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**Article**

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# Periurbanisation – evidence from Polish metropolitan areas<sup>1</sup>

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**Abstract:** This study analyses periurbanisation as a specific process of changes caused by the expansion of cities towards rural areas that are situated at a greater distance from the core city but still within the framework of the functional urban area. Peri-urban areas are determined by a particular set of urban and rural characteristics that coincide, but seem to be dominated by the rural aspect. By using a trans-disciplinary approach based on multivariate analysis, the authors identified peri-urban areas within three Polish metropolitan areas. Results show that the areas mostly predestined to be peri-urban are territories classified as rural *gminas* (communes) and rural areas of urban rural *gminas*, which are peripherally located in relation to the main city. In general, the findings are relevant from the point of view of policy-making because they provide new insights into the very complex nature of peri-urban areas.

**Keyword:** peri-urbanisation, peri-urban areas, multivariate analysis, metropolitan areas,

**JEL codes:** R12, R14, R58

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## 1. Introduction

The on-going process of making rural areas resemble urban ones and the diminishing geographic and civilizational distance between them entails an evolution in the perception of urban and rural areas as two opposite categories. The literature has already provided some arguments, however, about an emerging intermediate zone between urban and rural areas (Grochowski, 2011; Korcelli et al. 2012; Butt 2013; Mazur et al. 2015; Mrozik and Idczak, 2015). These areas have arisen as a result of the transition of rural areas and the adoption by them of certain characteristics specific to urban ones. Such a highly dynamic process affecting rural areas located beyond the contiguous built up urban area but within the functional urban region is often labelled as peri-urbanisation (Webster and Muller, 2009; Piorr et al. 2011). It follows that the peri-urban nature of such areas may be something in-between, neither urban nor rural, and the simple explication of the urban–rural dichotomy seems to be inadequate for dealing with some of these areas.

Although peri-urban areas may be structurally and functionally different to urban and suburban places, they are considered an inherent component of urbanisation (and suburbanisation) (Butt, 2013: 204). Their occurrence in the form of “areas of transition” is determined by the strong influence of large cities, and more specifically by progressive urbanisation drives. The power of such forces is not limited to a city’s administrative boundaries but should be considered on a larger scale, covering a functional urban region. Large cities are places from which new patterns of development spread to the directly surrounding areas and more distant areas as well (Małuszyńska, 1988: 229-230). This has been confirmed on the European scale by, inter alia, Kasanko et al. (2006) and ESPON (2013), and in Poland by Smętkowski et al. (2009) and Heffner (2016), who reported that the demographic and socio-economic growth over the last decades has put massive pressure on metropolitan areas. As a result, the traditional compact cities have expanded into adjacent rural areas. A remarkable feature of this process has been a variety of urban expansion patterns (understood in both physical and functional terms).

There are, however, surprisingly few studies in Poland looking into the peri-urban areas that are located somewhere in-between the urban core and the rural landscape. Hence, the present study provides further evidence for the debate on the specific nature of peri-urban areas with special reference to the relationships extant between the Polish large cities v. rural areas. The research issue is to determine a set of specific features which allow to identify peri-urban areas within the framework of three defined functional urban areas, i.e. the Lodz

Metropolitan Area (LMA), the Poznan Metropolitan Area (PMA) and the Wroclaw Metropolitan Area (WMA). This paper explores peri-urbanisation using a set of diagnostic variables and applying a trans-disciplinary approach based on multivariate analysis. To this end, data from the Local Data Bank of the Central Statistics Office of Poland were used. Summing up here, it must be stressed that this study is an exploratory research and should be regarded as a preliminary stage of the authors' investigation into the nature of peri-urban areas.

The structure of the paper is as follows: in the following, second section, an overview of periurbanisation is provided and a set of peri-urban characteristics presented. Section 3 illustrates the rationale for the selection of the metropolitan areas to be examined and includes a short description of these areas. This is followed by an outline of the research design and a presentation of diagnostic variables. The empirical results are then presented, which reveal greater details of the peri-urban areas. Conclusions are then drawn in the final section.

## **2. Periurbanisation – theory and review**

The conceptual definition of periurbanisation is still unclear and open to different interpretations. Although there is no consensus among researchers on how to identify territories being affected by the forces of periurbanisation, they are commonly determined by a certain range of rural and urban features which tend to increasingly co-exist on the outskirts of cities. Etymologically, this term refers to such concepts as urbanisation or suburbanisation. These concepts encompass a wide spectrum of processes that determine the changes taking place in settlements caused by agglomeration drives. The fundamental difference between urbanisation or suburbanisation lies in the territorial localisation of economic, social, cultural and environmental processes. The former term, urbanisation, is often considered in the context of the cultural and civilizational processes reflected in urban growth and a growing share of the population living in urban settlements due to the shift of populations from rural to urban areas (Parysek, 1995: 227). In turn, this leads to the concentration of populations in urban areas and their spatial development, the concentration of economic and administrative activities, shaping of specific cultural patterns of urban lifestyle and specific patterns of landscape and architecture (Węclawowicz, 2003: 160; Szymańska, 2007: 37-48; Słodczyk, 2012: 427–435). With all this, urbanisation is a process by which towns and cities are formed, and become larger and increasingly relevant at the expense of rural areas.

The latter term, suburbanisation, means the expansion of the city into suburban areas, i.e. the spread of both spatial forms of the city and patterns of urban life outside the central

city (Zagożdżon, 1988: 57-74). This complex and changing process takes place in suburbs that are situated relatively near, but on the exterior of, sizeable cities and that are directly affected by the economic power and the lifestyle of these central cities. Lisowski and Grochowski (2008: 223–233) argue that the territorial scope of suburbanisation generally covers suburban areas (suburbs) bounded by an urban-rural fringe which is, in turn, considered a transition zone between, on the one hand, the city and its suburbs, and – on the other one – the countryside. Although various socio-economic flows are indicated in both directions, the central city-to-suburb forces determine the most significant framework of this concept. In addition, as Markowski and Marszał (2006) note, suburbanisation is an integral element of the broader process of urban transformation, namely the metropolisation that covers transformation of functional linkages in both metropolitan and urban areas. The multiple interactions between the central city and its hinterland are weakened in favour of interconnections of a supra-regional importance. As a result, a new type of urban territory is created – the so called “diffuse city”, whose spatial layout remains rather scattered and is devoid of a spatial order.

Coming back to the question of periurbanisation, it is important to emphasize that this concept goes beyond that of suburbanisation, mainly due to the large scale of decentralisation.<sup>2</sup> It refers to the lands around cities and towns which can be defined as intermediate areas between suburban areas and typical rural areas. However, it does not necessarily mean that this term also holds when dealing with rural areas remote from large urban centres, but which do not necessarily need to be directly linked to the urban proximity (Grzeszczak, 1996: 40-41). All in all, it can be said that periurbanisation determines the overall processes taking place in rural areas adjacent to the suburban areas, resulting in the appearance of urbanisation effects. In other words, periurbanisation is a process of urban transformation that occurs in rural areas which are located in a catchment zone of urban forces and predisposed towards a multifunctional development (Idczak and Mroziak, 2016: 244-246). Nevertheless, this definition obviously provides only a common-sense explanation and does not give a complete picture of periurbanisation’s applicability in practice. It stems from the description that the areas being influenced by periurbanisation are predominantly rural and

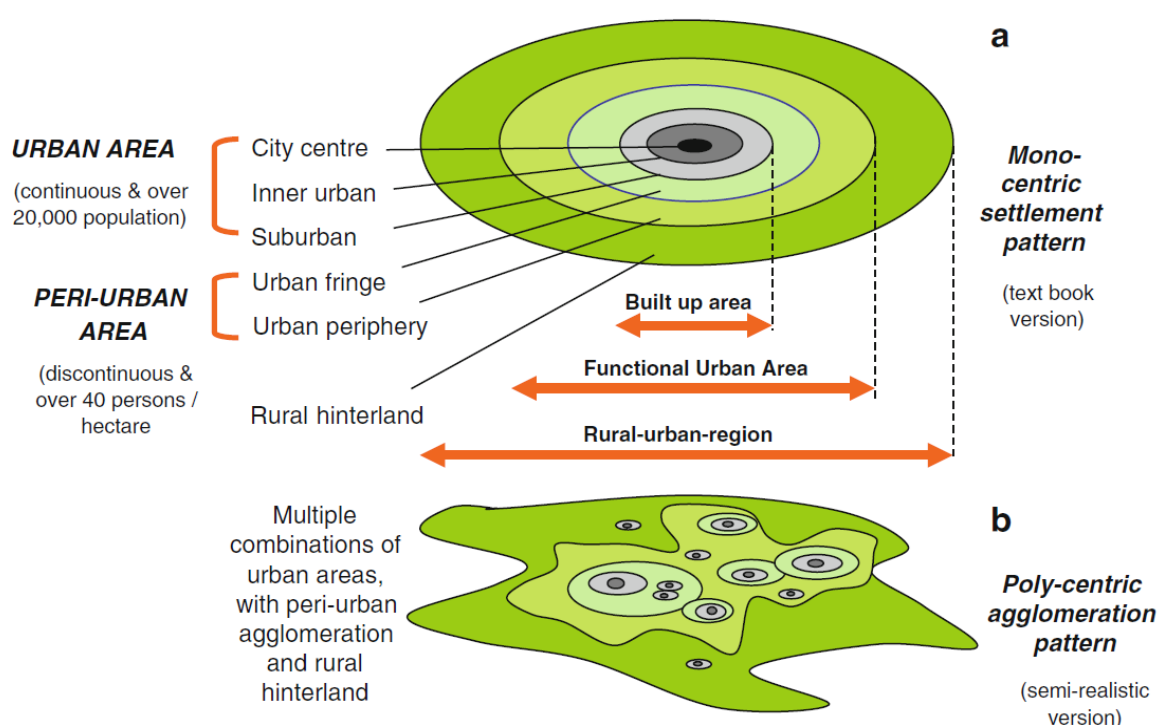
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<sup>2</sup> This article does not focus on providing an explanation of the differences between periurbanisation and suburbanisation. To put it briefly, however, periurbanisation may be seen as a result of chaotic suburbanisation and urban sprawl, i.e. processes taking place in rural areas remaining under urban influence. The rural aspect is evident here and constitutes the decisive difference in the perception of both terms. In addition, the latter term refers to areas which should be more agglomerated or dense. For more, see (Caruso, 2001).

may lie either very close to or at a considerable distance from the urban-rural fringe. This definition, however, does not offer definitive answers to the question what the main reasons for periurbanisation are, which leads to extensive changes that, in turn, have a significant impact on the development of particular rural areas. Hence, to move to a more precise definition that will yield a clear understanding and enhance substantially periurbanisation's practical utility, there is a need to scrutinise the concept of periurbanisation through its features and spatial scope.

As aforementioned, periurbanisation affects areas under increasing pressure from urban centres that are commonly defined as a transitional zone between urbanised areas (densely built up areas) and rural areas dominated by agricultural activities. These areas are characterized by a mixed land use and have indeterminate inner and outer formal boundaries. They usually cover territories split between different administrative areas (Webster and Muller, 2009: 282). The more precise placement is considered by Lamb (1983: 40-47), who underlines that such areas are situated beyond the permanent built up suburbs of a central city but still within the boundaries of a larger functional urban region. In a functional sense, they constitute a transitional (mixed) zone of urban and rural areas that, on the one hand, is strongly influenced by urban processes, and – on the other one – is characterized by the typical morphology of rural areas (Caruso, 2001: 9). Indeed, Gallent et al. (2006: 458-461) claim that these areas are places where urban and rural changes are closely dependent, and their main characteristics are land uses that are often “peculiar to the fringe”. However, they also clearly point out that despite the expansion of the urban structure and function, the rural land uses dominate in the rural-urban fringe. Along the same line of thought, Piorr et al. (2011: 24-29) developed a geographical (spatial) context of rural-urban areas more extensively. In their research on periurbanisation, they propose that areas under rural-urban transformation cover two types of zones: the urban fringe and the urban periphery. The former is defined as a zone lying along the edges of a built-up area, which includes a scattered pattern of lower density settlement areas, urban concentrations around transport hubs, as well as large green open spaces (e.g. urban woodlands, farmland, golf courses and nature reserves). The latter refers, in turn, to a zone surrounding the main built up areas, characterised by a lower population density, but belonging to the functional urban area, consisting of smaller settlements, industrial areas and other urban land-uses, all this within the context of functional agriculture (see Figure 1). Such a spatial location of these areas within an analysed functional and spatial structure makes them distinctive and stresses that they are known as peri-urban

areas. Moreover, Piorr and co-workers (2011: 24) elaborated a definition of the peri-urban area that, beyond the simple putting together of both the urban fringe and urban periphery, includes “discontinuous built development containing settlements of each less than 20,000 population, with an average density of at least 40 persons per hectare (averaged over 1km cells).” It is worth noting that this approach does not provide a comprehensive and general applicability, and the meanings of each of the terms used in the concept may, as the current authors found, vary between different countries. Nonetheless, this concept significantly simplifies the understanding of the matter of peri-urban areas, in particular when taking into consideration their place in the spatial structure.



**Figure 1.** Concept of peri-urban areas and the rural–urban-region

Source: Piorr et al. 2011: 25

As mentioned above, periurbanisation comprises all the forces that affect peri-urban areas. In other words, periurbanisation is seen as a conversion of urban or rural areas into peri-urban areas (defined according to the concept above), which is determined by urban development and urban expansion. Moreover, periurbanisation occurs as a complex set of processes of change triggered by a wide range of dynamic factors. This implies that periurbanisation cannot be seen as a static phenomenon, and occurring peri-urban areas are unlikely to be fixed zones. A key component of this approach stresses the more dynamic views on peri-urban areas, which should be seen as places of change and adjustment, being in

a continuous flux, distinct from urban as well as rural spheres (Masuda and Garvin, 2008: 112). By doing so, it may be assumed that peri-urban development involves, among others, physical, social, economic, environmental and institutional features, which are not constant but differ, depending on the time and place (Allen, 2003:136-138; Simon et al.; 2004: 237-238). Following a review of the existing literature, key characteristics of the periurbanisation process were singled out, including the following essential features shaping peri-urban areas (Iaquinta and Drescher, 2000: xx-xx; Parkinson and Tayler, 2003: 75-79; Webster and Muller, 2009: 280-281; Živanović Miljković et al. 2012: 15-17; Ravetz et al. 2013: 20-29):

- changing economic structure, a shift from agricultural to manufacturing-related activities as a dominant sector,
- change in employment structure – decrease in employment in agriculture in favour of employment growth in manufacturing sectors,
- inflow of new investments, including foreign direct investments,
- rapid population growth and urbanisation,
- change in spatial development patterns and increase of land costs,
- increasing number of commuters outside their place of residence,
- existing important extensions of the living space of cities as recreational and leisure activities,
- changing residents' lifestyles and social behaviours,
- consumption-oriented adaptation of farming activities, e.g. horticultural production, greenhouse production etc.,
- multifunctional agriculture – the joint production of commodities and non-commodities.

These general features can occur in different places with varying intensity and scope, but in principle their existence in combination with the geographical location defined above implies the demarcation of a particular zone, i.e. the peri-urban area. With this in mind, it is important to note that the scope of peri-urban characteristics can be developed further.

### **3. Study area**

Bearing in mind the above-mentioned evidence, it follows that this development has led to the expansion of cities thereby creating a far-reaching area of urban influence. More specifically, such an area, commonly known as the metropolitan area, is made up of a central core – a large city, and suburbs and nearby cities, towns, and environs – over which the major



city (the core) exercises the strongest influence. Metropolitan areas, as defined by Markowski and Marszał (2006: 14-17), Gaczek (2013: 23-31) and Kaczmarek et al. (2014: 9-10), involve an internally complex settlement system, whose essential dimension is the existence of functional relationships (metropolitan functions) that tie all units into a territorially coherent and developing socio-economic organism. These authors take also account of the existence of peripheral areas that are highly focused on a core, and whose growth depends directly or indirectly on the development of that core. Metropolitan areas, then, encompass both the more or less densely settled urban areas and the more or less sparsely populated rural areas.

In view of the above, three similar metropolitan areas were selected as a study area to carry out our research, i.e. the Poznań Metropolitan Area (PMA), Wrocław Metropolitan Area (WMA) and Łódź Metropolitan Area (LMA). These cities, with their functional areas, were ranked among the 76 European Functional Urban Areas (FUAs) that were separately classified as Metropolitan European Growth Areas (MEGAs), that is, the strongest areas characterised mainly by the highest development potential (ESPON, 2007). These cities are seen in the urban hierarchy as second tier cities, that is: “those cities outside the capital, whose economic and social performance is sufficiently important to affect the potential performance of the national economy” (Parkinson et al., 2012: 8; ESPON, 2012: 4). Such cities differ from capitals especially in functional terms, but also because of their “first city” status in national contexts. However, second tier cities have a functionally well-served urban region, and their urban functions are spread much more evenly over a wider urban area (Cardoso and Meijers, 2016). Moreover, these cities have seen major improvements in accessibility which has also contributed to an enhanced attractiveness and competitiveness of their surrounding areas (Komornicki et al., 2013; ESPON, 2016). All of this provides justification for the choice of the study areas for the purpose of this research.

As stated earlier, the study area comprises three metropolitan areas. The delimitations of the chosen metropolitan areas have been based on various methods and techniques which often deliver different results. Thus, in the course of this study the metropolitan areas are generally defined as laid down in the regional strategic and planning documents.<sup>3</sup> In this respect, the metropolitan areas are set as follows:

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<sup>3</sup> Both the delimitation criteria and the functional urban areas of all the regional capitals were worked out at the national level by Śleszyński (2013). However, regional authorities have also been obliged, based on the *National Spatial Development Concept 2030* (KPZG 2012), to delimit the functional urban areas of regional capitals and to incorporate them into their measures undertaken within their strategic and spatial planning. Taking this into account, the metropolitan areas of the cities examined were adopted from the following documents: SRLOM (2017), PZPWW (2017), WROF (2017).

- PMA – covers a territory of 45 communes, including 6 urban, 21 urban-rural and 18 rural ones. It occupies an area of 6201.94 km<sup>2</sup>, which accounts for 20.8% of Wielkopolska (Greater Poland) Region, and is inhabited by 1.42 million people, representing 40.08% of its population.
- WMA – occupies a territory of 28 communes, including 3 urban, 10 urban-rural and 15 rural ones. It covers an area of 4128.23 km<sup>2</sup>, which accounts for 20.7% of Dolnośląskie (Lower Silesia) Region, and is inhabited by 1.06 million people, representing 36.6% of the its population.
- LMA – consists of 28 communes, including 7 urban, 5 urban-rural and 16 rural ones. LMA covers 2498.93 km<sup>2</sup>, which accounts for 13.7% of Łódź Region, and is inhabited by approximately 1.08 million people, which constitutes 43.6% of its population.

The intention behind the analysis developed here is to identify peri-urban areas. Hence, it should be emphasised that their most important part is their rural aspect, which seems to be evident. Therefore all the urban-rural communes were divided into an urban part and a rural part, and the research covers separately the towns and rural areas of the urban-rural communes. In addition, the core cities (Poznań, Wrocław and Łódź) were excluded from the analysis.

#### **4. Research methods and data**

Since the question of peri-urban areas has been primarily discussed in the context of complexity and multi-functional phenomena occurring in some territorial configurations, the research focuses on an economic and spatial analysis, including especially taxonomic methods. These are very useful because, due to the use of proper measures and indicators, they allow for comparisons to assess the development of territorial units described by many characteristics. In other words, these methods are rated among the statistical multidimensional analyses that involve operations aimed at ordering and classification of multivariate objects in the featured space. Put simply, it divides a set of objects into some sub-groups on the basis of specified criteria and as a result creates the so-called typological groups (Heffner and Gibas, 2007: 9-10). A key element of multivariate analysis is to make a proper selection of the diagnostic features (variables) describing the objects investigated and at the same time carrying various kinds of information that is extremely important for the process of comparing these objects. Moreover, in order to avoid explaining separately particular endogenous variables describing complex (dependent) occurrences (phenomena), there is a

need to demonstrate the global impact of complex explanatory (independent) occurrences on other given complex occurrences (viewed as a uniform whole). To do this, it means applying composite indicators that aggregate multidimensional processes into simplified concepts (Nowak, 1990: 66-67). Each composite indicator has a very relevant feature, that is, it replaces the description of a complex reality done by multiple single diagnostic variables with a single aggregate measure (indicator).

When it comes to the identification of peri-urban areas within three metropolitan areas, the methodology of constructing composite indicators was used, first as a useful tool for summarising and next to compare complex, multi-dimensional realities between territorial objects (OECD, 2008). The study procedure was conducted separately for the three metropolitan areas in line with the following steps and methods:<sup>4</sup>

- selection of data suitable for describing peri-urban areas – this was done based on their analytical soundness, measurability and relevance to the features of peri-urban areas specified in section 2. As a result, 8 final variables were selected and expressed as mostly dynamic indicators (2016 – year considered; 2004 – base year) – see table 1.
- data normalisation – carried out with the use of the *min-max method*;
- identification of groups of objects (clusters) within the study area similar in terms of the scale of changes specific to periurbanisation. To this end, *cluster analysis* was applied, which groups data objects based on information found in the data. As a distance measure the *Euclidian distance* method was used, and then clustering was done with the use of *Ward's method*.
- weighting of diagnostic variables (indicators) – a *principal component analysis* was applied to give variables appropriate weights. By doing so, the values of the weights derive from statistical models, and this approach is deemed a non-arbitrary manner.
- aggregation of diagnostic variables (indicators) – this aimed at constructing a final composite indicator using the *additive aggregation method*.
- identification of peri-urban areas – with the use of the arithmetic mean, the average level of the composite indicator for particular groups of objects (clusters) and the total average of the composite indicator for all territorial units were calculated. If the average for a given cluster was higher than the total average, it was recognised that this indicates the domination of peri-urban features.

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<sup>4</sup> A full description and application of multivariate analysis on the spatial scale for assessment of territorial units is provided for instance by Idczak (2013). In addition, a similar approach was applied by Goncalves et al. (2017).

**Table 1.** Diagnostic indicators selected\*

No	Shortcut of indicators	Name of indicators
1	Ind. 1	Population density (per 1 km <sup>2</sup> )
2	Ind. 2	Distribution water supply network per 100 km <sup>2</sup>
3	Ind. 3	Retirement age population per 100 persons of working age
4	Ind. 4	Number of population
5	Ind. 5	Entities entered in the REGON register per 10 thous. population
6	Ind. 6	Entities by size for 10 thousand population at working age
7	Ind. 7	Number of new dwellings and non-residential buildings completed per 1 km <sup>2</sup> (average from period 2005 – 2016)
8	Ind. 8	Built-up and urbanized areas in the total area of the territorial unit in %, (2014 – year considered; 2012 – base year)

\* - note: the set of data does not fully reflect the extent of peri-urban characteristics specified in Section 2. Nonetheless, it strikes a compromise between the significance of the input data used in making the measurement of the examined phenomenon and the availability of data at the current stage of the study.

Source: Authors' own elaboration

## 5. Results and discussion

As outlined in the theory and literature review, peri-urban areas are marked by the presence of characteristics that are considered at a given time as periurbanisation characteristics. This is a regulatory approach because it encompasses both static and dynamic contexts taking into account the variability of characteristics, their dependence on time, and assumptions adopted for the importance of those characteristics as being peri-urban. Hence, given the assumptions of this approach, the peri-urban areas are those in which the dynamics of changes is substantial, that is, the dynamics exceeds the average level, and, equally important, they are situated peripherally in relation to a large city.

The analysis of the results of the agglomerative hierarchical cluster analysis summarised in the dendrograms highlights that in all the examined cases a few clusters (groups of similar territorial units) are found. As regards LMA, assuming that the increasing level of dissimilarity is noticeable from the linkage distance above 1.0, there are five main groups of units similar in terms of examined peri-urban characteristics (Figure 2.A). For the two remaining cases, PMA and WMA, their dendrograms (Figure 2.C and 2.D) display the occurrence of three clusters comprising similar units, provided that the best cut of diagram three is done at about the horizontal distance, respectively 2.2 and 1.5. In the spatial view shown in Figure 2.D and 2.F, it is noteworthy that the maps for both PMA and WMA illustrate a striking feature – 2 out of 3 clusters are arranged into two rings, the first one

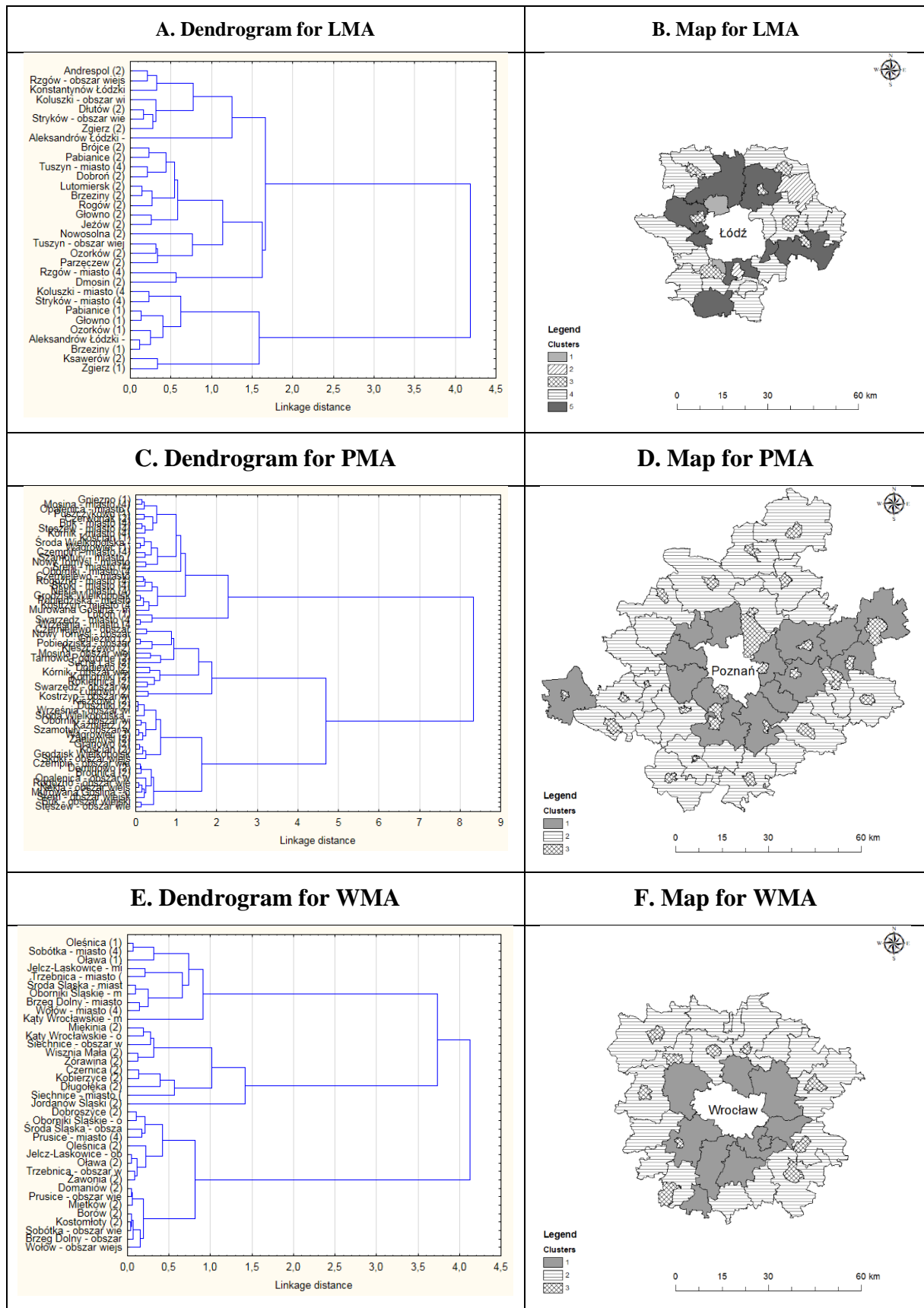


Figure 2. Results of the agglomerative hierarchical cluster analysis

Source: Authors' own elaboration

(cluster 1) surrounding the large city, and the second one (cluster 2) framing the first ring. Cluster 3 includes the remaining smaller objects that are widely scattered over the whole metropolitan area. PMA's Clusters 1 and 2 comprise rural communes and rural areas of urban rural communes, whereas Cluster 3 consists only of towns. A generally similar picture of the structure of clusters is painted as far as, notably, WMA is concerned. An exception to this are solely two towns: Prusice and Siechnice. When it comes, in turn, to LMA, the picture is not so clear (see Figure 2.B) The rural nature is represented in principle by Clusters 4 and 5, with the exception of two towns: Tuszyn and Konstanyń Łódzki. The smallest clusters 1 and 2 cover (each of them) only two territorial units that have both a rural and urban status. Cluster 3 includes exclusively towns and in this regard seems to be coherent.

As noted, the results of the agglomerative hierarchical cluster analysis provide only information on groups of territorial units that are similar in the light of characteristics investigated. However, in order to identify peri-urban areas according to the assumption relied on in this paper, an in-depth analysis of data is required. Table 2 displays the values of individual diagnostic indicators used in the study and the value of composite indicators for all clusters from all the metropolitan areas. The composite indicators reflect here the final result of all the characteristics defined in the study and expressed by individual indicators. It is also noteworthy that these data have to be analysed in conjunction with the results of the cluster analysis presented in Figures 2.C, 2.D and 2.F. What clearly emerges from Table 2 is disparities between the values of the composite indicators for particular clusters within individual metropolitan areas. In PMA and WMA, Clusters 1 rank highest. This means that the dynamics of changes was the highest and the units grouped by these clusters belong to the best performing territories. By comparing this with Figures 2.D and 2.F, one can see that Cluster 1 in PMA and Cluster 1 in WMA are from the so-called first rings, i.e. the fastest growing areas adjacent to Poznan and Wroclaw. In the second place of the ranking were Clusters 2 in both PMA and WMA, whose values of composite indicators reached the level above the average. When relating this to the spatial dimension, not surprisingly, these clusters correspond to the so-called second ring in both of the analysed metropolitan areas. Interestingly, the clusters marked with the number 3 in PMA, as well as in WMA, and which group exclusively towns, reached the lowest level of their composite indicators (considerably below the average). This means that rural communes and rural areas of urban-rural communes covered by the second rings and located far from large core cities are characterised by higher dynamics of development than the urban units that are scattered over the whole of the functional areas.

A slightly different picture is presented in LMA, where there are two expressly outlined areas around the core city. Through the use of spatial visualisation techniques, Table 2 reports two clusters, 1 and 2, that clearly stand out due to their having the highest level of composite indicators. As it is already known, they are a mix of both urban and rural areas. Clusters 4 and 5, being in principle classified as rural, recorded a similar value of the composite indicators – which are close to the average. By contrast, Cluster 3, grouping only towns, ranked lowest, and the composite indicator pointed to a level significantly below the average.

**Table 2.** Clusters and composite indicators for metropolitan areas\*

	Ind. 1	Ind. 2	Ind. 3	Ind. 4	Ind. 5	Ind. 6	Ind. 7	Ind. 8	Composite indicator
<b>Lodz Metropolitan Area</b>									
Average		0.4706	0.2018	0.2870	0.3515			0.1755	0.2911
Cluster 1		0.1214	0.1325	0.9122	0.1724			0.1810	0.3337
Cluster 2		0.5524	0.0682	0.2160	0.4673			0.8179	0.4753
Cluster 3		0.1137	0.0709	0.2288	0.1206			0.1228	0.1396
Cluster 4		0.7283	0.2166	0.1689	0.4233			0.1368	0.3130
Cluster 5		0.4311	0.3428	0.3911	0.4529			0.1226	0.3313
Weights		0.1677	0.1121	0.2324	0.2116			0.2762	
<b>Poznan Metropolitan Area</b>									
Average	0.2653	0.6195		0.2970		0.4353	0.1687	0.1526	0.3388
Cluster 1	0.5637	0.5844		0.3559		0.6709	0.0933	0.3122	0.4347
Cluster 2	0.1927	0.8079		0.2496		0.5287	0.0066	0.1035	0.3398
Cluster 3	0.1613	0.4785		0.3046		0.2248	0.3487	0.1058	0.2846
Weights	0.1994	0.2484		0.0434		0.1348	0.2080	0.1659	
<b>Wroclaw Metropolitan Area</b>									
Average		0.6822	0.1958	0.1964				0.5275	0.4636
Cluster 1		0.7312	0.5301	0.3438				0.6488	0.6105
Cluster 2		0.8524	0.1159	0.1225				0.4985	0.4912
Cluster 3		0.3239	0.1097	0.1823				0.4606	0.2907
Weights		0.3734	0.2300	0.1370				0.2596	

\* - the lack of values in particular indicators means that these were excluded from the analysis due to a strong correlation.

Source: Authors' own elaboration

In sum, over the time period analysed, the highest dynamics of changes was observed in rural territories adjacent to the core cities. Conversely, the towns dispersed across the study areas experienced a slight or insignificant rise. Interestingly, there is evidence that the most significant dynamics of changes expressed occurred in rural territories peripherally located in

relation to large cities. Returning to the theoretical framework posed at the beginning of this study, it is now possible to state that in the case of PMA and WMA the peri-urban areas are territories drawn by Clusters 2. An explanation for this statement is based on two reasons. The first is associated with the above-average progress (and one significantly higher than in the urban ones), in term of characteristics being currently specified as peri-urban, noted by all the territorial units grouped in these clusters. The second, as important as the first, refers to their location – both clusters are located at a greater distance from the core cities but still within the framework of the urban functional areas. Additionally, these clusters may include units that are predominantly rural compared to those grouped in Clusters 1, which further increases their significance as peri-urban areas.<sup>5</sup> Clusters numbered 1 surround core cities directly and hence their high results are suggestive of a strong influence from these cities. This finding confirms rather the dominant trend, that is, towards suburbanisation, which has already been discussed in the literature (Kaczmarek et al. 2014; ...).

However, in LMA this pattern is not followed and may be due to the demographic and social barriers (in particular depopulation) to development, which is likely to affect the development path (Szukalski et al., 2013; Świerkocki, 2013). Furthermore, Łódź and other cities of the region are still facing obstacles resulting from the domination of the textile and clothing industries that led to the socio-economic collapse in the transition period. Adding to this is the fact that LOM is one of the smallest in Poland (with one of the highest population densities) and the city of Łódź is surrounded by relatively well developed and urbanised small cities (SRLOM, 2017), and all in all, one can find a possible rationale behind the very mixed picture of results achieved. Nevertheless, this case needs to be examined further, focusing on the extension of the scope of data and in-depth analysis.

By referring to all the results presented above, it is possible to argue that the trans-disciplinary approach applied in the study can give an initial indication of what is meant by the peri-urban areas in Poland. It is clear that the large core cities in the analysed metropolitan areas exert a strong pressure not only on the adjacent areas, but also on those farthest away from them, i.e. peri-urban areas. These areas, subjected to a high degree of push-and-pull forces, can be better understood in terms of policy-making (Monsson, 2013) if their specificities are taken into consideration.

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<sup>5</sup> To the best of our knowledge, the rural territories covered by Cluster 2 in both PMA and WMA may be characterised more by peri-urban attributes in term of rural aspects than those grouped in Clusters 1. However, this is not operationalised here because of the lack of availability of the appropriate data. Indeed, it must be done in future research. Nevertheless, to confirm our assumptions in this field, please follow e.g. Rosner and Stanny (2017).



## 6. Summary

In this study, we have investigated the nature of a peri-urban area and its specific characteristics that are considered to be key determinants. What emerges from a closer reading of the literature is that the definition and attributes of peri-urban areas are not constant and can change according to time and place. They cannot be seen as some kind of a fringe, splitting a city and the countryside. The evidence from this study suggests that peri-urban areas are rather zones of transition or a new kind of multi-functional territories that evolve and can be shaped by spatial governance processes. To be more precise, they constitute some areas influenced intensively by urban drives and situated peripherally in relation to a large city but still within the urban functional area, where specific urban and rural features co-exist, and, more importantly, the rural aspect as such seems to be evident. Such complex and interdependent coexistence, on the one hand, can take the form of a substantial degree of urbanisation (new investments, population growth, employment opportunities beyond those provided by the agriculture etc.), whilst – on the other hand – it ensures the persistence of agricultural and non-agricultural rural functions (highly productive and multifunctional agriculture, organic farming, recreational and leisure activities etc.).

The results emerging from the empirical analysis confirm that peri-urban areas defined according to the characteristics adopted in this study have occurred in three metropolitan areas. For both PMA and WMA, it was shown that peri-urban areas are located far from the main cities and are distinguished by a relatively high dynamics of changes. Interesting insights come from the third examined area, LMA, where the finding does not provide a clear explanation at the present stage of this study. It turned out to be rather mixed and its investigation needs to be reinforced in further research to overcome the current limitations.

Other findings refer to the applicability of the research approach used in this study. The trans-disciplinary approach based on the multivariate analysis takes into account the multidimensional context of this subject and through the reduction of subjectivity makes it possible to identify peri-urban areas in a more accurate way.

This study also has some limitations that need to be addressed in any future investigation. First of all, due to the data availability at this stage of research, we were not able to examine in detail the metropolitan areas reality in terms of all peri-urban characteristics. In this sense, the findings do not necessarily reflect the theoretically assumed matters. We are aware of this and plan to extend and improve our study to deal with this constraint.

In sum, this study contributes to the debate on peri-urban areas and, by showing their complex nature also in Poland, highlights that they should be an area of particular interest for policy-makers, especially in the fields of spatial planning.

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## **PERYURBANIZACJA – ANALIZA ZJAWISKA W OBSZARACH METROPOLITALNYCH POLSKI**

### Streszczenie

W artykule dokonano analizy zjawiska peryurbanizacji jako procesu transformacji urbanistycznej zachodzącego na obszarach wiejskich leżących w strefie oddziaływania miast i predysponowanych do rozwoju wielofunkcyjnego. Obszary te stanowią pewną strefę przejściową (mieszaną) między obszarami miejskimi a wiejskimi, która z jednej strony jest poddana silnemu oddziaływaniu procesów miejskich, a z drugiej - charakteryzuje się morfologią typową dla obszarów wiejskich i posiadają cechy wiejskie oraz, co szczególnie istotne, owe aspekty wiejskie są tutaj ich kluczowym wyznacznikiem. Na podstawie analizy wielowymiarowej wykorzystującej metody taksonomiczne przeprowadzono ocenę procesu peryurbanizacji w ramach jednostek terytorialnych wchodzących w skład trzech obszarów metropolitalnych Polski. Uzyskane wyniki wskazują, że symptomy tego zjawiska są zauważalne na terenie gmin wiejskich i części wiejskiej gmin miejsko-wiejskich, które zasadniczo umiejscowione są peryferyjne w stosunku do głównych miast badanych obszarów. Wyniki te są szczególnie istotne z punktu widzenia procesu kształtowania polityki wobec tych obszarów, ponieważ ukazują ich zróżnicowaną specyfikę.

**Słowa kluczowe:** peryurbanizacja, obszary peri-urban, analiza wielowymiarowa, obszary metropolitalne

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