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Social and technical infrastructure development of municipalities (*gminas*) in Poland

This paper presents the institutional and spatial determinants for the development of social and technical infrastructure in municipalities (*gminas*) in Poland. According to the empirical results, there are significant differences between various types of *gminas* in terms of the level of development of technical and social infrastructure. Similar levels of technical or social infrastructure are associated with a significantly higher level of economic development in urban and urban-rural *gminas* than in rural *gminas*. Spatially, the position of *gminas* in relation to larger settlement centres and communication routes affects the development of technical infrastructure to a greater extent than social infrastructure. The relationship between infrastructure development and selected economic and social characteristics of municipalities is a feedback loop in which the relative wealth of a local administrative unit stimulates the development of the infrastructure while at the same time benefiting from this fact. This means that the present use of European Union Structural Funds for the development of infrastructure does not contribute to closing the gap in development. Sustainable development is largely the result of institutional factors related to infrastructure. It is therefore advisable to move away from a purely redistributive approach in this regard to targeted territorial support of the development potential of municipalities.

Keywords: sustainable development, technical infrastructure, social infrastructure, municipalities, rural development

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Introduction

The main objective of this paper is to identify and assess empirically the current institutional and spatial characteristics and determinants of the development of technical and social infrastructure of municipalities (*gminas*)[1] in Poland and their impact on sustainable development in these administrative entities. Institutional structures are systemic and dynamic in nature, and interact with socio-economic processes, strengthening or weakening sustainable development. The research hypothesis was formulated around the assumption that within institutional structures the public sector represented by the local administration is an important proponent of sustainable development, but that its impact is significantly affected by spatial factors.

Infrastructure can be classified differently – by emphasising its technical, economic, social, institutional and innovative attributes. For the purposes of this study it is defined according to A. Ginsbert-Gebert (cited by Jarosiński, 2003) as a system of devices and institutions that perform ancillary social, economic or technical functions in relation to other spatial systems. The considerations are limited to the analysis of technical and social infrastructure. The technical infrastructure includes *inter alia* roads, gas pipelines, water supply systems, drainage networks, facilities and devices for environmental protection (sewage disposal systems etc.), whereas the social infrastructure fulfils the educational, cultural and health needs of the population. Infrastructure is thus a spatial set of facilities and institutions that induces efficient operation of enterprises and households and is essential in the spatial development of local systems. It influences the formation of human, social and cultural capital and the opportunities for economic initiatives, attraction of external capital, modernisation opportunities for growth of agricultural production, the standard of living and the generation of multifunctional and sustainable rural development. It also determines the opportunity for *gminas* to progress in civilisational terms, to increase territorial cohesion and to reduce the distance between their inhabitants.

The importance of infrastructure in local development gained attention in the late 1980s with the evolution of the theory of regional development (Blakely, 1989; Krugman, 1998) predominantly conditioned by endogenous resources, *inter alia* physical capital and 'soft' factors such as human, social and cultural capital. Theoretical works (e.g. Schultz, 1976; Lucas, 1988; Reich, 1996; Romer, 2000) highlighted the importance of intangible factors in the development of the near area (rural or urban). Infrastructure is closely related to the area for which it performs its tasks, as a specific resource associated with the territory, and the organisation of the process of investing in infrastructure takes the form of a network. In addition to the territorial dimension, the development thereof consists of organisational, cognitive, normative, economic and environmental aspects.

Rural development is closely linked to the development of infrastructure. In the process of rural development, infrastructure is one of the elements supporting the economic activity and determines its scope, structure and spatial distribution. This applies also to increases in agricultural productivity (Pinstrup-Andersen and Shimokawa, 2006). The level of infrastructure may determine the attractiveness or unattractiveness of the region, and thus provide opportunities and barriers to its further development. Infrastructure as a factor activating socio-economic progress is also one of the important determinants of the living conditions of the population. In the initial phase of development of the infrastructure it attracts people, and later people become the stimulus for further development of infrastructure. Measures aimed at attracting entrepreneurs can only succeed if they are connected with the improvement of technical and social

[1] The Polish system of local self-government is organised in three layers with 16 regions (*voivodships*) that correspond to the EU NUTS 2 level, 379 middle level (*poviats*) entities and 2478 municipalities (*gminas*) as the lowest level of local authorities. Entities at each layer are organisationally and financially independent. Neither *voivodships* nor *poviats* have any control over *gminas* (LAU 2), which are administratively and financially independent, having their own sources of income, development strategies and elected authorities. Particular emphasis is placed on the *gmina* as the most important tool of decentralisation and reorientation on local needs.

infrastructure, creating the appropriate economic environment, appropriate for business (Naldi *et al*., 2015).

The infrastructural services are provided separately and jointly by the public, private and NGO sectors, with the most important role being played by the former. In Poland the State should alleviate the disparities in socio-economic development. Self-governments (*gminas*) are therefore primary owners of the infrastructure and depending on their financial capabilities are attempting to create favourable access to its services. *Gminas* are responsible for disbursement of budget funds to finance the infrastructural equipment and facilities. As the owners of most of the infrastructural equipment, territorial self-governments generate more favourable conditions for the recipients of infrastructural services than other owners. They do not perceive profitability as a primary task, but develop infrastructure towards comprehensiveness and complementarity of devices, hoping that this will improve the conditions for socio-economic development.

Infrastructure development requires an appropriate local investment policy that is aimed at increasing the attractiveness and credibility of a *gmina* as a place of residence and job creation, which in turn determines the opportunities for its further development. The areas that are well equipped with infrastructure accumulate various resources. Perroux (cited by Domański, 2006) refers to such areas as 'motoric units', where infrastructural devices attract investments from other economic fields, whereas Myrdal (1958) calls them 'core areas' where factors promoting the economic development and producing multiplier effects are concentrated. The concept of core areas also appears in Hirschman (1958).

Local authorities have the ability to use aid (primarily European Union (EU) funds obtained under the Rural Development Programme, a Regional Operational Programme and the Human Capital Operational Programme) for infrastructural development which is only available to local governments. The willingness of local communities to contribute their own financial resources to the cost of construction or extension of infrastructure is limited, and it usually happens for smaller projects such as the modernisation of a road. In such a situation, the development of the local economy (reducing unemployment and employment in agriculture, improving the living conditions of the population and increasing the professional and spatial mobility of the population) determine the State aid and search for extrabudgetary funds for infrastructural development.

Kołodziejczyk (ed., 2012) presented evidence for the dependence of socio-economic development in Poland on the level of infrastructural development. Related empirical studies carried out using Polish data in various regions of the country (e.g. Salamon, 2006; Krakowiak-Bal, 2007; Piszczek, 2010; Baran, 2011; Kłos, 2012; Wasiluk, 2013) have shown significant correlations between the level of development of local infrastructure and the economic, financial, social and demographic characteristics of local administrative units. In this paper, empirical analysis allowed the determinants of the institutional development of the technical and social infrastructure to be verified as a key factor for the sustainable development of rural areas in Poland.

Methodology

A heterogeneous statistical data set for the period 2005-2012 of the entire population of *gminas* in Poland was employed. Empirical analysis involved three steps. In the first step the development of individual elements of infrastructure in municipalities was examined, taking into account their types. Subsequently a synthetic index – as a composite measure of technical and social infrastructure development – was developed, serving as a basis for further calculations and spatial mapping. Based upon the calculated measures, in the final step a causality assessment was carried out, aiming at establishing the determinants of sustainable infrastructure development. The calculated measures were confronted with selected financial and organisational characteristics of the municipalities. Quantitative approaches included descriptive statistics and Pearson correlation coefficients. Data were supplied by Polish Statistical Office, GUS (the Regional Data Bank - *Bank Danych Regionalnych*).

In Poland, the distinction between rural, urban and urban-rural municipalities was introduced for the purpose of national territorial division in the Regulation of the Council of Ministers on 15 December 1998 entitled *On the detailed arrangements for implementing, using and sharing national official register of territorial division of the country and related responsibilities of the government and the local government units* (Journal of Laws [Dziennik Ustaw] 1998.157.1031 with amendments). According to § 2 points 6 to 8 of the Regulation, an urban *gmina* (304 in Poland) is a municipality with the status of the city, a rural *gmina* (1563) is a municipality in which there are only villages and an urban-rural *gmina* (611) is a municipality in which at least one of the settlements has the status of the city.

As explained above, infrastructure is defined as a system of devices and institutions that perform ancillary functions in relation to other spatial systems. Owing to significant differences in the spatial distributions of indicators, it was not possible to assess the infrastructure of rural areas by considering just one element. Instead, this was done using the synthetic index, a measure of development defined by Hellwig (1972). This is a taxonomical approach based upon a Euklidean distance of a set of characteristics from an artificially constructed limit; a higher level of the statistics correspond to a higher level of technical or social development.

In a very concise description of the estimation path, each *gmina* can be attributed to a point P in n-dimensional space, such that $P_i(x_{ij})$ is an array of characteristics x where $i=1,\ldots,n$; $j=1,\ldots,m$, $i=gmina$, $j=$descriptive variable, $n=$number of *gminas*, and $m=$number of variables. Each variable x is subsequently normalised $x_{ij} \rightarrow z_{ij}$. The identification of the development pattern follows with: $P_0=$an artificial point in the space with coordinates: $z_{01}, z_{02}, \ldots, z_{0n}$ where $z_{0j}=\max(z_{ij})$ or $z_{0j}=\min(z_{ij})$. The distance between $P_i(x_{ij})$ and P_0 is computed as $c_{i0} = \sqrt{\sum_{i=1}^{n}(z_{ij} - z_{0j})^2}$ and finally the synthetic measure for each *gmina* is estimated as: $d_i = 1 - \frac{c_{i0}}{c_0}$ where $c_0 = \overline{c} + 2_{S_0}$ and $\overline{c}=$the arithmetical mean of the distance between *gmina* and pattern, and $S_0=$the standard devi-

ation of the distance between *gmina* and pattern.

Synthetic values are determined in reference to the population mean, which in Poland in the case of both technical and social infrastructures amounts to 100. Higher values indicate a higher level of development of a given type of infrastructure in the *gmina*. For technical infrastructure, the estimation was based on elements such as the density of metalled roads, the length of the water supply system, sewage disposal system and gas network, while the evaluated elements of social infrastructure included the density of the network of educational institutions at different levels of education, and the numbers of health centres and cultural institutions.

Results

Level of development of technical infrastructure in municipalities

Water supply and sewage disposal systems are still the facilities with the highest degree of variation between the *gminas* (Table 1). In 2012, the water supply network density in rural *gminas* amounted on average to about 93 km, in urban-rural *gminas* about 90 km and in urban ones 327 km per 100 km^2. The values for the sewerage network were 32, 35 and 299 km respectively. The development of the water supply and sewerage networks in the examined *gminas* translated into an increase in the share of population served by the networks in relation to the total population in the period 2005-2012, in the case of water supply network on average by 1.5 per cent a year, and for the sewerage system by 1.3 per cent.

There are still *gminas* that have no water supply and sewerage networks. In 2012, 0.6 per cent of *gminas* had no water supply network, 8.2 per cent had no sewerage system, and these were mainly rural *gminas* (70 per cent). The density of sewerage systems featured much greater disparities than water supply networks. In 2012, the coefficient of variation for water supply networks in urban *gminas* was 47.6 per cent, in rural ones it was 62.2 per cent and in urban-rural ones 65.4 per cent. The equivalent values for sewerage networks were 56.6 per cent, 158.3 per cent and 107.5 per cent respectively. A comparison of the amount of supplied water and discharged sewage shows that in urban *gminas* it is currently 70 per cent of the water supply, in rural ones it amounts to 21 per cent and in urban-rural ones to 32 per cent. There were also large differences between *gminas* in 2012 in terms of inhabitants served by sewage treatment plants: 64 per cent in urban *gminas*, 17 per cent in rural ones and 34 per cent in urban-rural ones. The costs of rural infrastructure, both at the investment stage as well as due to ongoing maintenance, are generally much higher in rural than in urban areas because of the dispersed settlements. As a result, access to rural infrastructure components is still much worse than in urban areas.

Level of development of social infrastructure in municipalities

Within the *gminas* there was a significant reduction in the number of social infrastructure institutions between 2005 and 2012. One of the main factors that determines spatial distribution of pre-school education is the number of children aged 3-6. The share of this age group in the total population amounts to around 6.1 per cent in urban *gminas*, 6.3 per cent in urban-rural ones and 5.3 per cent in rural ones. As the number of kindergartens decreases, the number of children covered by pre-school education falls: in 2012, the number of children in pre-school institutions equalled 77.1 in urban *gminas*, 62.3 in urban-rural ones and 58.1 in rural areas per 1,000 children aged 3-6 (Table 2). In the period 2005-2012, there were also changes in the primary education: approximately 4 per cent of schools in urban *gminas*, 8 per cent of schools in rural-urban ones and 11 per cent rural ones were closed. Hence, within rural areas the spatial availability of basic educational institutions decreased.

Table 1: Characteristics of the technical infrastructure in different types of *gminas* in 2012.

Characteristic	Technical infrastructure				
	average	min	max	coefficient of variation	median
			Urban municipalities		
Inhabitants using the water supply (%)	93.3	38.2	99.7	10.5	96.4
Inhabitants using sewerage (%)	81.8	24.8	99.8	18.3	87.1
Inhabitants using gas installations (%)	60.4	0.0	99.4	57.2	75.9
Length of the sewerage network (km per 100 km^2)	299	6	913	56.6	295
Length of the water supply network (km per 100 km^2)	327	7	773	47.6	329
			Rural municipalities		
Inhabitants using the water supply (%)	76.0	0.0	99.9	27.3	82.4
Inhabitants using sewerage (%)	27.1	0.0	99.5	77.8	24.7
Inhabitants using gas installations (%)	15.1	0.0	97.1	162.3	0.0
Length of the sewerage network (km per 100 km^2)	32	0.0	448	158.3	15
Length of the water supply network (km per 100 km^2)	93	0.0	518	62.2	85
			Urban-rural municipalities		
Inhabitants using the water supply (%)	83.4	0.0	99.5	18.1	87.6
Inhabitants using sewerage (%)	47.8	2.4	96.8	40.9	48.3
Inhabitants using gas installations (%)	30.9	0.0	96.6	93.2	27.7
Length of the sewerage network (km per 100 km^2)	35	0.8	343	107.5	23
Length of the water supply network (km per 100 km^2)	89	0.0	438	65.4	81

Data source: GUS

Table 2: Characteristics of the social infrastructure in different types of *gminas* in 2012.

Characteristic	Social infrastructure				
	average	min	max	coefficient of variation	median
			Urban municipalities		
Kindergartens per 100 km^2	36.3	0.9	161.5	74.9	30.6
Kindergartens per 10,000 inhabitants	3.0	0.7	15.5	42.4	2.8
Clinics per 100 km^2	74.7	0.0	290.2	71.0	63.7
Clinics per 10,000 inhabitants	6.1	0.0	14.8	39.4	5.7
Middle schools per 100 km^2	21.5	0.9	80.0	63.7	20.0
Libraries per 100 km^2	14.2	0.9	66.7	68.1	12.0
Libraries per 10,000 inhabitants	1.4	0.3	7.4	62.7	1.2
Children in kindergartens per 1,000 children	77.1	2.8	912.6	137.8	44.9
Primary schools per 10,000 children	70.7	14.3	215.5	48.9	67.1
Children in primary schools per 1,000 children	97.3	59.5	124.2	6.6	97.8
Children in secondary schools per 1,000 children	96.5	40.8	186.7	11.3	97.3
			Rural municipalities		
Kindergartens per 100 km^2	2.2	0.0	42.9	136.6	1.2
Kindergartens per 10,000 inhabitants	2.9	0.0	17.9	81.1	2.5
Clinics per 100 km^2	2.5	0.0	28.0	120.1	1.7
Clinics per 10,000 inhabitants	3.6	0.0	18.5	53.8	3.3
Middle schools per 100 km^2	1.8	0.0	26.3	95.3	1.3
Libraries per 100 km^2	2.5	0.0	21.1	79.5	2.0
Libraries per 10,000 inhabitants	3.9	0.0	14.4	51.4	3.6
Children in kindergartens per 1,000 children	58.1	0.0	1601.6	135.7	40.7
Primary schools per 10,000 children	73.0	0.0	239.1	47.4	69.4
Children in primary schools per 1,000 children	97.3	0.0	172.0	10.0	98.3
Children in secondary schools per 1,000 children	95.8	0.0	182.1	15.4	97.3
			Urban-rural municipalities		
Kindergartens per 100 km^2	3.1	0.0	42.2	136.0	1.7
Kindergartens per 10,000 inhabitants	2.6	0.0	11.4	53.0	2.3
Clinics per 100 km^2	4.4	0.0	40.3	107.4	2.9
Clinics per 10,000 inhabitants	4.1	0.0	13.3	45.4	3.9
Middle schools per 100 km^2	2.1	0.2	14.8	96.1	1.5
Libraries per 100 km^2	2.6	0.0	17.4	82.1	2.1
Libraries per 10,000 inhabitants	2.8	0.0	8.0	50.4	2.6
Children in kindergartens per 1,000 children	62.3	0.0	3115.9	253.5	37.1
Primary schools per 10,000 children	74.2	0.0	240.0	50.0	71.8
Children in primary schools per 1,000 children	94.8	0.0	150.5	17.3	97.4
Children in secondary schools per 1,000 children	93.8	0.0	228.7	20.7	96.6

Data source: GUS

Generally, the average indicators of availability of social infrastructure are at a level higher than the median, which indicates a high concentration of such facilities in some *gminas* (Table 2).

Synthetic measures of technical and social infrastructure development

The overall level of infrastructure development in a *gmina* in the period 2005-2012 was assessed using the composite measure developed by Hellwig (1972). There are large disparities in the development of technical and social infrastructure between the types of *gminas* and their size measured by the number of inhabitants (Table 3).

A much higher level of social and technical infrastructure occurred in urban *gminas* and *gminas* with a higher population regardless of the type. Therefore, it can be concluded that from the point of view of the development and operation of these facilities, it is the population in a *gmina* that counts. This can be interpreted on the basis of certain theories on regional and local development, including the growth pole theory and gravity model (Perroux, Hirschman), where development is correlated mainly with the population potential and its demographic structure. Major differences in the level of development of the technical infrastructure were observed in the urban *gminas* rather than the urban-rural and rural ones, as evidenced by the coefficient of variation. However, as regards the technical infrastructure in urban *gminas*, as the population increased, these differences declined whereas in rural and urban-rural *gminas* they increased. For social infrastructure, major differences occur between urban-rural and rural *gminas* rather than between urban ones. Once again, it confirms a higher concentration of social infrastructure institutions in cities.

When comparing the 2005 and 2012 coefficients of variation in individual types of *gminas*, a decrease in these indicators for social infrastructure and a slight increase in the case of technical infrastructure can be seen. It results, on the one hand, from the closure of numerous social infrastructure institutions because of a demographic low but, on the other hand, from increased financial potential to develop technical infrastructure facilities.

Table 3: Composite ratio of technical and social infrastructure according to the type and size of *gmina*.

Type of *gmina* and no. inhabi-tants (000)	Technical infrastructure				Social infrastructure			
	measure of development		coefficient of variation		measure of development		coefficient of variation	
	2005	2012	2005	2012	2005	2012	2005	2012
Urban-rural	***94.0***	***93.4***	***20.4***	***23.0***	***87.2***	***86.8***	***60.6***	***53.6***
< 5.0	79.7	77.2	12.1	14.5	114.4	92.8	56.5	22.6
5.0-7.5	82.6	81.4	13.9	15.7	86.2	71.8	38.2	68.1
7.5-15.0	90.1	89.2	16.4	18.0	82.5	80.8	32.5	46.8
15.0-30.0	101.2	101.2	17.6	20.9	84.9	99.2	34.4	56.2
> 30.0	126.1	127.1	17.9	20.4	109.7	108.8	62.9	36.3
Rural	***82.2***	***82.5***	***26.9***	***29.9***	***80.0***	***89.5***	***47.3***	***35.2***
< 2.5	64.8	63.7	23.5	23.2	89.8	89.3	32.2	51.2
2.5-5.0	76.7	75.0	19.3	21.4	83.2	90.4	47.5	38.3
5.0-10.0	81.6	81.3	24.8	26.4	77.6	87.3	44.5	33.5
10.0-15.0	96.3	99.4	29.3	31.0	79.4	92.5	59.6	31.8
> 15.0	111.8	114.5	36.4	35.6	80.2	98.2	43.7	26.5
Urban	***203.4***	***203.0***	***33.2***	***31.1***	***227.9***	***179.7***	***60.6***	***33.6***
< 10.0	136.2	138.0	36.9	38.2	180.2	138.3	62.4	42.7
10.0-20.0	186.3	187.2	32.6	30.9	194.2	167.1	43.3	37.9
20.0-50.0	228.5	222.6	28.3	25.8	229.0	185.6	36.5	29.3
50.0-100.0	228.2	230.9	25.9	24.0	292.9	199.4	91.8	25.5
> 100.0	229.4	227.7	18.3	16.4	268.5	214.3	24.5	22.9

Data source: GUS

Table 4: Definitions of five groups of *gminas* in terms of their level of infrastructure development.

Group name	Range of values ($\overline{x}$ - average, δ_x - standard deviation)
Very low	$x_i < \overline{x} - 0.9 * \delta_x$
Low	$\overline{x} - 0.3 * \delta_x > x_i \geq \overline{x} - 0.9 * \delta_x$
Average	$\overline{x} + 0.3 * \delta_x > x_i \geq \overline{x} - 0.3 * \delta_x$
High	$\overline{x} + 0.9 * \delta_x > x_i \geq \overline{x} + 0.3 * \delta_x$
Very high	$x_i \geq \overline{x} + 0.9 * \delta_x$

Source: own calculations

Spatial characteristics of infrastructure development

From the analysis of the level of infrastructure development, by taking into account the average value of the synthetic index and the standard deviation from the mean, five groups of *gminas* were identified (Table 4). Clear differences in the level of development of both technical and social infrastructure can be observed between individual NUTS 2 regions (*voivodeships* or *województwa*) and within regions. As regards the diversity of infrastructure development, the differences between the *gminas* are larger in terms of social rather than technical infrastructure, both at the local and the regional scales. The highest diversity in terms of technical infrastructure occurs in Małopolskie and Śląskie *voivodeships* (in the far south) and the lowest in the central Kujawsko-Pomorskie and Łódzkie *voivodeships* (Figure 1), and for social infrastructure in Opolskie and Małopolskie *voivodeships* (again in the south), and Świętokrzyskie (south) and Pomorskie (north) *voivodeships* respectively (Figure 2).

Very high levels of development of technical and social infrastructure are evident in about 80 per cent of urban *gminas* (such as Gdańsk, Poznań and Warszawa) but only in 3.1 per cent of rural *gminas*. Rural and urban-rural areas had the highest shares of *gminas* with low and average levels of development. This confirms that, in general, the level of infrastructure development is much lower in rural and urban-rural *gminas* than in urban *gminas*. However, the position of *gminas* in relation to larger settlement centres and communication routes affects the development of technical infrastructure to a greater extent than social infrastructure. As far as social infrastructure is concerned, *gminas* within the hinterland of a city have a lower level of infrastructure development, the cities become then the main centres of concentration of infrastructural facilities.

From the coefficients of variation for infrastructure it can be concluded that there is a clear polarisation of the phenomena. This applies in particular to the social infrastructure in urban-rural and rural *gminas* with bigger populations. It may mean that a higher coefficient of variation results from

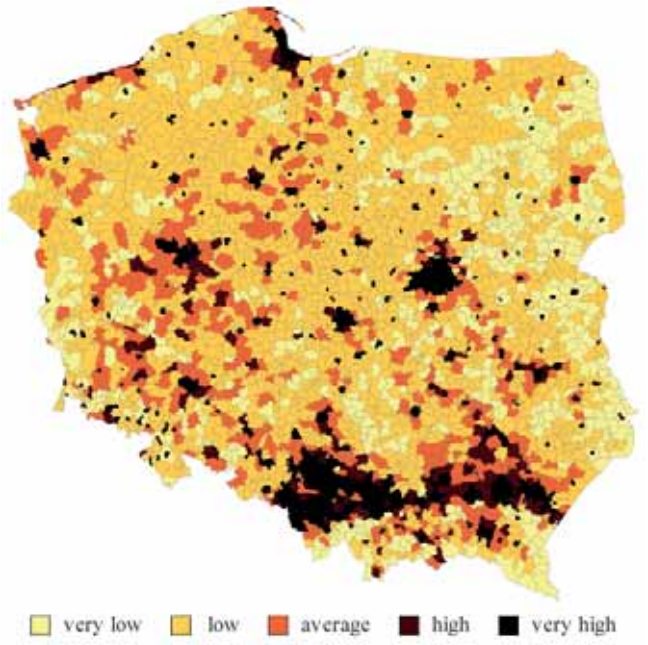

Figure 1: Level of technical infrastructure development of *gminas* in 2012.

For the definitions of the five groups of *gminas* see Table 4
Data source: GUS

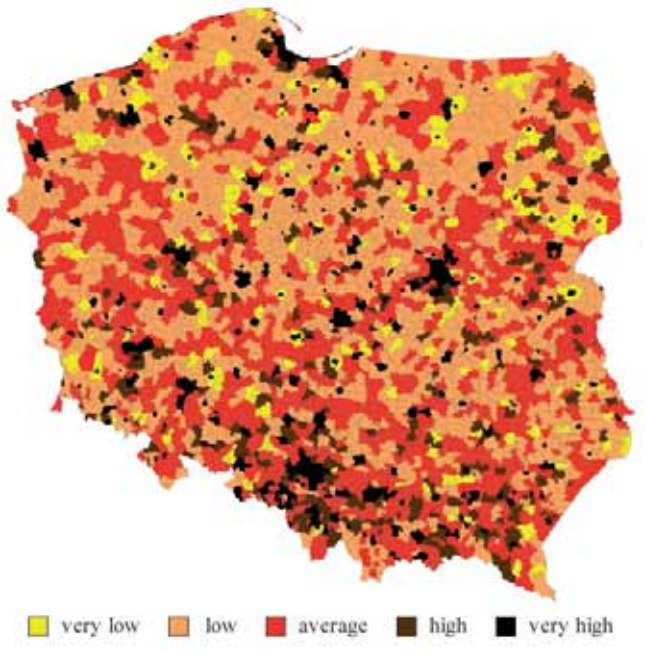

Figure 2: Level of social infrastructure development of *gminas* in 2012.

For the definitions of the five groups of *gminas* see Table 4
Data source: GUS

the different rates of development of these areas. The result can be regarded as empirical evidence for the validity of assumptions of the theory of polarisation (Hirschman, 1958), according to which the increase comes from the core, resulting in the polarisation process. In this sense, spatial polarisation means the concentration of resources in selected (core) entities and is characteristic of the early stages of economic development, or areas undergoing economic transformation.

Budgetary determinants of infrastructure development

In Poland, the investment policy on infrastructure is a domain of activity of *gmina* self-government, and its effectiveness depends on the knowledge of the needs and available financial resources. Obtaining more EU funds by richer *gminas* might lead to further marginalisation of the *gminas* that are lagging behind as far as development is concerned and to increased distance between them. In 2012, EU funds represented about 6.6 per cent of total income of all *gminas*; in rural *gminas* it was about 6.7 per cent, in urban-rural ones 6.6 per cent and in urban ones 6.3 per cent (Table 5). However, a much higher percentage of urban *gminas* (22.2 per cent) had such funds amounting to over 7 per cent of their budget than rural *gminas* (17.3 per cent) or urban-rural ones (18.0 per cent). Most *gminas* – about 27 per cent (in each category group) – obtained EU funds amounting to 3-5 per cent of their budget. A high impact on obtaining such funds, confirmed in this study by a high Pearson correlation coefficient (r=0.59), is exerted by the amount of own income in a *gmina*.

It was however not observed that the share of such funds in the total income of *gminas* is affected by the population of a *gmina*. The highest Pearson correlation coefficient of the overall evaluation of the level of development of the technical infrastructure was found in the case of own income per inhabitant (r=0.56) and the share of capital expenditure in total expenditure of *gminas* (r=0.61). However, in 2010, 41 per cent of the *gminas* had an own income per inhabitant below the average, i.e. below PLN 700, and in 49.1 per cent of *gminas* the share of capital expenditure in their total expenditure was below the average, i.e. approximately 17 per cent. This suggests that about 50 per cent of the examined *gminas* cannot develop their infrastructure due to their financial situation.

Similarly to the EU funds in the budget of *gminas*, the share of capital expenditure in the total expenditure of *gminas* increased in the period 2009-2011, followed by a slight decrease in 2011, in all types of *gminas* (annual data not shown). In the period 2006-2012, in the structure of expenditure of the *gminas*, capital expenditure accounted for 20.4 per cent on average (Table 5). Studies have shown that the *gminas* with a less favourable financial situation also proved to be active in terms of investment. In this case, there was also a tendency for this ratio for different types and sizes of *gminas* to become similar with the influx of EU funds. The relationship between the share of EU income in the *gmina* budget and the share of capital expenditure in the total expenditure measured by the Pearson correlation coefficient is statistically significant (r=0.72).

Discussion

When analysing the availability and changes in water supply and sewerage systems in Polish *gminas*, Kołodziejczyk (2012a) observed that more advantageous changes in water supply systems occurred in *gminas* that obtained more EU funds, in *gminas* with fewer inhabitants, and which were rather rural than urban-rural. As far as sewerage networks were concerned, such changes occurred in *gminas* with a higher population, but also in rural *gminas* and in *gminas*

Table 5: Shares of income from EU funds and capital expenditure in total expenditure, according to the type and size of *gmina*.

Urban-rural			Rural			Urban		
No. inhabitants (000)	Income, 2012 (%)	Expenditure* (%)	No. inhabitants (000)	Income, 2012 (%)	Expenditure* (%)	No. inhabitants (000)	Income, 2012 (%)	Expenditure* (%)
< 5.0	4.7	19.4	< 2.5	7.0	19.5	< 10	7.1	19.6
5.0-7.5	7.5	21.0	2.5-5.0	7.4	19.8	10-20	7.1	20.3
7.5-15.0	7.2	20.8	5.0-10.0	6.6	20.2	20-50	5.2	20.6
15.0-30.0	5.7	19.9	10.0-15.0	5.5	22.0	50-100	5.6	18.0
> 30.0	5.1	21.9	> 15.0	4.2	21.4	> 100	7.4	21.8
All *gminas*	6.6	20.6	All *gminas*	6.6	20.3	All *gminas*	6.3	20.1

*Average of the period 2006-2012
Data source: GUS

with a higher share of EU funds. Owing to the high cost of infrastructural investments, not every *gmina* is able to cover fully the expenses on the basis of their own income. The downward trend in recent years in the share of own income in the total income of *gminas***,** from 45 per cent in 2005 to 42 per cent in 2012, makes the financial situation of local authorities uncertain, it does not guarantee stability of own sources of income. Therefore, under-investment of infrastructure grows in accordance with the reported needs and becomes a barrier to the initiation of development processes within some areas (Kołodziejczyk, 2012b).

The relationships of rural infrastructure with the population system are reciprocal in nature. On the one hand, population and how the population is distributed in space affect the overall level of development of infrastructure; on the other hand, the level of development of infrastructure impacts on the number and structural changes taking place in the population system. The comparison of the density of population within rural areas with the synthetic measure of infrastructure development showed a strong correlation. What should be pointed out in particular is the strong dependence in the case of social infrastructure ($r=0.64$). Because social infrastructure services are point-based, they have to be used at the place where they are provided, and therefore their distribution should be proportionate to the number of inhabitants and space. The correlation is different in the case of rural areas remaining under the influence of cities. The concentration of population is not promoted by an appropriate development of social infrastructure. In such a case, the cities are the main centres of concentration of infrastructure. This is a conscious decision of local authorities (distribution of infrastructure investment projects in large centres) due to the scarcity of financial resources. Large centres also exhibit more bottom-up initiatives, and social pressure on the authorities are much more developed – as regards the allocation of funds in such localities.

As rural areas are subject to numerous negative impacts and pressures arising predominantly from the unfavourable demographic situation, there is an urgent need to modernise the existing technical infrastructure in order to ensure the implementation of the new needs of the local community, *inter alia*, appropriate level of mobility and ensuring proper care for the elderly. Technical infrastructure is important not only within the area of administrative unit where the investment is located, but also for the neighbouring units.

As regards social infrastructure development, the area of social services is still treated by many government and self-government politicians as a secondary element that needs to be addressed after the resolution of the major economic problems. The significant decrease in the number of kindergartens (by about 14 per cent) and preschool education establishments (by about 11 per cent) in Poland may be particularly dangerous. Owing to the reduced availability and accessibility of such institutions, it will result in fewer educational opportunities for children from rural areas and might also contribute to a reduction in population growth. Similarly, the declining share of expenditure from the budget of *gminas* on culture and art in recent years has also caused the regression of traditional culture media, such as libraries, community centres, youth clubs and sports clubs. However, new forms of cultural activity are becoming more and more popular owing to mobile devices such as computers with Internet access. According to the GUS, access to the Internet within rural areas is provided to around 42 per cent of households, compared to 69 per cent in the cities.

There are significant differences between various types of *gminas* in terms of the impact of the level of development of technical and social infrastructure on individual aspects of sustainable development. The same levels of technical or social infrastructure contribute to a significantly higher level of economic development in urban and urban-rural *gminas* than in rural *gminas*. A low level of infrastructure development in *gminas* in 2012 was associated with a significant deterioration in the socio-economic situation in 2012, in particular in rural *gminas* in comparison with 2005. Given that in 2012, *gminas* with a very low or low level of development of their technical infrastructure accounted for about 50 per cent of all *gminas*, and for the social infrastructure for about 52 per cent, there is no reason for optimism about their future economic and social development. Sustainable development is largely the effect of institutional determinants of infrastructure. Therefore, it is necessary to depart from the redistributive approach in this regard towards the territorially-oriented support for the development potential of *gminas*.

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