
Polycentricity of the Settlement System - Example of an Urban Network in Poland

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Abstract:

Purpose: The article had two purposes. The first was to present the settlement structure in Poland with a special focus on cities, and the second was to compare the classification of cities in Poland as presented in planning documents at different levels with the classification of cities based on population in 2020.

Design/Methodology/Approach: The characterisation of the settlement structure was based on an analysis of statistical data published by the Central Statistical Office on the number of settlement units and the population of cities. The statistics used represent the situation at the end of 2020. The planning documents were examined in terms of the urban classifications they contain. The research by T. Bocheński (2021) on cities performing the functions of regional and sub-regional centres was very helpful.

Findings: The study confirms that Poland has a polycentric settlement network structure. It consisted of 43053 villages and 944 cities. Among the cities there were centres of various sizes and ranks, including metropolitan, regional, and subregional centres. The cities included centres of different sizes and ranks. The paper uses the division of cities into six classes of centres: metropolitan, supra-regional, regional, sub-regional, supra-local and local.

Practical Implications: The research shows the polycentricity of the Polish settlement network. This type of settlement pattern is beneficial in the pursuit of sustainable national development. It has a positive impact on residents' access to services and reduces the need for transport.

Originality/Value: The article presents the results of own desk research and analysis of official statistics. The paper analyses the settlement structure of Poland and classifies cities based on their population and their position in the settlement system. In addition, classifications of cities contained in planning documents at different levels are presented: European, national, and regional.

Keywords: National spatial planning, Poland, polycentricity, regional centres, regional spatial planning, settlement structure, urban system.

JEL codes: R12, R23, R58, H83.

Paper type: Research article.

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1. Introduction

Poland is a country characterized by a polycentric settlement network, which means that cities of different sizes are relatively evenly distributed. The indicator of morphological polycentricity was highest among EU and EFTA countries in Germany (93.4), the Netherlands (90.8), Poland (85.6) and Italy (86.2) (ESPON 1.4.3, 2007, p. 144).

This characteristic is advantageous because it allows optimal use of spatial accessibility and economic efficiency in terms of resource concentration. In addition, it reduces the leakage of functions from lower-order centres to higher-order centres (Śleszyński, 2018, pp. 34-37).

In order to verify the actual polycentricity of the settlement structure in Poland, a study was carried out. The settlement structure was analysed in terms of the number of settlements and the number and population of cities in Poland. Planning documents at different levels were reviewed and the classifications of cities contained in them were compared.

These classifications, in the broadest sense, included 6 types of centres: metropolitan, supra-regional, regional, sub-regional, supralocal and local. They were then compared with the classification of cities according to their size in terms of population. The analysis included: the vision of spatial development at the European level – ESPON project (2006), at the national level - the National Spatial Development Concept - hereafter referred to as NSDC (Koncepcja Przestrzennego..., 2012) and the spatial development plans of all 16 voivodships in Poland (hereafter referred to as SDPV) - based on a study by T. Bochenski (2021).

2. Literature Review

The urban system is hierarchical and includes cities and towns of different sizes in each country or region. The concepts and definitions of the urban system have been widely discussed in the literature (Smailes, 1971; Simmons, 1981; Coffey, 1998; Pacione, 2009; Bourne and Simmons, 2017). One of the five schools of urban analysis identified by Burger *et al.* refers to the concept of polycentricity of the settlement network (Burger *et al.*, 2014).

The polycentric spatial structure presupposes the existence of a plurality of urban agglomerations of similar size at the different levels of the urban hierarchy, as

opposed to situations in which a single large urban centre dominates each level and even excludes the presence of intermediate levels (CEMAT Glossary..., 2007). The importance for sustainable development and the need to support the functioning of the polycentric settlement structure was highlighted in the Ljubljana Declaration on the Territorial Dimension of Spatial Development (Ljubljana Declaration..., 2003).

It is pointed out that polycentric development contributes to the reduction of environmental pressures and social tensions and helps to stabilise democratic structures (Council of Europe..., 2010). A balanced network of cities with many regional centres favours the development of a given area (Moldar, 2016; Živanović *et al.*, 2019; Dieleman and Faludi, 1998).

The pursuit of sustainable development by strengthening the polycentric settlement system is enshrined in the European Spatial Development Perspective (ESDP). This idea was developed by the European Spatial Planning Observatory Network (ESPON) and the Interreg IIIB programmes (Sýkora *et al.*, 2009). There is also a visible preference for urban policy and the strengthening of the polycentric structure regarding the distribution of EU aid funds (Szabó and Pintér, 2014).

The topic of polycentricity of the settlement network, and in particular its measurement and implications for spatial and economic development, was present in the academic literature. Research in this area has been carried out at different spatial scales - national, regional, and local. Two approaches can be distinguished: comprehensive and purely morphological, focusing on the effects of urban agglomeration and ignoring their service functions and interactions between them (Wegener, 2013).

Polycentricity analyses have been carried out for many countries and regions. Among whole country studies, we can mention Switzerland (Khiali-Miab *et al.*, 2019), Czech Republic (Sýkora and Muřiček, 2017), Slovenia (Drozg, 2012), Turkey (Sat, 2018), Poland (Korcelli, 2008) and Serbia (Živanović *et al.*, 2019). Single-region studies were more popular, e.g., analyses of the polycentricity of selected regions were popular.

For example, studies on the eastern part of the Czech Republic (Seidenglanz, 2010), the region of Craiova in Romania (Peptenatu *et al.*, 2012), the region of Tuscany in Italy (Burgalassi, 2010) and metropolitan regions from different countries can be cited, Bangalore, Istanbul, Jakarta, Shanghai, Sydney and Tokyo (Alpkokin *et al.*, 2010), Randstad Holland in the Netherlands (Burger, 2011), Frankfurt Rhine-Main in Germany (Peterek and Bürklin, 2014), Upper Silesia and Basin Metropolis in Poland (Zuzńska-Żyśko, 2018).

Research on polycentricity has also been conducted in Hungary, which has one of the most monocentric spatial structures in Europe (Szabó and Pintér, 2014). Rozenblat drew attention to the need for polycentric analysis at the national level

and to the fact that large urban centres are poles of growth and diffusion. At the same time, in many cases the economic development of the state capital is superior to the rest of the state territory (Rozenblat, 2009).

Some results from comparative studies of European countries contradict the thesis that polycentric development helps to achieve greater cohesion and reduce regional disparities (Meijers and Sandberg, 2006). However, these studies considered only one aspect of polycentricity, namely the number of cities of different sizes. The size of a city, as measured by its population, does not fully reflect its role in the settlement system.

According to the author, the potential of these cities resulting from their functions is equally important. Burger (2011) points out that studies of polycentric urban regions are limited to an analysis of their spatial organisation, examining only one type of functional links between cities.

One of the leading directions in the study of settlement systems, including urban systems, was the classification of cities in terms of demographic size, for example, using the rank size rule model (Živanović *et al.*, 2019; Meijers and Sandberg, 2006). An important place in the analyses was occupied by the issue of transport connections, including, among others, commuting (Zuzańska-Żyśko, 2018), public transport connections (Seidenglanz, 2010), the impact of road network development on the polycentricity of the settlement network (Komornicki, 2018).

3. Results – Analysis of Poland's Settlement Structure, Focusing on Cities

It was mainly the status (city or village), the administrative function (seat of local government at various levels) and the population that determined the importance of a given locality in the settlement system.

The administrative division in Poland had three levels and included: provincial level – 16 voivodships, supralocal (district) level – 380 poviats and local level – 2477 communes. Voivodships were governmental and self-governing units, while poviats and communes were purely self-governing. The basic administrative unit in Poland was the commune.

There were three types of commune: 302 urban (covers one city only), 642 urban-rural (includes covers one city only the city and its surrounding rural areas) and 1,533 rural, as well as two types of poviats: 66 urban poviats (cities with poviat's rights) and 314 land poviats, whose seats were in cities. It should be added that 45 cities with poviat rights were also the seat of a land poviat. In the two voivodships, administrative functions were divided between two cities – one was the seat of self-government and the other was the seat of the voivode, who was the representative of

the government. Table 1 summarises the number of settlement units by administrative status. It also shows the number of inhabitants in each type of unit.

Table 1. Settlement structure in Poland in terms of administrative status in 2020

Settlement unit by administrative status		Localities		Population	
		number	percentage	number	percentage
urban (cities)	voivodship cities with poviat status	18	0.03	7,940,263	20.85
	other cities with poviat status (urban poviat)	48	0.09	4,583,026	12.03
	urban commune	236	0.44	5,761,706	15.13
	other cities – the seat of the urban-rural commune	642	1.20	4,492,280	11.79
	total cities	944	1.77	22 777 275	59.80
rural	villages that are the seat of the rural commune	1,533	2.87	15,311,289	40.20
	other villages	41,519	77.73		
	other localities	9,419	17.63		
	total rural settlements	52 471	98.23	15 311 289	40.20
Total		53,415	100.00	38,088,564	100.00

Source: Author study based on Local Data Bank, 2022.

Cities were the most important part of the settlement system. They were not only centres of population, but also concentrated a variety of functions, both administrative and economic.

Currently in Poland, the status of a city is granted by the Council of Ministers if certain criteria are met (Act of 8 March 1990; Ordinance of the Minister..., 2008). Most Polish cities have medieval roots. The density of the urban network is historically determined – it is highest in the areas that belonged to the German state in its history.

Cities in Poland varied in size. The largest group was made up of small towns with fewer than 10 000 inhabitants – in 2020 this included 729 towns (77.2%) with a total population of 4.9 million (21.7% of the country's population). This group included 9 cities with less than 1 000 inhabitants.

The smallest group was that of very large cities – in Polish conditions such cities can be considered as having more than 0.5 million inhabitants (Table 2). This group, often referred to as the 'Big Five', includes the cities of Warsaw, Cracow, Wrocław, Łódź and Poznań. In Poland, cities with more than 250 000 inhabitants are assumed to be metropolitan centres.

Some cities, especially the largest ones, form complexes of settlements in the form of agglomerations or conurbations. In such cases, it is justified to consider the potential of the whole ensemble rather than of individual cities.

These complexes have been defined in different ways. In the narrowest sense, an urban agglomeration can be considered to include only neighbouring cities, thus forming a compact urban area.

Table 2. *Division of Polish cities and cities by population and role in the settlement system in Poland in 2020.*

Size of city in terms of number of inhabitants	Number of cities	Percentage of cities	Total population of cities	Percentage of urban population
million and more	1	0,11	1,861,774	8,17
500-999 thousand	4	0,42	2,694,903	11,83
250-499 thousand	6	0,64	2,139,057	9,39
100-249 thousand	26	2,75	3,921,415	17,22
40-99 thousand	72	7,63	4,224,719	18,55
20-39 thousand	106	11,23	2,989,047	13,12
10-19 thousand	178	18,86	2,575,989	11,31
1-9 thousand	542	57,42	2,363,329	10,38
less than 1 thousand	9	0,95	7,042	0,03
Total	944	100,00	22,777,275	100,00

Source: Author study based on Local Data Bank, 2022.

If the population of conurbations is taken into account, the composition of the ‘Big Five’ is changing even from this narrow perspective, with the Górnośląsko-Zagłębiowska conurbation (Katowice and other cities) and Tricity (Gdańsk, Gdynia, Sopot) replacing Wrocław and Poznań. Although Wrocław itself had a larger population than Łódź, the Wrocław agglomeration was smaller than the Łódź agglomeration.

The population of the Szczecin agglomeration was around 500 000. The agglomerations of Lublin and Bydgoszcz, on the other hand, did not exceed 400 000 inhabitants. In addition to the voivodship cities, T. Bocheński (2021) points to the existence of another 15 urban agglomerations in Poland. The largest of these is Rybnik conurbation (Rybnik, Jastrzębie-Zdrój, Żory) with over 300,000 inhabitants (Table 3).

Table 3. *Population of the core cities in largest Polish agglomeration in 2020*

Agglomeration	Number of core cities	Core cities population
Warsaw	1	1,861,774
Górnośląsko-Zagłębiowska	13	1,686,570
Tricity	3	765,406
Cracow	1	800,531
Łódź	1	673,003
Wrocław	1	673,592
Poznań	1	547,777
Szczecin	1	397,289

Rybnik	3	281,271
Lublin	1	335,114
Bydgoszcz	1	339,068
Białystok	1	294,675
Częstochowa	1	213,942

Source: Author study based on Local Data Bank, 2022.

It is also worth noting the changes taking place in the settlement system. In recent years, there has been a decline in the number of settlements, mainly due to the merging of individual units, including the enlargement of towns. The number of cities increased systematically, but they were small units. Despite the population criterion (2,000 inhabitants), the status of city was often granted to smaller units. The number of communes, on the other hand, did not change significantly, as the places gaining urban status were previously the seats of rural communes

The population decline observed in Poland in recent years has largely taken place in cities. A downward trend in population change was recorded in 625 cities and was due to the demographic situation - a negative migration balance and low natural growth. On the other hand, 298 cities recorded an increase in population, mainly due to a positive migration balance and the enlargement of cities by changing administrative boundaries (Bocheński, 2021).

The demographic changes, combined with the increase in suburbanization, resulted in a slight decrease in the level of urbanization, measured by the number of urban residents in Poland. In the largest cities and their agglomerations, there is a noticeable increase in the population, Cracow, Warsaw, Wrocław and Rzeszów. The largest decrease in population was recorded in Łódź. In addition, the population of the Górnośląsko-Zagłębiowska conurbation is declining significantly (Local Data Bank, 2022).

As a result of the analysis of the classification of cities contained in planning documents (ESPON, NSDC, SDPV) and their harmonisation (according to Bochenki, 2021), six classes of centres were adopted. Cities and their agglomerations were classified on the basis of an analysis of the number of inhabitants in 2020:

- Metropolises - agglomerations with more than 0.5 million inhabitants;
- Supra-regional centres - agglomerations with 200,000 ≥ 500,000 inhabitants;
- regional centres - cities with 100,000 ≥ 200,000 inhabitants;
- sub-regional centres - cities with 40,000 ≥ 100,000 inhabitants;
- supralocal centres - cities with 10,000 ≥ 40,000 inhabitants and smaller district cities;
- local centres - small towns with less than 10,000 inhabitants.

4. Discussion

The division and classification of cities in Poland according to their population size can be done in different ways. In the group of medium-sized cities, the Central Statistical Office included cities with a population between 20,000 and 99,000. Runge (2013), using Hellwig's criterion, defined the population range of medium-sized cities as 26.1 - 108.9 thousand, while Kaczmarek (1998) and Szlachta (2011) indicated a range of 40 - 180 thousand. Bocheński (2021) suggests considering the fact that a city reached 100,000 inhabitants at the turn of the 20th century, even if the population declined afterwards. This would shift the boundary between medium and large cities to around 90,000 inhabitants.

Differences in the approach to classifying cities and assessing their role in the settlement system were evident in the different documents. The ESPON project considered functional urban areas, distinguishing between metropolitan, transnational and regional areas. The classifications at national (NSDC) and voivodeship (SDPV) level included all cities and therefore more classes were distinguished.

The SDPVs of the different voivodeship differed in their methodology for classifying cities. On the basis of the population of the cities and their agglomerations and the planning documents analysed, the cities studied can be divided into six groups (Table 4). The classifications of cities compared were most convergent for metropolitan and supra-regional centres. For regional and sub-regional centres, the classification based on provincial plans (SDPV) was the most outlier.

Table 4. Overview of the analysed classifications of cities in Poland

Classification	Category city / agglomeration					
	Metropolitan	Supra-regional	Regional	Sub-regional	Supra-local	Local
Population criterium	8 (1)	8 (2)	12	51	249	515
ESPON	8	11	13	-	-	-
NSDC	10	8	14	48**	216	600
SDPV	9	9	20	69	242	

Note: (...) including the potential with marginally smaller population

**only cities outside metropolitan areas and agglomerations are included

Source: Own study.

5. Conclusions

The settlement structure in Poland is clearly polycentric. Cities vary in size, although there is a clear dominance of small cities – 77.2% were cities with less than 20,000 inhabitants. Warsaw, which performs capital functions, is clearly

larger than other cities. However, in addition to the capital, seven other metropolitan areas have been identified in Poland. There are two metropolitan areas with more than 2 million inhabitants - the Warsaw agglomeration and the Upper Silesia agglomeration. In addition, the Tricity conurbation has reached over one million inhabitants, followed by the Cracow agglomeration.

An important role was played by the function of the city as a voivodeship capital. Today's voivodeship cities are classified as metropolitan and supra-regional centres. Cities that had this function before 1999 were classified as regional and sub-regional centres. The group of supra-local centres includes mainly small powiat's cities.

There were differences in the allocation of cities to the centre category. At the three highest levels, which are included in all four classifications, only 14 cities were classified in the same way. A further 17 had the same classification in three cases and five in two cases (Table 5).

Table 5. Classification of cities in Poland based on spatial development plans of

Category	Compliance with classification	Cities / agglomeration
Metro-politan	in all analysed	Warsaw, Górnośląsko-Zagłębiowska (Katowice), Tricity (Gdańsk), Cracow, Łódź, Wrocław, Poznań, Szczecin
	NSDC, SDPV	Lublin
	NSDC	Bydgoszcz-Toruń
Supra-regional	in all analysed	Rzeszów*
	population, ESPON, SDPV	Bydgoszcz, Toruń*
	ESPO, NSDC, SDPV	Białystok, Kielce, Olsztyn, Zielona Góra, Opole
	population, ESPON	Lublin, Bielsko-Biała, Częstochowa
	NSDC, SDPV	Gorzów Wielkopolski
Regional	population	Rybnicki, Radom
	in all analysed	Koszalin, Elbląg, Kalisz-Ostrów, Płock, Wałbrzych
	ESPO, NSDC, SDPV	Radom, Legnica, Słupsk
	population, ESPON, SDPV	Tarnów, Włocławek
	ESPO, NSDC	Rybnik, Grudziądz
	NSDC, SDPV	Częstochowa, Bielsko-Biała
	Population, ESPON	Gorzów Wielkopolski
Population	Kielce, Olsztyn, Opole	
SDPV	Piotrków Trybunalski, Skierniewice, Radomsko, Kutno, Sieradz, Chojnice	

Note: *potential due to a minimally smaller population

Source: Own study.

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