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THE DYNAMICS AND SPATIAL DIFFERENTIATION OF MUNICIPAL INFRASTRUCTURE IN 2004-2013 (EG. MALOPOLSKA REGION)

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Abstract

The article deals with the issues of spatial diversity network of technical infrastructure in Poland. Research objects were the counties forming the Malopolska Voivodeship, as a region with rich internal diversity and specific structural problems in rural areas. The length of the water and sewage networks and the participation of residents served by these facilities infrastructure were evaluated. Comparative analysis methods and statistical measure of the dynamism and diversity were used. The analyzes carried out that there is a high spatial differences in access to basic infrastructure. Definitely more residents of Malopolska were equipped with access to water supply than sewerage. While the sewage system showed a much higher growth rate compared to the water supply. The highest values of variation coefficients were recorded for the length of the sewerage network and the percent of inhabitants equipped it.

Key words**:** *infrastructure, municipal economy, self-government units*

INTRODUCTION

The essence of communal economy is to achieve the objectives of a public utility and the scope designate the public tasks defined by the law [1]. Municipal services management is a vital area of operations of territorial self-government units. To the greatest degree it is realized by basic level self-governments, i.e. *gminas*, as, according to the Self-government Act, an important part of public tasks falls within the competence of that level of territorial self-government units [13]. Pursuant to art. 7 of the said Act, *gmina*'s own tasks include satisfying collective needs of its inhabitants. The statutory list of *gmina*'s competencies is, in this case, extensive and includes a dozen or so types of tasks.

Activities performed in the area of municipal services management mainly involve completing works related to the construction and maintenance of technical and social infrastructure facilities. Public sector's engagement in the development of components of such infrastructure and their use in the process of rendering public services has a tradition of many years [4]. At present uninterrupted satisfaction of various needs of local communities and the entire society is so natural that it would be difficult to imagine individual communities efficiently functioning without them [8].

Municipal services management includes, in particular, the completion of public utility tasks by territorial self-government units aimed at current and uninterrupted satisfaction of collective needs of the population by rendering commonly available services [14].

The term "municipal services management" also evolved in relation to the perception of the role of the territorial self-government in Poland. Before the transformation of the political system it had been understood in a relatively narrow way and referred to the satisfaction of basic, current financial and material needs of mostly inhabitants of towns and cities. After the political system's transformation and reactivation of the territorial self-government at the level of *gminas*, the term was broadened to include any and all forms of economic activities of *gminas* both in towns and cities and in rural areas. The municipal services management came to be understood as maintaining facilities and institutions satisfying needs

related to the inhabitancy of a specific area by a population [3].

MATERIALS AND METHODS

Statistical data acquired from the Local Data Bank Central Statistical Office (LDB CSO) accounted for source material. Nineteen local government units having the status of a county (NUTS-4), comprising the area Malopolska Region were enrolled to the analysis.

The analysis excluded 3 largest cities in the region (Krakow, Tarnow and Nowy Sacz) having the status of independent city due to their different characteristics and economic conditions. The study uses comparative method and dynamic analysis. To assess the level of volatility of equipment in infrastructural objects were also used statistical measures (eg. interval, standard deviation, variation coefficient).

The purpose of this paper is to analyze and assess transformations of basic components of the municipal infrastructure. Due to its size only selected components of the infrastructure were analyzed (those for whose condition *gmina* authorities are to the largest degree responsible). In terms of the area under analysis the paper was limited to territorial self-government units of the Malopolska Voivodeship whereas the time span under analysis was a period of 10 years (2004-2013).

RESULTS AND DISCUSSIONS

Infrastructure is described as a set of facilities and investments creating bases for the proper functioning and development of the national economy and ensuring proper conditions for the existence of population and the possibilities of their improvement [6]. It is a basis that allows entities of the national economy to efficiently and effectively function [9], hence the purpose of its existence can be demonstrated through the prism of people and economic entities relying on it.

The importance of the infrastructure to the economic development in economic analyses is mostly demonstrated in the context of the theory of an enterprise's location. The influence of infrastructure on the economic development is also presented from the perspective of decreasing enterprises' overheads [2]. According to such statement, a given region's attractiveness for investments depends on overheads which are inherent in order to establish a company there. Territorial units may affect decisions on location venues of enterprises first of all by equipping a given area with infrastructural facilities and then by using it as a serious asset presenting their offering to investors and convincing entrepreneurs to invest in that area [5].

Apart from a direct contribution of infrastructural components to the functioning of economic entities, also indirect influence is important which, in the economy, takes the form of externalities. Currently direct effects are repeatedly treated as more important than the direct contribution to the volume and structure of a social product which is particularly strongly stressed in new models of the economic growth. It is shown that externalities created by the infrastructure may lead to the acceleration of a long-term economic growth rate. One of such effects is the diffusion of innovations and the so-called spillover effects in the R&D sector [10].

The said analyses prove that infrastructural elements are quite important to the initiation and dynamization of the local and regional growth processes. It should also be stressed that the infrastructural facilities are a measure of the advancing civilization, to a certain degree determining the level of the economic growth of states or regions. We can see an interrelation whereby "a degree of the development of the infrastructure is related to the level of a country's economic development as a feedback. Economic development creates demand for the infrastructure's services and contributes to its development. At the same time the infrastructure whose development advances thanks to externalities creates reasons for the development of the economy's production-related sectors" [11].

In the situation of a decentralized model of the state and the resulting objectification of

the self-government, issues related to the functioning of the network and infrastructural facilities become a subject of interest of units of local administration which initiate conditions for economic activation in a given area by determining rules of the development of the policy of the infrastructural development.

An important task of the technical infrastructure is the location function which is mainly reflected in influencing the placement of a settlement network and manufacturing facilities [12]. The level of the development of basic infrastructural facilities is thus an important determinant in the process of taking location-related decisions by entrepreneurs.

Table 1. The length of the water supply system in the Malopolska Voivodeship in 2004-2013 (km/100 km^2)

County	Year			
	2004	2007	2010	2013
Bochenski	92.2	104.6	114.9	130.6
Krakowski	182.8	188.4	198.3	209.8
Miechowski	126.8	127.2	129.5	137.4
Myslenicki	88.0	94.1	97.8	107.1
Proszowicki	170.9	172.8	170.4	188.1
Wielicki	243.5	263.1	271.4	278.0
Gorlicki	16.8	20.9	21.9	27.9
Limanowski	43.9	53.3	67.8	64.7
Nowosadecki	39.9	41.4	71.1	78.7
Nowotarski	39.5	37.9	29.3	25.4
Tatrzanski	57.6	58.7	71.2	57.1
Chrzanowski	190.4	192.2	193.0	199.6
Olkuski	112.4	114.2	115.8	116.5
Oswiecimski	217.6	220.3	232.1	236.1
Suski	30.0	33.4	45.4	46.2
Wadowicki	147.5	157.5	166.0	173.2
Brzeski	78.6	98.7	109.6	124.4
Dabrowski	173.1	174.9	186.8	187.7
Tarnowski	76.3	81.6	86.4	94.8
Malopolska Voivodeship	102.2	107.8	116.1	121.9

Source: own elaboration based on LDB CSO.

Table 1. presents the density of the water supply system expressed as the length of the distribution network per 100 km^2 of the area by *counties*. During the 10 year period under the analysis (2004-2013) nearly each *county* managed to develop its water supply system with the exception of the Nowotarski and Tatrzanski *Counties* where a reverse tendency was observed, nevertheless, the above can be attributed to group or individual systems of supplying water to inhabitants in those *gminas* (the so-called water supply companies) which the municipal services management statistics do not account for.

The most dynamic increase of the water supply facilities was recorded in the Brzeski *County* and in the Nowosadecki and Bochenski *Counties*. It is worthwhile to stress that these were also the areas with the relatively lowest rate of equipping with the water supply system [7] which, in a way, forced local authorities to take efforts to reduce the existing related infrastructural gap. On the other hand. the relatively lowest rate of the increase of the network density was characteristic of the best equipped areas at the beginning of the analysis (2004), which, in consequence, meant that there was no important pressure to develop such element of the infrastructure. The above mostly referred to the western part of the region (the Olkuski. Chrzanowski and Oswiecimski *Counties*) which are. at the same time. the most industrialized areas of the voivodeship.

In the course of the process of assessing how municipal services management functions. apart from the presented rates illustrating the density of the water supply and sewerage systems. it is also important to show the population of the inhabitants who are able to rely on such services (Tables 2 and 4).

Average percentage of the inhabitants of the Malopolska region benefiting from the collective water supply rose from 71.4% in 2004 to 76.4% in 2013. The result is below the national average by approximately 14-12 percentage points. They are formed at the level of average values calculated for the population of rural municipalities in Poland (71.1% and 76.7% respectively). However, it should be stressed that the Malopolska Voivodeship is considerably internally diversified in that respect. There are *counties* where nearly all inhabitants have access to the water supply system (Chrzanowski. Olkuski and Oswiecimski *Counties*). whereas in the case of the Suski. Gorlicki and Limanowski *Counties*. the situation with access to water supply is the worst (35.4%. 36.6% and 43.8%. respectively).

Table 2. The population using the water supply system in the Malopolska Voivodeship in 2004-2013 (% of a total population)

County	Year			
	2004	2007	2010	2013
Bochenski	60.7	63.5	65.3	67.7
Krakowski	81.4	83.0	85.1	86.3
Miechowski	76.5	77.4	78.2	79.7
Myslenicki	55.6	56.9	59.2	60.9
Proszowicki	75.0	75.7	76.6	78.3
Wielicki	79.5	81.6	83.6	84.8
Gorlicki	31.9	33.2	35.7	36.6
Limanowski	36.4	39.9	42.9	43.8
Nowosadecki	32.2	36.2	43.3	44.8
Nowotarski	42.1	42.3	47.0	46.7
Tatrzanski	78.6	79.7	80.5	83.8
Chrzanowski	97.5	97.6	97.6	97.6
Olkuski	96.8	96.8	96.9	96.9
Oswiecimski	95.9	96.0	96.1	96.2
Suski	26.1	29.6	33.8	35.4
Wadowicki	71.0	72.6	74.5	75.5
Brzeski	50.9	56.3	60.0	62.7
Dabrowski	85.0	85.3	85.7	86.1
Tarnowski	49.4	54.8	56.1	58.1
Malopolska Voivodeship	71.4	74.2	75.7	76.4

Source: own elaboration based on LDB CSO.

Located peripherally to the administrative center, those areas are mostly agricultural and have relatively low local entrepreneurship rates. Their economic structure is reflected in low abundance of budgets of local self-governments and. consequently. limited possibilities of financing the development of the water supply network using own funds.

Despite the fact that the highest increases of the percentage of the collective water supply system users were recorded for areas which were initially the least equipped. still the dynamics of changes was not high enough to allow the considerable advancement of *gminas* characterized by the greatest infrastructural gap. They still lag behind *gminas* which are better managed in that respect.

It is worthwhile to note that the dynamics of the increase of the percentage of the population serviced by the water supply system was lower compared to the dynamics of the growth of the length of the system itself (compare Table 1). Such discrepancy proves that the areas with the highest population density were equipped with the water supply systems in the first place. while currently the system is developed mostly in non-urbanized areas with scattered buildings and low population density. From the perspective of the efficiency of the provision of municipal services. such situation is not advantageous both owing to high unit costs of the construction of new infrastructural systems and high expenditure related to their use. especially per single service customer.

The development of the sanitary sewerage should follow the construction of the water supply system so that conditions could be created for the protection of natural environment by treating sewage from households.

Table 3. The length of the sewerage system in the Malopolska Voivodeship in 2004-2013 (km/100 km^2)

County	Year			
	2004	2007	2010	2013
Bochenski	45.9	53.5	63.5	78.1
Krakowski	42.1	62.4	84.6	106.8
Miechowski	11.0	13.2	14.3	18.5
Myslenicki	36.3	41.7	52.9	94.0
Proszowicki	16.6	23.7	34.2	52.8
Wielicki	54.6	69.4	90.7	93.6
Gorlicki	26.3	35.5	47.2	77.2
Limanowski	23.0	32.2	43.9	57.6
Nowosadecki	22.5	31.8	35.0	47.1
Nowotarski	38.8	40.9	55.1	66.9
Tatrzanski	57.1	67.1	75.9	77.0
Chrzanowski	65.6	67.8	113.4	121.3
Olkuski	21.0	23.9	27.6	31.0
Oswiecimski	68.1	98.2	107.0	135.4
Suski	11.2	14.5	27.9	38.6
Wadowicki	55.9	69.6	79.0	92.1
Brzeski	23.0	53.5	46.5	60.4
Dabrowski	37.1	45.4	50.6	60.7
Tarnowski	34.8	52.5	66.2	83.0
Malopolska Voivodeship	42.7	53.9	65.9	81.5

Source: own elaboration based on LDB CSO.

Development of the water supply infrastructure leads to the increased water consumption which, in the case of the absence of the sewerage system in a given area, causes increased pollution of water mostly. However, based on many data, frequently there occurs a

considerable discrepancy between water supply and sewage systems present in individual territorial units. Even though there are many reasons for such a situation. nevertheless. the most important ones should be stressed at this point with the first one being high costs of the construction and use of the sewerage systems. The second reason is the necessity to have a given territorial unit equipped beforehand with the sewage treatment facilities of proper efficiency.

The development of the sewerage system in the Malopolska Region in 2004-2013 was intensified vis-à-vis the development of the water supply infrastructure. The above is naturally due to a diversified initial status of these components. The level of the equipment with the water supply system vis-à-vis the sewerage system is much lower (compare tables 1 and 3). *Gminas* from the Suski and Proszowicki *Counties* were the ones that developed their sewerage systems in the most dynamic manner (at the end of the period the density rate was in such case more than two times higher than in 2004). In the other seven *counties* the length of the sewerage system per area unit in the period under analysis (10 years) increased at the rate between 100-200%. In this case, just like in the case of the water supply system. high rates of the dynamics resulted from a low base back in 2004. It is worthwhile to stress that even despite a high initial level of the sewerage system infrastructure, it was regularly developed in the entire area of the region. The high dynamics of the system's development in a few cases contributed to the level of the density of the sewerage system in 2014 exceeding the level of the density of the water supply system (e.g. Gorlicki. Nowatarski and Tatrzanski *Counties*.)

Definitely fewer inhabitants of the Malopolska Region have access to the sewerage system than to the water supply system. The differences in individual *counties* range from a few to 51.7 percentage points (in the Miechowski County).

With regard to the rate of the equipment of the population using the sewerage system. the following interrelation was observed: the higher the speed of its increase. the lower the initial percentage of the inhabitants whose households were serviced by the collective sewage treatment systems facilities (eg. Suski and Limanowski Counties with respectively 1.776 and 1.691 dynamics rates).

Table 4. The population using the sewerage system in the Malopolska Voivodeship in 2004-2013 (% of the total population)

County	Year			
	2004	2007	2010	2013
Bochenski	37.7	40.9	44.7	48.8
Krakowski	25.7	30.4	34.3	40.2
Miechowski	22.9	23.6	25.8	28.0
Myslenicki	26.9	29.2	34.0	42.7
Proszowicki	19.9	21.4	23.1	27.7
Wielicki	29.3	33.0	37.4	41.8
Gorlicki	34.3	38.0	41.2	47.6
Limanowski	17.5	20.2	23.6	29.6
Nowosadecki	19.4	24.2	25.8	29.7
Nowotarski	39.4	42.0	46.7	50.6
Tatrzanski	71.4	74.0	74.9	82.0
Chrzanowski	52.6	53.2	62.1	66.3
Olkuski	46.4	47.8	48.1	49.6
Oswiecimski	49.3	53.1	54.3	57.8
Suski	15.6	19.1	25.1	27.7
Wadowicki	36.1	38.8	41.3	42.9
Brzeski	20.7	28.3	29.6	31.9
Dabrowski	31.4	33.7	36.1	39.6
Tarnowski	19.6	25.6	29.6	35.6
Malopolska Voivodeship	47.6	50.1	52.7	56.0

Source: own elaboration based on LDB CSO.

The Suski *County* was characterized by the highest dynamics of the share of the population using the sewage system infrastructure, however, it should be added that in 2004 only 15.6% of its inhabitants discharged sewage to municipal sewage facilities, which was the lowest result recorded among all 19 Malopolska *counties*. The rate of the percentage of the sewerage system users was quite diversified both in terms of space (*counties*) and time (in individual years). The calculated values of standard deviations and variation coefficients were recorded in such case only for [units with] top scores. The above evidences that the region's territory is considerably diversified in such regard. Despite considerable progress in that area made by less equipped *gminas*, still

many years will have to pass and much investment expenditure will be required in order for them to reach the same level as that recorded in the case of the largest cities in the region.

CONCLUSIONS

Changes in the level of the infrastructural equipment are. as a rule. a result of the development or modernization of the facilities and the system rendering specific public services. Increased access to individual components of the infrastructure leads to better satisfaction of the inhabitants in the area of their living conditions. in this way contributing to their improved living standards. Technical infrastructure being a basis for the provision of services in the area of the municipal services management must be subject to ongoing transformations adjusting its level to current standards.

In 2004-2013 in the Malopolska Voivodeship changes occurred affecting basic infrastructural systems which were not uniform. The increase of the length of the sewerage system was definitely faster as compared to the increase of the length of the water supply system which can be logically justified with differences in the initial density of both systems. Growth rate of the sewage network was particularly high in the period 2010-2013, while the water supply network dynamics explicitly slowed. However, an unquestionable majority of the inhabitants already has access to the water supply system, yet there are also areas where only every third inhabitant is the system user. It should be stressed that despite the progressing development of the water supply system. water consumption in households declined.

Despite more dynamic development of the sewerage system over the past 10 years. the level of the equipment of the area with such infrastructural component is still unsatisfactory. Only in four *counties* more than half of their inhabitants have access to the sewerage system. In seven others the respective rate is between 40-50%. With regard to the low level of the equipment with the sewerage treatment facilities, the above is mostly true in the case of rural areas predominantly engaged in agriculture.

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