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## VARIABILITY OF THE LEVEL OF DEVELOPMENT OF FUNCTIONAL URBAN AREAS

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## ZRÓŻNICOWANIE POZIOMU ROZWOJU MIEJSKICH OBSZARÓW FUNKCJONALNYCH

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**Summary:** Functional urban areas are of high importance both in the implementation of the National Urban Policy 2023 and territorial development policy. The objective of the study is to determine the level of development of functional areas of voivodship capitals in Poland. The study involved the application of the taxonomic method in a dynamic approach covering the period 2005-2015. The determination of taxonomic values was based on a set of diagnostic indicators in three dimensions of development: social, economic, and environmental. The study involved the assessment of the level of development of central cities of FUA, and separately of cities and the surrounding communes. Moreover, the level of development of each of dimensions of sustainable development was determined. This permitted the assessment of the structure of development of functional areas in Poland.

**Keywords:** functional urban areas, level of development, sustainable development, growth centres, taxonomic method.

**Streszczenie:** Miejskie obszary funkcjonalne mają istotne znaczenie w realizacji zarówno Krajowej Polityki Miejskiej 2023, jak i terytorialnej polityki rozwoju. Celem badania jest określenie poziomu rozwoju obszarów funkcjonalnych miast wojewódzkich Polski. Badania przeprowadzono z wykorzystaniem metody taksonomicznej w ujęciu dynamicznym obejmującym okres 2005-2015. Podstawę wyznaczenia wielkości taksonomicznych stanowił zestaw wskaźników diagnostycznych ujętych w trzech wymiarach rozwoju: społecznym, gospodarczym i środowiskowym. W ramach badania została podjęta ocena poziomu rozwoju miast centralnych MOF oraz oddzielnie miast i gmin ich otoczenia. Dodatkowo określono poziom rozwoju każdego z wymiarów rozwoju zrównoważonego, co pozwoliło ocenić strukturę rozwoju obszarów funkcjonalnych miast w Polsce.

**Słowa kluczowe:** miejskie obszary funkcjonalne, poziom rozwoju, rozwój zrównoważony, centra wzrostu, metoda taksonomiczna, wymiar społeczny, gospodarczy, środowiskowy.

## 1. Introduction

Functional Urban Areas (FUA) are currently one of the types of units of territorially-oriented development policy. They constitute a group of territorial units covered by considerable financial support and new instruments of governance [Markowski, Kudłacz 2017; Szafranek 2017b; Szlachta 2017]. The effects of prioritising FUAs in the process of socio-economic development of countries and regions should be the improvement of the level of their development and functional and spatial cohesion. In Poland, for the purposes of the implementation of the assumptions of the development policy, FUA were defined in the National Spatial Development Concept 2030 (NSDC 2030) [Koncepcja... 2012]. Its formal and legal form was stipulated by the Act on the planning and the spatial planning [Ustawa o planowaniu... 2003].

Pursuant to NSDC 2030 [Koncepcja... 2012, p. 182] and legal acts [Ustawa o planowaniu..., art. 2, point 6a, 2003; Ustawa o zasadach art. 7., point 1a], a functional area is a compact spatial system composed of functionally interrelated areas characterised by common conditions and expected uniform development objectives. In the group of FUA in Poland, their four types are designated. They can be located around voivodship, regional, subregional, and local centres [Koncepcja... 2012, pp. 185-210]. At the national level, a total of 17 FUAs are designated, including 10 metropolitan and 7 national [Koncepcja.. 2012, p. 192] subject to analyses in this paper. The selection of the units was based on their designation according to uniform criteria. The Ministry in charge of public statistics also collects comparable information material on them.

Pursuant to the assumptions of the development policy, FUA should constitute growth centres, spreading development processes to their surroundings [Davoudi, Wishardt 2005; Heffner, Gibas 2013; 2016; Szafranek 2015, Markowski, Kudłacz 2017]. In such a context, it is important to determine the state and direction of changes in the scope of development of FUA. The objective of the presented study is the assessment of the level of development of FUA performed in several aspects. The first one is the determination of the variability of the level of development of FUA in spatial terms in the country and in internal systems of the units (differences between the level of development of central cities and their surroundings). Another aspect concerns the identification of changes in the level of development of FUA in time, between 2005 and 2015. Moreover, an attempt was undertaken to assess the level of development of each of the dimensions of sustainable development of FUA, i.e. economic, social, and environmental. Sustainable development of urban areas is both the idea and objective of the development of EU and Poland [Programowanie... 2014; Mierzejewska 2017].

The research was conducted with the application of taxonomic measures of development for 2005 and 2015. A model method of linear ordering was applied, designating separate models for each group of units and dimensions of development.

## 2. Objectives and conditions of development of functional urban areas

Pursuant to the assumptions of the development policy of Poland, cities, and particularly FUA play the key role, and the basic objective of urban policy is “strengthening the ability of cities and urbanised areas for sustainable development and creating workplaces, and improvement of the quality of life of residents” [Krajowa... 2015, p. 12]. The following key objectives of development of cities were adopted: efficiency, cohesion, sustainable development. They should lead to the development of competitive and strong cities [Krajowa... 2015, p. 12].

Efficiency as an objective of development of cities and FUA particularly concerns integrated development and partnership-based governance of development. It is based on institutional conditions [Noworól 2013; 2015; Szlachta, Zaucha 2014]. Cohesion in the context of development policy means the development of a harmonious urban organism through the inclusion of degraded areas and social groups in development [Zaucha et al. 2015]. The sustainable and compact city is defined as one with special order and efficient management of all resources. As a consequence of implementation of such objectives, FUA should become competitive. This type of centres develops a network of interrelated elements in space. Growth factors particularly appear in the nodes of the network and in strands between them [Gaczek, Komorowski 2006]. In the conditions of territorial integration, they lead to the development of FUA. Competitive FUA should be distinguished by the optimisation of transport connections, diverse and abundant labour market, and a well-developed R+D sphere and business-related institutions. The fact is also confirmed by Veltz [1996, p. 238] who points to the important role of external benefits of agglomerations leading to the development of competitive centres. Considering the aforementioned objectives of development of FUA, the multi-aspect effect on their development should be emphasised. It is directly related to the concept of sustainable development of cities, defined as support of the economy efficiently using resources, more friendly to the environment and more competitive [Europe 2020... 2010]. In the context of socio-economic development of territorial units, it is understood as maximisation of net benefits from economic growth, protecting and ensuring renewal of the usefulness and quality of natural resources in the long term [Pearce, Turner 1990, pp. 25-41]. In such a scope, it is important to respect the multi-aspect character of sustainable development [Borys 2005; Hull 2011; p. 54; Mierzejewska 2017; Piątek 2007; Papuziński 2011; Dembicka-Niemiec 2017], entailing the necessity to respect the social, economic, and environmental objectives. Such a perspective is adopted in the practice of planning and development of cities, particularly in the assumptions of the development of the EU and Poland. According to Leśniak [2009, p. 7], sustainable development is “a socially recommended, economically purposeful, and ecologically desired strategy of economic development”.

The development of FUA in accordance with the rules of sustainable development is a difficult task, but as emphasised by Kowalewski [2005], the implementation of such rules is necessary, and their idea is to “search for a pragmatic compromise between the objectives of sustainable development and economic preferences and possibilities of societies” [Kowalewski 2005, p. 135].

Therefore, the discussion of the objectives and conditions of the development of FUA should consider social, economic, as well as spatial challenges, while approaching them in terms of the rules of sustainable development.

### 3. Study methodology

The research was conducted with the application of the taxonomic method of distance from the model by Z. Hellwig [1968] for 2005 and 2015, in reference to two distinguished groups of territorial units, i.e. centres of FUA (19 cities)<sup>1</sup>, as well as cities and communes included in all of the analysed FUA (365 units). The calculations of the measures of development were based on diagnostic indicators obtained from the collection of the Ministry of public statistics. The indicators were selected to describe three dimensions of sustainable development, i.e. social, economic, and environmental (spatial-environmental). The final number and type of the adopted measures particularly depended on the possibilities of obtaining relevant statistical data in the analysed spatial systems, and statistical criteria of qualification of diagnostic variables. The following indicators were finally applied, divided into three groups:

a) social dimension:

- balance of migrations for permanent residence per 1000 residents,
- population density,
- contribution of population at pre-productive age,
- natural growth per 1000 residents,
- contribution of children attending nurseries,
- number of foundations, associations, and social organisations per 1000 residents,
- number of children aged 3-5 per one place in a kindergarten;

b) economic dimension:

- number of economic entities per 10 thousand persons,
- number of new economic entities per 10 k persons,
- number of natural persons providing business activity per 1000 persons,
- percent of newly registered entities of the creative sector in the total number of newly registered entities,

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<sup>1</sup> 17 FUA are designated in Poland, but two of them include two cities of central importance, i.e. Bydgoszcz and Toruń in the Bydgoszcz-Toruń FUA, and Gdańsk and Gdynia in the Tricity FUA.

- percent of the unemployed,
- number of the employed per 1000 residents;
- c) environmental dimension:
  - percent of population using sewage treatment plants,
  - number of entities of section E per 10 k residents,
  - percent of parks and green areas in total area,
  - industrial and municipal sewage requiring treatment discharged to waters or soil in a year per 1 resident,
  - density of cycling paths per 10 thousand km<sup>2</sup>.

The first stage of the procedure involved the creation of a so-called development model for each group of research units, adopting the abstract model<sup>2</sup>. The next steps, in accordance with the algorithm, led to obtaining a measure of development with a value between 0 and 1<sup>3</sup>. The works resulted in a ranking of the analysed units based on the prepared taxonomic measures of development in a holistic approach, and in the scope of particular dimensions.

#### 4. Variability of the level of development of FUA

The assessment of the level of development of FUA was performed based on results of measurements of development of central entities of such areas (Table 1, Fig. 1) and their external zones (Fig. 1).

The spatial distribution of the level of development of central units of FUA particularly shows the permanence of such variability. The highest values of the level of development are reached by the largest cities in Poland, and Warsaw takes a permanent leading position. The group of such units also includes Wrocław, Poznań, Gdańsk, Kraków, and Katowice which however lost its position in comparison to other analysed units with time. Nonetheless, the potential of the largest Polish cities is largely related to the population mass of the centres, and fulfilling social and economic functions at the supra-regional scale. Let us notice the increase in position in the ranking of cities and therefore improvement of the level of development of cities from East Poland, and particularly Olsztyn and Rzeszów. The remaining units have not shown a substantial change in the level of development in comparison to other cities.

The variability of the level of development of cities and communes included in particular FUA (Fig. 1) also shows certain patterns. Concentric spatial layouts are

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<sup>2</sup> I.e. specified based on values included in the information matrix in a way that for stimulants it respectively adopts maximum values, and for destimulants minimum values.

<sup>3</sup> The more approximate to 1 the value is, the stronger the development of the unit is. This means that the highest position is taken by units which obtained a value the most approximate to 1.

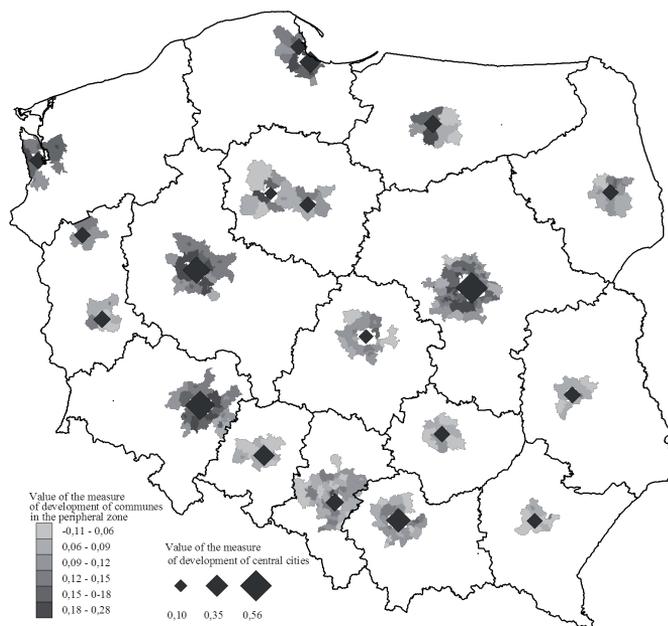
**Table 1.** Taxonomic measures of development of cities constituting centres of FUA in 2005 and 2015

Cities	2005		2015	
	value	position in the ranking	value	position in the ranking
Białystok	0,128	18	0,205	16
Bydgoszcz	0,141	16	0,114	19
Gdańsk	0,443	5	0,326	5
Gdynia	0,202	8	0,216	11
Gorzów Wielkopolski	0,182	12	0,202	17
Katowice	0,508	2	0,241	7
Kielce	0,174	14	0,205	15
Kraków	0,429	6	0,388	4
Lublin	0,179	13	0,209	12
Łódź	0,145	15	0,208	14
Olsztyn	0,113	19	0,239	8
Opole	0,191	10	0,312	6
Poznań	0,443	4	0,443	3
Rzeszów	0,136	17	0,186	18
Szczecin	0,182	11	0,226	9
Toruń	0,198	9	0,208	13
Warszawa	0,524	1	0,558	1
Wrocław	0,485	3	0,505	2
Zielona Góra	0,205	7	0,225	10

Source: own elaboration.

largely dominant, where the most developed units are located near the central unit. Such a situation is observed in the case of Warsaw, Poznań, Wrocław, Kraków, and Łódź. This suggests that the strongest development processes occur in the center, and their spreading is related to the diffusion of development processes to the surrounding areas according to distance.

The study involved an attempt to assess the degree of development of each dimension of sustainable development. Fig. 2 presents results of measurements of development of each dimension for central cities of FUA in 2005 and 2015. The study results show several patterns. The first of them concerns the permanence of the state of spatial variability of the level of development of particular dimensions. Metropolitan centres of the country both in 2005 and in 2015 were characterised by the highest level of economic and social development. An exception in this group are the city of Łódź and Katowice, which are distinguished by a decrease in economic potential in comparison to other studied cities. Moreover, the study shows an imbalance in the level of development of particular dimensions. Economic



**Fig. 1.** Spatial variability of the level of development of central cities and cities and communes included in FUA in 2015

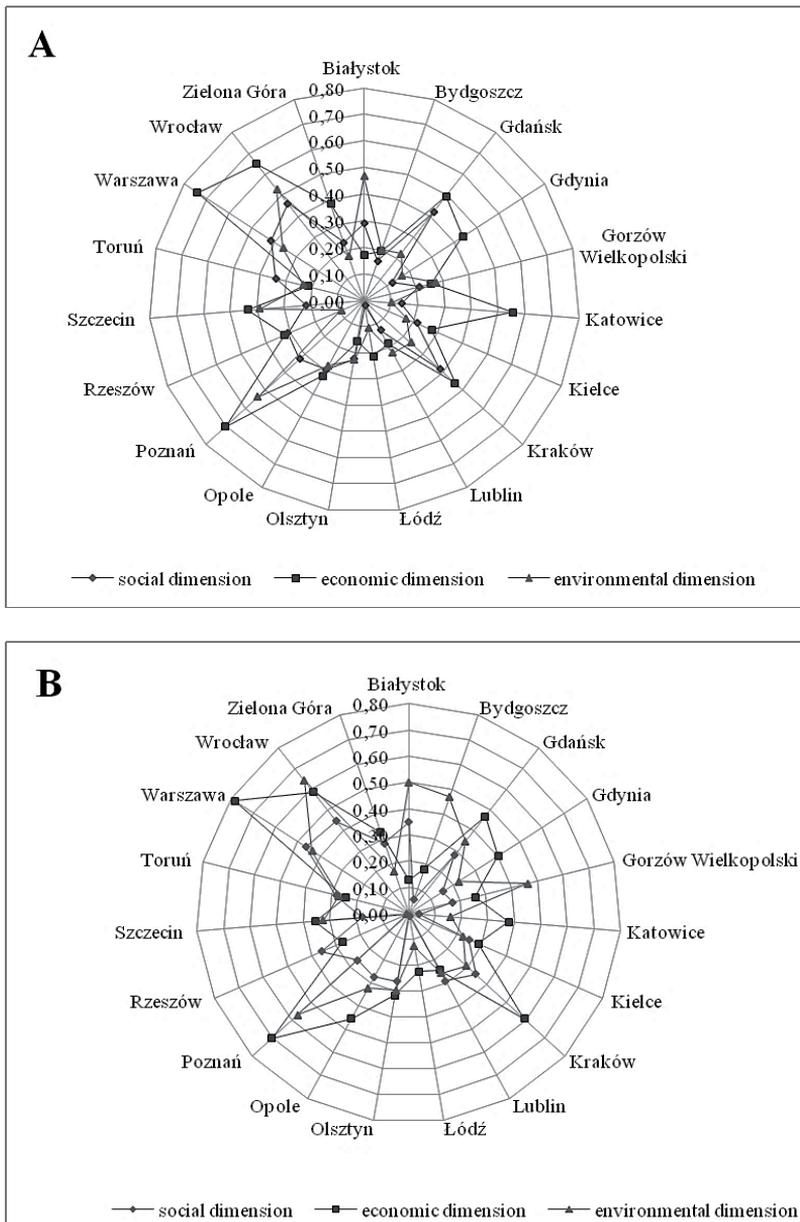
Source: own elaboration.

development reaches the highest results, and the environmental dimension is the least developed in a major part of the analysed centres. However, let us notice that the disproportions between the levels of development of particular dimensions have been slightly minimised. An analogical analysis was performed in reference to the external zones of individual FUA (Fig. 3). In particular, a lower level of their development than that of the central cities is observed. This is suggested by higher values of the measures of development obtained by central cities.

This means, they are becoming more similar to the model unit designated in the study – with the highest level of development<sup>4</sup>.

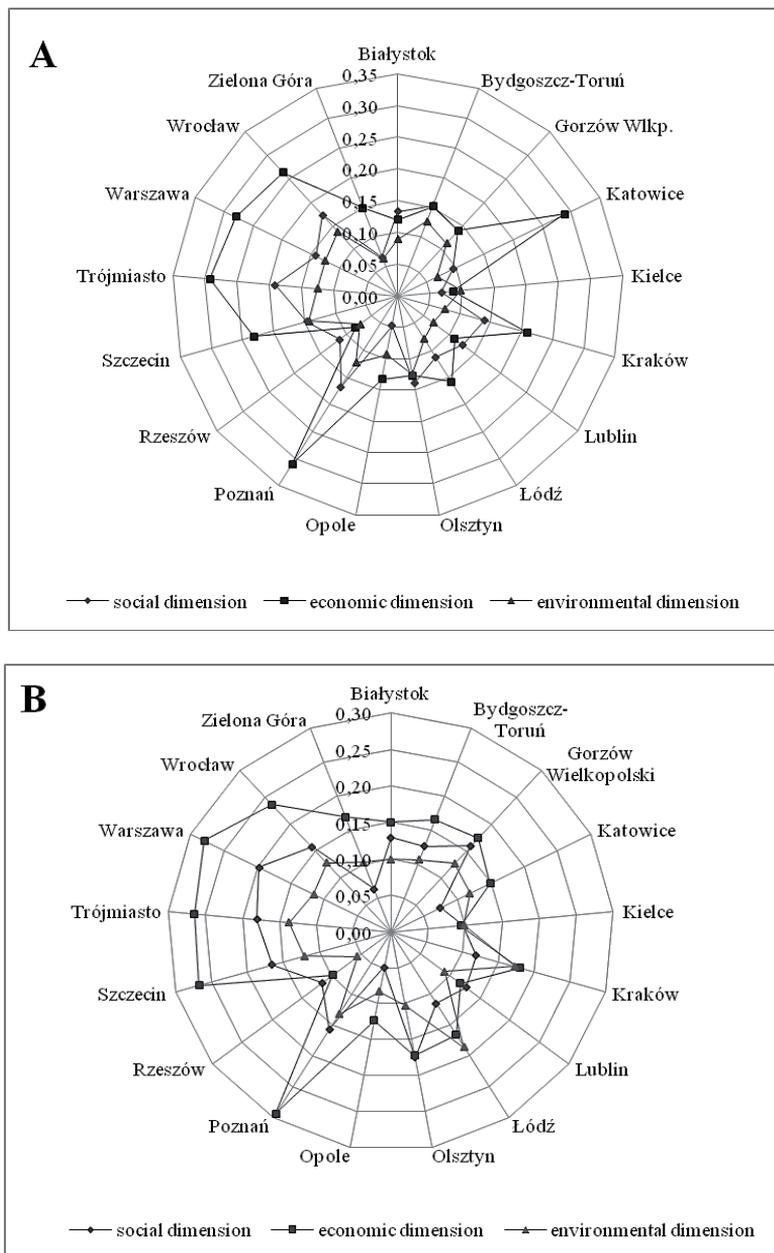
The obtained results show the highest level of development of cities and communes constituting the hinterland of the largest urban centres in Poland. This suggests the polarisation of the processes of socio-economic development. However, the disproportion in the level of development between particular functional areas decreases in the study period. In terms of relations between the dimensions of the level of development, the highest level of development is observed in the economic sphere. The scale of disproportion in the development in particular dimensions,

<sup>4</sup> For each group, separate model units were designated, in accordance with their specifics.



**Fig. 2.** Measures of development of central cities of FUA in three dimensions of sustainable development in 2005 (A) and 2015 (B)

Source: own elaboration.



**Fig. 3.** Measures of development of cities and communes surrounding the centres of FUA in three dimensions of sustainable development in 2005 (A) and 2015 (B)

Source: own elaboration.

however, is lower than in the case of central cities. In cities and communes surrounding central units, the level of environmental as well as social development considerably improved.

The obtained results suggest that in central cities, development is particularly based on economic potential, with deficit of the social and environmental aspect. In cities and communes surrounding the centre, such differences disappear more quickly, balancing development in particular dimensions.

## 5. Discussion and conclusions

The study shows the permanence of variability of the level of development of FUA in Poland, and the polarisation of development processes. In the study period, the positions in terms of level of development of both central cities and the surrounding zones have been subject to only inconsiderable changes. The largest centres also use the conditions of development the best, and are distinguished from their surrounding areas. This suggests considerable disproportions in the level of development between central units and their surroundings. Assuming that the economic dimension of development is at the highest level in such centres, it is economic factors that determine their development potential. The phenomenon is common in regional development, and also described among others by (compare: [Dunford 2003; Gaczek 2013, Szafranek 2015]). Because in the assumptions of functioning of FUA it is not possible to separate the development of the central unit from that of its surroundings, it is recommended to undertake activities for the development of functional relations. In such a context, it is also important to skilfully conduct cooperation and building multilateral relations, as emphasised by Herrschel and Newman [2002] and Kociuba [2015]. However, it cannot be unambiguously determined that no positive effect of the large city on the development of its surroundings occurs. Manifestations of such an effect take form of an increase in the level of development of almost all units included in a FUA. It is also observed in the case of cities located in East Poland. This is particularly important, because the problem of delayed development especially concerns this part of the country. The positive changes, however, are insufficient. A separate aspect was the determination of levels of development of each dimension of sustainable development. In this scope, a disproportion is evident between levels of development of three dimensions, with the dominance of the economic dimension over the social and environmental one. Simultaneously an improvement of the level of development in the environmental dimension is worth noticing. In a certain scope, this is in accordance with the study by Dembicka-Niemiec [2017]. It is also important that a higher degree of “balance” between the levels of development of particular dimensions is shown by cities and communes surrounding the centre. The changes should be associated with the adopted directions of expending financial resources and implementation of investments by cities (compare: [Szafranek 2017a]).

The analysis shows that activities minimising the disproportions in development between the central city and its surrounding, and aligning the level of development between particular dimensions of sustainable development are especially desirable. This is supported by the model of integrated planning and governance of development of cities implemented in the territorially-oriented development policy.

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