

SOCIO-ECONOMIC DEVELOPMENT IN POLAND'S WARSAW METROPOLITAN AREA AND THE REST OF MAZOWIECKIE VOIVODESHIP

Iwona Pomianek, PhD

Warsaw University of Life Sciences – SGGW, Poland

Abstract. The peripheral character of areas located outside urban centres makes it possible to preserve traditional landscapes and their rural character. On the other hand, territorial units of rural administrative status surrounding urban centres (such as Warsaw, Poland's capital), usually lose their rural character as a result of intensive development. The analysis of the differences in socio-economic development of semi-urban and rural gminas in Mazowieckie Voivodeship (Poland) using Hellwig's measure proves that rural gminas in the Warsaw Metropolitan Area are better developed than semi-urban ones in the other parts of the region.

Key words: rural areas, semi-urban areas, socio-economic development, Hellwig's measure.

JEL code: R51

Introduction

One of sixteen regions in Poland, Mazowieckie Voivodeship is located in the central-eastern part of the country. In the centre of the voivodeship, is Warsaw, Poland's capital. The region is diversified in terms of development conditions, such as road and rail accessibility, quality of infrastructure, investment attractiveness and the quality of social capital (Stanny, 2013; Wojewodzka-Wiewiorska 2014). The peripheral character of the outer part of the voivodeship enables the preservation of traditional landscapes and rural gminas (communes, municipalities, LAU 2); (Banski, Stola, 2002; Courtney, Errington, 2000). WMA is characterized not only by preferable arrangement of the road infrastructure and free spaces investment, but also by high natural values (Drejerska, Chrznowska, Pomianek, 2014). A mismatch between the types of administrative territorial units and their functional type is very characteristic for the Warsaw Metropolitan Area (Gieranczyk, Kluba, 2008). The large share of urbanized areas in relation to the formal status of an administrative unit is visible in the majority of rural gminas surrounding Warsaw from the west. This is the result of intensive development, which leads to the loss of their rural character (Potencjaly i wyzwania..., 2014).

The aim of the paper is to uncover the differences in socio-economic development of semi-urban and rural gminas in Mazowieckie

Voivodeship (Poland), and to identify clusters of gminas with similar levels of development. The study includes all semi-urban (51) and (228) rural gminas in Mazowieckie Voivodeship (NUTS 2) in Poland (Table 1). The data of 2014 used to construct socio-economic development indexes come from the Local Data Bank of the Central Statistical Office in Poland (CSO LDB).

Table 1

Units accepted in the research

Group of gminas	Gminas - LAU 2		
	rural	semi-urban	total
Warsaw Metropolitan Area (WMA)	36	19	55
The rest of Mazowieckie Voivodeship (non- WMA)	192	32	224
Total	228	51	279

Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

Considering the data availability at the LAU-2 level and their correlation, a set of 14 variables was prepared (Table 2).

The multidimensional character of rural development justifies the use of multivariate analysis methods, including taxonomic ones. Hellwig's synthetic measure of development (SM_i) groups information from a set of diagnostic features and assigns a single (aggregate) measure to an analysed objects using values from 0 to 1 under the assumption that in doing so, a lower value SM_i determines a higher level of the occurrence under analysis (Hellwig Z., 1968).

Diagnostic variables applied in the research

Symbol	Diagnostic variable
Society	
X ₁	Population density (population per 1 square kilometre)
X ₂	Change of inhabitants number per 1000 population
X ₃	Proportion of councillors with university degrees
X ₄	Proportion of councillors with high professional qualifications
X ₅	Foundations, associations and social organisations per 10000 population
Economy	
X ₆	National economy entities registered in REGON per 10,000 population
X ₇	Proportion of public entities in all entities registered in REGON
X ₈	Gmina's own-sources revenues per capita
X ₉	Proportion of registered unemployed in the working-age population
X ₁₀	Demographic dependency ratio (population of post-working age per 100 population of working age)
Infrastructure	
X ₁₁	Proportion of population with a water supply connection
X ₁₂	Proportion of population with a waste water disposal connection
X ₁₃	Gmina's property investment expenditures per capita
X ₁₄	Proportion of children aged 3-5 participating in preschool education

Source: author's calculation

The formula for determining this measure is as follows (Pomianek, Chrzanowska, 2016).

- 1) Normalization of diagnostic variables (x_{ij}),
- 2) Making all variables homogenous by transferring them into stimulants.
- 3) Construction the object with the best (highest) value of diagnostic variables (pattern)

$$z_{0j} = \max_i \{z_{ij}\} \quad (1)$$

where: z_{ij} - normalized values which have been observed in the (whole) data set;

- 4) Calculating the Euclidean distance (d_i) of each object from the constructed pattern.

$$d_i = \sqrt{\frac{1}{m} \sum_{j=1}^m (z_{ij} - z_{0j})^2} \quad (2)$$

where $i=1, \dots, n$ - the number of objects $j=1, \dots, m$ - number of variables, z_{ij} - normalized value of the variable j for the object i , z_{0j} - normalized value of the variable j of the pattern

- 5) Normalization of Hellwig measure was carried out by the following formula:

$$z_i = 1 - \frac{d_i}{d_0} \quad (3)$$

where: d_0 - value determined by the formula:

$$d_0 = \max_i \{d_i\} \quad (4)$$

The Hellwig's method was used to provide 4 rankings of semi-urban and rural communes in Poland. In each of them, communes were divided into following development classes.

Two parameters: arithmetic mean and standard deviation were used in classification of communes by their level of development. Following classes were defined:

- Class 1 (very high level of development)

$$d_i \geq \bar{d}_i + s_{d_i},$$
- Class 2 (high level of development)

$$\bar{d}_i + s_{d_i} > d_i \geq \bar{d}_i + \frac{1}{2} s_{d_i},$$
- Class 3 (medium level of development)

$$\bar{d}_i + \frac{1}{2} s_{d_i} > d_i \geq \bar{d}_i - \frac{1}{2} s_{d_i},$$
- Class 4 (low level of development)

$$\bar{d}_i - \frac{1}{2} s_{d_i} > d_i \geq \bar{d}_i - s_{d_i},$$
- Class 5 (very low level of development)

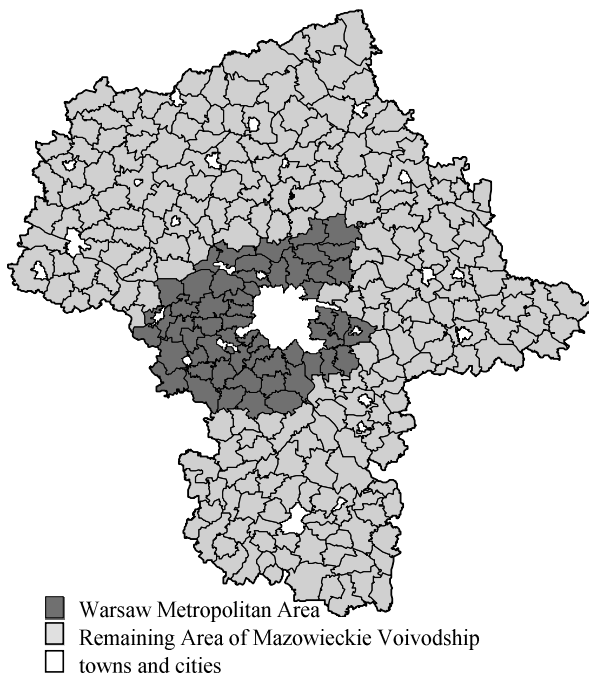
$$d_i < \bar{d}_i - s_{d_i},$$

where:

d_i - value of synthetic measure calculated by Helliwig's method,
 \bar{d}_i - arithmetic mean of d_i ,

s_{d_i} – standard deviation of d_i .

The gminas were divided into two types: rural and semi-urban (urban-rural), and grouped into two areas (Figure 1).



Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

Fig. 1. Mazowieckie Voivodeship including Warsaw Metropolitan Area in 2015

The first group is the Warsaw Metropolitan Area, consisting of 55 gminas (36 rural and 19 semi-urban), located around Warsaw. The second group includes 224 gminas (192 rural and 32 semi-urban), covering the remainder of the Voivodeship.

The following hypothesis was formulated: rural gminas in the Warsaw Metropolitan Area are more developed than semi-urban ones elsewhere in the voivodeship.

Research results

There were no gminas in the Warsaw Metropolitan Area in two lower classes (4 and 5). Moreover, there were no semi-urban gminas in

the very low development level class. Moreover, as Table 3 shows, 41,7 % of WMA rural gminas were in the very high development level class (class 1), and 19.4 % in the high development level (class 2). Together they account for more than 60 % of the highly developed gminas among the WMA rural gminas. On the other hand, analysis of the semi-urban gminas reveals that only 15.6 % of the units are in the very high development class and another 12.5 % fall into the high level class. This is more than twice lower (28.1 %) than the percentages for the WMA rural gminas.

The results (Table 4) show that an average proportion of population using the gmina water supply was higher in the non-WMA gminas than in the other spatial group. The WMA was highly differentiated: In Kampinos and Lesznowola, the proportion was 100 %, while in Teresin it was 97 %. The lowest proportion was observed in Jablonna, where only 13 % of the population used water supply connections. However, the suiTable investments are in progress. The situation was similar in the case of access to a wastewater disposal connection. The gminas' property investment expenditures were the highest in rural gminas of the first class (1217.79 PLN in WMA and 1142.09 in non-WMA). The WMA gminas were clearly superior in terms of the proportion of children aged 3-5 participating in pre-school education. Nonetheless, the preschool infrastructure needs to be improved in rural areas, especially in peripheral ones.

Structure of development classes determined by Hellwig's method

Groups of gminas	Development classes										Total
	1 st Class		2 nd Class		3 rd Class		4 th Class		5 th Class		
	number of gminas	% of gminas in the group	number of gminas	% of gminas in the group	number of gminas	% of gminas in the group	number of gminas	% of gminas in the group	number of gminas	% of gminas in the group	
WMA											
Rural	15	41.7	7	19.4	14	38.9	0	0.0	0	0.0	36
Semi-urban	14	73.7	3	15.8	2	10.5	0	0.0	0	0.0	19
Total	29	52.7	10	18.2	16	29.1	0	0.0	0	0.0	55
non-WMA											
Rural	1	0.5	5	2.6	95	49.5	71	37.0	20	10.4	192
Semi-urban	5	15.6	4	12.5	21	65.6	2	6.3	0	0.0	32
Total	6	2.7	9	4.0	116	51.8	73	32.6	20	8.9	224
Total											
Rural	16	7.0	12	5.3	109	47.8	71	31.1	20	8.8	228
Semi-urban	19	37.3	7	13.7	23	45.1	2	3.9	0	0.0	51
Total	35	12.5	19	6.8	132	47.3	73	26.2	20	7.2	279

Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

Table 4

Average values of the infrastructural component's variables

Groups of gminas	1 st Class		2 nd Class		4 th Class		5 th Class	
	rural	semi-urban	rural	semi-urban	rural	semi-urban	rural	semi-urban
Proportion of population with water supply connection								
WMA	82	86	87	91	-	-	-	-
non-WMA	92	93	91	90	84	70	68	-
Proportion of population with wastewater disposal connection								
WMA	53.1	61.3	25.2	52.8	-	-	-	-
non-WMA	50.5	62.4	37.0	56.4	16.6	20.6	4.9	-
Gmina's property investment expenditures per capita								
WMA	1217.79	740.62	723.29	685.07	-	-	-	-
non-WMA	1142.09	862.79	900.30	510.59	489.00	414.43	622.25	-
Proportion of children aged 3-5 participating in preschool education								
WMA	93.6	83.6	79.0	86.4	-	-	-	-
non-WMA	77.4	82.2	66.7	78.9	55.7	55.2	48.5	-

Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

When it comes to the economic component of local development (Table 5), the number of national economic entities registered in REGON per 10000 population was higher in the WMA units, proving the greater investment attractiveness of these areas, and not only for

local entrepreneurs. On the other hand, the proportion of public entities in the total number of entities registered in REGON was growing unproportionally to the level of development. However, that was because the total number of entities was falling. WMA gminas' own-source

revenues were usually higher than in the rest of Mazowieckie Voivodeship, with one exception – Slupno, the only non-WMA gmina in Class 1, with 4163.58 PLN per capita. Metropolitan gminas were characterised by lower registered unemployed in the working-age population. However, the situation was otherwise as

concerned another development destimulus – the demographic dependency ratio. The results show that many of post-working age individuals opt to settle down in suburban areas. The rate exceeded 30 % in the following suburban gminas: Konstancin-Jeziorna, Brwinow, Blonie, Karczew, Michalowice, Raszyn and Kampinos.

Table 5

Average values of economic component's variables

Groups of gminas	1 st Class		2 nd Class		4 th Class		5 th Class	
	rural	semi-urban	rural	semi-urban	rural	semi-urban	rural	semi-urban
National economy entities registered in REGON per 10,000 population								
WMA	1556	1380	905	1004	-	-	-	-
non-WMA	1113	980	811	787	528	543	506	-
Proportion of public entities in all entities registered in REGON								
WMA	1.4	1.5	2.3	2.3	-	-	-	-
non-WMA	1.4	3.7	2.7	3.2	5.4	5.2	5.8	-
Gmina's own-source revenues per capita								
WMA	3506.32	2570.72	1716.10	2453.86	-	-	-	-
non-WMA	4163.58	2102.30	1462.44	1350.22	953.67	1141.07	810.01	-
Proportion of registered unemployed in the working-age population								
WMA	5.1	5.7	5.5	5.8	-	-	-	-
non-WMA	7.4	12.1	10.0	11.6	11.7	6.8	10.0	-
Demographic dependency ratio (population of post-working age per 100 population of working age)								
WMA	25.4	27.6	25.7	29.3	-	-	-	-
non-WMA	22.5	29.2	23.3	26.9	30.1	34.9	33.9	-

Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

WMA gminas were more populated per 1 square kilometre. The difference between WMA and non-WMA gminas in the first class was two or even three times. Moreover, there is a tremendous gap between well-developed non-WMA gminas and the peripheral ones. The analysis shows that number of inhabitants per 1000 population, according to birth and migration rates, was positive in rural areas of the first and the second development classes (both regional groups) and in the WMA semi-urban gminas. The proportion of councillors with university degrees, high professional qualifications as well as the number of foundations, associations and social

organisations per 10000 population indicates the population is socially active. Again, there is a clear gap between the less developed gminas and those with a high or very high level of socio-economic development. Finally, there were more foundations or social organizations per 10000 population in the non-WMA gminas than in the metropolitan ones, which proves there is more social activity in the former one (Table 6).

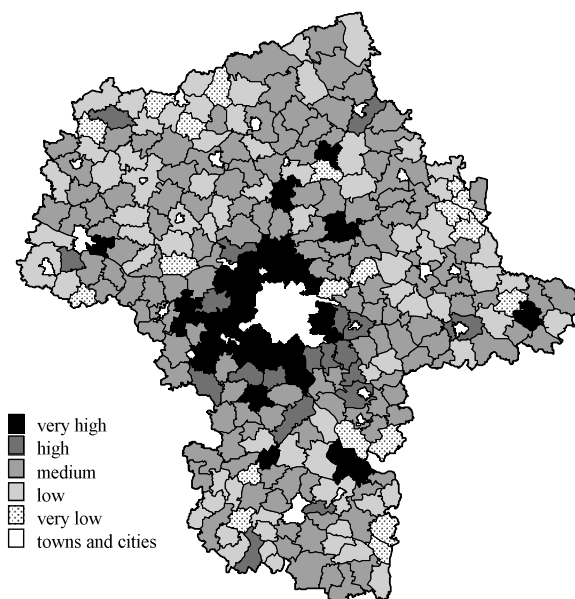
Table 7 presents the top and bottom 10 gminas in the ranking based on Hellwig's method. Di informs of matching the pattern. In the ranking of 279 gminas, the bottom 10 of the WMA group takes the last position, with 142.

Average values of social component's variables

Groups of gminas	1 st Class		2 nd Class		4 th Class		5 th Class	
	rural	semi-urban	rural	semi-urban	rural	semi-urban	rural	semi-urban
Population density (population per 1 square kilometre)								
WMA	209	354	107	124	-	-	-	-
non-WMA	95	116	108	121	44	34	38	-
Change in number of inhabitants per 1,000 population								
WMA	14.1	10.0	6.5	-1.8	-	-	-	-
non-WMA	16.1	-1.2	9.9	-1.0	-4.0	-12.1	-8.8	-
Proportion of councillors with university degrees								
WMA	46.1	57.3	35.2	26.7	-	-	-	-
non-WMA	40.0	50.7	36.6	53.3	19.6	16.7	12.5	-
Proportion of councillors with high professional qualifications								
WMA	35.2	48.7	30.5	20.0	-	-	-	-
non-WMA	40.0	35.0	33.8	46.7	10.3	13.3	5.7	-
Foundations, associations and social organisations per 10,000 population								
WMA	29	26	20	22	-	-	-	-
non-WMA	29	31	22	23	26	36	25	-

Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

Figure 2 shows the spatial distribution of five levels of socio-economic development. Very highly and highly developed gminas concentrated around Warsaw, excluding the east part of the circle. The voivodeship's peripheral, outer gminas were characterised by a low or very low level of development. The relatively high level of social activity in these areas represents an opportunity to bolster development of these areas in the long term.



Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

Fig. 2. Ranking of socio-economic development of rural and semi-urban gminas in Mazowieckie Voivodeship

Top and bottom 10s of the socio-economic development ranking

Top 10						Bottom 10					
WMA			non-WMA			WMA			non-WMA		
Position in ranking	Gmina	d_i	Position in ranking	Gmina	d_i	Position in ranking	Gmina	d_i	Position in ranking	Gmina	d_i
1	Lesznowola (r)	0.525	17	Slupno (r)	0.326	89	Zakroczym (s-u)	0.173	270	Rzewnie (r)	0.069
2	Piaseczno (s-u)	0.484	24	Kozienice (s-u)	0.294	93	Dąbrowka (r)	0.170	271	Nur (r)	0.068
3	Michalowice (r)	0.482	29	Pultusk (s-u)	0.271	101	Pniewy (r)	0.164	272	Lipowiec Koscielny (r)	0.066
4	Konstancin-Jeziorna (s-u)	0.426	32	Losice (s-u)	0.263	102	Baranow (r)	0.164	273	Ceranow (r)	0.066
5	Lomianki (s-u)	0.423	33	Bialobrzegi (s-u)	0.263	111	Leoncin (r)	0.158	274	Przylek (r)	0.063
6	Nadarzyn (r)	0.416	35	Rozan (s-u)	0.247	112	Brochow (r)	0.157	275	Szulborze Wielkie (r)	0.063
7	Grodzisk Mazowiecki (s-u)	0.401	36	Warka (s-u)	0.242	124	Puszcza Marianska (r)	0.149	276	Przesmyki (r)	0.058
8	Ożarów Mazowiecki (s-u)	0.399	37	Siedlce (r)	0.236	128	Chynow (r)	0.148	277	Maciejowice (r)	0.047
9	Stare Babice (r)	0.393	40	Lack (r)	0.226	140	Sochaczew (r)	0.144	278	Dzierzgowo (r)	0.023
10	Raszyn (r)	0.388	42	Szydłowiec (s-u)	0.222	142	Somianka (r)	0.144	279	Lutocin (r)	0.016

r – rural gminas, *s-u* – semi-urban gminas

Source: author's calculations based on the Local Data Bank, Central Statistical Office in Poland

Conclusions

- 1) The peripheral character of areas located outside urban centres makes it possible to preserve traditional landscapes and their rural character. The analysis shows that these areas usually have a low or very low level of development.
- 2) Territorial units of rural administrative status surrounding urban centres (such as Warsaw, Poland's capital), usually lose their rural character as a result of intensive development. These areas are characterised by high or very high socio-economic development.
- 3) The analysis of the differences in socio-economic development of semi-urban and rural gminas in Mazowieckie Voivodeship (Poland) using Hellwig's measure proves that

rural gminas in the Warsaw Metropolitan Area are better developed than semi-urban ones in the other parts of the region.

- 4) There were no gminas in the Warsaw Metropolitan Area in the two lower classes. This indicates the importance of WMA as a functional zone (suburban area, housing, industry, tourism, logistics, warehousing, trade). It also proves that these gminas have been attractive both for residents and investors due to their well-developed infrastructure, good accessibility and proximity to the capital.

Bibliography

Journal paper with author(s)

1. Banski, J. Stola, W. (2002). Przemiany struktury przestrzennej i funkcjonalnej obszarow wiejskich w Polsce (Transformation of Spatial and Functional Structure of Rural Areas in Poland). Wydawnictwo IGiPZ PAN, Warszawa.
2. Courtney, P. Errington, A. (2000). The Role of Small Towns in the Local Economy and Some Implications for Development Policy. *Local Economy*, Taylor and Francis Journals, vol. 15(4), November.
3. Gieranczyk, W. Kluba, M. (2008). Problemy i metody oceny kontinuum miejsko-wiejskiego w Polsce (Problems and Evaluation Methods of Urban-Rural Continuum in Poland). PTG, IGiPZ PAN, Warszawa.
4. Hellwig, Z. (1968). Zastosowanie metody taksonomicznej do typologicznego podzialu krajow ze wzgledu na poziom rozwoju i strukture kwalifikowanych kadr (The Application of the Taxonomic Method to the Typological Division of a Countries due to Their Level of Development, Resources and Structure of Qualified Personnel). *Przeglad Statystyczny*, no 4, pp. 307-328.
5. Pomianek, I. Chrzanowska, M. (2016). A Spatial Comparison of Semi-Urban and Rural Gminas in Poland in Terms of Their Level of Socio-Economic Development Using Hellwig's Method. [in:] *Sroda-Murawska S., Dymitrow M. (red.), Bulletin of Geography. Socio-economic Series*, 33, Torun: Nicolaus Copernicus University, s. 103-117. DOI: <http://dx.doi.org/10.1515/bog-2016-0028>
6. Wojewodzka-Wiewiorska, A. (2014). Dynamika rozwoju społeczno-ekonomicznego gmin wiejskich wojewodztwa mazowieckiego na tle innych typow gmin (Dynamics of the Socio-Economic Development of Rural Communes Relating to Other Types of Communes in the Masovian Voivodeship). *Journal of Agribusiness and Rural Development* 2014, no 2, pp. 213-223.

Books

7. Drejerska, N. Chrzanowska, M. Pomianek, I. (2014). *Strefa podmiejska Warszawy: wybrane zagadnienia (Warsaw Suburban Area: Selected Issues)*. Wydawnictwo SGGW, Warszawa.
8. Stanny, M. (2013). *Przestrzenne zroznicowanie rozwoju obszarow wiejskich w Polsce (Spatial Diversification of Rural Development in Poland)*. Problemy Rozwoju Wsi i Rolnictwa, IRWiR PAN, Warszawa.

Internet sources

9. Local Data Bank, Central Statistical Office in Poland, <https://bdl.stat.gov.pl/>. Access: 29.05.2016.
10. *Potencjaly i wyzwania dla Obszaru Metropolitalnego Warszawy (Potentials and Challenges for the Warsaw Metropolitan Area) (2014)*, Miasto Stoleczne Warszawa, Warszawa, <http://omw.um.warszawa.pl/potencjaly-i-wyzwania-obszaru-metropolitalnego-warszawy/> Access: 15.07.2016.