN	0,808	0,837	0,816	0,828	0,881
R ET	0,170	0,208	0,331	0,344	0,168
R BG	0,986	0,987	0,944	0,981	0,990

Source: own work

The situation in terms of unemployment showed strong visible relationships with poverty in poviats (Tab. 2). According to expectations, improvement in the aggregate unemployment rate (an increase of *P AM* measure) was correlated with a decrease in poverty (a decrease of *S HB* measure). In the consecutive years the

correlation was slightly weaker. Taking into consideration the stability of tendencies in the spatial distribution of the phenomena of unemployment and poverty it is of little surprise to notice deferred effects of the improvement in the aggregate unemployment rate on poverty, which is manifested in the persistence of similar values of correlation indicators between the aggregate unemployment rate in period *t* and poverty in period *t* + 1.

Table 2. Pearson *r* correlation coefficient between measures in the areas of *pressure* and *state*

2009		***P AM***					
		2010	**2011**	**2012**	**2013**	**2014**	
S HB	2009	**–0,670**					
	2010	–0,666	**–0,650**				
	2011	–0,665	–0,653	**–0,655**			
	2012	–0,659	–0,643	–0,646	**–0,654**		
	2013	–0,658	–0,642	–0,646	–0,656	**–0,640**	
	2014	–0,655	–0,638	–0,645	–0,654	–0,639	**–0,606**

Source: own work

The possibility to influence unemployment levels by economic growth is confirmed by a statistically significant correlation between the aggregate measure of economic development (*R AM*) and unemployment rate (*P UR*). The correlation coefficients here are at –0.4 which means medium to low correspondence of the changes concerning improvement of economic situation with simultaneous decrease of unemployment rate.

Table 3. Pearson *r* correlation coefficients in the areas of *response (R AM)* and *pressure (P UR)*

2009		***R AM***					
		2010	**2011**	**2012**	**2013**	**2014**	
P UR	2009	**–0,400**					
	2010	–0,410	**–0,413**				
	2011	–0,414	–0,415	**–0,338**			
	2012	–0,413	–0,410	–0,334	**–0,401**		
	2013	–0,412	–0,405	–0,334	–0,406	**–0,372**	
	2014	–0,403	–0,394	–0,329	–0,405	–0,368	**–0,371**

Source: own work

Also in this relationship a deferred influence of economic growth on unemployment can be observed. Decreasing values of correlation coefficients indicate that improvement in economic situation in poviats in a given period (*t*) has less and less impact on the decrease in unemployment rate in consecutive years (*t* + 1, *t* + 2, …).

3.2. Evaluation of cluster forming tendencies for positive or negative areas with the use of spatial statistics

The spatial analysis showed strong tendencies to form clusters of poviats with similar situations in the areas of *state* and *response*, that is for unemployment and poverty (Fig. 2 and 4, Tab. 4). Weaker cluster forming tendencies were observed for phenomena from the area of economic development, particularly for investment outlays.

Table 4. Global Moran's *I*

	2009	2010	2011	2012	2013	2014
P AM	**0,488**	**0,461**	**0,470**	**0,472**	**0,454**	**0,454**
P UR	0,507	0,492	0,484	0,476	0,472	0,483
P LT	0,426	0,348	0,382	0,419	0,399	0,332
P FM	0,523	0,532	0,580	0,618	0,583	0,580
S HB	**0,447**	**0,474**	**0,486**	**0,492**	**0,492**	**0,491**
R AM	**0,185**	**0,190**	**0,131**	**0,146**	**0,071**	**0,107**
R IN	0,081	0,045	0,092	0,085	0,094	0,082
R ET	0,426	0,439	0,205	0,299	0,056	0,270
R BG	0,446	0,462	0,462	0,417	0,416	0,412

Source: own work

In the case of variables from the area of *pressure* there was a strong tendency towards cluster-forming for all measures (*P AM* and its components), for the long-term unemployment it was on a slightly lower level. For all the variables from the area of *pressure* (except from *P FM*) – cluster-forming tendencies were slightly decreasing over time. To the areas with the least favourable situation expressed by the aggregate unemployment rate in 2014 (Fig. 2 – right marked medium grey) one can include clusters of poviats in the following voivodships: warmińsko-mazurskie and the western part of pomorskie, zachodnio-pomorskie, kujawsko-pomorskie and the northern parts of mazowieckie and podlaskie, podkarpackie, southern part of dolnośląskie and the border area between mazowieckie and świętokrzyskie. These clusters do not correspond to the borders of voivodships. The regions with a favourable situation regarding unemployment in 2014 were: poviats in wielkopolskie, śląskie, the cities of Wrocław, Warszawa, Trójmiasto and Szczecin with neighbouring areas (Fig. 2 right – marked light gray). In the case of these cities there is a visible spill-over effect of positive tendencies on neighbouring units. There are also a few areas, which can be described as singular exeptions (*hot spots*) of favourable situation surrounded by crisis areas (Fig. 2 right – marked dark grey). These exceptions in 2014 were poviats: bolesławiecki (dolnośląskie), biłgorajski and łęczycki (lubelskie), iławski (warmińsko-mazur-

skie) and kołobrzeski (zachodniopomorskie). Three poviats (marked square) are *hot spots* of unfavourable situation surrounded by poviats with favourable situation.

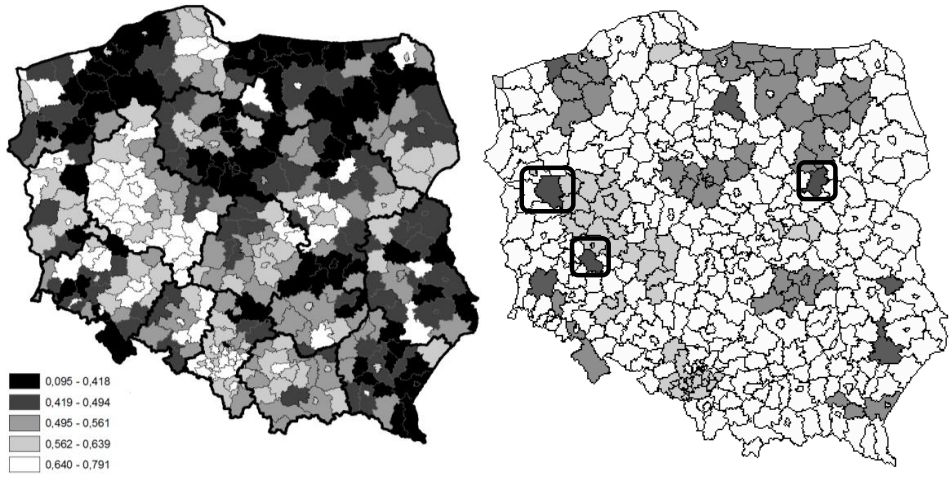

Figure 2. Spatial distribution of aggregate unemployment rate (*P AM*) in 2014

LEGEND right map – light gray: favorable situation, medium grey – unfavorable situation, dark grey: hot spot – poviat in favorable situation surrounded by poviats with unfavorable situation; squered: hot spot – poviat in unfavorable situation surrounded by poviats with favorable situation.

Source: own work

When analysing the spatial distribution of long-term unemployment, one can observe that the clusters are less numerous in the western part of Poland but the number of poviats with a large proportion of individuals affected by long-term unemployment is higher (Fig. 3). In terms of gender imbalances the country is visibly divided into two parts: with females dominating in the west (marked dark gray) and males prevailing in the centre and east (marked light gray).

When comparing the spatial distribution of indicators for poviats in the areas of *Pressure* and *State*, attention should be paid to two following aspects: a strong tendency towards forming large clusters and a significant accordance in the spatial distribution; groups of poviats identified within the *State* area are more numerous and compact (particularly these with unfavourable situation). The following voivodships can be included into the group of regions with high number of poverty poviats: warmińsko-mazurskie, parts of pomorskie, zachodnio-pomorskie, kujawsko-pomorskie, also lubelskie and podkarpackie. In these regions a few *hot spots* were identified: kołobrzeski poviat and 2 city-poviats: Grudziądz (almost 100.000 inhabitants) and Elbląg (over 123.000 inhabitants) – the three poviats are surrounded

by areas with very unfavourable situation; their economies proved not to be strong enough to generate positive spill-over effects on those neighbouring areas.

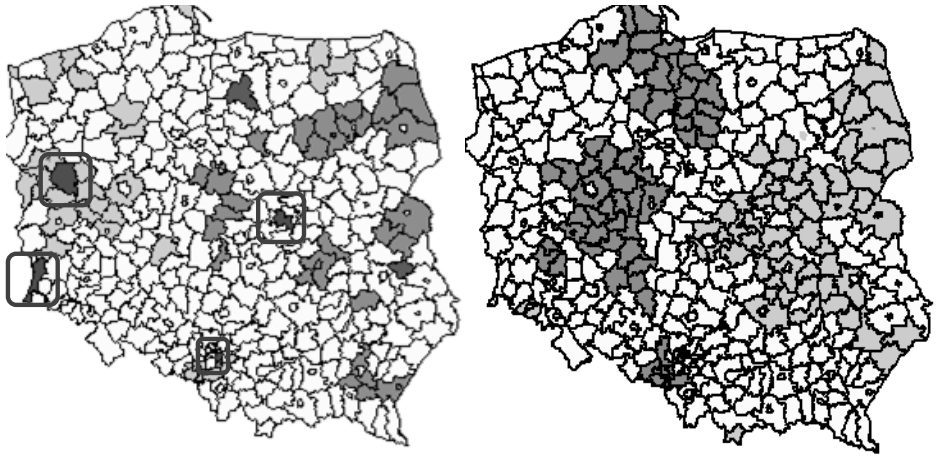

Figure 3. Spatial distribution of Moran's local statistics and clusters of poviats for the components of the aggregate unemployment rate: long-term unemployment (left – legend as in Fig. 2) and female/male prevalence (right – females dominating: marked dark grey) in 2014

Source: own work

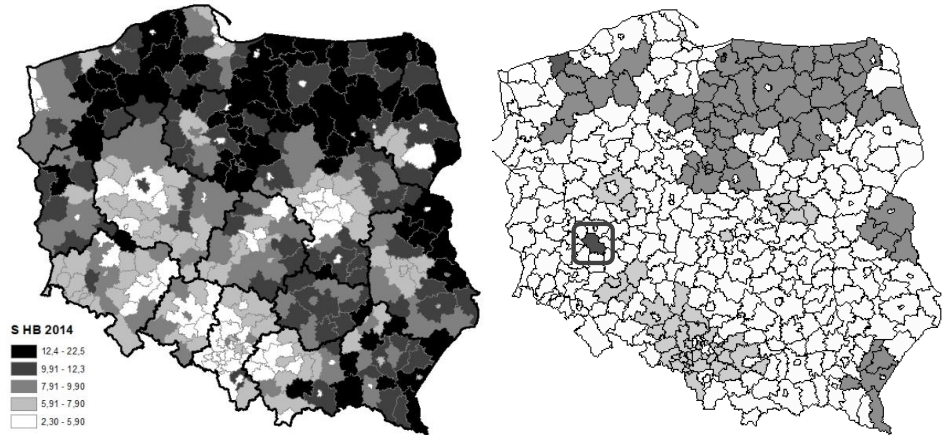

Figure 4. Spatial distribution and clusters of poviats of poverty indicator (*S HB*) in 2014 (right – legend as in Fig. 2)

Source: own work

Poviats with a more favourable situation formed somewhat smaller clusters. The largest of these can be identified within the borders of four voivodships: dolnośląskie,

opolskie, śląskie and małopolskie – they form a visible 'silesian belt'. Clusters consisting of a few poviats were observed in the immediate vicinity of the metropolies of Poznań, Warsaw and Wrocław along with the smaller ones around Gdańsk and Łódź.

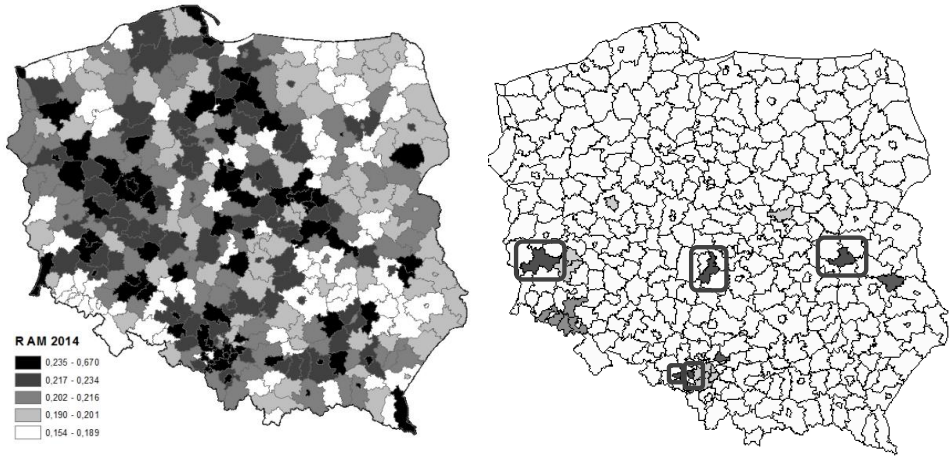

Figure 5. Spatial distribution and clusters of poviats for aggregate measure of economic development (*R AM*) in 2014 (right – legend as in Fig. 2)

Source: own work

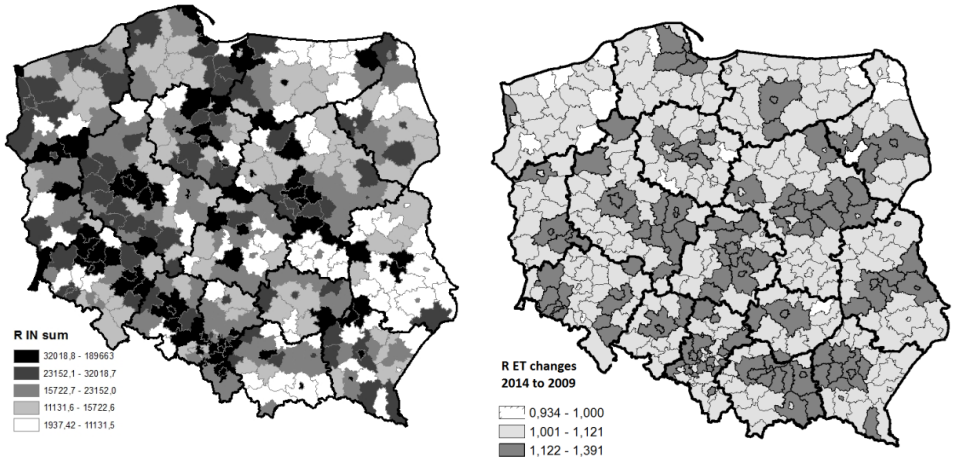

Figure 6. Cumulative of investment outlays in enterprises per 1 inhabitant at the working age in the period of 2009–2014 (left *R IN*) and changes of number of entities of the national economy recorded in the REGON register per 10,000 inhabitants in 2014 compared with 2009 (right *R ET*) – legend as in Fig. 2

Source: own work

According to the approved policy, lifting local communities out of poverty is possible through back-to-work schemes and improvements in the labour market. Picture 4 presents the spatial distribution and clusters of poviats for aggregate measure of economic development (*R AM*). Compared with the phenomena from the areas of *Pressure* and *State* they show little concentration and almost no clustering tendencies. In 2014 only singular clusters were visible – they appeared in the vicinity of Warsaw, Poznań, polkowicki and głogowski poviats (dolnośląskie) and the cities in Śląsk. The areas with the most favourable situation are as a rule large cities and also numerous, scattered poviats in wielkopolskie, northern part of dolnośląskie, śląskie and poviats with quite favourable situation in kujawsko-pomorskie. One cluster showing particularly low economic activity was noticed in 2014 for poviats: jeleniogórski, kamiennogórski and wałbrzyski (dolnośląskie).

The influence of investment outlays is prolonged in time; incurred outlays in a time period (*t*) affect labour market and competitiveness, also in the consecutive periods. Picture 5 presents cumulative investment outlays in poviats throughout the time scope of the research, i.e. 2009–2015. Results of this analysis confirm the tendency of investment to concentrate in a small number of poviats clustered around big cities and areas of growth. The lowest investment in the period of the last 7 years was characteristic of numerous poviats in lubelskie, małopolskie and warmińsko-mazurskie voivodships.

Considering economic activity of entities, the number of enterprises per 10,000 inhabitants increased in the vast majority of poviats. Only in voivodships: zachodnio-pomorskie, warmińsko-mazurskie, podlaskie, świętokrzyskie and kujawsko-pomorskie there were a few poviats, in which the number of enterprises per 10.000 inhabitants fell in 2014 compared with 2009. It has to be emphasised, that despite the general increase in the number of economic entities, the vast majority of poviats noted a decrease in the number of enterprises employing 10 or more employees (10+). In 2014, compared with 2009, only 51 poviats saw an increase in the 10+ enterprises per 10.000 inhabitants, and 57% of the cases of those were city-poviats. An increase of more than 10% for this category of enterprises (10+) was noted in the city of Opole, białogardzki poviat and the city of Wrocław. In zachodniopomorskie voivodship an increase of 10+ enterprises was observed in 6 of the poviats (neighbouring with the ones, for which the overall number of enterprises per 10.000 inhabitants fell).

3.3. Evaluation of changes in the situation over time

The final stage of the analysis is the evaluation of changes over time in the context of relationships between phenomena from the areas of *PSR*. The average level of *P AM* was worsening until 2013 and in 2014 it bounced back significantly – this in-

dicated improvement in the labour market (Fig. 5 left). A decrease in the value of the aggregate employment rate for the country in the initial period of the research was accompanied by the worsening of the situation in many poviats, particularly visible in 2012 (Tab. 5). At the same time the improvement in the situation at a country scale was also noticed in 84.2% of poviats. It corresponded with the tendency showed by the unemployment rate *P UR* for Poland, which slowly increased from 12.1% to 13.4% in 2014 and then fell to the lowest level in the researched period – 11.4% in 2014. Long-term unemployment grew throughout the entire period, also in the period when overall unemployment decreased. It may be due to the fact, that individuals who were unemployed in the short term found jobs, and so the significance of the long-term unemployed in the aggregate measure of unemployment grew.

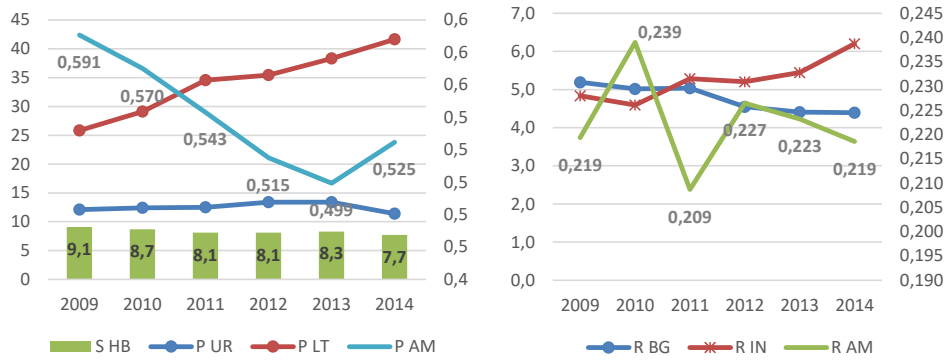

Figure 7. Changes of selected indicators' values for Poland in the period of 2009–2014

Source: own work

Table 5. Change matrix – evaluation of the situation of the poviats in a given year compared with previous one

	2010	2011	2012	2013	2014
P_AM	V1 = –3.5 V2 = 23.2	V1 = –4.7 V2 = 13.9	V1 = –5.2 V2 = 10.5 Overall deter.	V1 = –3.0 V2 = 21.8	V1 = 5.1 V2 = 84.2 ***Overall impr.***
S_HB	V1 = –4.4 V2 = 74.5	V1 = –6.9 V2 = 83.9 ***Overall impr.***	V1 = 0.0 V2 =44.5	V1 = 2.5 V2 = 14.5	V1 = –7.2 V2 = 97.1 ***Overall impr.***
R_AM	V1 = 8.9 V2 = 77.3 ***Overall impr.***	V1 = –12.7 V2 = 7.6 Overall deter.	V1 = 8.5 V2 = 79.5 ***Overall impr.***	V1 = –1.4 V2 = 37.4	V1 = –2.1 V2 = 36.3

V1 = change in the absolute value of the indicator's value for Poland ($t - 1$) = 100; V2 = the percentage of poviats that reported improvement.

Source: own work

Poverty in Poland decreased over the course of analysed period (except for a slight increase in 2013). The share of individuals relying on social assistance and transfers was decreasing regardless of the situation in the labour market. Exceptionally favourable changes occurred in 2011 and 2014, for which improvement in the situation was noted in 83.9% and 97.1% of households, respectively. Only in 2014 these positive changes were accompanied by a significant improvement in the labour market.

The economic situation in poviats changed year to year (Fig. 5 right), showing local or overall decline in one year, and local or overall improvement in the following one (Tab. 5). One can point to 2010 and 2012 as the years with robust economic development, in which over 75% of poviats noted an improvement in the situation. 2011 was the year of the strongest economic slowdown.

Investment outlays showed growing tendency (except for slight downturns in assorted time periods, however it did not affect the general rising trend). The balance of newly registered and removed economic entities changed significantly year to year, however, as it was mentioned in 3.2, in the final balance check for 2014 the number of economic entities registered in the Regon register was larger in the vast majority of poviats compared to 2009. This tendency with a particularly positive influence on the labour market was weakened by the fall in the share of 10+ enterprises (which are identified as the ones creating workplaces for a larger number of employees) in the overall number of enterprises. In 2014 the number of microenterprises (with up to 9 employees) amounted to 1625.5 per 10 000.00 inhabitants and was 12.8% higher compared to 2009, while the number of large enterprises (more than 250 employees) decreased by 10% to the level of 1.8 per 10 000.00 inhabitants. The number of small enterprises (up to 50 employees) fell by 7% over the period of the research. The number of medium-sized enterprises remained at about the same level. The changes in the enterprise structure could point to the fact, that the increase in the overall number of enterprises is only a partial success, because when joined by the decrease in the number of medium-sized and large enterprises it might not signify a real increase in the number of workplaces.

4. Summary

Relationships between aggregated unemployment rate and poverty were defined, indicating that its values point to the level of the gravity of the problem. Back-to-work schemes directed at the long-term unemployed or those lacking skills required in the present labour market pose greater challenge than in the case of those who are unemployed short-term. Improvement in the situation in the labour market happens when unemployment is restricted, regardless of its type. Positive changes in the levels of short-term unemployment can paradoxically adversely affect the structure of overall unemployment (by increasing the share of the long-term unemployed in the total). In order to avoid such interpretational nuances

one should use male/female or long-term unemployment rate, which could prove difficult regarding available data.

In order to summarise the results of the panel analysis of Sustainable Development in Polish poviats in terms of unemployment and its relationships with other resulting phenomena (poverty) and counteractive factors (economic entities – employment) one can state that:

– Unemployment is strongly correlated with poverty level expressed as a share of people in a household that rely on social benefits.
– Unemployment and poverty show stability in time.
– Unemployment and poverty show distinct cluster –forming tendencies for poviats; one can also observe that poviats with high poverty form more numerous clusters, located mainly in the north of the country (and slightly less numerous) in the east.
– Factors connected with the improvement of the economy potential of a region, e.g. investment and economic activity (expressed as a balance of business entities) show statistically significant relationship with unemployment.
– In the case of economic development the situation is much more beneficial in western and southern regions of the country and the Warsaw area.
– Economically developed areas do not show strong clustering tendencies for neighbouring poviats.
– Large cities like Warsaw, Poznań, Gdańsk and poviats in the 'silesian belt' of dolnośląskie – śląskie voivodships are centres towards which investment and economic activity gravitate.
– Despite general improvement in terms of poverty, visible structural imbalances persist. They manifest in a weak position of regions in northern and eastern Poland and strong position of areas clustered around selected large cities.

Despite an improvement in the economic activity in poviats, at least on local scale, the situation regarding unemployment deteriorated throughout the largest part of the time scope of the research, pointing to a limited effectiveness of economic activity as a tool for improvement of the situation in the regions. It is clearly visible that areas with high unemployment and poverty levels are poviats and cities in regions that lack robust economic centres, while the existing economic centres prove to be too weak to generate positive incentives for the development of neighbouring areas (even if their own situation is favourable, it does not correspond with the development of the whole region). In order to improve the situation in the areas of unemployment and poverty in numerous poviats of northern, central and eastern Poland, much effort would be required towards strengthening of their economic centres. Also, somewhat disturbing is the situation of the groups of poviats with a high level of long-term unemployment, clustered in the central and eastern Poland. It is worth mentioning though, that their distribution does not necessarily overlap poverty areas, which could point to other factors influencing poverty rather than only the prolonged lack of sources of income.

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Analiza czasowo-przestrzenna wybranych zagadnień społeczno-gospodarczych w zakresie zrównoważonego rozwoju w układzie przyczyna–stan–reakcja

Streszczenie: Zjawiska z zakresu zrównoważonego rozwoju (ZR) obejmują zmiany w czasie i przestrzeni oraz wzajemnie przenikające się relacje w sferze gospodarczej, społecznej, środowiskowej, instytucjonalnej i przestrzennej. O rozwoju zgodnym z koncepcją zrównoważonego i trwałego rozwoju mówimy wtedy, gdy zmiany zachodzące w otoczeniu mają na celu podnoszenie jakości życia mieszkańców Ziemi, z zachowaniem zasad ochrony zasobów środowiska na poziomie pozwalającym na rozwój kolejnym pokoleniom. Koncepcja ZR jest jednym z celów polityk rozwojowych prowadzo-

nych na poziomie globalnym, unijnym, krajowym i regionalnym. Stąd powstaje pytanie, jak zmiany w rozwoju w jednym z obszarów przekładają się na pozostałe sfery w przestrzeni jednostek terytorialnych. Badanie przeprowadzono dla zagadnień społeczno-gospodarczych, gdzie przez aktywizację gospodarczą oczekuje się poprawy w zakresie bezrobocia i ubóstwa. Analizowane zjawiska, opisane wskaźnikami, ustrukturyzowane są według zasady od problemu do jego rozwiązania *PSR* (*przyczyna–stan–reakcja*). Metodami analizy ZR w układzie *PSR* były syntetyczne miary rozwoju, analiza korelacji, statystyki przestrzenne oraz makroocena z wykorzystaniem „tablicy zmian". Analiza prowadzona była dla panelu danych o powiatach Polski w latach 2009–2014.

Słowa kluczowe: zrównoważony rozwój, analiza przestrzenna, model *PSR*

JEL: O18, Q56, R11, R12

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