



URBAN AND REGIONAL
POLICY OBSERVATORY



Urban functional hierarchy in Poland and its changes from 1990 to 2020

Authors:

Agnieszka Sobala-Gwosdz

Karol Janas

Wojciech Jarczewski

Piotr Czakon

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Authors:

Dr Agnieszka Sobala-Gwosdz <https://orcid.org/0000-0001-5603-4910>

Dr Karol Janas <https://orcid.org/0000-0003-3184-1315>

Dr Wojciech Jarczewski <https://orcid.org/0000-0001-5833-6162>

Dr Piotr Czakon <https://orcid.org/0000-0001-9724-9176>

Coordination of research and editing of the *Urbanisation* series: **Dr Karol Janas**

Review:

Professor Jerzy Bański, Institute of Geography and Spatial Organization, Polish Academy of Sciences

Professor Paweł Churski, Faculty of Socio-Economic Geography and Spatial Management, Adam Mickiewicz University, Poznań

Professor Robert Krzysztofik, Institute of Social and Economic Geography and Spatial Management, University of Silesia

Professor Iwona Sagan, Institute of Socio-Economic Geography and Spatial Management, University of Gdańsk

Professor Przemysław Śleszyński, Institute of Geography and Spatial Organization, Polish Academy of Sciences

Cartographic compilations: **Karolina Piech**

Language editing: **Krzysztof Winiarski, Justyna Sobala-Puchalska**

Proofreading: **Justyna Sobala-Puchalska**

Desktop publishing: **Aleksandra Słowińska, Stereoplan**

Institute of Urban and Regional Development

Targowa 45, 03-728 Warsaw

www.irmir.pl

Urban and Regional Policy Observatory

www.obserwatorium.miasta.pl

Figures 1, 2, 3, 10, 11, 14, 15, 16, 17 and 18 contain hyperlinks to interactive versions of the maps on the IRMiR OPMR Geoportal.

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of Poland**



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Krakow-Warsaw 2024

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Agnieszka Sobala-Gwosdz

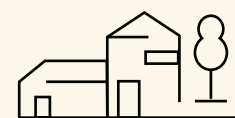
Karol Janas

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Piotr Czakon

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Foreword

Developed as part of the Urban and Regional Policy Observatory research programme, the classification of cities is the result of a study of central functions. The methodology adopted was based on the identification of 66 index functions in all Polish cities and allowed for the identification of natural breaks in the values of the synthetic index, which made it possible to objectivise the assignment of cities to the seven levels of the urban settlement hierarchy. The *novelty* of this study, apart from the research method adopted, lies in the holistic view of large urban centres taking into account the functional areas of metropolitan centres and national agglomerations.

The results of this report provide an important starting point, based on sound research, for a debate on the development challenges of cities of different categories and the territories served by these centres – the country, regions, sub-regions and smaller systems of supra-local or local scope. Identifying the most vulnerable links in this network should allow action to be taken tailored to their specific needs. In the case of dynamically developing centres, on the other hand, knowledge of their position and role in the settlement system may facilitate the selection of measures that will more adequately strengthen their potential and links with the regional hinterland. At this stage, it will be crucial to discuss how we can – within the framework of public policies and using the available tools – counteract the negative effects of metropolisation and the increasing centralisation of the settlement network, as well as urban shrinkage in the wake of the demographic crisis. A crisis that is also affecting major cities and even some metropolitan areas.



The report on the Polish urban functional hierarchy is the foundation on which we will base further research and analytical work carried out in the second stage of the programme. This study also represents a new opening for the reason that, although the starting point here is the cities, an extremely important context is their interconnectedness and the role they play in relation to their surroundings. One of the important lessons we have learned from the research experience so far is precisely that separating the issue of urban and regional development is not the right approach. Hence, the next iteration of the programme was supplemented by a regional policy element.

Detailed information on the assumptions and goals of the IRMiR long-term research programme Urban and Regional Policy Observatory, but above all the rich output in the form of more than 40 research and recommendation reports, expert studies, commentaries and videos, can be found at: obserwatorium.miasta.pl. A valuable source of knowledge is also the Cities and Regions Geoportal (geoportal.miasta.pl), where we include the results of our research in the form of interactive maps and charts. All maps and cartodiagrams included in this study also have their interactive equivalent in the Geoportal – simply click on the figure or copy the hyperlink (in the case of the electronic version), or, in the case of the printed version, transcribe the abbreviated link provided in the figure description or scan the QR graphic code.

Wojciech Jarczewski
Director of the
Institute of Urban and Regional Development

Karol Janas
Head of the
Urban and Regional Policy Observatory

Short and to the point

Report of the Urban and Regional Policy
Observatory on the urban functional
hierarchy in Poland and its transformation
in the period 1990–2020

Background, or why we undertook this study

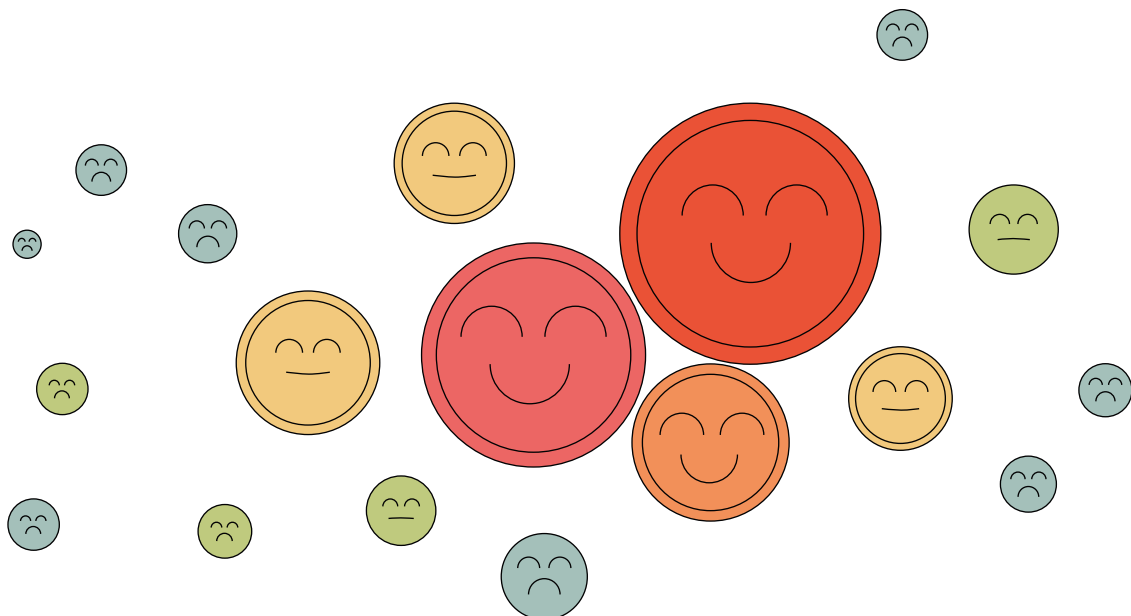
One of the features that distinguish our country from Europe and the world is the **polycentric settlement structure** developed over the centuries. It ensures that the country's development is not concentrated in just one major centre, but spreads through **a network of cities of different sizes, spread relatively evenly across the country.**

Poland has developed dynamically over the past three decades. **However, this development is not evenly** distributed and, despite the implementation of various instruments aimed at levelling development opportunities, the development trajectories of individual cities and territories vary strongly. Over the past decade or so, there has been a trend towards spatial polarisation and concentration of development resources, particularly in the form of metropolisation.

Although the existing settlement structure is a consequence of long-lasting processes, significant and irreversible changes may be in the offing in Poland in the medium term if current trends are maintained. In addition to the continued concentration of development resources in the largest centres, **the maintenance of the current position for many smaller cities may be at risk due to the consequences of the deep demographic crisis.**

The settlement structure, in particular the network of cities of different sizes, should be the reference point for the territorialisation of national and regional development policies, as it is the basic backbone on which the territorial development of the country, including the development of rural areas, is based.

The EU Territorial Agenda 2030 encourages 'decision-makers at all levels to promote polycentric development models in which all areas play their part' (Agenda... 2020:19), pointing to the benefits of doing so (Box 1).

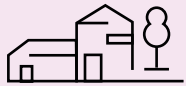




‘Europe’s territorial diversity brings with it significant potential for development. It can contribute to more balanced territorial development by counteracting over-concentration, strengthening secondary growth centres and reducing inequalities between people and between areas. **Cooperation on polycentric networks of cities, metropolitan areas and regions contributes to a more optimal spread of development potential.** [...]

Small and medium-sized cities in particular have an under-utilised potential for cushioning polarisation. They play a key role in regional economic development and social well-being, particularly in terms of accessibility at the national and international level, and adequate access to services at the local and regional level. Polycentric networks can also contribute to more sustainable transport’ (Agenda... 2020: 19)

What and how did we investigate?



979

settlement units
with urban rights

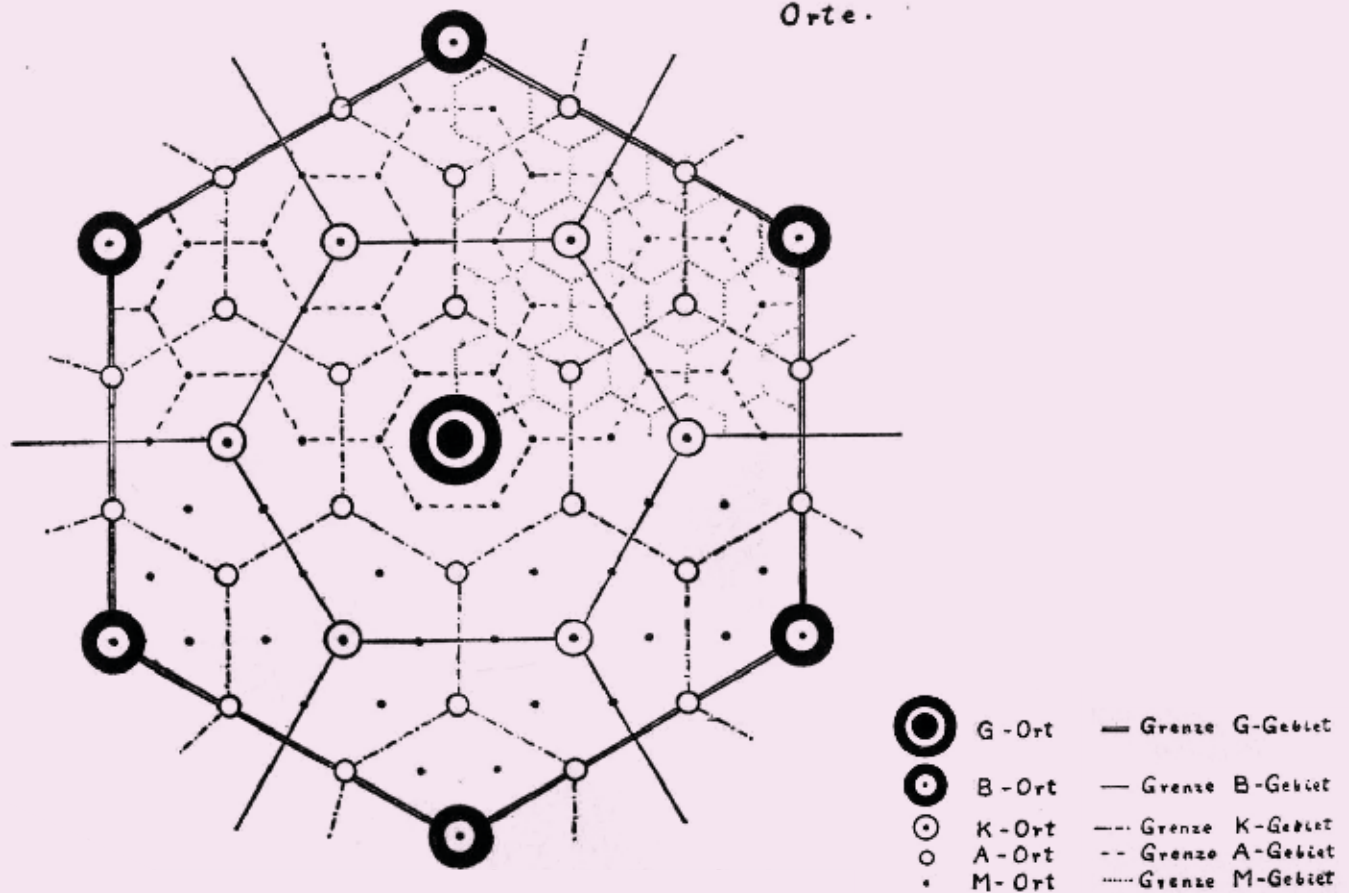
The report presents the first after 1989 such a detailed and comprehensive classification of Polish cities in terms of their place and role in the country's settlement system, taking into account functional areas of regional and metropolitan centres.

NOTE: We surveyed all 979 settlement units with urban rights – urban municipalities and urban areas in urban-rural municipalities (as of January 2023). In the final version, however, we have taken into account the fact that some centres that are formally separate administrative entities *de facto* constitute a functional whole, being part of urban functional areas of larger centres or forming multi-centre urban agglomerations. The position of 1st (national metropolis), 2nd (supra-regional metropolises) and 3rd tier (regional agglomerations) centres is therefore the result of the accumulation of central functions identified in all cities forming a given functional area / urban agglomeration. In order to maintain a uniform frame of reference, we have adopted the delimitation of urban functional areas following P. Śleszyński and T. Komornicki (2016).

The particular value of the study lies in the method used to determine the position of cities in the settlement network, using the identification of so-called central functions. These are primarily service functions that extend beyond serving the urban centre itself and its residents. This classification captures the diversity, functions and role of individual cities much better than simplistic approaches that classify cities by their size as measured by population or administrative status.

The study, carried out as part of the Urban and Regional Policy Observatory of the Institute of Urban and Regional Development, also enabled the characterisation of the transformation of the urban settlement network in Poland after the system transformation, including the impact of market and non-market services on the positioning of individual centres.

Fig. 2. Die Ergänzungsgebiete im System der zentralen Orte.



Source: W. Christaller (1933)

Central functions of cities

The study of the urban functional hierarchy is based on one of the classic theories of urban development and settlement network formation developed by the geographer Walter Christaller. The central place theory still offers a very attractive model that can provide a starting point for analysing the transformation of the settlement network from the point of view of the variation in the availability of central services/ functions provided across the country. The theory has also found practical application in the regional development planning of many countries (including Germany). Fundamental to this is the notion of **central functions** – these are essentially different types of goods and activities of a service nature that serve an area larger than the city itself. Central functions can vary in nature and market coverage and are therefore divided into higher- and lower-tier services and goods.

Higher-tier services are characterised by less frequent occurrence and wider spatial coverage (e.g., a philharmonic), while lower-tier services are more common and serve a smaller area (e.g., a car repair shop). Observing the distribution patterns of various types of central goods in the cities of southern Germany, Christaller concluded that they form a hierarchical and fairly regular network in which the position (rank) of a city is determined by the degree of development of higher-tier functions. Identification of the type and number of central functions in cities makes it possible to determine the range of influence of individual centres (the so-called service area or hinterland of the city) and, on this basis, also to assign cities to seven hierarchical tiers – starting with centres that have central functions of national and supra-regional range, through regional centres, sub-regional centres, cities of supra-local importance and local centres.

What are the key findings of the study?



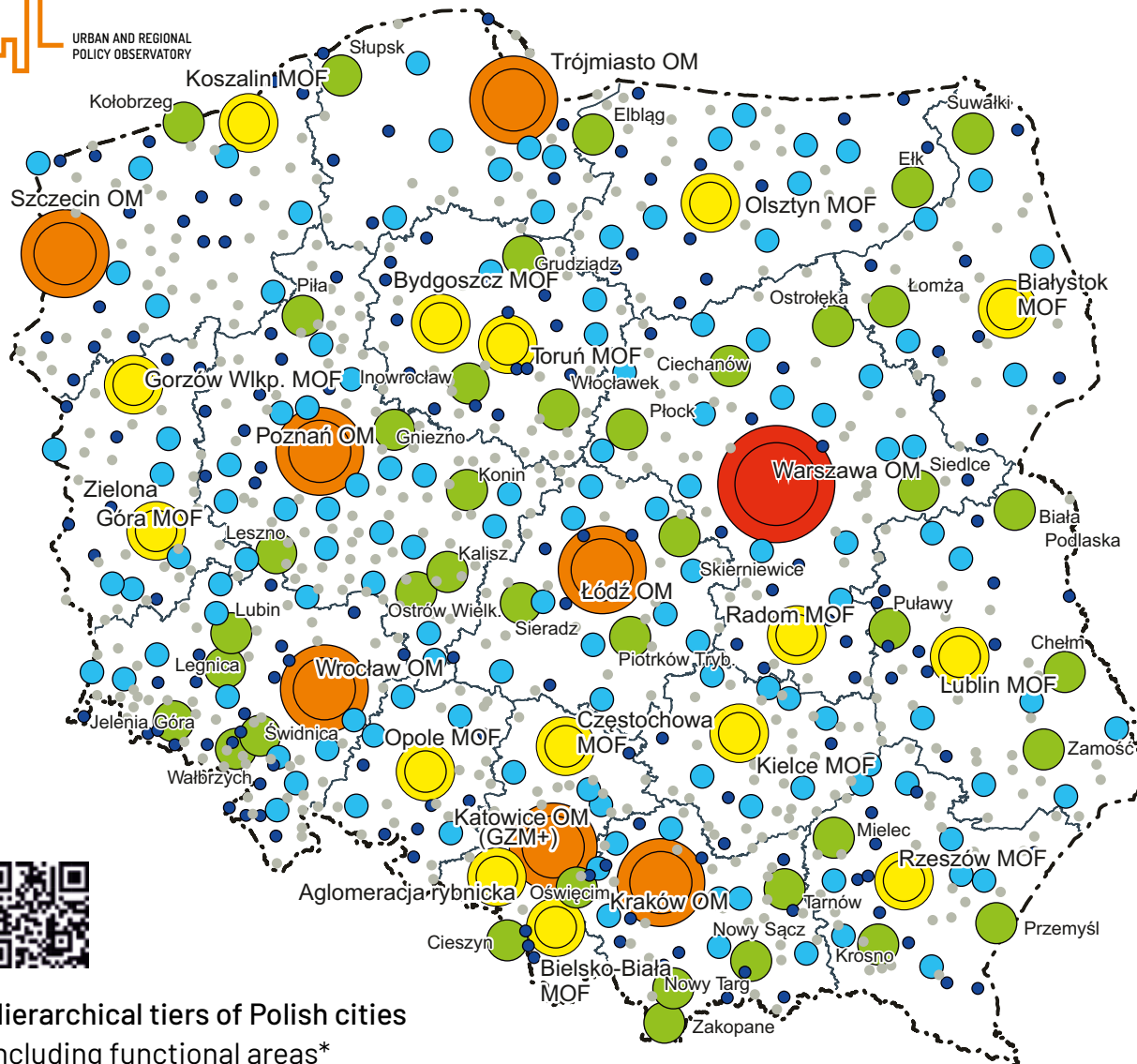
At the very top of the hierarchy taking into account the functional areas of the cities is Warsaw, a first tier centre, which is the only **national metropolis**. Despite the significant gap in the tier of development between the capital and the second-tier cities, the latter deserve to be called **supra-regional metropolises**. There are as many as seven such metropolises in Poland (not counting Warsaw): Krakow, Wrocław, Poznań, the Tricity, Łódź, Szczecin and Katowice (GZM+). The analysis taking into account the metropolitan area highlighted the weakness of Szczecin's metropolitan functions, emphasising the importance of such functions in the Katowice and Tricity conurbations (Fig. 1).

The 3rd tier of the settlement hierarchy includes **agglomerations of regional importance**, including all provincial centres, and five large agglomerations which, despite not having provincial city status, play an important role. As many as three of them are located in the Śląskie Province: Bielsko-Biała, the Rybnik agglomeration, and Częstochowa. The other two are Radom and Koszalin. Analysis at the functional area level shows the weakness of Gorzów Wielkopolski's hinterland, while it highlights the significant position of Bielsko-Biała.

4th tier of the hierarchy is made up of **sub-regional cities**. This level seems to be particularly important for the settlement system in Poland, as it is the key link for maintaining the polycentric settlement network of the country. Each of the 40 4th tier centres concentrates a number of central functions, the quality and accessibility of which largely determines the standard of living of the residents of both these cities and the suburban and rural areas they serve.

The network is supplemented by strong **supra-local towns** (5th tier), while the two lowest levels of the hierarchy (6th – supra-local centres and 7th – local centres) do not have any significant central functions and hence do not distinguish themselves fundamentally from other local municipalities.

Note: for a full summary of the surveyed urban centres, taking into account their position in the country's settlement hierarchy, see the table attached as *Appendix 3*. Detailed analysis is also provided by interactive versions of the figures/maps included in the study, which can be accessed by clicking (electronic version) or scanning the QR code / entering the web address (printed version).



Hierarchical tiers of Polish cities including functional areas* of 1st-3rd-tier cities (2020)

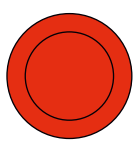
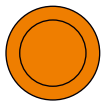





-  National metropolis – 1st tier (1)
-  Supra-regional metropolis – 2nd tier (7)
-  Regional agglomeration – 3rd tier (15)
-  Sub-regional centre – 4th tier (40)
-  Strong supra-local centre – 5th tier (131)
-  Supra-local centre – 6th tier (168)
-  Local centre – 7th tier (454)

Fig. 1. Urban functional hierarchy in Poland including functional areas for 1st-3rd tier

Link to map on Urban Geoportal: <https://tinyurl.com/yicyftt9a>

Note: *Delimitation of urban functional areas (1st- 3rd tier) per: P. Śleszyński and T. Komornicki (2016), in the case of GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

What do we recommend?

- The results of research based on the central place theory can have practical applications in the planning of regional and national policies. This approach makes it possible to respond more effectively to the individual development needs of cities and to take into account the role they play for the country and for individual regions.
- **We recommend taking into account the results of the study carried out** and in particular the hierarchical classification of urban centres taking into account the functional areas of metropolises and regional agglomerations **as a starting point for planning and better territorialisation of national policies and development programming documents.**
- In the situation of a strong decline in the population of rural areas in some provinces, it seems crucial to identify those centres whose degradation may most threaten the cohesion of the country's settlement network and significantly affect the accessibility of central services in a given area. **From the point of view of being able to provide effective support for urban development from the national level, the group of sub-regional cities is particularly important, as they guarantee the availability of many basic services.**
- In areas with lower population density or sparser settlement networks, it may also be necessary to identify supra-local strong cities to complement the network and provide a service system similar to that of the sub-regional city.
- The development policy pursued by individual regions should be complementary to the support programmed from the level of national policies, and should in particular take into account the support of other supra-local centres.
- It should not be forgotten that development policies (national and regional) should at the same time take into account the needs and strengthen the development potentials of Polish metropolises and regional cities, which are the most decisive factor for the competitiveness and innovativeness of the Polish economy.
- A separate reflection and **particular support is required for the three shrinking metropolises:** Katowice (GZM+), Łódź and Szczecin.
- Aiming to maintain as polycentric a development model as possible and the spread of development impulses requires not only the maintenance of a diversified settlement structure, but also the provision of efficient flows between these centres, above all with the use of effective railway connections and with reference to the identified hierarchical relationships between the cities.
- Researchers and analysts are encouraged to use the presented classification of urban centres as a reference for planned research. As part of the second stage of the Urban and Regional Policy Observatory research programme, we are planning in-depth research into the conditions, situation and development potentials of Polish cities, taking into account their position within the identified settlement hierarchy. It is hoped that they will provide further concrete recommendations for optimising public policies at all levels – from national to regional to local.

Key conclusions



The polycentric and hierarchical network of cities in Poland is an important determinant of the possibilities to pursue a balanced territorial policy and an optimal spread of development potential aimed at minimising development disparities. The dense network of cities allows easier access to a variety of market and non-market services. The use of a polycentric network of cities, evenly distributed across the country, also contributes to a more resilient settlement and socio-economic system, which can even be strengthened by shocks and stressors.

Using the functional hierarchy of urban centres established as a result of the identification and analysis of the extent of central services in the process of territorialisation of public policies is an optimal approach, more sophisticated than using a simplified division of cities by population or only the administrative urban hierarchy. Indeed, the role that an urban centre plays in relation to its surroundings is important, and this role is very well reflected in the central functions.

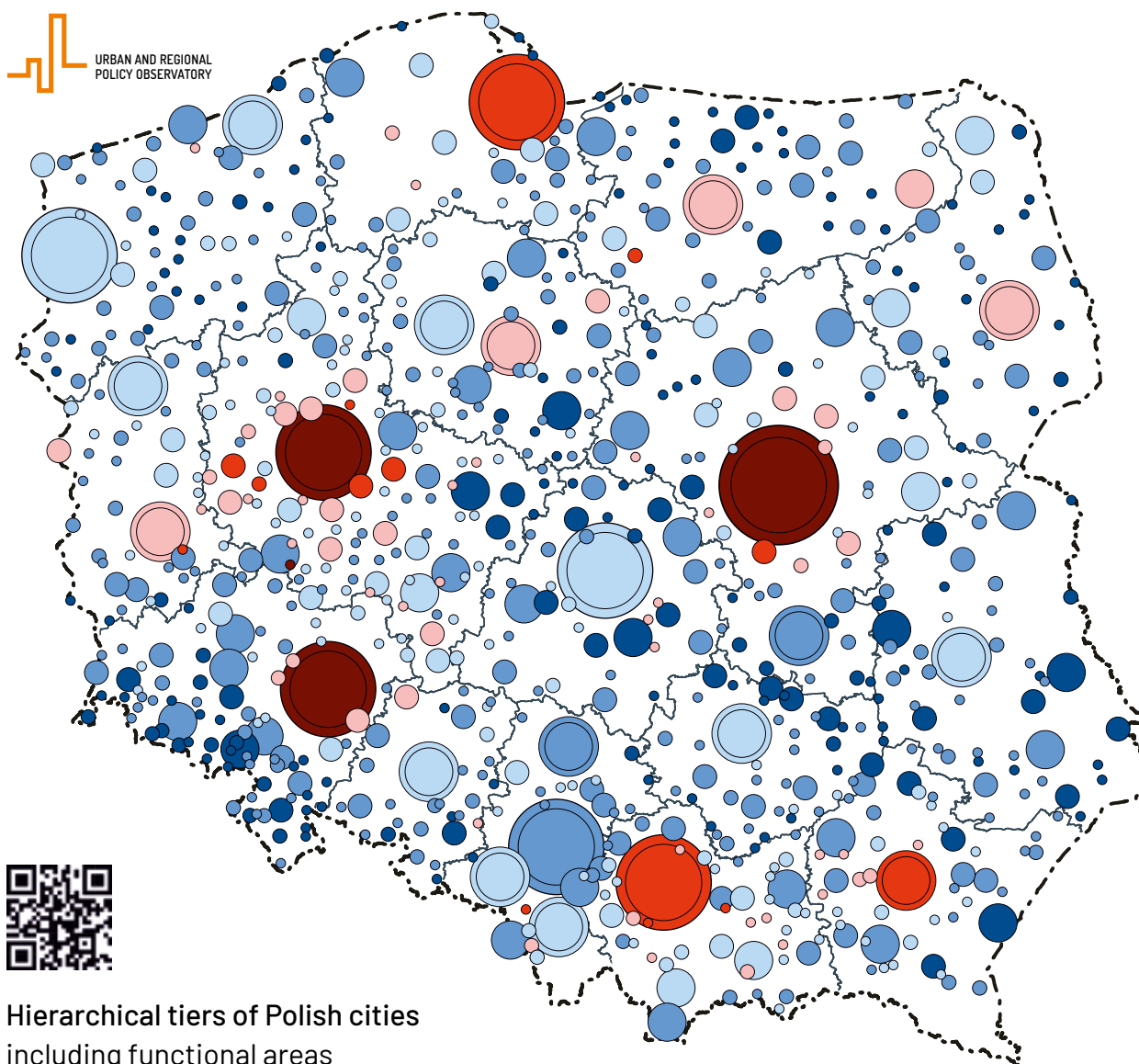
Administrative divisions are often arbitrary and/or refer to historical divisions and therefore do not always reflect changing socio-economic and political conditions. **In addition, the functional hierarchy of urban centres and their interdependencies are much more complex than the three-tier administrative division would indicate** – district cities include

supra-local, sub-regional, regional centres as well as metropolises. In turn, among the provincial centres, in addition to the national metropolis, six serve as supra-regional metropolises and another eight as regional cities.

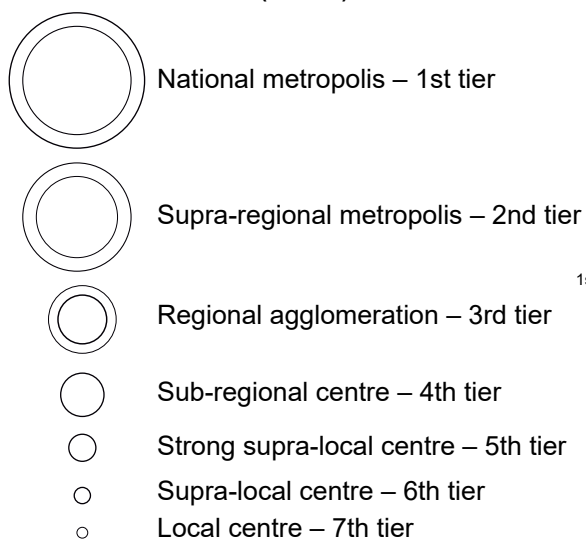
The size of centres measured in terms of population does not always reflect the importance of a city from the perspective of its service function.

These differences are important and should not be overlooked when territorialising national public policies or planning regional policies.

The development and evolution of the country's settlement structure are the result of a number of processes and economic, social, geographical and political factors. Settlement structures are long-lived structures, which is not to say that they are not subject to them. A comparative study of the functional hierarchy in 1990 and 2020 illustrates the shifts in the hierarchy of urban centres over three decades. The period of transition was characterised by continuous economic growth, and market mechanisms played a key role in shaping the settlement network hierarchy during this period. Another important factor was the reform of the country's administrative division in 1999, which introduced a three-tier administrative division, reinstating districts and reducing the number of provinces from 49 to 16.



Hierarchical tiers of Polish cities including functional areas of 1st-3rd-tier cities (2020)



Population change 2011–2021 [%]

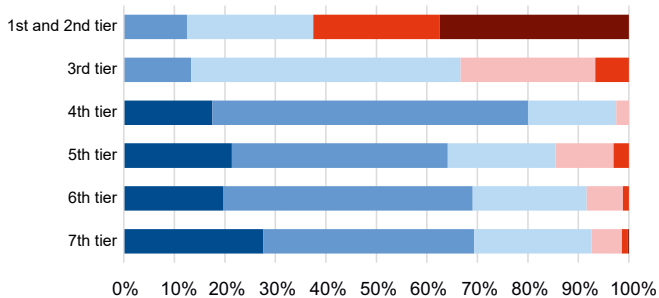
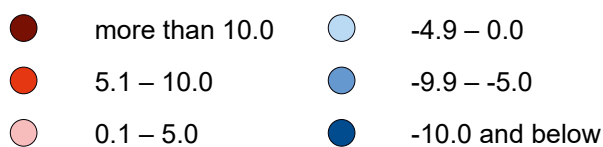


Fig. 2. Population change from 2011 to 2021 against the background of the functional hierarchy of urban centres in Poland, taking into account functional areas for 1st–3rd tier

Link to map on Urban Geoportal: <https://tinyurl.com/ypst63hb>

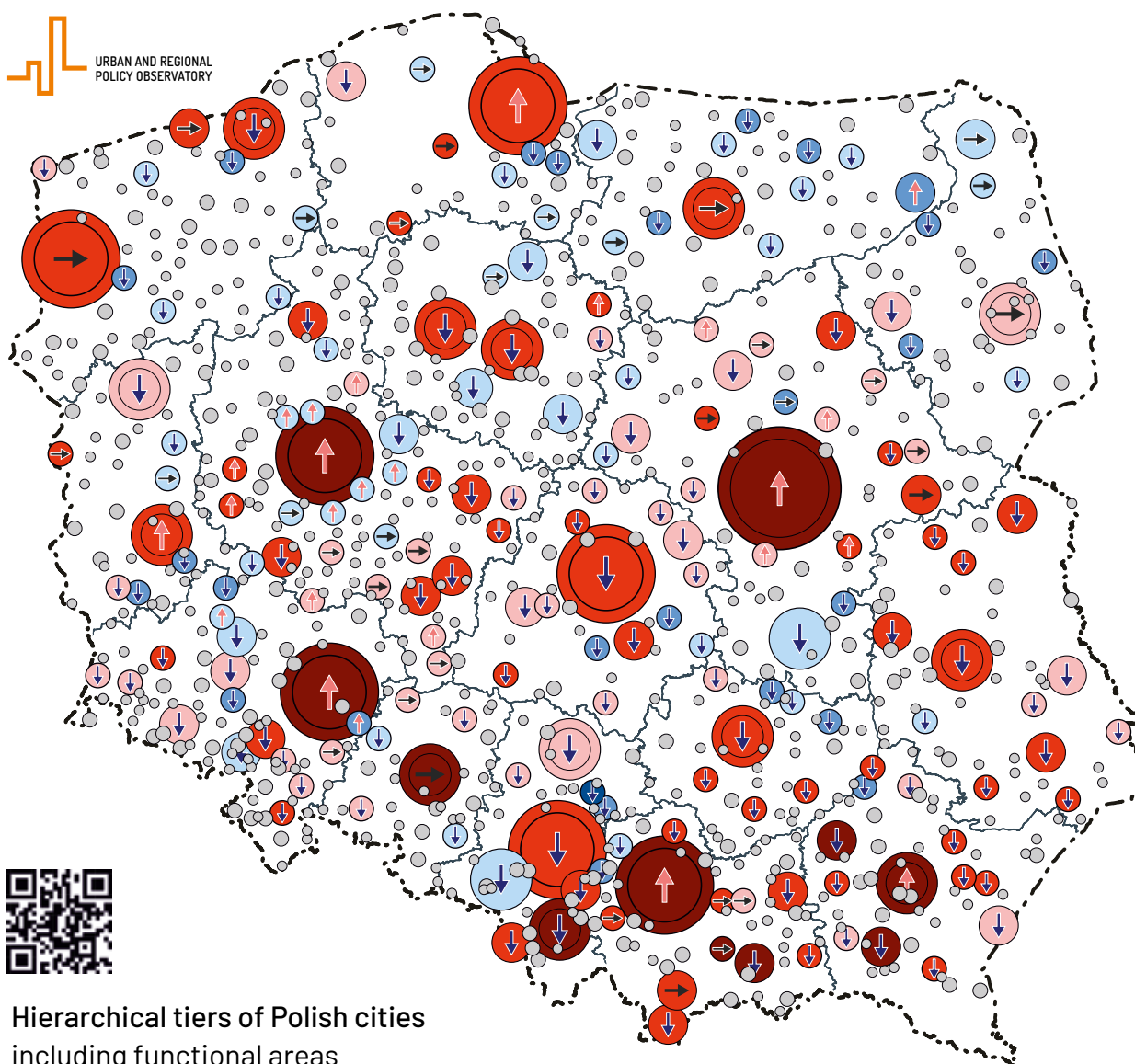
Note: *Delimitation of urban functional areas (1st–3rd tier) per: P. Śleszyński and T. Komornicki (2016), in the case of the GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

Source: compiled by ©Urban and Regional Policy Observatory on the basis of K. Piech et al. (2024)

From the point of view of accessibility and the development of central services in the settlement hierarchy, sub-regional tier cities and supra-local (6th tier) centres have improved their position the most, especially in metropolitan areas. The stronger importance of market functions in the overall settlement hierarchy index has also verified the position of former regional cities (former provincial capitals). Eight of these were recognised as sub-regional cities. At the same time, it is worth noting that three of the former provincial centres – Bielsko-Biała, Częstochowa and Radom – have maintained central functions at regional level. On the other hand, the functions of a supra-regional metropolis were lost in Lublin – now a regional centre – which, due to its location in eastern Poland, had the least chance, compared to the other metropolises, of benefiting from external development impulses. The introduction of the district level in the administrative division of the country may also partly explain the upward shift in the hierarchy of some centres of supra-local and sub-regional importance.

The phenomena observed in Poland – on the one hand the demographic collapse and rapid shrinkage of lower tier cities, and on the other hand the polarisation of the development of metropolitan regions – result in a national metropolis and five supra-regional metropolises becoming beneficiaries of the changes taking place (Piech et al. 2024; Krzysztofik 2019; Śleszyński 2018). **The observed directions of change in this respect allow the thesis to be put forward that the settlement structure of the country will undergo further transformation in the coming decades. The most at risk of degradation and loss of at least some central functions will be some of the regional centres that do not fulfil capital city functions and the majority of sub-regional and supra-local cities, especially in north-eastern Poland and within the inner periphery** (Fig. 2) The most vulnerable cities are those already characterised by a long-term decline in population and a low nodality index, illustrating the declining role of the city in relation to the service area (see Fig. 3, Appendix 2).

The results of research based on the central place theory can have practical applications in the planning of regional and national policies. This approach makes it possible to more effectively diagnose not only the endogenous barriers to development, but also to identify what are the endogenous potentials that cities can more fully exploit for their development. The urban functional hierarchy with the surplus of central services shows the role of individual cities for their hinterland areas (city regions).



Hierarchical tiers of Polish cities including functional areas 1st-3rd-tier cities (2020)

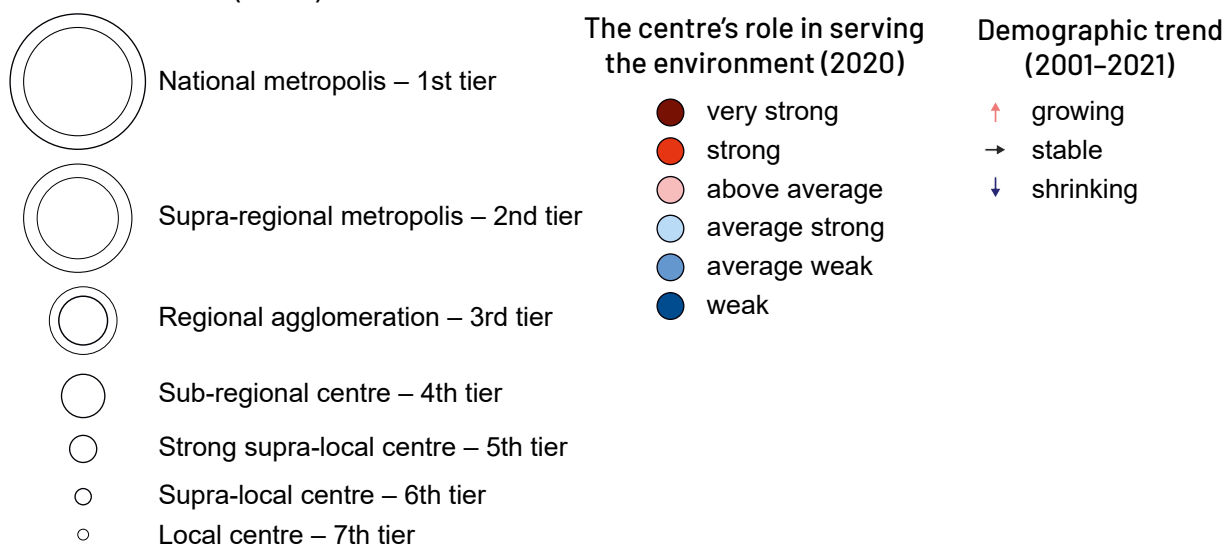


Fig. 3. Nodal strength and demographic trend in the urban functional hierarchy in Poland including functional areas for 1st-3rd tier

Link to map on Urban Geoportal: <https://tinyurl.com/5xpka2a>

Note: *Delimitation of urban functional areas (1st- 3rd tier) per: P. Śleszyński and T. Komornicki (2016), in the case of GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

Source: compiled by ©Urban and Regional Policy Observatory, nodal strength per: A. Sobala-Gwosdz (2023a, 2023c), demographic trend after: K. Piech et al. (2024)

Recommendations for policies at national level



We recommend taking into account the results of the study carried out and, in particular, the hierarchical classification of urban centres taking into account the functional areas of metropolises and regional agglomerations, as a starting point for planning and better territorialisation of national development policies and programming documents.

In some provinces, there is a strong decline in the population of rural areas, so it seems crucial to identify those centres whose degradation may most threaten the cohesion of the country's settlement network and significantly affect the accessibility of central services in a given area. Sub-regional cities (6th tier) require special attention, as it is at their level that many basic services with a reach beyond the immediate surroundings are provided.

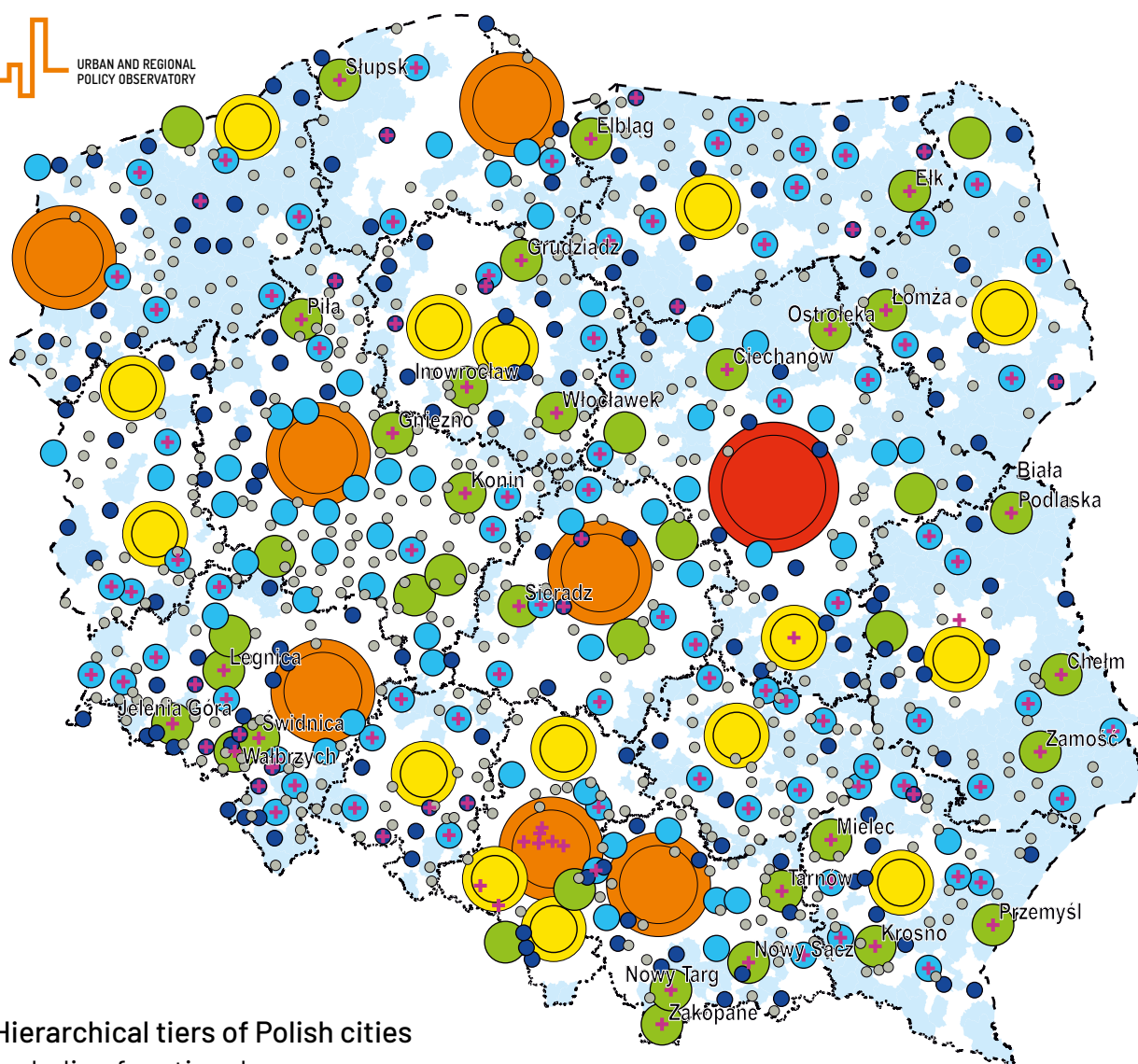
In regions characterised by lower population density and a sparser settlement network, strong supra-local centres should be identified to complement the network of sub-regional centres and provide a system of services in these cities similar to the level of sub-regional cities.

The targeting of support for the maintenance of a network of sub-regional cities from the tier of national policies does of course not mean that the territorial dimension of the policies should not also include higher-tier cities. At the level

of supra-regional metropolises (2nd tier), there are both centres experiencing transformation difficulties, where the number of inhabitants is dynamically decreasing (e.g., GZM+, Łódź), as well as centres that, due to their peripheral location and weak population base, are balancing on the border of metropolitan centres (Szczecin). These centres certainly need individualised support and comprehensive programmes to stimulate their development potential.

Other metropolises may only need more targeted support in specific areas to be able to compete for high-tier services with other centres in Europe and the world. The integration of metropolitan governance and better coordination of the development of the entire metropolitan system remains a major challenge.

The identified functional settlement urban hierarchy, complemented by an analysis of their current impact on their surroundings and demographic trends, can form the basis for discussions on which of these centres should be prioritised for support, both at national and regional level. By analysing Poland's settlement network and its hierarchy, we can clearly see two challenges for public authority – key objectives for national urban policy and regional development. Firstly, responsible management of the development of Polish metropolises, and secondly, support for the development of lower tier cities.



Hierarchical tiers of Polish cities including functional areas of 1st-3rd-tier cities (2020)

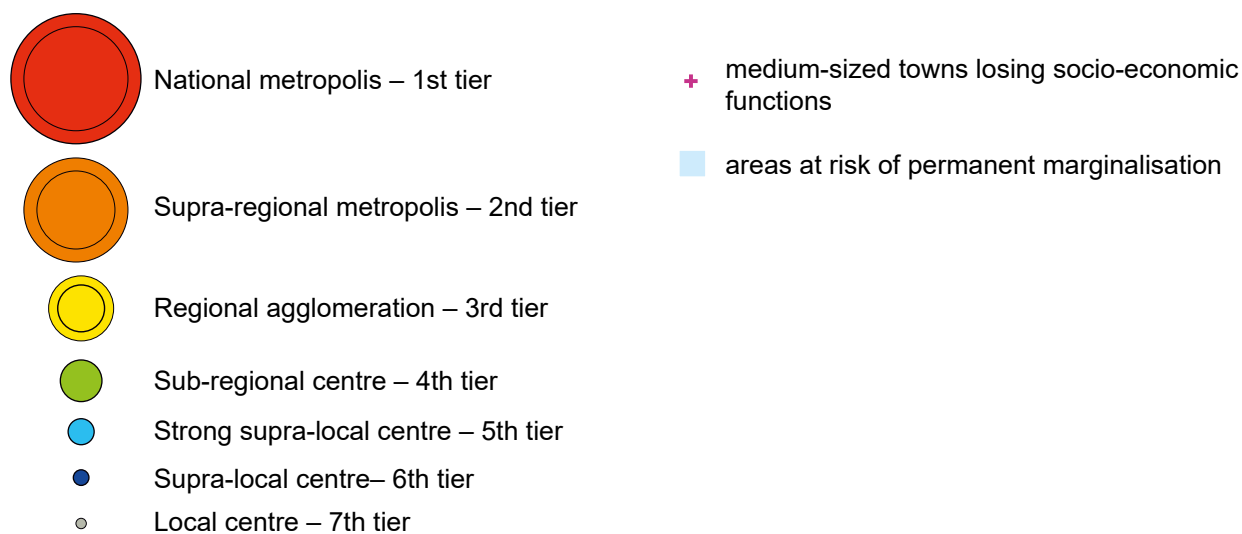


Fig. 4. Urban functional hierarchy taking into account functional areas for 1st-3rd 5th tiers. medium-sized cities losing socio-economic functions (according to the *Strategy for Responsible Development by 2020.... 2017* and the updated 2019 list)

Attention: *Delimitation of urban functional areas (1st- 3rd tier) per: P. Śleszyński and T. Komornicki (2016), in the case of the GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łączy.

Source: compiled by ©Urban and Regional Policy Observatory, cities losing socio-economic functions according to the *Strategy for Responsible Development (SOR)* – list of 139 cities

Perhaps the order should even be reversed: firstly, strengthening a group of regional and sub-regional cities that are quite numerous and crucial for polycentric development, but mostly afflicted by the depopulation crisis, and secondly, further strengthening the metropolises.

In this context, it would be appropriate to revise the assumptions of the programme of support for medium-sized cities losing socio-economic functions in such a way that the support that is already being implemented takes more account of their specificities. The spatial context is important here – location in functional zones of stronger core cities (Fig. 4), as well as the role they play in the settlement network, expressed, inter alia, by the surplus of central market services (Fig. 15) or nodality (Fig. 1, *Appendix 3*). An in-depth diagnosis of these cities, identifying their biggest barriers or potentials, will increase the effectiveness of public intervention and enable the desired results to be achieved more quickly.

An analysis of the urban functional hierarchy is therefore a tool to make regional policy much more efficient in the use of its resources and means and creates opportunities to increase its effectiveness. The approach adopted makes it possible, in addition to being able to determine the rank of a city's socio-economic potential and the spatial extent of its influence, to identify the external linkages of urban centres beyond administrative and territorial boundaries. An expression of the need to act across administrative boundaries is the increasing use of metropolitan area or urban functional area analyses in planning practice today. It makes it possible to take planning and management measures that are in line with the actual urban drawdown areas developed in the space.

The report's analysis of the urban functional hierarchy makes it possible to move away from a one-dimensional market-based interpretation of the spatial consequences of socio-economic processes, generally expressed only in terms of measures of growth (population, employment), to a broader interpretation of cities in terms of their role as the keystones of nodal regions. Thus, this approach creates a better basis for implementing corrective or rescue mechanisms depending on the stage of the processes.



Introduction

Urban settlement system as a backbone for national and regional development

Cities, understood not only as a specific form of settlement but also as a more complex system of social and economic organisation, are considered one of the most important markers of any civilisation (Christian 2011).

In both ancient and modern history, the importance of cities was determined by their central functions – initially related to power, religion and trade. Although cities have played a fundamental role in the development of the social and economic systems of individual civilisations, countries and regions for centuries, it was not until the 19th century Industrial Revolution that urbanisation processes and urban growth began to accelerate rapidly. Adna Ferrin Weber (1899), summarising the results of her research, concludes

that the most significant social phenomenon of the nineteenth century was the tendency for people to concentrate in cities on an unprecedented scale, present in virtually all countries of Western civilisation – and, in time, in other countries and regions of the world undergoing modernisation. As the French historian Fernand Braudel wrote: ‘The city is a turning point, a violent change, a place where the fate of the world is fulfilled.’

It is also worth noting the bidirectionality of these processes and dependencies – on the one hand, technological change and industrialisation were the driving force behind the rapid development of cities and the emergence of new centres; on the other, the city was the form of socio-spatial organisation that enabled the development of new economic activities, the absorption of innovation and the rush to modernise. And although, with spatial concentration, a number of so-called disadvantages of agglomeration were soon observed to emerge, the benefits proved to be by far the overwhelming ones (Cheshire et al. 2014) **The functioning, strength and position of cities are linked to their closer and further surroundings and their links and relations with other urban centres.** Each city is part of a settlement network and plays a specific role in it depending on the central functions developed and the functional specialisation. The layout of the settlement network is the result of a number of economic, geographical, political and historical conditions and processes.

From the comments of and on the fact that the current layout of the settlement network is largely the result of evolutionary development over hundreds of years (long duration), it is sometimes taken as an attribute of external, unchanging conditions – **forgetting that the position and role of cities are subject to constant change under the influence of many factors,**

The functioning, strength and position of cities are related to their closer and further surroundings and their links and relations with other urban centres.

both external and internal. Also of considerable importance here are conscious or unconscious (in terms of consequences and side effects) political decisions related, for example, to the reform of territorial administrative structures, the location of various types of economic investments or the development of communications infrastructure.

Shaping of the urban settlement pattern in Poland

It is no different in the case of the contemporary network of Polish towns and cities, which is made up of settlement units established in different historical periods and influenced over the years by different organisational and political systems in connection with, among other things, the partitions or border changes after World War II. **On the territory of contemporary Poland, the processes of mass urbanisation related primarily to industrialisation lagged behind Western European countries for the most part;** on top of this, the stage of large-scale industrial development occurred or was intensified (as in the case of older industrial districts such as the GOP) during the communist period, i.e., under the system of centrally planned economy, which emphasised the development of raw material industrial districts on the one hand, and promoted the doctrine of even industrialisation of the country on the other. **The prevailing socio-economic doctrine of the time led to what was known as flawed urbanisation – the development of urban infrastructure and services often failed to keep pace with the rapid growth of industrial functions** (Zagożdżon 1983: 68; Węgleński 1992: 35; Szymańska 2002: 68)

The political changes that took place in our country after 1989 were overlaid with the impact of wider economic processes associated with increasing globalisation. Thus, in characterising urbanisation changes in post-socialist countries, Luděk Sýkora (2009) writes of **a double transition – Polish cities and regions underwent profound transformations due to the rapid transition from a centrally controlled to a free market economy; at the same time, they had to face the challenges of a globalising economy.** The position of cities in the network, their rank, degree of connectivity and economic conditions (e.g., the degree of diversification of the economic base and its mono-functionality) greatly influenced the way in which these challenges were dealt with. The hegemony of the neo-liberal approach in development policies at all levels of territorial governance in Poland in the era of political and economic transition (Sagan 2016) has only exacerbated the development disparities between the fastest growing large urban centres and smaller cities and peripheral areas outside the direct reach of metropolitan

influence. The extent of this impact has steadily shrunk with the removal of rail and bus services.

Dariusz Sokołowski (2006: 8) notes that due to the complexity of these processes, 'there is no consensus of opinion on the direction of the transformation of the urban hierarchy under conditions of radical changes in social, economic and political structures'. This author also draws attention to trends that are already being observed: **(1) the increasing importance of network structures and cooperation between higher tier centres, including the emergence of centres of international and global importance; (2) changes in the extent and nature of central services at lower tiers of the hierarchy¹, due to changes in means of transport and communications, but also the development of e-services and e-commerce.**

According to D. Sokołowski (2006: 9) The increasing internationalisation of the national economy and the entry into the post-industrial phase of development betray tendencies towards the dilution of settlement structures and their petrification. The researcher also draws attention to the polarisation of centres in Poland, with the reduction of hitherto existing multi-row structures in favour of fewer tiers while the distance separating the central places of the outermost tiers is increasing. A similar scenario for the transformation of the hierarchical network was drawn up by Christaller himself (1933, Part III), who predicted the disappearance of the lowest tiers of the hierarchy (7th tier) in a situation of rural population decline. However, as is evident from the observation of today's strong suburbanisation processes of metropolises or major agglomerations, there is a high probability of additional tiers emerging among the top tiers of the hierarchy (1st-3rd tier).

What next for Poland's polycentricity?

The search for an answer to the question of the directions of the transformation of the settlement network is not only important from a theoretical point of view, but also has extremely important practical implications; in particular in the context of the country's sustainable territorial development policy objectives. In spatial economics in its classical sense, e.g., A. Lösch (1940), it is assumed that **a well-organised (coherent and polycentric) urban system is an important factor in the**

Numerous contemporary scientific and strategic studies emphasise the polycentric nature of the urban settlement network as a unique asset, favouring the implementation of cohesion policy and the levelling of development opportunities between regions.

¹ In the report, we use 'rows' as a synonym for 'tiers of hierarchy'.

sustainable development of a region and a country. Thus, in order for the implementation of urban policies to be effective, it is necessary to define the role played by individual urban centres – to reflect **on the position of cities in the hierarchical settlement network** and to identify which are predisposed to act as key links in this network.

Numerous contemporary scientific and strategic studies emphasise the polycentric nature of the urban settlement network as a unique asset, favouring the implementation of cohesion policy and the levelling of development opportunities between regions (Kunzmann, Wegener 1991; Vandermotten et al. 2007) authors of one of the largest research studies on polycentric development in Europe (ESPON 111 2005: 7) rightly point out that **polycentricity is not an end in itself, but can be seen as a potential and a means to foster public policy objectives**, such as increasing the economic competitiveness of countries and regions, territorial and social

cohesion, or sustainable development. **Urban centres play/could play a role in relation to their surroundings (hinterland) in stimulating local and regional development as so-called growth poles (growth centres)**(cf. Paelinck 1965; Boudeville 1966; Grzeszczak 1999; Sobala-Gwosdz 2005, 2023c), but also offer access to a range of services – in the language of theory referred to as ‘central services’ (Christaller 1933/1966). This role is pointed out more figuratively by Rafał Matyja (2021: 15), writing that **‘Cities today are [...] mainly network hubs with different scales of services offered [...] and more or less attractive labour markets.** Simple medical advice will be obtained in a nearby district centre, with a more serious problem we will go to a provincial town. It is in this sense that we are not only residents of a particular locality, but also customers of the urban network.’

The already mentioned report carried out as part of the ESPON 111 project (2005) **indicates Poland as having one of the highest polycentricity indices in Europe, with a very well developed and dense hierarchical settlement network** (Fig. 5). Both the present study on the transformation of the Polish settlement hierarchy and the other studies carried out as part of the series of reports of the Urban and Regional Policy Observatory on urbanisation in Poland clearly indicate **that the polycentric settlement structure of our country is undergoing accelerating dynamic changes towards an increasingly strong polarisation of the development of large cities and urban agglomerations and depopulation of peripheral areas and shrinkage of medium-sized and small towns located outside the direct influence of a few largest centres** (Piech et al. 2024).

(...) the polycentric settlement structure of our country is undergoing accelerating dynamic changes towards an increasingly polarised development of large cities and urban agglomerations and the depopulation of peripheral areas and shrinkage of medium-sized and small cities located outside the direct range of influence of a few major centres....

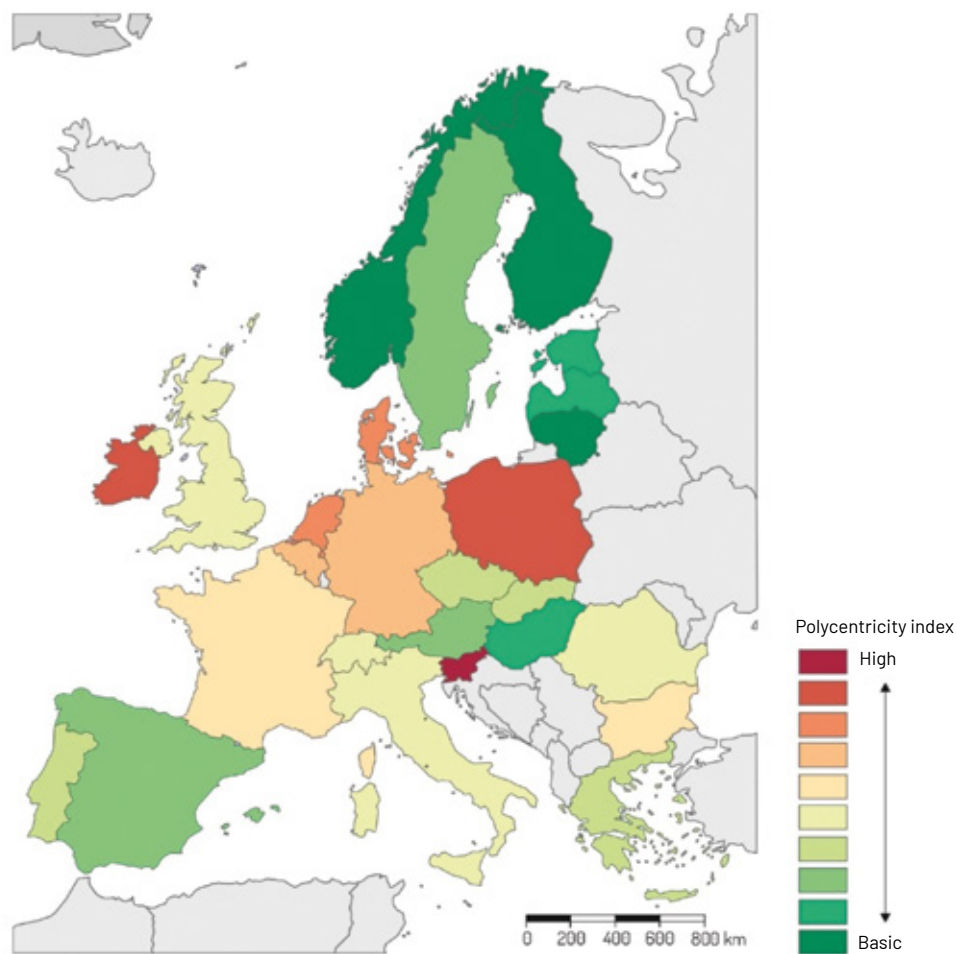


Fig. 5. Polycentricity index in Europe in 2005

Source: ESPON 111 (2005: 77)

The degree of connectivity of cities intended to act as nodes in Poland's settlement network is also not encouraging (Komornicki, Śleszyński, Węclawowicz 2006; Guzik and Kołós 2015, 2021; Guzik et al. 2020a-b, 2021a-d; Komornicki and Rosik 2022; Mróz and Štraub 2023).

The fundamental question is: are we able, within the framework of public policies, to counteract the process of centralisation and the weakening of the polycentric settlement structure of the country? And also: should we set ourselves such a goal at all, and if so, for the sake of what?

Although a high level of polycentricity does not automatically affect the rate of economic development (Veneri, Bulgarasi 2010; Brezzi, Veneri 2014; Urso 2016) and it does not guarantee good availability of services and their high quality or a large number of jobs, but it is undoubtedly a huge potential for a more territorially balanced development policy and for reducing

disparities between development centres and peripheries. This mechanism is well explained by the theories (described below) that formed the starting point of the research conducted. The theoretical and empirical justification of the values derived from the polycentric and hierarchical nature of the settlement network is important – especially when it comes to the principle of *evidence-based* policy. **However, one cannot abstract from the normative assumptions – the recognition that the existence of a network of well-functioning cities, conventionally referred to as medium-sized and small cities, is of enormous value – not only from the point of view of their inhabitants and the local communities they form, but also of the more peripheral regions, the rural areas, for which these centres still perform important service functions.**

Rafał Matyja writes about this normative imperative of polycentricity in his insightful historical and social analysis (2021: 414): ‘The majority [of medium-sized cities – ed.] have been outside the authorities’ focus, and [...] the inclusion of ‘cities losing socio-economic functions’ indicates an extremely defensive thinking about this extremely important element of the urban network. Meanwhile, it is on the idea of these cities that the real polycentricity of Polish space depends. Polycentricity, the everyday content of which is universal access to the city, a situation where residents from different parts of the country have both a district centre and a slightly larger one in close proximity, offering additional services, attractions or opportunities. [...] The third decade of the 21st century may prove to be decisive in this sphere, determining what the real extent of ‘urban living’ will be.

We also fully agree with the author of ‘*Urban Land*’: ‘The search for an idea for the several dozen Polish cities that are not full-fledged metropolises, which must not be reduced to the role of unhappily overgrown district centres, will be one of the most interesting processes of the next two or three decades’ (Matyja 2021: 415). We hope that this study will at least in a small way become part of that process.

However, one cannot abstract from the normative assumptions – the recognition that the existence of a network of well-functioning cities, conventionally referred to as medium-sized and small cities, is of enormous value – not only from the point of view of their inhabitants and the local communities they form, but also of the more peripheral regions, the rural areas, for which these centres still perform important service functions.

'There is nothing more practical than a good theory'

Although the research carried out has a primarily practical dimension (policy implications), at the same time both the research itself and the process of inference and recommendation-making flow from theoretical premises.

As Bolesław Domański and Krzysztof Gwosdz (2010:10) note:

'The strength and development potential of cities lies in themselves, in their immediate hinterland, and in the synergies they create with other cities in a suitably coherent and polycentric network of cities.'

The two main theories explaining the geographic-economic dimension of urban development and the formation of the urban settlement network are based on the assumption that city-generating factors are related to activities provided to areas and populations outside the city itself – responding to the demand of its closer and further surroundings.

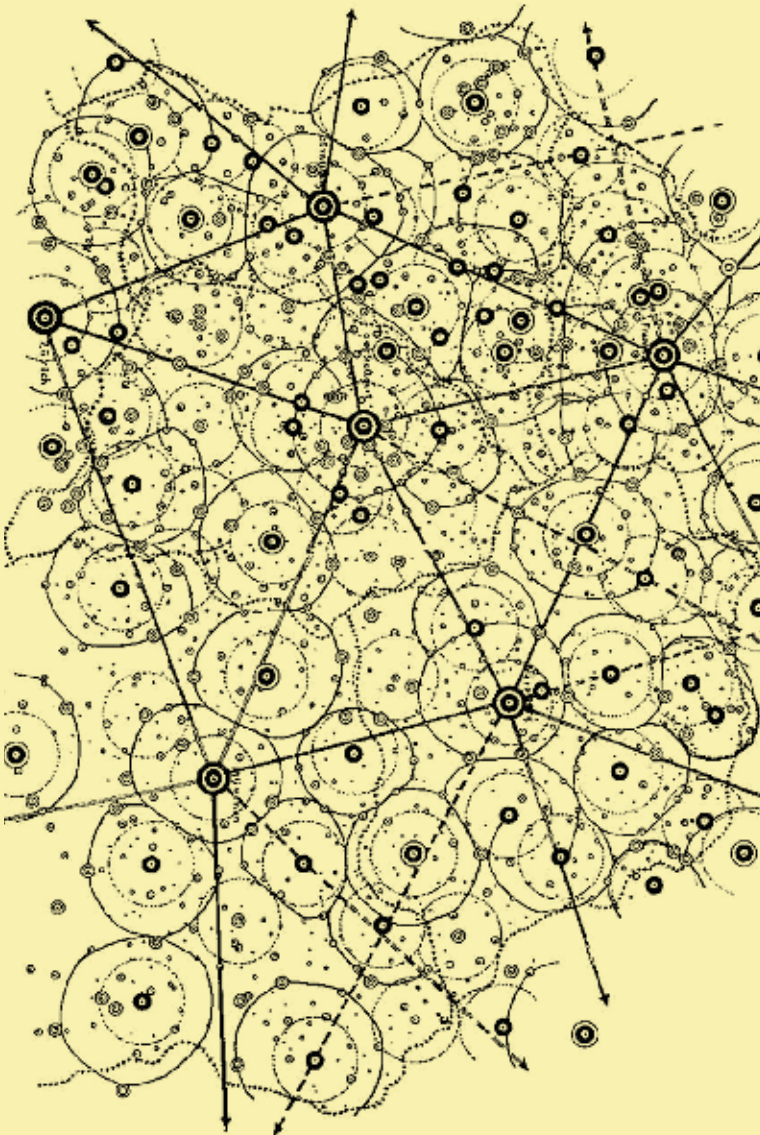
Appreciation of endogenous development inherent in the strength and potential of central services can undoubtedly help in the pursuit of sustainable development and in maintaining socio-economic and spatial cohesion, which are the objectives guiding the main strategic documents related to national development, i.e., *the National Regional Development Strategy 2030*, *the National Urban Policy 2030* and *the Strategy for Responsible Development 2020 (with an outlook until 2030)*.

Economic base theory

According to Werner Sombart's theory of the economic base (in Poland see Dziewoński 1971; Jerczyński 1971, 1973; Sokołowski 2008; Gwosdz, Ciechowski, Micek 2010), two types of economic activity influence the development of a city: exogenous, i.e., directed at external demand, and endogenous – related to serving the residents themselves and the companies operating within the city. Exogenous functions are a priority for the city's development, as they primarily lead to added value in the form of additional demand for various types of goods and services, but also to the increasing of the disposable income of employees, which in turn generates so-called multiplier effects. The emergence of multiplier effects in turn drives the growth of the endogenous sector. To put it simply: **a city does not exist just for itself (endogenous functions), but its strength and success depend on how much it is needed by its environment (exogenous functions) and how wide this influence is.** The inhabitants of the 'needy city' get rich and drive the development of the internal market (endogenous activities).

Walter Christaller's central place theory

Walter Christaller's (1933) central place theory in turn explains the hierarchical nature and spatial regularities of settlement network development. We discuss it at some length here, as it forms the main theoretical and methodological foundation for the research we present in this publication. Although this theory was created based on observations of the regularities of the distribution and functioning of cities in a particular economic system, in a given time and space, it still offers a very attractive explanatory model that can provide a starting point for analysing the transformation of the settlement network from the point of view of the variation in the availability of central services provided in the national space. As with the economic base theory, Christaller assumed that the growth and importance of cities is determined by those activities (central functions) that serve an area larger than the city itself. However, central functions can vary in nature and market coverage and are therefore divided into higher- and lower-tier services and goods.



Source: W. Christaller (1933)

Higher-tier services are characterised by rarer occurrence and wider spatial coverage (e.g., a philharmonic hall), while lower-tier services are more common and serve a smaller area (e.g., a car repair shop). Observing the distribution patterns of various types of central goods in the cities of southern Germany, Christaller concluded that they form a hierarchical and fairly regular network in which the position (rank) of a city is determined by the degree of development of higher-tier functions. Although this theory is based on numerous simplifications and ignores, among other things, urban development based on specialised industrial functions, it at the same time captures very well the importance of a polycentric and hierarchical settlement pattern for the sustainable development of the whole territory. When selected cities are removed from this system, the network becomes sparser and the hinterlands larger, which in practice means that the availability of many essential services for residents and businesses in the area decreases. This, in turn, makes the area less developable, less attractive and more peripheral.

Today, there are many other factors that make the Christaller model less and less relevant to reality. The accessibility and reach of market services of various kinds is influenced primarily by the enormous changes that have taken place in the possibilities of rapid transport and long-distance communication. The nature of the urban environment is also changing, and rural areas have been transformed by the intensification of agriculture. These transformations clearly also affect the cities themselves and the transformation of the settlement network. Earlier in Western countries, and now also in Poland, we are witnessing an acceleration of the processes of metropolisation and suburbanisation combined with depopulation of more peripheral areas, loss of functions and the shrinkage of many medium-sized and small towns.

Urban hierarchy and settlement network transformation examined – and what next?

The study carried out is both a diagnosis of the contemporary (2020) network of cities in a hierarchical and spatial (stop frame) perspective, consisting of an in-depth identification and analysis of the provision of central services to cities in a dynamic (historical) perspective, and carried out using data from telephone directories (*Ogólnopolski Spis Teleadresowy 1990*). Such an approach has made it possible to identify the fundamental directions of the evolution of the rank of cities and thus the transformation of the entire network under conditions of a free-market economy and the prevailing processes of metropolisation and suburbanisation. This, in turn, provides a starting point for discussion and the identification of conclusions relating primarily to policy issues: urban, regional and national development.

It is often pointed out in academic and public discourse that Poland and other Central European countries are moving towards a Western social, economic, and cultural circle. With the opening up of the country to the Western cultural and economic sphere, the development trajectories of urban centres have changed. On the one hand, the key importance of the inflow of foreign capital and technology for the modernisation of Poland is pointed out. On the other hand, critics of the transformation draw attention to the concentration of development impulses within the larger cities, with a concomitant degradation of the importance of medium-sized and small centres. The controversy surrounding the changing role of lower tier cities has been described in numerous publications and is also developed elsewhere in this study (see the chapter: *'Changes in the urban functional hierarchy between 1990 and 2020'*).

Over the past three decades, our country, Polish cities and regions have undergone intensive transformation and modernisation, developing continuously. A very important factor stimulating this development was Poland's accession to the European Union and the implementation of cohesion policy based on the redistribution of European funds. Leaving aside the risks associated with the cessation of the inflow of external funds for political reasons (as of 2023), we can venture to say that the existing model of supporting and balancing the territorial development of the country is coming to an end. This situation, as well as the increasing likelihood of further so-called 'black swans', e.g., in connection with the geopolitical situation (the war in Ukraine and its consequences), mean that the country's development policy and its constituent regional and urban policies need to be further prioritised.

'Gentlemen, we have run out of money. We need to start thinking' – this sentence, once attributed to Winston Churchill and at other times to the New Zealand chemist and Nobel Prize winner Ernest Rutherford, may soon prove very pertinent in the context of the further pursuit of development policy in our country. And not just because of the possible absence or reduction of external funding streams, but also (if not primarily) because of the demographic and environmental challenges we face. To paraphrase: **Gentlemen and ladies! The 'stewardship of Europe's gifts' is coming to an end, the population is declining, the population is ageing, cities are shrinking, valuable natural resources are being lost... We can no longer afford extensive and chaotic suburban development, it will become increasingly difficult to maintain a high level and decent availability of costly public services... It is high time to start pursuing a more rational and targeted territorial development policy.**

We hope and firmly believe that this report will contribute to the initiation of a serious debate on how we can, within the framework of public policies and using the available tools, counteract the negative effects of metropolisation and the increasing centralisation of the settlement network, and that the identification of the most threatened links in this network will make it possible to take action tailored to their specific needs.

The classification of cities according to the position they occupy in Poland's settlement system, identified as part of the study and presented in this report, will be a reference point for the study of their development in Phase II of the IRMiR long-term research programme of the Urban and Regional Policy Observatory. Within the framework of the city group reports, we will try to take a much closer look at the foundations and development pillars of each of the sub-regional, regional and metropolitan centres. The aim of this ambitious endeavour will be to identify detailed conditions, barriers and development potentials with a view to optimising support for the development of these centres from the level of national and regional policies. We are confident that the results and the conclusions and recommendations can also be used to inform local urban policy-making.

Research
objectives
and methods

Structure of the study

This thesis consists of several chapters. A discussion of the theoretical underpinnings, empirical research and conclusions and recommendations are presented in the first three chapters: *Brief and to the point*, *Key findings* and *Recommendations for policies at national level*. The main in-depth content of the report is contained in the fourth chapter and includes an introduction to the research topic and its theoretical background. In addition to this, the study contains chapters treating the purpose, scope and methods of the study, as well as basic concepts and interpretative notes. The section of the report describing the empirical results is divided into three parts within the chapter '*Urban functional hierarchy in Poland – results of the study*'. The first of these, '*Characteristics of Distinct Hierarchical Tiers of Cities*', is a description of the current settlement structure of the country (as of 2020), broken down into seven tiers of cities, which emerges from an analysis of the equipment of centres with central market and non-market functions. The subsection also analyses the country's settlement hierarchy, taking into account the strength of urban centres in relation to their metropolitan areas (1st-2nd tier) and urban functional areas (3rd tier). The second empirical part was devoted to the compilation and description of the most important changes in the urban functional hierarchy in Poland between 1990 and 2020, as it was assumed during the preparation of the report that thirty years of socio-economic transformation may have significantly influenced the strength and position of some centres (e.g., those losing their status as province capitals as a result of the 1999 local government reform). As an important addition to the data presented in the report, the last of the chapters of an empirical nature – *Differentiation of centres in terms of surplus/shortage of central market services* – can be regarded as an important addition to the data presented in the report, prepared on the basis of surveys of service areas delimited by the gravity method.

Research objectives and questions

The aim of the study was to identify key aspects of the spatial and functional structure of the urban settlement network in Poland. In this context, we focused on the terms:

- a hierarchy of central centres taking into account the potential of the entire metropolitan area or urban functional area,
- changes in the Polish urban functional hierarchy between 1990 and 2020,

- spatial extent of urban influence in 2020,
- the strength of the cities' impact on their surroundings/service area,
- the role of the urban functional hierarchy in shaping national and regional policies.

The study sought answers to the following specific questions:

1. What was the rank of Poland's cities in the country's settlement system in 1990?
2. Which types of urban centres have seen an increase in their position in the functional hierarchy and which have experienced a decline between 1990 and 2020?
3. How do the development and potential of metropolitan areas and urban functional areas contribute to changes in the position of individual centres in the functional hierarchy?
4. What elements and determinants shape the spatial extent of urban influence?
5. Which centres, based on the urban functional hierarchy, have a key role as reference points and determinants for national and regional policy-making?

Methods for examining the urban functional hierarchy

The analysis carried out on the urban functional hierarchy in 2020 focuses on 979 towns and cities in Poland² which had urban rights on 1 January 2023. In order to show the changes in the provision of central functions between 1990 and 2020, 927 localities were included in the determination of the hierarchy in 1990, 832 of which then had municipal rights. An analysis of the urban hierarchy taking into account metropolitan areas (1st–2nd tier) and urban functional areas (3rd tier) was carried out for 816 units in 2020. It covers 8 metropolitan areas (Warsaw, Katowice³ Krakow, Tricity, Wrocław, Poznań, Łódź and Szczecin), 15 urban functional areas (Lublin, Bielsko-Biała, Bydgoszcz, Białystok, Rzeszów, Toruń, Kielce, Olsztyn, Częstochowa, Radom, Opole, Zielona Góra, Koszalin, Gorzów Wielkopolski and Rybnik agglomeration), as well as 795 cities (Fig. 6).

In order to show the changes in the provision of central functions between 1990 and 2020, 927 localities were included in the determination of the hierarchy in 1990, 832 of which then had municipal rights.

² A study of the urban hierarchy by A. Sobala-Gwosdz (2023a) was supplemented by cities that had municipal rights on 1 January 2023.

³ GZM+ includes the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

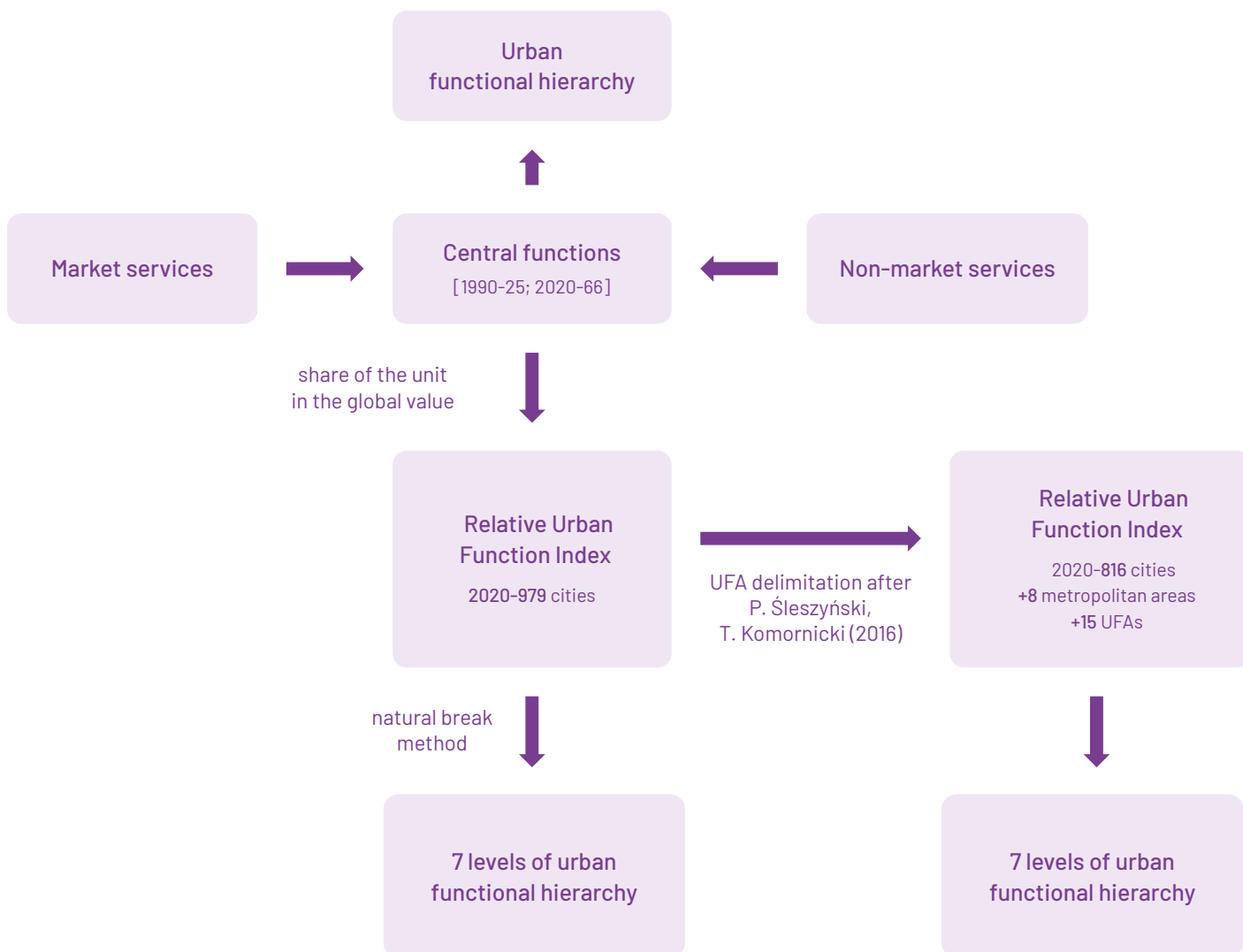


Fig. 6. Scheme of investigation

Source: compiled by ©Urban and Regional Policy Observatory

The delimitation of metropolitan areas and urban functional areas in this paper follows P. Śleszyński and T. Komornicki (2016: 475)⁴. A decisive factor in its selection was the application of a uniform procedure and criteria for all administrative units in the country and a hierarchical approach to the process of determining the extent of urban functional areas. Other available delimitations, prepared for provincial spatial development plans (SPPs) or provincial development strategies (STWs), differ in the methods and criteria used. An additional argument in favour of the chosen delimitation was its consistency, resulting from the equal treatment of cities in polyfunctional systems (taking into account as core area not only the capital city but also the other cities). This type of approach was not used in the most recent

⁴ Delimitation was defined on the basis of a hierarchy of administrative units and took into account administrative and settlement functions, functional links, economic functions and the morphological character of the municipalities.

delimitation proposed by P. Churski et al. (2023), which consciously rejects the hierarchical classification of localities in relation to a higher-tier central city, focusing more on distinguishing functional areas with inner periphery characteristics. The third argument was that this delimitation was in line with P. Śleszyński's (2013) earlier work on the delimitation of UFAs of provincial centres, which has been applied in other studies conducted by the Institute of Urban and Regional Development (IRMiR), including economic analyses. This makes it possible to compare data within similarly defined metropolitan areas. The authors' choice of a particular delimitation was mainly dictated by its consistency with the assumptions made in the study and the possibility of comparing the data within the UFA with other IRMiR studies. The aim of the authors was not to evaluate or compare the available delimitations, whether carried out for all urban functional areas⁵ or for selected cities in individual provinces. The authors only examined to what extent the choice of a particular delimitation at the stage of determining the urban functional hierarchy including functional areas can influence the position of cities in this hierarchy. They found that such a relationship does not exist and that the differences between the different delimitations are minimal due to the fact that they mainly concerned individual municipalities located at the outer border of the urban functional areas.

The analysis of the functional hierarchy within functional areas was limited to first- to third-tier cities. This was due to the most prominent zone of spillover effects associated with central functions, as measured by indices such as Alonso's borrowed value and the surplus of central market services. In the case of cities below 3rd tier, spillover effects are also present, but they are more related to the presence of specialised activities (e.g., economic zones) in the functional areas, which can at most indirectly influence a slight change in the rank of these cities in the system of central centres. There is also a greater problem here with the delimitation of their urban functional areas as, among other things, due to the high investment dynamics between 2011 and 2021 (which affects the scale of commuting) they need to be revised using the latest Census data from 2021. The authors, aware of the impact of hinterland on urban development, attempted to capture these relationships through the construction of a synthetic nodality index, comprising seven sub-indices, including centrality indices, school commuting, commuting to work (cf. Fig. 3 and the *nodality* chapter). More detailed studies, including analyses of the functional zones of all cities using the latest data, will be presented by the IRMiR in future studies.

The identification of central functions was done through an institutional base built using a variety of datasets. For 1990, this was CSO data and the *Nationwide Teleaddress Census* (1990), while for 2020 it was CSO data, as well as other supplementary information obtainable from public records.

⁵ The detailed differences in the methodological approaches used in the delimitations to date are discussed in more detail in the work by P. Churski et al. (2023).

Data obtained from internet searches (e.g., Panorama Firm – see *Appendix 1*).

To calculate the centrality index, the report relies on the methodology proposed by Agnieszka Sobala-Gwosdz (2023a). The central services (activities) for 1990 were defined on the basis of 25 service activities⁶ and for 2020, 66 such activities were taken into account (see *Appendix 1*). They were selected to show variation not only across the set of cities of different sizes (low-, medium- and high-tier central services – Fig. 7-8), but also within cities of similar size operating in different spatial contexts (suburban areas, rural agricultural areas). The centrality index is mainly based on the criterion of the number of types of service institutions and their prevalence in the set.

The centrality index is mainly based on the criterion of the number of types of service institutions and their prevalence in the set.

The centrality of service centres has been defined in several steps:

- 1) the centrality of the type of service is determined, then the centrality of the service (urban) centre – this is the resultant of the centrality of the types of services located in the unit;
- 2) the resulting shares of the given characteristics for each city were summed up to obtain a synthetic index;
- 3) the calculated totals were prorated, making the synthetic index for medium-sized and smaller cities visible;
- 4) the results of the root sums obtained for each city made it possible to determine their rank. It was acted on the assumption that the city with the best score should be given a rank value of 1st tier. Instead, the division into seven tiers was made using the method of natural breaks. An identical procedure was used to determine the rank for market services (uR) and those of a non-market nature (uNR).

⁶ The number of service activities adopted for 1990, although more modest, included all key areas related to central services. Due to the nature of the period, non-market services were more represented than market services.

Calculations were made according to the formula:

R_{mi} - rank in the range from 1 to 100 cities i

$$R_{mi} = \frac{(R_{Ai} - \min(R_{Ai})) \times 99}{\max(R_{Ai}) - \min(R_{Ai})} + 1$$

where; $R_{Ai} = \sqrt{\sum \frac{a_j}{A_j}}$

R_{Ai} - value of the primed synthetic index for the city in question Ai

a_j - value of the j -th characteristic in the city a

A_j - value of j -th characteristic in all surveyed cities

n - number of characteristics adopted for the analysis

Overview of the city rank index and its size in terms of population⁷

(NWUR) on the correlation chart allows the identification of those centres that show a surplus or shortage in terms of services. Those characterised by a surplus are cities with strong central functions. In contrast, cities with a deficit in the provision of central services tend to represent the economic model of a highly specialised industrial city or a satellite centre basing its development on residential functions. The surplus or shortage of a city's nodality in relation to its population was expressed by means of standardised residuals from a linear regression between the city's rank index and its population. As both city size and rank are characterised by an asymmetric statistical distribution, measuring their relationship using the Pearson correlation coefficient required first transforming their distributions using the decimal logarithm. In this way, an index of nodality surplus in terms of market activities was obtained.

⁷ The most up-to-date and reliable population figures based on the 2021 National Census.

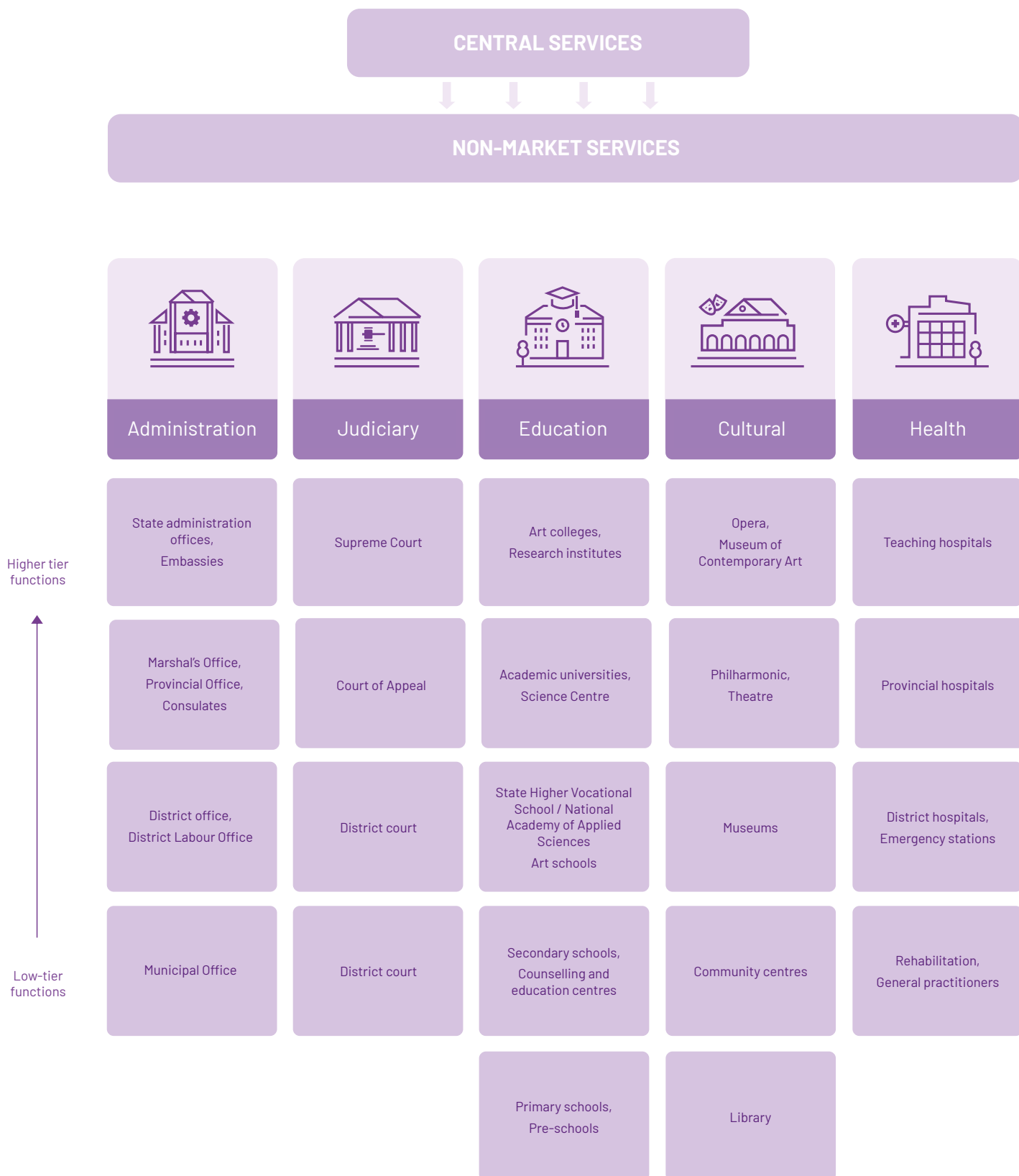


Fig. 7. Examples of central higher tier and lower tier market services

Source: compiled by ©Urban and Regional Policy Observatory

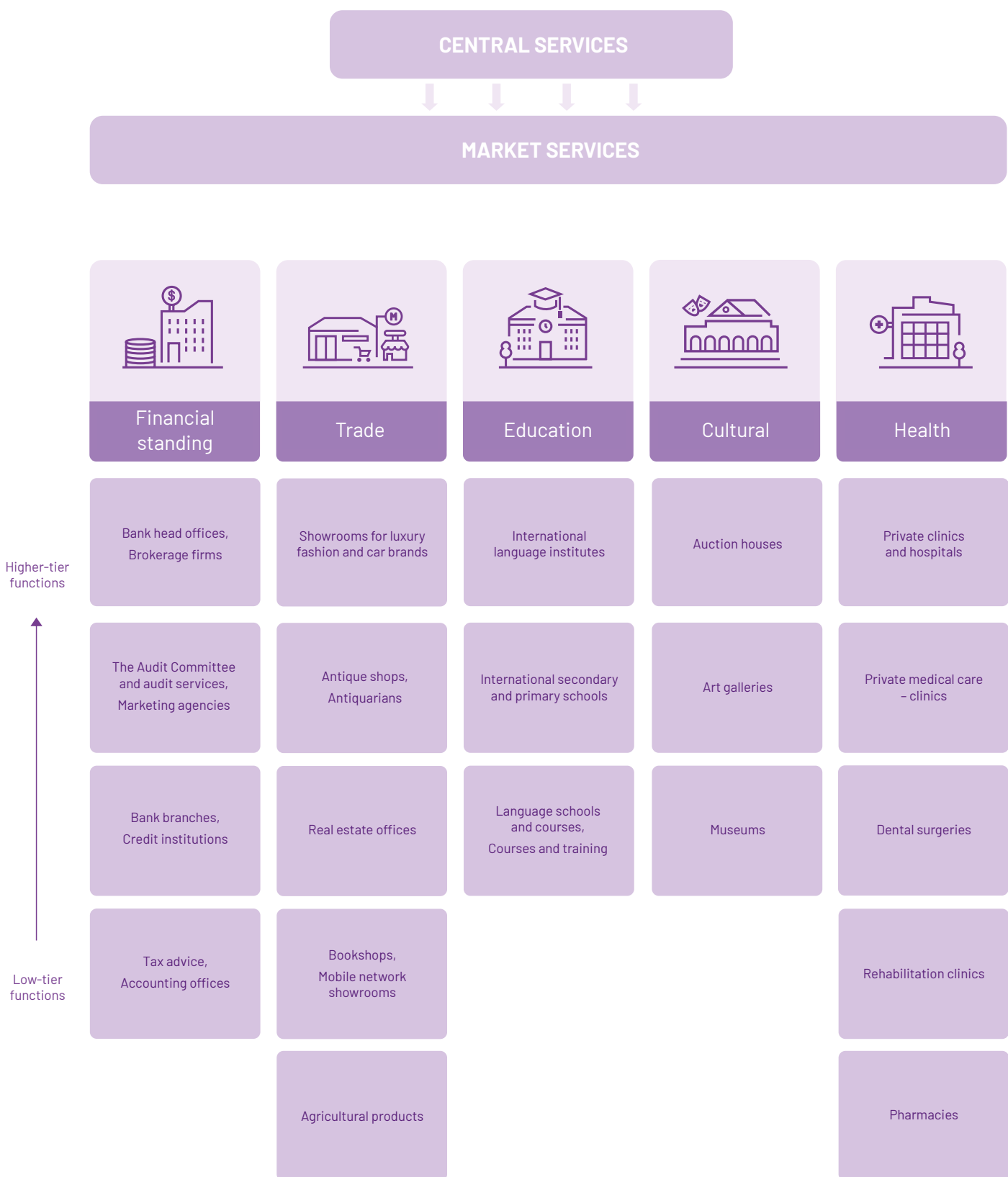


Fig. 8. Examples of central non-market higher-tier and lower-tier services

Source: compiled by ©Urban and Regional Policy Observatory.

Central place theory – basic concepts

Central activities

Sale of goods and services in a compact area around the centre in which the activity is located. Central activities include most services and retail. In contrast, most industries and some services, e.g., spas or modern business services (outsourcing services: *Business Process Outsourcing* (BPO) and dedicated shared service centres: *Shared Service Centres* (SSCs) are not central activities.

Central functions

Service activities that serve the population living in their area of influence (service area).

Central service

Any good or service that serves the hinterland population (e.g., a bakery, post office, or hospital). Central services are characterised by different market reach and sales thresholds.

Central centre

Most commonly understood as a city, but can be any settlement unit that meets the needs of the inhabitants of the surrounding area (e.g., a communal village).

Upper sales range

(market reach)

The maximum distance a consumer is willing to travel to use a good or service.

Lower sales threshold

The minimum market size necessary for the economic viability of the business. In other words: the minimum number of people using a central function to make its location viable.

Low tier functions

Have a small market reach and a small sales threshold (e.g., grocery shop).

Higher-tier functions

Have a broad market reach and a high sales threshold (e.g., philharmonic).

Low tier goods and services

Goods and services of everyday use, frequently purchased. They are characterised by a low sales threshold and a small market reach.

High tier goods and services

Goods and services that are rarely purchased. They are characterised by a high sales threshold and a very large market reach.

Source: compiled by the Urban and Regional Policy Observatory based on:
G. Nagle and K. Spencer (1997) and *School Encyclopaedia. Geography* (2005:359)

Nodality

This index illustrates the role the city plays for its surroundings/service area, taking into account not only central functions but also specialised ones (see below para. 3 and 5). It was based on seven sub-indices that cover five key areas, including educational issues (para. 2), economic (para. 1, 3 and 5) and infrastructure (para. 4). Details of data sources and scoring are included in Tab. 1–2.

Key areas:

1. **Cities' potential for central market services.**

Sub-indices:

- central market services surplus index,
- an index of the prevalence of central market services over non-market services (see Sobala-Gwosdz 2023a).

2. **Students' transportation to secondary schools.**

Sub-indices:

- **Service index 'secondary schools'** school year 2019/2020 (CSO) – number of pupils coming to a given centre from other municipalities / number of pupils from a given town,
- **Closure factor 'secondary schools'** school year 2019/2020 (CSO)
- the ratio of the number of pupils from a city studying there to the number of pupils from that city studying there and in other centres.

3. **Commuting.**

Sub-index:

- **the balance of commuting in 2016 per 100 employees in 2018.**
- captures the sphere of influence of urban centres, especially 4th and 5th tier, whose functions rarely extend beyond the zone of opportunity for daily interactions, and were used as sub-indices to determine the nodal strength of individual urban centres.

4. Hypothetical traffic drawdowns by time. Drawdown zone determined by the gravity method taking into account the importance of the city in the hierarchical network and commuting time.

Sub-index:

– **service index** – hinterland population/city population.

5. The economic power of the city as a pole of growth.

Sub-index:

– **growth pole** – the identification of a growth pole has been done through six dimensions, taking into account: size, nodality, development dynamics, innovation, intensity (density) and economic resilience (see Sobala-Gwosdz 2023c: 22–23).

Table 1. Nodality index – data sources of sub-indices

Indices	Data sources	Other comments
Surplus of central market services in relation to population (NWUR)	Own calculations	
Prevalence of central market services over non-market services (RnNR)	Own calculations	Difference in standardised values for the rank of market and non-market services
Number of pupils coming to the centre from other municipalities / number of pupils from the municipality (service index)	Total number of students in post-secondary schools (excluding post-secondary) according to CSO in 2021.	
Index of the number of pupils from a city studying there to the number of pupils from that city studying there and in other centres (closing index)	Total number of students in post-secondary schools (excluding post-secondary) according to CSO in 2021.	The number of pupils coming from a particular city was created by subtracting the number of incoming pupils from the number of outgoing pupils. The number of city pupils studying in the city is the number of pupils in the city minus those coming in
Balance of commuting in 2016 per 100 employees in 2018.	Commuting balance for 2016 after CSO data, number of employees after P. Sleszynski and K. Wiedermann (2020)	
Hinterland population/city population (service index)	Own calculations, population according to Census 2021	The gravity zone was determined using the gravity method, assuming that the gravity is directly proportional to the importance of the city in the hierarchical network and inversely proportional to the distance calculated in terms of travel time (see <i>Spatial extent of urban influence</i>)
The power of the growth pole	A. Sobala-Gwosdz (2023c: 23)	The identification of the growth pole was done through six dimensions: size, nodality, growth dynamics, innovation, intensity (density) and economic resilience (see Sobala-Gwosdz 2023c: 22–23)

Source: compiled by ©Urban and Regional Policy Observatory

Table 2. Nodality index – detailed description of the scoring of sub-indices

Indices	Nodality	Other comments
Nodality derived from the sub-indices of the settlement hierarchy	0-3	3 pts. – NWUR and RnNR index ≥ 0 2 pts. – NWUR index ≥ 0 1 pt. – RnNR index ≥ 0
Surplus of central market services (NWUR)	0-3	3 pts. – NWUR index ≥ 0.10 2 pts. – NWUR index 0.05–0.10 1 pt. – NWUR index 0.00–0.05
Number of pupils coming to the centre from other municipalities / number of pupils from the municipality (service index)	0-3	3 pts. – service index ≥ 2.50 2 pts. – service index 1.25–2.50 1 pt. – service index 0.9–1.25
Index of the number of pupils from a city studying there to the number of pupils from that city studying there and in other centres (closing index)	0-3	3 pts. – closing index ≥ 0.9 2 pts. – closing index 0.7–0.9 1 pt. – closing index 0.5–0.7
Balance of commuting in 2016 per 100 employees in 2018.	0-3	3 pts. – index ≥ 30 2 pts. – index 5.0–30.0 1 pt. – index –0.5–5.0
Hinterland population/city population (service index)	0-3	3 pts. – service index ≥ 4.00 2 pts. – service index 1.25–4.00 1 pt. – service index 0.90–1.25
The power of the growth pole (see Sobala-Gwosdz 2023c: 23)	0-3	3 pts. – strong growth pole 2 pts. – growth pole weak 1 pt. – centre for balancing development
Nodality	Average = 9.9 Median = 10.0 Max = 19	Very strong ≥ 17 (11 cities) Strong 13–16 (61 cities) Above average 10–12 (51 cities) Average strong 7–9 (45 cities) Average weak 4–6 (25 cities) Weak 1–3 (1 city)

Source: compiled by ©Urban and Regional Policy Observatory

Spatial extent of urban influence

In order to determine the size of the hinterland, the drawing directions and the extent of the impact of the urban centres, the transport draw method was used. The drawdown zone was determined using the gravity method, assuming that the drawdown is directly proportional to the importance of the city in the hierarchical network and inversely proportional to the distance calculated by commuting time. Economic distance (time) is one of the most important factors determining, for Christaller, the extent of a good. This is related to the principle that too great a distance results in the abandonment of the acquisition of a good either in a given centre or at all (Nowosielska 1992: 42).

Methodology for delimiting city coverage zones at each level:

1. According to the formula

$$V_i = \frac{O_i}{d_{ij}}$$

where:

V_i – potential in the municipality i ,

O_i – city rank of municipality i (for the city with the highest rank 7, then 6, then 5, down to 4, which was the lowest rank considered in the analysis),

d_{ij} – distance (expressed as travel time by individual road transport in minutes) between the centroid of municipality i and the centroid of city j , was calculated how a given city (of a given rank) interacts with a given municipality; the travel time was calculated in ArcGIS using speed data from OpenStreetMap (as of 2021), taking into account the maximum allowed traffic speed.

2. Selection of the city with the highest impact (highest value calculated above):
 - a. including only cities of rank VII and VI,
 - b. including only cities of rank VII, VI and V,
 - c. including only cities of rank VII, VI, V and IV.
3. Compile the data on a map, delineate the urban impact zones and adjust the results as intended:

- a. areas must be territorially coherent – in case of incoherence, the municipality was assigned to the sphere of influence of the city for which the second-best value was calculated in point 1,
- b. if the inconsistency was due to the different assignment of an urban and a rural municipality having the same name (and at the same time functional-spatial links), the rural municipality was assigned to the same sphere of influence as the urban municipality.

The method used defines the theoretical extent of the spatial impact of cities and is a prelude to further research within the Urban and Regional Policy Observatory. This method will be supplemented by actual flows, including migration, educational flows and commuting. The empirical data crucial to determining actual coverage, i.e., commuting collected as part of the 2021 National Census, was not yet available at the time of the study. As mentioned earlier, the level of new investment, especially in non-metropolitan areas, has changed so significantly in some regions that using 2016 commuting data could give a misleading picture of reality. It was therefore considered that taking the theoretical impact ranges as a starting point was a reasonable compromise to enable further research and analysis in this area.

Methodological and interpretative remarks

What do we need a settlement hierarchy for?

In order to effectively implement urban policies, it is important to define the role played by individual cities in Poland, taking into account their position in the urban hierarchy. In particular, we are interested in which of them play a key role not only in terms of regional development, but also in terms of their ability to compete internationally, for example by attracting investment, advanced functions or talented individuals. It is also important to ensure equal opportunities for residents through access to cities that provide basic services such as retail, education, health care or culture.

It is therefore important to define the role of urban centres by means of different levels of central functions (i.e., the functions performed by a city in relation to its hinterland/affected area), which will determine the functional specificity of cities and their role in the settlement system. We are not able to satisfactorily establish the specificity of the functioning of towns and their role in the settlement system using a method of defining the settlement hierarchy constructed solely on the basis of criteria such as the administrative status of the town or the population (Tab. 3).

Why is a urban functional hierarchy determined by central functions better than a hierarchy determined by administrative functions and population?

The administrative hierarchy is based on the territorial division and administrative structure of a region or country. The attribution of a given administrative rank to a city can be arbitrary and depend more on political decisions, whereas the central functions that are the basis for determining the settlement hierarchy are more objective and related to the city's actual role in the socio-economic area. In the proposed urban functional hierarchy according to administrative boundaries, the first- to third-tier centres are exclusively cities with district rights (Tab. 3). In most cases, they also serve as the seats of land districts and have capital functions of provincial rank (see Table 4). 4th tier cities, which are sub-regional centres, are mostly district seats, with the predominance of cities with district rights accounting for over 60% of this category. The 5th–6th tier urban centres group as many as four administrative-territorial categories (Tab. 4). The cities in the last category are mainly the seats of municipalities, mainly urban-rural municipalities.

A settlement hierarchy based mainly on population is not a good index of a city's role for several reasons. Firstly, the population figure does not reflect the full extent of the city's functions and role in the state's socio-economic system. There are cities with large populations (usually industrial cities) that do not have key central functions and are functionally subordinate to other cities. On the other hand, there are smaller towns, especially in agricultural, forested or peripheral areas characterised by lower population density, which perform important service functions for a significant hinterland area. Thirdly, cities with similar populations can operate in different spatial contexts (monocentric *versus* polycentric layout or metropolitan area *versus* non-metropolitan area). Determining the settlement hierarchy on the basis of central functions allows, in this case, a better assessment of the importance of cities in the context of regional or national development.

The settlement hierarchy is not a 'ranking'

Determining the position in the settlement hierarchy is a more comprehensive approach than using the ranking method. To determine the role and importance of cities in the settlement system, the hierarchy takes into account many more aspects. Firstly, it takes into account the central functions of cities, their position in the network and their relationship to other cities.

The city's functions are determined by its relationship with its surroundings as a centre for services, retail, education, transport, etc., which gives a fuller picture of the city's role in the context of the whole settlement system. Secondly, unlike the rankings, it does not attach as much importance to the exact position (order) of the city in the overall collection. Often the differences between cities are small, but they are ranked far apart in the rankings. Rather, the

settlement hierarchy focuses on grouping a set of cities according to similar values, allowing boundaries to be drawn between centres where there are relatively large differences in the data, for example by relying on the natural breaks classification method. The natural breaks method is particularly useful for presenting data values with an uneven distribution on a map, such as the decreasing number of cities with increasing central functions (there are many small cities and only a few large ones) – see Fig. 4.

When it comes to city rankings, the most common mistake is to rank strongly divergent cities in a single list. The rankings do not always recognise the fundamental implications of the functional diversity of cities, the differences in the impact of cities on surrounding hinterland areas or the relationship with the nearest centres. Meanwhile, cities form a functional-hierarchical system, which means that certain institutions and activities are concentrated only in selected centres because they require a correspondingly large (market) base. In particular, knowledge production infrastructure (e.g., academic centres, research institutes, corporate R&D centres) is concentrated at the top of the functional hierarchy, in metropolitan-type centres or their immediate surroundings. The same applies to knowledge implementation infrastructure in the form of business support institutions such as technology parks, technology transfer centres, regional and local development agencies, business incubators or coworking spaces. In this situation, comparing, for example, medium-sized cities with district rights and the largest national metropolises is unjustified. The former will always be at a lower hierarchical level. An equally common mistake is the lack of a defined reference point for the research results presented. The authors do not always take into account the fact that in some cases, the development of the city, especially in the 1990s, has been a major concern. In the 1990s, it was associated with the liquidation or deep restructuring of its existing economic base.

When it comes to city rankings, the most common mistake is to rank strongly divergent cities in a single list.

Another mistake often made by ranking authors is to marginalise the fact that cities function in a system of complex connections resulting from their geographical location (metropolitan areas, conurbations, bipolar areas) or transport accessibility. As a result, the analysed phenomenon or process may proceed differently in monocentric agglomerations (e.g., Warsaw, Poznań, Krakow or Wrocław) than in conurbational systems (e.g., GZM, Tricity). For example, the cities of the Upper Silesian and Zagłębie Metropolis (GZM), which are separate entities in legal-administrative and statistical terms, functionally form a single urban organism with Katowice as its main service centre.

Another mistake often made by ranking authors is to marginalise the fact that cities function in a system of complex connections resulting from their geographical location (metropolitan areas, conurbations, bipolar areas) or transport accessibility.

Determining the centrality of cities provides an insight into the rank of individual urban centres and the nodal role they play in the settlement network, and thus allows the ranking result to be interpreted in a broader context. Among other things, it allows the following questions to be answered: what impact will a high or low ranking of a given city have in the wider spatial context? To what extent can it be an opportunity and to what extent a barrier to the development of areas functionally linked to the core city?

Bydgoszcz and Toruń – two cities with separate, partly competing functional areas

One of the methodological assumptions of the study was that for 3rd-1st tier cities, their functional areas were also taken into account. This means that all the cities that make up an area – both those forming the core area and those forming the outer part of the functional area – were treated as a single functional whole.

The development of two large cities, Bydgoszcz and Toruń, within a short distance of each other (about 50 km) was possible because factors other than the natural concentration of higher-tier services proved to be crucial. A similar situation exists in the Silesia Province. In the case of the cities in question, these were both historical and political conditions (see Sierzputowska 2015), as well as the emergence and dominance of specialised transport and industrial functions, and later also, – in the case of Bydgoszcz, – the military.

After the administrative reform of 1999, the newly created Kuyavian-Pomeranian province became the only region besides the Lubusz province to have two capital cities. The governor's office is located in Bydgoszcz, while the marshal's office is located in Toruń. While in the case of the Lubuskie province the full separateness of Zielona Góra and Gorzów Wielkopolski is not in doubt, the much shorter distance and the proximity of the functional areas mean that Bydgoszcz and Toruń form a specific bipolar system. When the examined central functions are added up, the Bydgoszcz-Toruń centre (together with the UFA) would constitute the eighth supra-regional metropolis.

At present, however, most indications point to a separation and competition between the two centres, one political emanation of which is the establishment (after numerous perturbations) of separate ZIT associations (see Kubiak 2018).

Even more important, however, are the objective reasons highlighted by the Bydgoszcz local government, among others, and also referred to by the president of the Bydgoszcz Metropolis Association when protesting against the joint treatment of the Bydgoszcz and Toruń UFAs in the study of UFAs of province centres carried out by the IRMIR Urban Policy Observatory (see Janas, Jarczewski 2017):



Bydgoszcz



Toruń

'The two capital cities, Bydgoszcz and Toruń, are centres for a variety of services (including education, culture, health care, business services, etc.) and the labour market, above all for their functional areas, as the results of the analysis of commuting to the core cities from the municipalities of the Bydgoszcz and Toruń functional areas demonstrate very clearly. It is also important to note that some of the services, of a regional or national nature, provided by the two cities are not provided on a complementary and sometimes even competitive basis (...). The functional area should be a compact spatial arrangement. By contrast, in the case of Bydgoszcz and Toruń, it is not possible to speak of the compactness of the area. The cities are divided by natural geographical obstacles: primarily the Vistula River and its floodplains, the Bydgoszcz Forest and agricultural areas with high quality soils, and urbanisation of the areas in the municipalities between Bydgoszcz and Toruń has been very slow' (Bydgoszcz Metropolis 2017).

The integration of the two centres is also not favoured by the limited offer of agglomeration rail connections – especially when set against the large financial outlay for the BIT City project.

Urban functional hierarchy in Poland

survey results

The presented results of the study on the urban functional hierarchy in Poland concern 816 centres and refer to their state as at 2023. It has been assumed that in the case of large agglomerations, which function at least as regional cities, the core centre (city or cities in the case of polycentric agglomerations) constitutes a functional and complementary whole together with the other cities which are part of the urban functional area⁸ (UFA) of that centre. The central functions of cities located in the functional areas of 3rd tier to 1st tier centres (regional centres, supra-regional metropolises and the national metropolis) are cumulative and are counted together with the central functions of the core city (or cities). Hence, the total number of centres analysed is less than the number of all cities in Poland, which is 979 in 2023. The difference is the 161 cities, of different sizes and administrative status, which make up the core areas of the urban functional areas of regional agglomerations and metropolitan centres (MCs) or are part of their outer zone. Terms such as metropolis / metropolitan centre and agglomeration do not refer to a single city, but to an entire functional area. In the case of metropolitan centres, we identify the concept of metropolitan area with the urban functional area of the metropolis.

8 The extent of urban functional areas was adopted following the delimitation of P. Śleszyński and T. Komornicki (2016).



I National metropolis



IV Sub-regional centre



II Supra-regional metropolis



III Regional agglomeration



V Strong supra-local centre



VI Supra-local centre



VII Local centre

Characteristics of the distinguished hierarchical levels of cities

Based on the analysis of the overall rank index and the natural breaks method (see also chapter *Objectives and research methods*), with reference to W. Christaller's central place theory (cf. *Introduction*), 7 tiers of urban functional hierarchy were distinguished in Poland (Fig. 9–10), which define the importance and range of influence of the 816 centres: **national metropolis** – 1st tier, **supra-regional metropolises** – 2nd tier, **regional centres** – 3rd tier, **sub-regional centres** – 4th tier, **strong supra-local centres** – 5th tier, **supra-local centres** – 6th tier and **local centres** – 7th tier.

The names of each row reflect the extent of the impact of the central functions. The actual extent of the impact of cities of the same tier can vary considerably, not only because of the number and quality of central services offered, but also because of the proximity of other cities of the same or higher tier.

The higher the tier of the hierarchy a centre occupies, the more higher-tier functions it has and the greater its range of influence. Higher-tier centres also have a greater capacity to generate development impulses and transfer them to lower tiers. As the position in the settlement hierarchy increases, the number of urban centres decreases, while the uniqueness of the services they offer increases. The centres at the top of the settlement hierarchy (1st–3rd tier) offer medium and low-tier goods and services in addition to higher-tier functions. However, it should be borne in mind that the availability of central services can vary not only according to the level in the functional hierarchy, but can also be driven by the local context.

In the adopted urban functional hierarchy, three main groups can be observed, which are characterised by a similar level of services offered. 1st–3rd tier cities provide more than 90% of the types of services or service activities included in the analysis, while 4th–5th tier cities only offer 75% of the types highlighted. In contrast, 6th and 7th tier cities, compared to higher tier cities, show much more modest functional provision, covering only 25–39% of the 66 adopted service types. In addition to the observed decrease in the number of service types with their decreasing position in the hierarchy, it is also noticeable that they are less diverse (such as headquarters, branches, delegations) and have a limited number within each category.

The higher the tier of the hierarchy a centre occupies, the more higher-tier functions it has and the greater its range of influence. Higher-tier centres also have a greater capacity to generate development impulses and transfer them to lower tiers.

Table 3. Urban functional hierarchy in Poland in 2020 including urban functional areas for 1st–3rd tier

Urban functional hierarchy		Value of the overall rank index (1–100)	Number of cities (2023)	Percentage of urban population (2021)	Population (2021) – median (thousands)
tier	type				
I	National metropolis*	100.00	1	11.4	2596.1
II	Supra-regional metropolis*	32.40–56.19	7	29.9	870.0
III	Regional agglomeration*	16.92–29.69	15	16.1	210.0
IV	Sub-regional centre	10.03–16.47	40	11.7	63.6
V	Strong supra-local centre	6.35–9.85	131	15.5	23.7
VI	Supra-local centre	3.73–6.33	168	8.3	10.6
VII	Local centre	1.00–3.70	454	7.1	3.0
Total	x	x	816	100.0	x

Note: *Delimitation of urban functional areas for 1st–3rd tier centres adopted after P. Śleszyński and T. Komornicki (2016); population according to Census (2021).

Source: compiled by ©Urban and Regional Policy Observatory

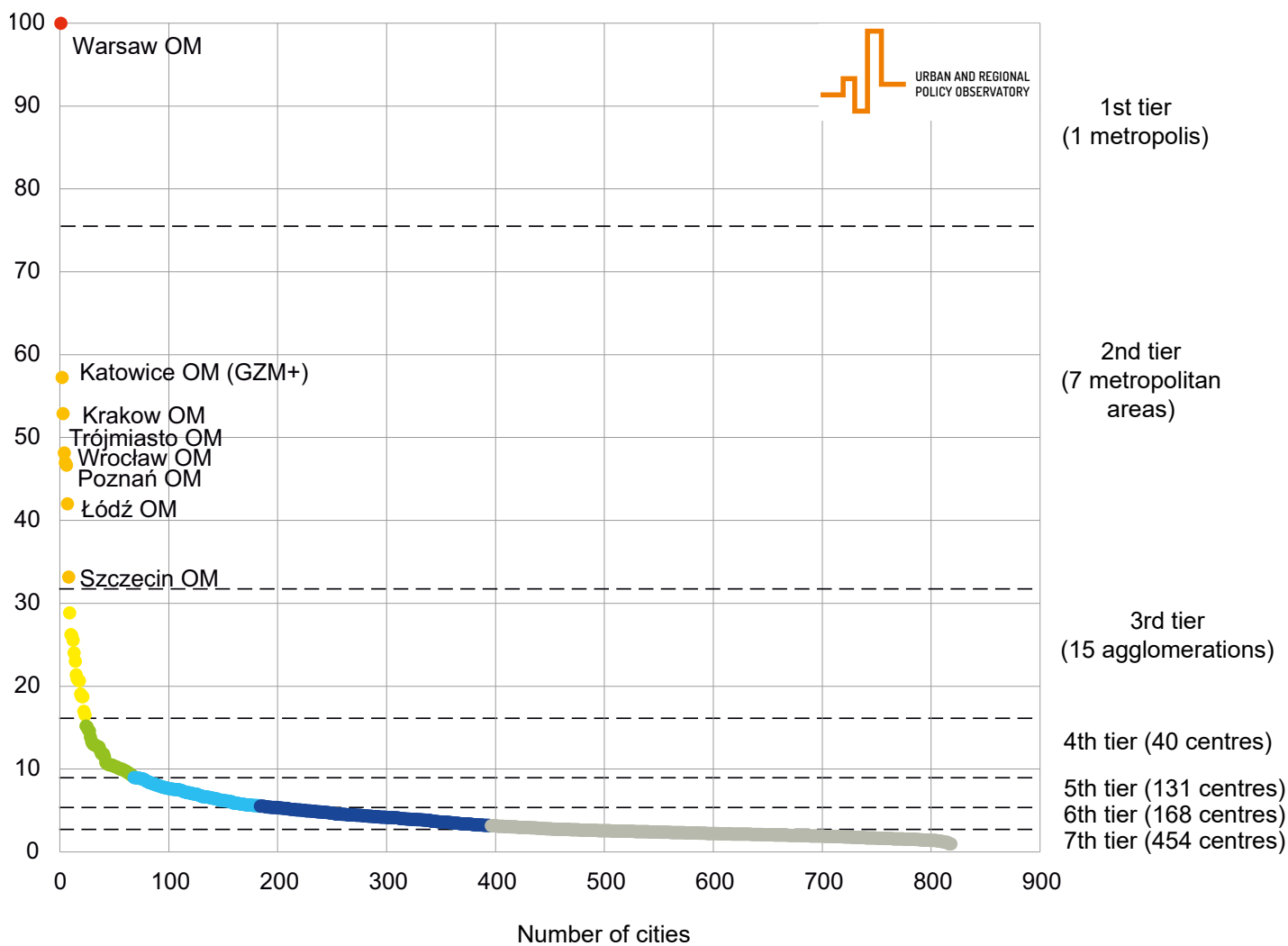
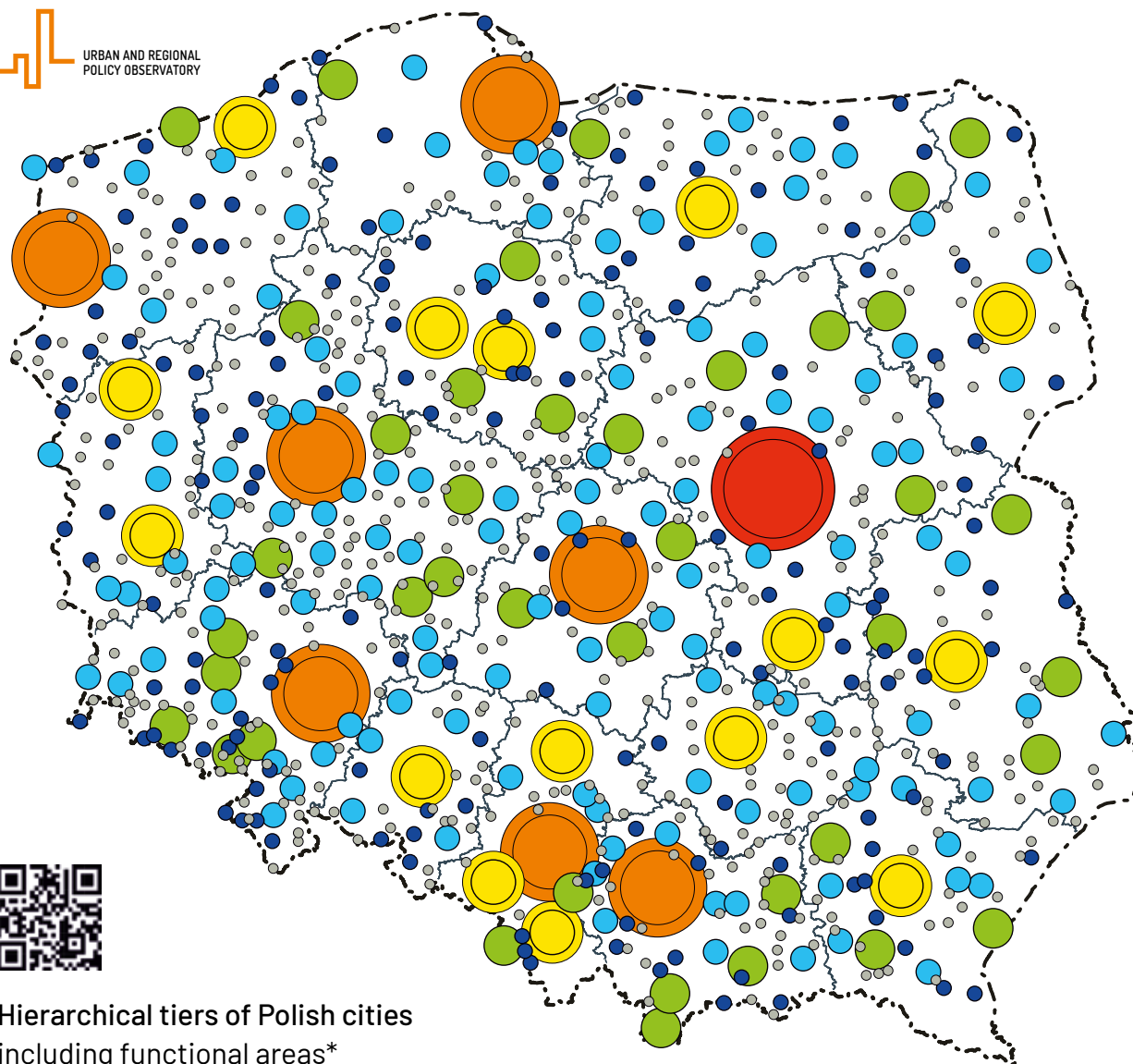


Fig. 9. Tiers of the urban functional hierarchy including functional areas for 1st-3rd tier

Source: compiled by ©Urban and Regional Policy Observatory



Hierarchical tiers of Polish cities including functional areas* of 1st-3rd-tier cities (2020)

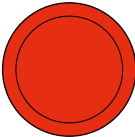
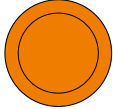





-  National metropolis – 1st tier
-  Supra-regional metropolis – 2nd tier
-  Regional agglomeration – 3rd tier
-  Sub-regional centre – 4th tier
-  Strong supra-local centre – 5th tier
-  Supra-local centre – 6th tier
-  Local centre – 7th tier

Fig. 10. Urban functional hierarchy in Poland in 2020 including urban functional areas for 1st-3rd tier

Link to map on Urban Geoportal: <https://tinyurl.com/ycyftt9a>

Attention: *Delimitation of urban functional areas (1st- 3rd tier) per: P. Śleszyński and T. Komornicki (2016), in the case of GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

First tier centre – national metropolis

National metropolises represent the highest order of the settlement hierarchy and play a key role in the country. They are characterised by an extensive and varied system of central services affecting, through their uniqueness, various spheres of economic, social and political life throughout the state. It is not uncommon for their reach to extend beyond national borders through central services with international reach.

Examples of 1st tier-specific institutions: government, parliament, government administration, seats of the highest courts in the country (Supreme Court, Constitutional Court, Supreme Administrative Court), embassies, offices of international organisations, headquarters of financial institutions, including the central bank, most boards of directors of major companies, leading scientific and research units, universities, specialised medical services (clinics), high culture institutions, international fairs, congress centres, luxury brand shopping centres, the most important airport.

It is certainly no surprise that the highest order of the Polish urban functional hierarchy is occupied by **the Warsaw metropolitan area**, with the capital city of **Warsaw** at its core. It is a monocentric metropolis with nationwide coverage. Its prominence as a capital city clearly dominates subsequent cities in terms of its central functions. Some of these are non-market functions directly related to Warsaw's capital status. The capital city and its associated proximity to decision-making political centres undoubtedly also influences the above-average accumulation of higher-tier market functions. Warsaw is characterised by the highest concentration of state institutions, international representations and corporate headquarters. It is also an important node of international transport corridors. Warsaw, together with its metropolitan area, is the largest metropolis in the country in terms of population, with 2.6 million inhabitants (according to the Census 2021).



Second-tier centres – supra-regional metropolises



The supra-regional metropolis ranks second in the settlement hierarchy. It is important for the development of a region larger than the province. Although it offers many high-tier specialised central services, its range of non-market services is smaller compared to the national metropolis. It acts as a supra-regional economic, scientific, service, commercial, cultural and educational centre. More often than not, supra-regional metropolises are also significant hubs for international transport links. They have major international airports and important rail and road hubs for easy connections to other cities and countries. As a result, they play an important role in trade, tourism, cultural exchange and international networking.

Examples of 2nd tier-specific institutions: consulates, offices of international organisations, head offices of financial institutions, company boards, research and development units, universities, polytechnics, medical universities, art colleges, music academies, research and development units of the Ministry of Health, congress centres, high culture facilities (theatre, opera house, philharmonic hall, national museums, contemporary art museums, art galleries, national libraries).

In Poland in 2023, the group of supra-regional metropolises (apart from Warsaw, which, being a national metropolis, also performs the functions of a supra-regional metropolis⁹), seven centres are included: Katowice with the entire metropolitan area (GZM+), Krakow (MC), Tricity (MC), Wrocław (MC), Poznań (MC) and the metropolitan areas of Łódź and Szczecin.

In terms of population, the metropolitan area of Katowice definitely stands out in this group, which, with a population of over 2.15 million, does not stand out significantly from the 1st tier centre. However, the difference in central function equipment is already almost double (Fig. 9). The Katowice Metropolitan Area (GZM+) is also among the three supra-regional centres experiencing depopulation. Another significant supra-regional metropolis close to Katowice is Krakow. Its metropolitan area has a population of just over 900,000, but both the core city and – to an even greater extent

⁹ According to the central place theory, each higher-tier centre simultaneously performs all the functions typical of lower-tier centres, so the Warsaw metropolis also serves its hinterland in terms of services typical of a supra-regional metropolis, regional agglomeration or sub-regional centre.

– its outer area are characterised by positive demographic trends (at least in terms of real growth). It is worth noting that the geographical proximity of these two metropolitan areas predisposes them to cooperate and develop a complementary bipolar centre. In terms of population, the MC of Krakow is slightly ahead of the Tricity metropolis (nearly 955,000 inhabitants), but it is slightly behind the Krakow metropolis in terms of central service facilities. The supra-regional metropolises of Wrocław and Poznań are ranked next and at a similar level in terms of central functions. The metropolitan areas of Łódź and Szczecin round out the group of centres. Although the MC of Łódź ranks fourth in terms of population (870,000 inhabitants), at the same time the centre is noticeably weaker in the area of provision of central services (6th position). The Szczecin metropolitan area, the smallest in the group (470,000 inhabitants), balances on the border between a supra-regional metropolis and a regional agglomeration in terms of central services. This is largely a result of the weakness of Szczecin's hinterland, particularly its functional area (Rudewicz 2024). Both Łódź and Szczecin are characterised by negative demographic trends (Piech et al. 2024)

Adopting a functional area perspective primarily strengthens the position of conurbational systems such as GZM+ and the Tricity. Although Katowice, taken on its own, is also a supra-regional metropolis, in terms of its component parameter scores it is only in seventh place – ahead of Szczecin in penultimate position. If we present the metropolitan area around Katowice as a single entity (GZM+) in the analysis, it will constitute the second strongest national structure of this type after Warsaw. The cumulative combination of the potential of Katowice and Gliwice in terms of higher-tier services is responsible for strengthening the potential of the GZM+ metropolitan area. In addition, several medium-sized towns and a dozen smaller towns play an important role here, complementing each other in terms of the other market and non-market functions offered. The inclusion of metropolitan areas in the analysis also strengthens the position of the Tricity (complementarity of the higher-tier functions of Gdańsk, Gdynia and Sopot).

In the case of monocentric metropolises, irrespective of whether they were studied within their administrative boundaries or within their functional areas, the high position in the hierarchy is maintained by Krakow. In 2020, it ranked second as an independent city or third as a metropolitan area. The functional approach, on the other hand, highlights the weakness of Szczecin, whose metropolitan area has a lower rank than if we were to consider it solely within its administrative boundaries. In relation to Szczecin the statement of P. Śleszyński and K. Wiedermann (2020) that in its case we are dealing with a metropolis in the process of formation, whose development is heading towards a fully formed metropolitan structure.

An analysis taking into account the perspective of functional areas makes it possible to determine the often debated number of cities in Poland that actually meet the criteria of supra-regional metropolises: whether only

those included in the so-called 'big five', i.e., the metropolises of Warsaw, Krakow, Poznań, Tricity and Wrocław, have such a character (Śleszyński 2017; Janas 2020), or whether the Upper Silesian and Zagłębie metropolis and the Łódź metropolis, which P. Śleszyński and K. Wiedermann (2020) described as metropolises in formation. Moreover, if one accepts *the sine qua non* operation of such bipolar systems as: Warsaw-Łódź and Krakow-GZM+, then we would have two strong, complementary metropolitan structures in Poland, and then the discussion about whether GZM and Łódź are fully-fledged metropolises takes on a different dimension.

When analysing the distribution of supra-regional metropolises in the country's space, attention is drawn primarily to their absence in the eastern part. The area is still characterised by an existing development disparity, particularly evident in terms of transport infrastructure – both road and rail. In addition, the lower population density and depopulation process of the eastern provinces contribute to a relatively weaker hinterland for cities such as Lublin and Białystok. These factors also affect the relative weakness of Szczecin, which balances on the border between supra-regional metropolis and regional agglomeration.

Table 4. Rank index and surplus of market services in metropolitan areas in 2020

Metropolitan areas	Overall rank index value (1-100)			Central market services surplus index	
	total	market services	non-market services		
Warsaw (I)	100.00	100.00	100.00	0.162	very large surplus
GZM+ (II)	56.19	57.26	61.54	-0.039	slight shortage
Krakow (II)	52.41	52.90	58.87	0.115	very large surplus
Tricity (II)	48.21	48.17	56.82	0.063	large surplus
Wrocław (II)	46.54	46.97	53.17	0.099	large surplus
Poznań (II)	45.49	46.68	48.10	0.122	very large surplus
Łódź (II)	41.28	42.03	47.97	0.024	slight surplus
Szczecin (II)	32.40	33.20	38.98	0.056	large surplus

Source: compiled by ©Urban and Regional Policy Observatory

changes the perception of the position of the Bielsko-Biała agglomeration, which is promoted from eighth to second place in its group, and is thus placed just behind the Lublin agglomeration. This demonstrates the great strength and complementarity of Bielsko-Biała's hinterland. The Śląskie Province is unique in the accumulation of regional agglomerations that do not perform administrative functions for the region – in addition to Bielsko-Biała and the Rybnik agglomeration already mentioned, there is also Częstochowa. Both Bielsko-Biała and Częstochowa are former province cities, which lost this status after the change of administrative division in 1999. Their development trajectories differ significantly. Bielsko-Biała maintains its position as a strong regional centre, despite also experiencing a slight decline in population over the past decade. Częstochowa, on the other hand, is struggling with a number of problems and its depopulation rate is much higher. Radom, the only 'non-province' regional agglomeration in the Mazovian Province, is in an even more difficult situation. All regional agglomerations have more than 100,000 inhabitants, and the group – both in terms of population and central functions – is closed by the agglomerations of Koszalin (located roughly halfway between the two port metropolises of Tricity and Szczecin) and Gorzów Wielkopolski, the seat of the Lubuskie Province Office. Due to its location at the border of the province, although it is a regional centre, its scope of influence and the area served also includes parts of the West Pomeranian Province.

4th-tier centres – strong supra-local centre

The sub-regional city is a strong economic centre important for the development of its sub-region, providing nearby counties and municipalities with a full range of mid-level services such as education, health care, cultural institutions, sports infrastructure or shopping centres.

Examples of institutions specific to the 4th tier: district office, district labour office, district veterinary inspectorate, district sanitary-epidemiological station, district police station, banks, 2nd tier hospitals, secondary schools, community centres, sports halls, chain cinemas, shopping centres, innovation centres, science and technology parks.

This level seems particularly relevant to our settlement system. Many central functions are concentrated in the 4th tier centres, the quality and accessibility of which largely determine the quality and standard of living of the inhabitants not only of the cities but also of their service areas. In the case of sub-regional cities, we have not taken into account their functional



areas, as these consist almost exclusively of rural municipalities and small towns, which are devoid of significant central functions and thus have little influence in shaping the hierarchical position of the centre.

In the end, 40 cities were included in the group of sub-regional cities – bearing in mind, of course, that sub-regional functions are performed simultaneously by all higher tier centres (metropolises and regional agglomerations). The group of sub-regional cities is quite strongly differentiated in terms of size. Here we have five large cities with more than 100 000 inhabitants: Wałbrzych, Włocławek, Tarnów, Płock and the largest, Elbląg (over 115,000). At the other extreme is Zakopane, which is more than four times smaller. In this case, however, it should be borne in mind that the relatively high rank index is linked to the existence of a strong specialised function in this city, such as tourism. In addition to Zakopane, the smallest sub-regional cities (3337,000 inhabitants) include nearby Nowy Targ, Oświęcim (also located in the Lesser Poland Province) and Cieszyn, the only sub-regional centre in the Śląskie Province. It is also a rather interesting example of a sub-regional city located on a national border, whose impact and service area also includes part of the cultural region of Cieszyn Silesia on the Czech side. More than half of the centres (24 cities) are sub-regional centres with between 50,000 and 100,000 inhabitants – the largest being Kalisz, Legnica, Grudziądz, Słupsk, Nowy Sącz, Jelenia Góra and Siedlce. A further seven towns have a population of between 40,000 and 50,000.

Unfortunately, almost all sub-regional cities are depopulating – in total, they lost nearly 220,000 inhabitants between 2011 and 2021. The problem of depopulation is most acute in the central part of Poland, with cities such as the following having lost more than 10% of their population in the last decade: Włocławek, Konin, Piotrków Trybunalski. Traditionally, cities in the eastern regions are affected by depopulation, led by Chełm, Przemyśl or the more inland town of Puławy. Sub-regional cities in all other regions are also shrinking, including the largest ones – especially Wałbrzych, which is struggling with the effects of the transformation of a traditional industrial region. The exception is Ełk, the only sub-regional city in the Warmian-Masurian Province, which has recorded stable population growth since 2011. This trend only broke down in 2019.

Although sub-regional cities appear to be fairly evenly distributed across the country, their numbers are considerably smaller in the north-western part of the country and are decreasing in the north (12 sub-regional centres in Podlaskie, Warmińsko-Mazurskie, Pomorskie and Zachodniopomorskie). The large Zachodniopomorskie Province has only one sub-regional centre – Kołobrzeg, which is located close to the regional agglomeration of Koszalin. As in the case of Zakopane, Kołobrzeg's sub-regional functions are partly due to its specialisation in tourism. Only one sub-regional city is located in the Pomeranian Province. This is Słupsk. Due to its remoteness from higher-tier centres, it plays a fairly important role for the coastal area between Koszalin and the Tricity. The three smallest provinces

– Świętokrzyskie, Opolskie and Lubuskie – do not have sub-regional centres at all, but this lack is partly compensated for by the proximity of other higher-tier centres and a relatively dense network of supra-local centres and sub-regional centres located in neighbouring provinces.

It is also worth noting arrangements where two sub-regional centres are in close proximity. According to the central place theory, such a situation should not occur because there is too much overlap between service areas. In reality, however, the position of cities and the provision of central services are also indirectly influenced by specialised functions, e.g., tourism, transport hub or industry. Such pairs include Wałbrzych and Świdnica, Ostrów Wielkopolski and Kalisz, Lubin and Legnica, as well as Nowy Targ and Zakopane. In such situations, it is certainly worth considering development strategies based on cooperation and complementarity, as is the case for the cities of the Rybnik agglomeration and, since the last EU financial perspective 2014-2020 within the framework of Integrated Territorial Investments (ITA), also for the cities of Wałbrzych-Świdnica and Kalisz-Ostrów Wielkopolski. After the conglomeration of Wałbrzych and Świdnica, Ostrów Wielkopolski and Kalisz and the accumulation of their central functions, these cities could play the role of a regional agglomeration in the future, which from a spatial point of view would fit quite well into the space of their respective provinces. The Kalisz-Ostrów Wielkopolski agglomeration would additionally fill the large gap that currently exists at the level of regional agglomerations, between the metropolitan areas of Poznań, Wrocław and Łódź.

5th-tier centres – strong supra-local centres



A supra-local strong city has a central function for an area larger than the district. It has similar mid-tier central services to the sub-regional city, although its offer may be slightly narrower and less diverse. It is usually an economic centre with a supra-local labour market. For its hinterland, it has administrative, service, educational, commercial and cultural roles.

Examples of institutions specific to 5th tier: district office, district employment office, district veterinary inspectorate, district sanitary-epidemiological station, district police station, banks, 1st-tier hospitals, secondary schools, language schools, community centres, cinema, sports halls, swimming pools.

The results of the survey indicate that the group of such centres in Poland is quite numerous. 131 supra-local centres of strength were identified. All are district towns (district seats), 24 cities in this group are cities with district rights. The group of cities with supra-local functions is quite diverse in terms of size as well as demographics. In terms of population,

the largest supra-local towns are strong with more than 60,000 inhabitants and are: Stargard (over 67,000) in the West Pomeranian Province, Ostrowiec Świętokrzyski in the Świętokrzyskie Province and Głogów in the Lower Śląskie Province. Five other cities are centres with 50,000 inhabitants (Tomaszów Mazowiecki, Tczew, Stalowa Wola, Kędzierzyn-Koźle and Bełchatów). In contrast, the smallest strong supra-local centres – Węgrów in the Mazowieckie Province and Miechów in the Małopolskie Province – have a population of between 11,000 and 12,000. the 46 supra-local strong cities (35%) are statistically classified as small cities, with a population of less than 20,000. A further 77 supra-local strong cities (59%) are in the category of smaller medium-sized cities, with populations between 20,000 and 50,000.

The vast majority of these centres are subject to demographic shrinkage, although it is worth noting a group of a dozen or so strong supra-local centres in the Wielkopolskie Province and a few around the Warsaw metropolitan area, which have maintained a positive population balance between 2011 and 2021.

Due to their considerable size, strong supra-local centres can be found in all regions of the country, although their density obviously increases in more densely populated areas. In contrast, in these less densely populated areas, the role of strong supra-local cities may be relatively more important, as they complement the polycentric urban network, especially in those regions where sub-regional centres have not developed.

6th-tier centres – supra-local centres



A supra-local centre is usually a smaller city that acts as a district or municipal centre. It offers basic services including secondary schools, primary schools, shops, services, primary health care and local cultural institutions.

Examples of institutions specific to the 6th tier: municipal office, health centre, community centre, library, basic retail outlets, post office, beauty services, hairdressing services.

This group of cities is even larger, with 168 centres forming irregular clusters in the national space. Some stand alone, serving a fairly extensive area, such as Bytów and Miastko in the Pomeranian Province or Włodawa in the Lublin Province. 88 towns in this group (52%) are district seats, while the rest are municipalities. Only four cities (2%) of this type are medium-sized towns with more than 20,000 inhabitants, of which three are in the Lower Silesian Province (Bielawa, Świebodzice and Nowa Ruda) and one (Działdowo) in the Warmian-Masurian Province. As in the case of sub-regional cities,

the rank of the seven smallest cities in this group (35 thousand inhabitants) is strengthened by their specialised tourist function (e.g., Kazimierz Dolny, Nałęczów, Duszniki-Zdrój, Karpacz, Międzyzdroje). 68 supra-local centres (41%) are towns between 5,000 and 10,000 inhabitants, and the largest group is made up of 90 towns (54%) between 10,000 and 20,000 inhabitants. The vast majority are subject to shrinkage, although we will also find examples of growth centres. However, given the size of these cities in absolute terms, these are not large changes.

7th-tier centres – local centres



A local centre is a locality that plays a central role for the immediate area. The provision of central services in such centres aims to meet the basic daily needs of residents and to provide a minimum of public and private infrastructure, such as a primary school, grocery shop, post office, pharmacy or hairdresser.

Cities of this type make up by far the largest group, with 454 centres – almost half of all centres with urban rights in Poland. All the towns in this group are small and only four have slightly more than 10,000 inhabitants (Boguszów-Gorce, Głuchołazy, Zdieszowice and Kowary). The vast majority are – statistically speaking – micro towns (less than 5 000 inhabitants). From the point of view of the provision of basic central services, they are not fundamentally different from most municipal centres that are rural settlements, and it is likely that many municipal villages rank higher than those that have been granted urban rights. Suffice it to say that the smallest town in the surveyed set, Opatowiec in Świętokrzyskie Province, has a population of only 314 inhabitants, more than 40 times less than Kozy in Silesia Province, which is formally a village.

The density of local centres correlates with the overall population density in each part of Poland. The smallest number of such centres is in the Pomorskie Province – the western and central parts of the region are almost completely devoid of them. Wielkopolska, on the other hand, abounds in local centres – it is, after all, the region with the largest number of cities overall.

Characteristics of the distinguished hierarchical levels of cities distinguishing between central market and non-market functions

Considering the perspective of the economic power of a city, it is important to distinguish between central functions with a public service character and central services with a market character. Although there is an interdependence between the two, it is primarily market services that demonstrate the economic potential of the city.

Rank – market services

The distribution of central market services relates strongly to the total synthetic rank index. **At the top three levels of the hierarchy considering urban functional areas, the results of the delimitation based on total rank and rank of market activities are almost identical.** Noticeable, small differences are only found within 3rd tier, where, for example, the Bydgoszcz UFA has a higher index value in terms of market services than the Bielsko-Biała UFA, the Kielce UFA ahead of the Toruń UFA, the Częstochowa UFA ahead of the Olsztyn UFA, and the Zielona Góra UFA ahead of the Opole and Radom UFAs.

In terms of market services, the lower position of sub-regional cities, as well as supra-local cities, is evident. In relation to the synthetic index, five sub-regional centres (Skierniewice, Sieradz, Nowy Targ, Ciechanów and Oświęcim – 13%) and forty supra-local strong centres (31%) were characterised by a lower position in relation to the total rank, with only three cities from the latter group of cities (Głogów, Stargard and Świnoujście) moving up in the hierarchy.

At level VI of the hierarchy, in the group of strong supra-local cities, no significant shifts were observed in relation to rank overall. Ustroń was promoted by one tier, whose stronger position in market services is due to the marshalling nature of the town in relation to the surrounding mountain areas. A slightly larger number of cities (7) recorded a decrease compared to the rank overall: Nasielsk, Kazimierza Wielka, Więcbork, Ciechanowiec, Duszniki-Zdrój, Sejny and Koniecpol.

In contrast, in the group of local cities (7th tier), 10 cities (2%) recorded an increase in hierarchy by one tier compared to the rank overall. These include: Koźmin Wielkopolski, Kruszwica, Bukowno, Głuchołazy, Twardogóra, Terespol, Łochów, Łądek-Zdrój, Czersk and Czaplonek.

Rank – non-market services

The distribution of non-market central services relates much less than market services to the total synthetic rank index. The rank of cities in terms of non-market services strengthens primarily the position of the 7th to 4th tier centres, i.e., local centres (93%, of which 7% saw their position rise by two tiers), supra-local centres (89%, of which more than half improved their position by as many as two tiers), supra-local strong centres (100%) and sub-regional centres (53%). **At the top three levels of the hierarchy considering urban functional areas, the results of the delimitation based on total rank and rank of non-market activities are almost identical.** The only promotion by one 1st tiers shown by the Lublin UFA.

Differentiation of centres in terms of surplus/shortage of central market services

The degree of development of market services is considered a good measure of the economic strength of cities based on serving their hinterland. An important diagnostic index here is the surplus or shortage of central market activities in relation to the population.

Not surprisingly, both the capital metropolis and the other supra-regional metropolises (with the exception of the MC of Katowice) are characterised by a significant surplus of central market services relative to population (Fig. 11). At the same time, the metropolitan centres are quite strongly differentiated in terms of the index studied. The surplus of market services is very high, as for the cities themselves, for the MCs of Warsaw, Poznań and Krakow. In relation to the other metropolises (MC of Wrocław, Tricity and Szczecin) it is large or insignificant (MC of Łódź – see Fig. 11). The lower position of the MC of Łódź and the MC of Katowice (GZM+), which is the only one of the metropolises to record a slight shortage of central market services, is the result of the unfinished process of transformation of the (post-)industrial economies. At the same time, in the case of the MC of Katowice (GZM+), it should be emphasised that this problem does not affect the city of Katowice itself, which has a strong position among the metropolises, but is a result of the weakness of the other cities in its hinterland (with the exception of 7 cities: Gliwice, Tarnowskie Góry, Mikołów, Sławków, Łazy, Sośnicowice and Siewierz).

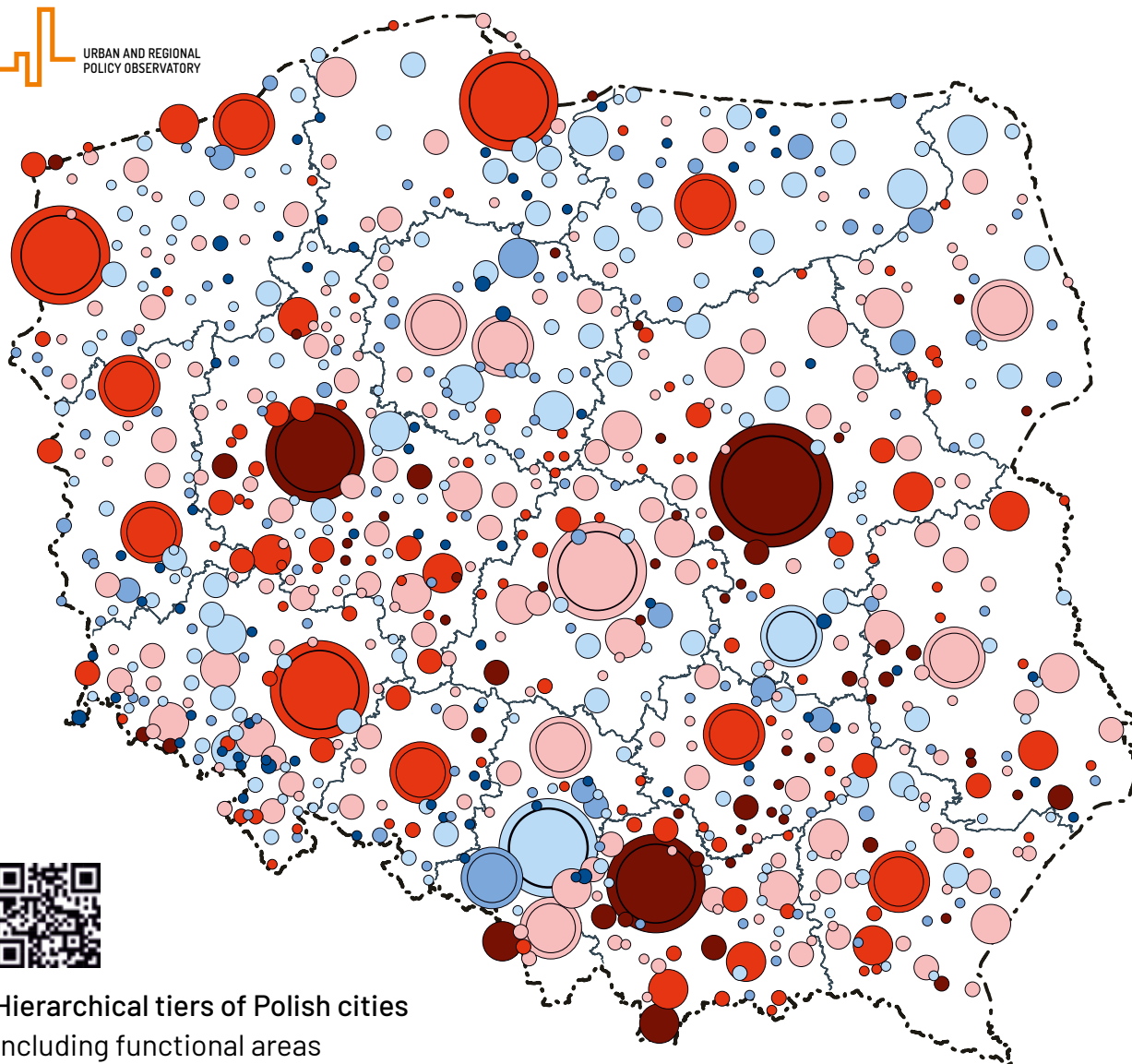
Regional agglomerations (tier III of the hierarchy) are mostly characterised by a surplus of central market services. However, this surplus is lower and more diverse than for metropolitan centres and does not apply to all cities at this level. Seven out of 16 agglomerations have a clear surplus from this group. Four of them even have comparable or higher values than the Tricity or Szczecin MC. These include: UFAs of Koszalin, Opole, Rzeszów and Olsztyn. The other three agglomerations are Kielce, Gorzów Wielkopolski and Zielona Góra. On the other hand, there is a slight surplus in agglomerations located in the Śląskie (Bielsko-Biała and Częstochowa), Kujawsko-Pomorskie (Toruń and Bydgoszcz) and two Eastern Polish provinces: Lubelskie (Lublin) and Podlaskie (Białystok). The only agglomerations with a shortage of central market functions in relation to their size are Radom (slight shortage) and the Rybnik agglomeration (high shortage).

In the group of sub-regional cities (4th order of the hierarchy), the vast majority of cities (78%) recorded a functional surplus, of which $\frac{2}{3}$ were characterised by a large surplus. The other cities in this group recorded a slight shortfall, with only Grudziądz recording a large shortfall. However, the group of cities with a shortage of central market services has the potential to generate development impulses using specialised activities and a correspondingly large labour market. All of them recorded an employment surplus of up to 5,000, and in the case of Mielec even more than 5,000, and were among the centres balancing development – with the exception of Ełk.

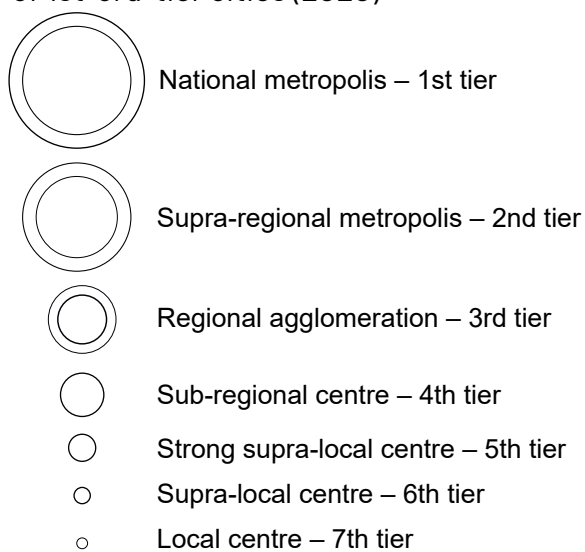
In the case of the cities of the other tiers, there is a large or very large surplus of central market services for tourist destinations, including Karpacz, Kazimierz Dolny and Zakopane. When it comes to the selection of market-based central services, the group is dominated by 6th- and 7th-tier and cities (83%).

The degree of development of market services is considered a good measure of the economic strength of cities based on serving their hinterland.

An important diagnostic index here is the surplus or shortage of central market activities in relation to the population.



Hierarchical tiers of Polish cities including functional areas of 1st-3rd-tier cities (2020)



Surplus/deficit of central market services

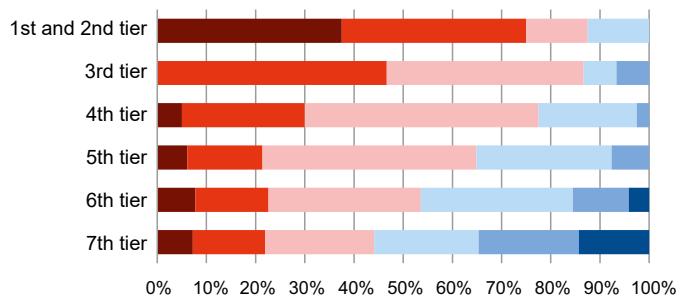


Fig. 11. Urban functional hierarchy in Poland in 2020 including functional areas for 1st- 3rd tier centres in terms of surplus/shortage of central services

Link to map on Urban Geoportal: <https://tinyurl.com/3b9yu8xc>

Remark: *Delimitation of urban functional areas (1st- 3rd tier) per: P. Śleszyński and T. Komornicki (2016), in the case of the GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

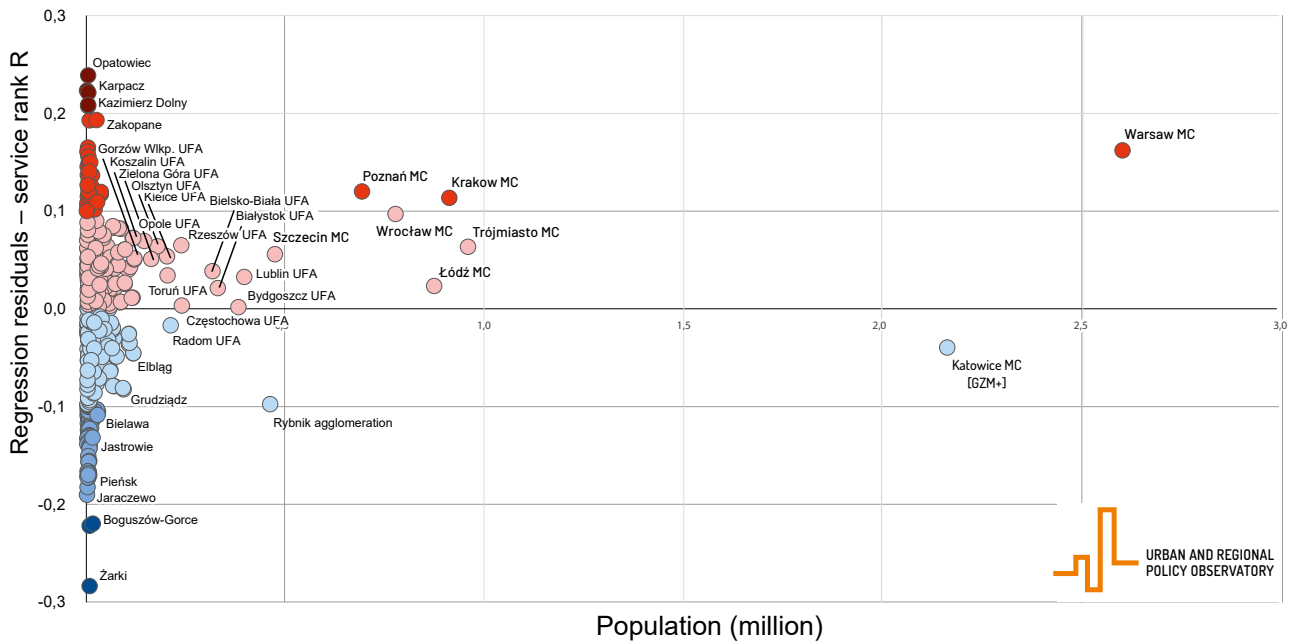


Fig. 12. Urban functional hierarchy in Poland in 2020 with consideration of functional areas for 1st- 3rd- tier centres in terms of surplus/ shortage of central services – graph

Source: compiled by ©Urban and Regional Policy Observatory

Changes in the urban functional hierarchy from 1990 to 2020 taking into account functional areas for 1st-3rd tier centres

The urban network and settlement hierarchy are among the structures of long duration. However, this does not mean that they are not subject to transformation and modification. The most spectacular changes are related to the emergence of new centres as a result of political factors (e.g., decisions to build a new city, to give administrative functions) or the decline of cities as a result of catastrophic events. However, a number of other economic and social factors influence the transformation of the structure. Under the conditions of a centrally controlled economy under the socialist system, the flourishing of central market functions in Polish cities was severely limited. The distribution of many non-market services was also sometimes far from economically rational. However, it is worth mentioning that Christaller's theory, developed under conditions of a free market economy, was also used by Polish planners in establishing the first post-World War II national plan study (Chmielewski et al. 1948, Fig. 13).

After 1989, again, to a much greater extent than by the action of planners, issues of availability and distribution of many central services and goods began to be shaped by economic processes and the principles of the free-market economy.

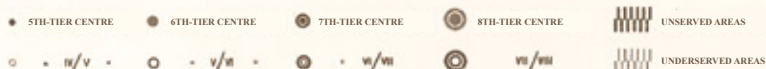
Comparing the index of central services in Polish cities (including UFAs for first- and third-tier centres) is not a straightforward task, not only because of the difficulty of identifying central services in cities more than 30 years ago, but also because of the changing role and importance of various types of services or service activities and the emergence of new central functions. Therefore, the results presented below should not be taken literally. Nonetheless, the use of data from an analogue source, such as telephone directories, which have now been forgotten, has ultimately produced interesting results, quite accurately approximating the changes

Within the framework of this report, it was decided to include the eight metropolitan areas most frequently mentioned in the Polish literature, namely: Warsaw, Krakow, the Tricity, Wrocław, Poznań, Łódź, Katowice and Szczecin. The majority of these maintained rank II in the settlement hierarchy in both 1990 and 2020, demonstrating the basic stability of the metropolitan structure.

NATIONAL PLAN STUDY



THEORETICAL SPHERES OF INFLUENCE OF EXISTING URBAN CENTRES



CHIEF SPATIAL PLANNING OFFICE
OFFICE OF STUDIES

Fig. 13. Classification of urban centres in the 1948 National Plan Study

Source: J. Chmielewski et al. (1948: board II 41, modified for translation purposes)

that also occurred in the country's settlement structure during the period of socio-economic transformation.

Within the framework of this report, it was decided to include the eight metropolitan areas most frequently mentioned in the Polish literature, namely: Warsaw, Krakow, Tricity, Wrocław, Poznań, Łódź, Katowice and Szczecin (see Table 5). The majority of these maintained rank II in the settlement hierarchy in both 1990 and 2020, demonstrating the basic stability of the metropolitan structure. The exception to this rule is the issue of a surplus of central market services compared to the population. Over the last thirty years, for most metropolitan areas there has been a decline in this index in relation to the core centre. The metropolitan areas breaking out of this trend are the MC of Wrocław, whose surplus index of central market services increased minimally in the period under consideration (from 0.095 to 0.122), and Szczecin (from 0.044 to 0.056 – see chapter *Changes in surplus of central market services between 1990 and 2020*).

Analogous to the 2020 study, seven levels of the settlement urban hierarchy in Poland were distinguished for 1990 based on the values of the overall rank index (Fig. 14). A look at a map comparing the overall ranking of the urban hierarchy between 1990 and 2020 (Fig. 15) shows a picture of change within the settlement system. Of the 781 urban centres included in the analysis, as many as 624 (79%) have remained at their initial rank in the hierarchy over the thirty years, 71 (9%) have downgraded, 86 (11%) have seen an increase (Tab. 6). The provinces leading the way in terms of the number of centres improving their rank over a thirty-year period were, in order: Wielkopolskie (16 centres), Mazowieckie (13), Dolnośląskie (10) and Małopolskie (9). Five provinces are characterised by a situation in which the number of centres experiencing promotion and decline practically balances out (Lower Silesia, Warmia-Masuria, Lublin, Lubusz, Silesia). For a further five provinces, a greater number of cities experienced a drop in position in the hierarchy than a promotion. These are the following provinces: Podkarpackie (-6), Kujawsko-Pomorskie (-5), Opolskie (-4 balance), Świętokrzyskie (-3) and Pomorskie (-2).

The inclusion of metropolitan areas in the analysis of changes in the urban functional hierarchy widens the possibilities for interpreting the data (Tab. 5). The grouping of several towns together with their hinterland leads to a change of position in the settlement hierarchy. Compared to its basic version, established only for cities within their administrative boundaries, the classification taking into account functional areas shows more clearly the share of metropolises in the settlement network structure. **The concentration of the urban population increased from around 27 to more than 42% in 1990, and for 2020 the described change in structure represents a jump from 25 to more than 41%.** Adopting the perspective of metropolitan areas has the greatest impact on the position of the cities of the Katowice conurbation (GZM+).

It should be recalled that although both the city of Katowice and the MC of Katowice (GZM+) are ranked second, individually Katowice is only seventh in the ranking. If, however, all cities of the Katowice conurbation are included in the analysis, the metropolitan area in question will constitute the second strongest national structure of this type after Warsaw.

Table 5. Characteristics of metropolitan areas in Poland in 1990 and 2020

Metropolitan areas (rank in 2020)	Overall rank index value (1-100)		Value of overall rank index – market services (1-100)		Value of overall rank index – non-market services (1-100)		Central market services surplus index	
	1990	2020	1990	2020	1990	2020	1990	2020
Warsaw MC (I)	100.00	100.00	100.00	100.00	100.00	100.00	0.355	0.162
Katowice MC (II)	65.15	56.19	63.02	57.26	66.55	61.54	0.136	-0.039
Krakow MC (II)	55.27	52.41	51.39	52.90	57.64	58.87	0.214	0.115
Tricity MC (II)	48.88	48.21	45.91	48.17	50.78	56.82	0.152	0.063
Poznań MC (II)	48.27	46.54	39.55	46.97	52.93	53.17	0.129	0.099
Wrocław MC (II)	44.95	45.49	37.14	46.68	49.18	48.10	0.095	0.122
Łódź MC (II)	44.67	41.28	38.36	42.03	48.21	47.97	0.050	0.024
Szczecin MC (II)	36.72	32.40	28.84	33.20	40.85	38.98	0.044	0.056

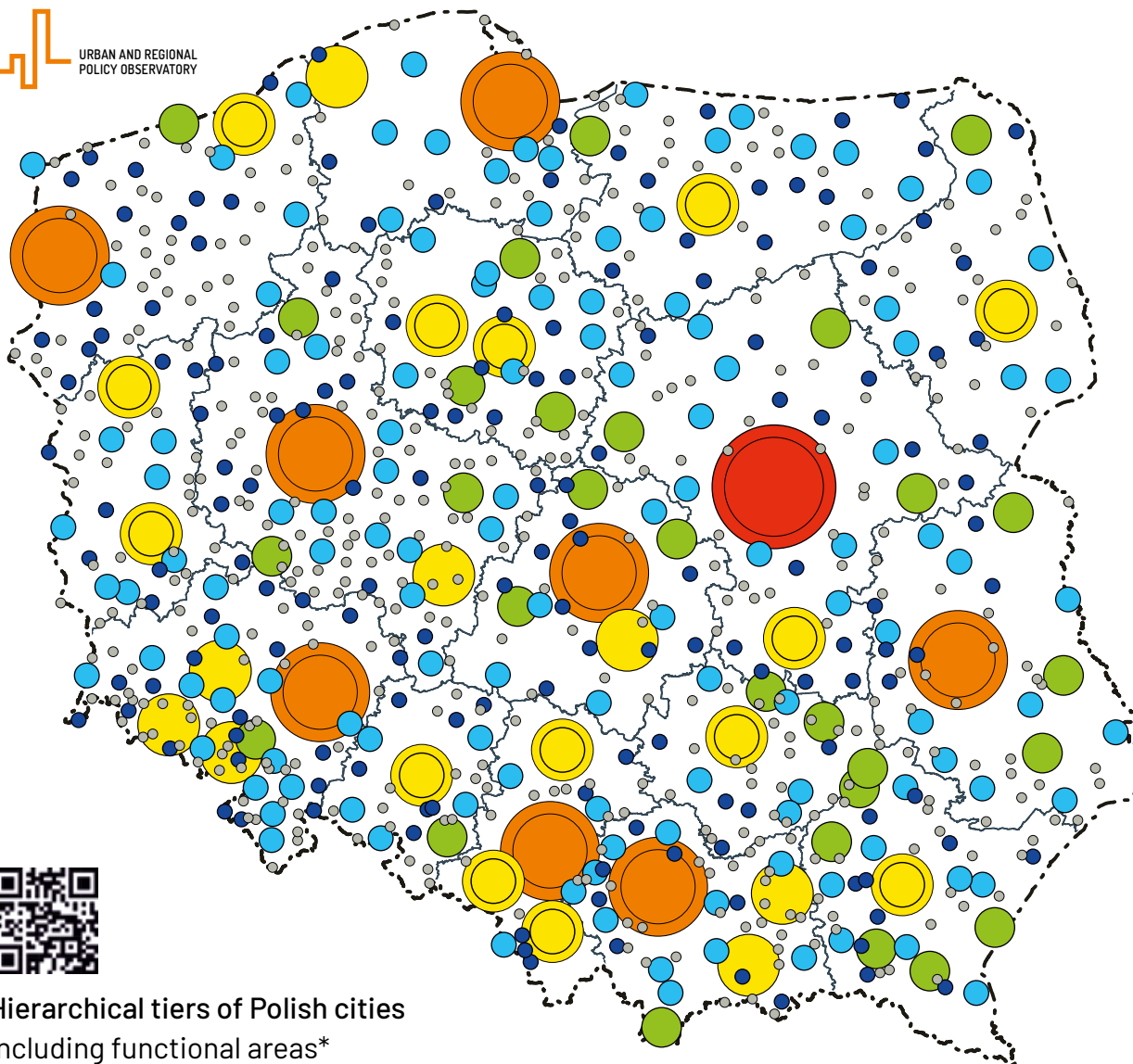
Source: compiled by ©Urban and Regional Policy Observatory

Table 6. Urban hierarchy in Poland 1990–2020. Number of cities experiencing promotion and relegation by province

No.	Name of the province	Balance of change	Number of centres experiencing promotion	Number of centres experiencing a decline
1st	wielkopolskie / Greater Poland	↑	16	4
2	mazowieckie / Mazovian	↑	13	1
3	dolnośląskie / Lower Silesian	●	10	11
4	małopolskie / Lesser Poland	↑	9	6
5	zachodniopomorskie / West Pomeranian	↑	6	3
6	łódzkie / Łódź	↑	6	5
7	warmińsko-mazurskie / Warmian-Masurian	●	5	5
8	lubelskie / Lublin	●	4	3
9	podlaskie / Podlachian	↑	3	1
10	lubuskie / Lubusz	●	3	3
11	opolskie / Opole	↓	3	7
12	kujawsko-pomorskie / Kuyavian-Pomeranian	↓	3	8
13	śląskie / Silesian	●	2	0
14	pomorskie / Pomeranian	↓	1st	3
15	świętokrzyskie / Holy Cross	↓	1st	4
16	podkarpackie / Subcarpathian	↓	1st	7
Total		↑	86	71

↑ significant increase ↓ significant decrease ● no major change

Source: compiled by ©Urban and Regional Policy Observatory



Hierarchical tiers of Polish cities including functional areas* of 1st- 3rd-tier cities (1990)

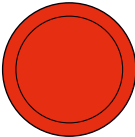
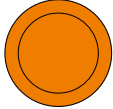





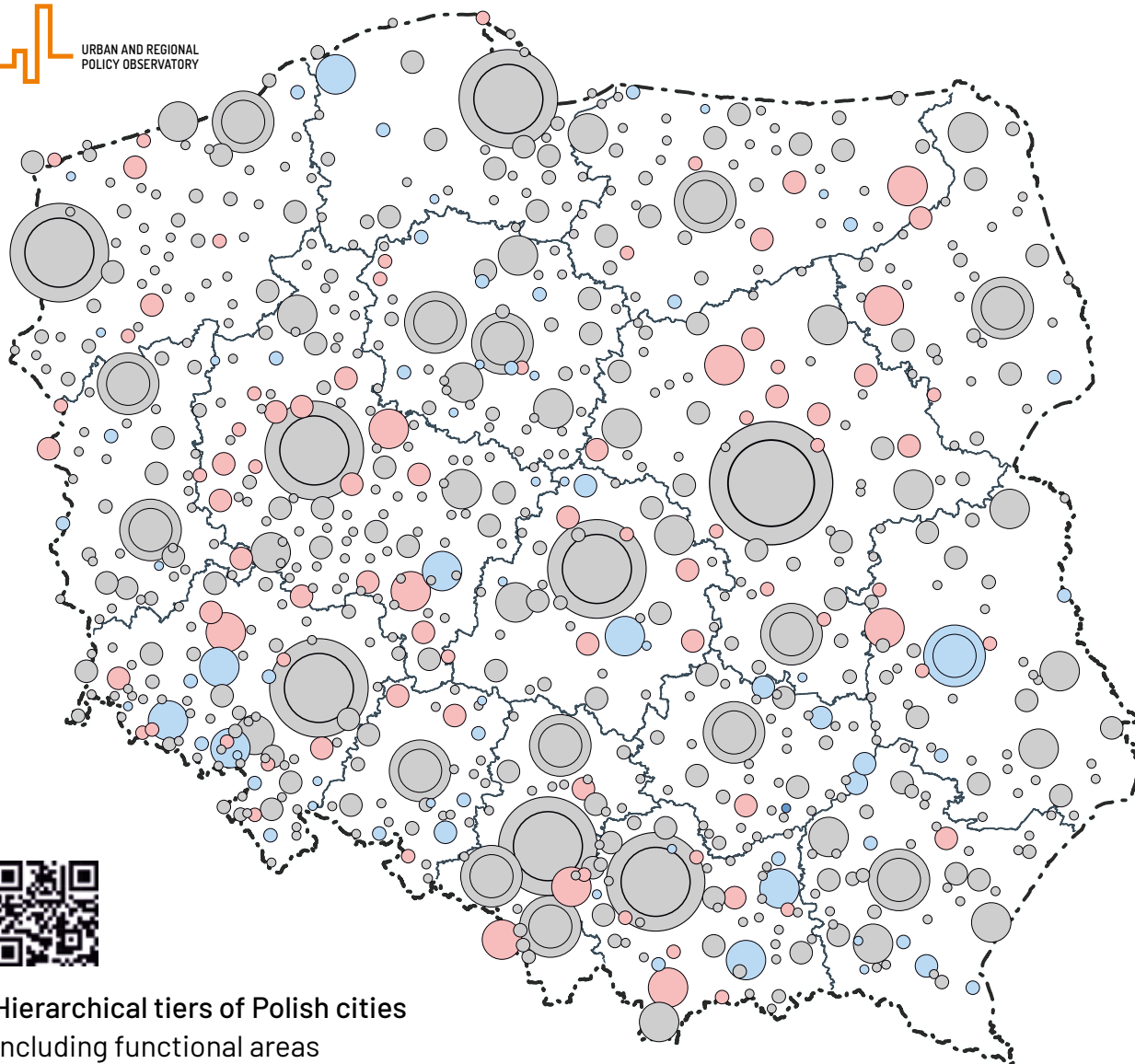
-  National metropolis – 1st tier
-  Supra-regional metropolis – 2nd tier
-  Regional agglomeration – 3rd tier
-  Sub-regional centre – 4th tier
-  Strong supra-local centre – 5th tier
-  Supra-local centre – 6th tier
-  Local centre – 7th tier

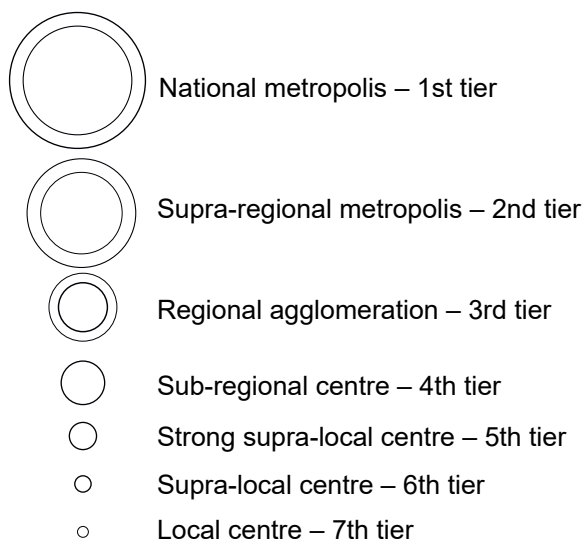
Fig. 14. Urban functional hierarchy in Poland in 1990 including functional areas for 1st- to 3rd-tier centres

Link to map on Urban Geoportal: <https://tinyurl.com/dn55h62d>

Attention: *Delimitation of urban functional areas (1st- to 3rd-tier) per: P. Śleszyński and T. Komornicki (2016), in the case of the GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poreba and Łazy.



Hierarchical tiers of Polish cities including functional areas of 1st-3rd-tier cities (2020)



Change in levels of urban functional hierarchy 1990-2020

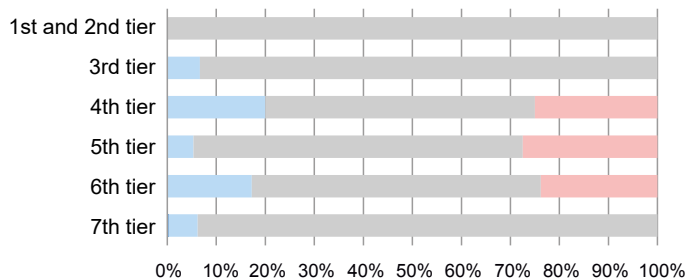
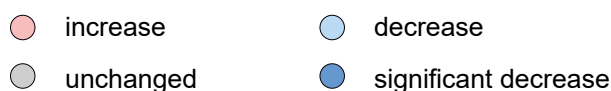


Fig. 15. Change in the urban functional hierarchy in Poland 1990-2020 with consideration of functional areas for first- and third-tier centres
Link to map on Urban Geoportal: <https://tinyurl.com/2e5xbrs3>

Attention: *Delimitation of urban functional areas (1st- to 3rd-tier) per: P. Śleszyński and T. Komornicki (2016), in the case of GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

Whether we consider the hierarchy for the cities themselves or for the MCs, Krakow's position is high. In both 1990 and 2020, it maintains a second (as a city) or third place (as a metropolitan area). The inclusion of metropolitan areas also strengthens the position of Tricity (up from 6th to 4th position), and to a lesser extent Poznań and Wrocław. In the case of Szczecin, on the other hand, a different situation is observed, where the inclusion of the city in the context of a metropolitan area results in a worsening of its position. Both in 1990 and thirty years later, the city, taken on its own, is positioned as a 2nd-tier centre. Although Szczecin does not rank high on the list of supra-regional metropolises, it is superior to Lublin in terms of its component parameters (central market and non-market services). However, when we consider the Szczecin MC, it appears that it would be in the group of regional cities today, not supra-regional metropolises. The weakness of this city's population and functional base should be cited as a reason for this. The cities in Szczecin's surroundings represent the fifth, sixth and even seventh order in the hierarchy and show weak or moderately weak nodality in relation to their hinterland. The service index (index of hinterland population to city population) is the lowest among the group of supra-regional metropolises, which is mainly due to the low population density in areas with high forest cover and lakes. What more, the localities of the Szczecin agglomeration have been characterised by a long-term negative demographic trend for the last thirty years (real attrition, see Piech et al. 2024; Rudewicz 2024).

The value of the surplus index of central market functions (14) accentuates the significant disproportion between the group of cities that have longer metropolitan traditions and already before the industrialisation era concentrated higher tier service functions (Warsaw, Krakow, Wrocław, Gdańsk, Poznań) and post-industrial metropolises that emerged as important elements of the country's settlement network only in the 19th century (Katowice with other cities of the Katowice conurbation, and Łódź).

In summary, the Western research perspective treats Warsaw only as a low-ranking metropolitan centre. Other Polish cities are not recognised as metropolises because their importance for the flow of capital, transport and communication is too small. An explanation for this can be found in the macro-structural perspective, according to which Poland's position remains semi-peripheral within the global distribution of economic advantage (Jasiecki 2013).

At the same time, it is worth emphasising that thanks to the development and strengthening of supra-regional metropolises after 1989, excessive polarisation between Warsaw, as a national metropolis, and the rest of the country has been avoided in Poland, although the capital's advantage over other centres remains clear.

In addition to the metropolitan areas, fifteen functional areas have been identified, the cores of which are made up of cities of regional character (Tab. 7). By far the strongest among them is the Lublin UFA, which was characterised in 2020 by a significant advantage over other regional

agglomerations in all categories of the hierarchy, but it was strongest in the area of non-market services. It should be noted that in 1990 Lublin was classified as a supra-regional city (2nd tier, Tab. 7) A factor that led to the weakening of the rank of the Lublin UFA between 1990 and 2020 was the much weaker growth of market services relative to centres with similar population potential, which may have been due to the strong decline in population across the Lublin province over the last thirty years (Piech et al. 2024), in addition to the city's peripheral location in relation to the main economic development bands.

Also notable is the high position of the Bielsko-Biała UFA, surpassing all other centres, including those that have been provincial cities since 1999. Behind the high position of the Bielsko-Biała UFA is its residential attractiveness, strong local entrepreneurship and a diversified structure of industrial activities, which together drive the development of business services and consumer services for the population.

Overall – in 2020, five groups of UFAs can be distinguished on the basis of an overall rank index for regional centres:

- a) strongest Lublin;
- b) Bielsko-Biała, Bydgoszcz and Białystok;
- c) Rzeszów, the Rybnik agglomeration, Toruń, Kielce, Olsztyn and Częstochowa;
- d) Radom, Opole and Zielona Góra;
- e) Koszalin and Gorzów Wielkopolski, which have the lowest index value.

Compared to the situation in 1990, the position of Bielsko-Biała and Bydgoszcz has increased relatively. The Rybnik agglomeration, the Toruń UFA and the Radom UFA also recorded an increase of several positions compared to 1990. The UFAs of Rzeszów, Częstochowa, Opole and Gorzów Wielkopolski were relatively stable. On the other hand, the UFAs of Kielce, Olsztyn, Zielona Góra and Koszalin, in addition to the aforementioned Białystok UFA, recorded a decline of several positions, while the largest decline was recorded in Opole.

In the timeframe 1990–2020, some population consolidation of the metropolitan areas of the described rank is taking place. Although they concentrate a slightly smaller percentage of the urban population than three decades ago (down from 17.6 to 16.1 per cent), the median value indicating the size of their population increases significantly (from 141,000 to 210,000). It is additionally worth noting in this context that eight cities have fallen out of the regional agglomeration level over a period of thirty years: Jelenia Góra, Legnica, Wałbrzych, Piotrków Trybunalski, Nowy Sącz, Tarnów and Słupsk. Their common feature is their status as provincial capitals before the 1999 local government reform. Some of them are also located in the western part of the Lower Silesia Province.

Table 7. Characteristics of functional areas of tertiary cities in Poland in 1990 and 2020

Functional areas	Overall rank index value (1-100)		Value of overall rank index – market services (1-100)		Value of overall rank index – non-market services (1-100)		Central market services surplus index	
	1990	2020	1990	2020	1990	2020	1990	2020
Lublin UFA	34.89	29.69	30.35	28.86	37.54	38.29	0.093	0.033
Bielsko-Biała UFA	28.77	26.13	28.43	26.10	29.32	31.85	0.094	0.038
Bydgoszcz UFA	28.37	25.90	25.19	26.23	30.36	30.52	0.008	0.002
Białystok UFA	29.99	25.70	27.17	25.56	31.82	33.50	0.093	0.021
Rzeszów UFA	27.55	24.15	25.07	24.03	29.19	32.08	0.137	0.066
Rybnik agglomeration	22.46	22.59	23.48	23.02	22.26	27.26	-0.035	-0.097
Toruń UFA	22.71	21.98	17.31	20.66	25.55	31.78	-0.048	0.035
Kielce UFA	26.44	21.78	24.41	21.38	27.86	28.76	0.091	0.055
Olsztyn UFA	25.84	21.42	22.66	20.69	27.81	28.81	0.100	0.064
Częstochowa UFA	23.68	21.01	22.35	20.88	24.75	27.80	0.003	0.004
Radom UFA	19.34	19.52	20.61	18.74	19.00	27.88	0.011	-0.016
Opole UFA	26.06	19.43	23.92	18.79	27.53	26.91	0.148	0.071
Zielona Góra UFA	24.85	19.05	21.46	19.07	26.90	24.89	0.110	0.051
Koszalin UFA	22.05	17.36	22.53	16.99	22.16	23.99	0.153	0.073
Gorzów Wielkopolski UFA	17.60	16.92	20.05	16.55	16.54	22.90	0.094	0.052

Source: compiled by ©Urban and Regional Policy Observatory

The period under consideration is associated with a significant increase in the number of sub-regional cities, the fourth tier of the hierarchy presented. For 2020, 40 can be identified, which is 11 more centres compared to 1990. At the same time, the share of the urban category in the total urban population has been increasing over the three decades, from 7.9 to 11.7 per cent. Invariably, sub-regional cities remain centres with a population of around 60,000. Today, the vast majority of sub-regional cities are centres that lost their status as provincial capitals in 1999.

The next distinguished rank consists of strong supra-local centres. 128 cities could be assigned to this category in 1990, which was only five fewer than in 2020. Despite this similar stock of cities, their list has fluctuated more over the three decades. Seven sub-regional cities fell to the status of strong supra-local centre in 1990 (Sandomierz, Kutno, Kędzierzyn-Koźle, Sanok, Ostrowiec Świętokrzyski, Skarżysko-Kamienna, Tarnobrzeg). On the other hand, as many as 36 towns and cities (e.g., Bełchatów, Namysłów, Rawa Mazowiecka) were promoted to the rank of strong supra-local cities during this period. In this category, cities with a population of around 23,000 people dominate, and this is similar to the figure from thirty years ago.

The list of rank VI cities opens with Lubań, Polkowice and Strzelin. Supra-local centres were characterised by an even smaller population (median = 10,600 people). In the time horizon considered, i.e., over the period 1990-2020, a stabilisation of their share of the population at around 8.5% can be observed.

Both in 1990 and today, the category of local centres is the most represented. At the same time, it should be noted that although their number has increased from 433 to 456 over the three decades under consideration, the statistics that define their population situation have remained practically similar (a median population of around 3,000 and a 7 per cent share of the total urban population).

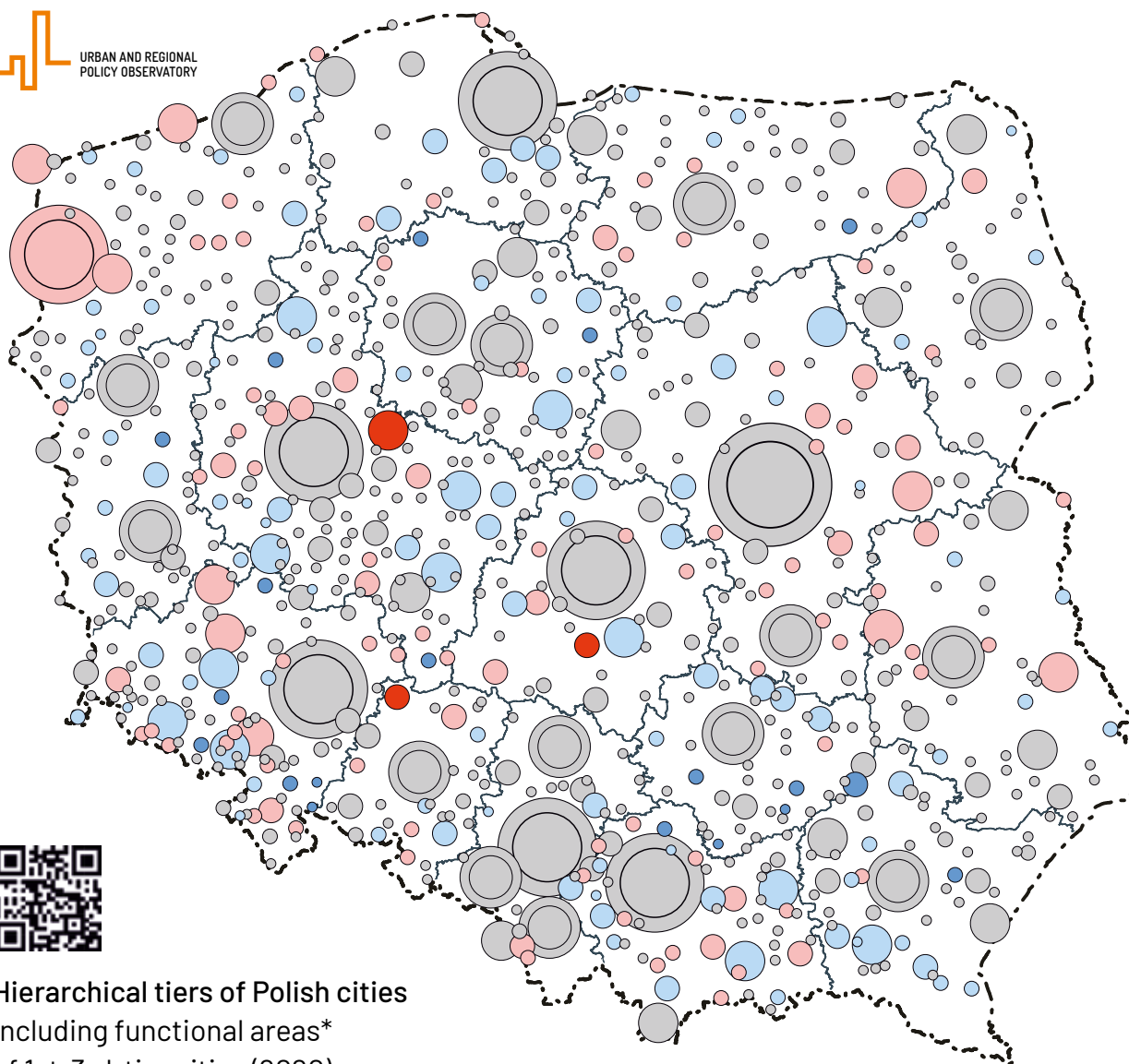
Changes in the hierarchy of market and non-market services between 1990 and 2020

It is interesting to look separately at the two main components that make up the overall rank – namely the central market services ratio and the non-market services ratio. The map of the transformation of the hierarchy according to the measure of concentration of central market services shows a fundamental stabilisation in terms of first- to third-tier centres. Of these, it is worth noting that only the Szczecin metropolitan area has experienced a promotion, jumping from the status of regional agglomeration to supra-regional metropolis (Fig. 16). Furthermore, the lower tier cities of Świnoujście (5th), Kołobrzeg (4th) and Drawsko Pomorskie (6th), located in the joint province and in relatively close proximity, have also increased the range of market services on offer.

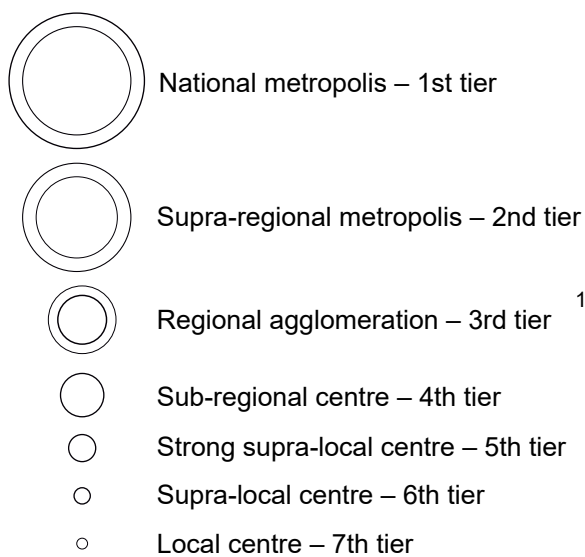
A common feature of all other metropolitan areas, apart from remaining within the same rank as thirty years ago, is an increase in the value of the market services concentration index. The only area breaking out of this trend is the Katowice MC (GZM+), which appears to be concentrating market services to a lesser extent than three decades ago. With the deterioration of this reading for the referenced metropolitan area comes a negative surplus value for market services in 2020. The greatest improvement in market potential was in the Poznań and Wrocław MCs. With the strengthening of the metropolitan area in the case of the Wielkopolskie and Dolnośląskie provinces, the situation within the hinterland is improving. For Wielkopolska and Lower Silesia, the largest numerical increase (next to Mazovia and Lesser Poland) in the number of cities improving their position in the hierarchy according to the market services concentration index is observed. It is followed by 13 and 17 cities out of 108. What additionally stands out for the Wrocław metropolitan area is the surplus of central market services, which is growing the most next to the metropolis of the capital Warsaw.

Within the tertiary forming urban functional areas, there is no change in terms of the rank of concentration of market services in thirty years. Within the same tier, all functional areas are weakening in the area of the referenced index. The only exception to this rule is the Toruń UFA, for which the value of the coefficient increases slightly.

Looking at the referenced rank more broadly, we recall that in 1990 it was not only constructed by the cities with functional areas given earlier (Tab. 7), but the status of regional agglomerations also fell to several cities considered individually. The abstracted market services concentration index is no different. Over the course of three decades, as many as 15 cities in terms of market offer have fallen from the circle of regional agglomerations to lower



Hierarchical tiers of Polish cities including functional areas* of 1st-3rd-tier cities (2020)



Change in levels of urban functional hierarchy 1990-2020 – central market services

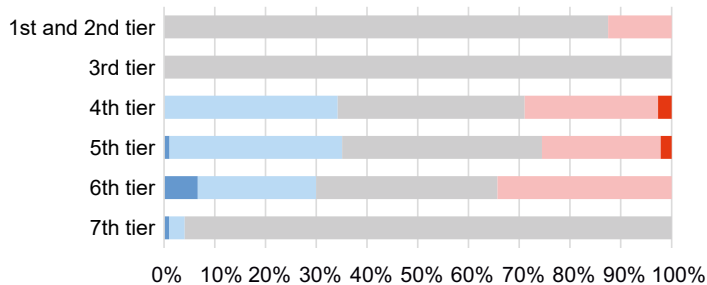
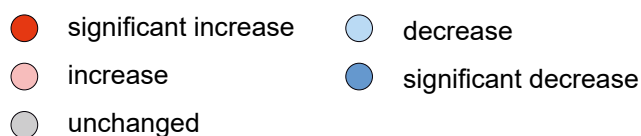
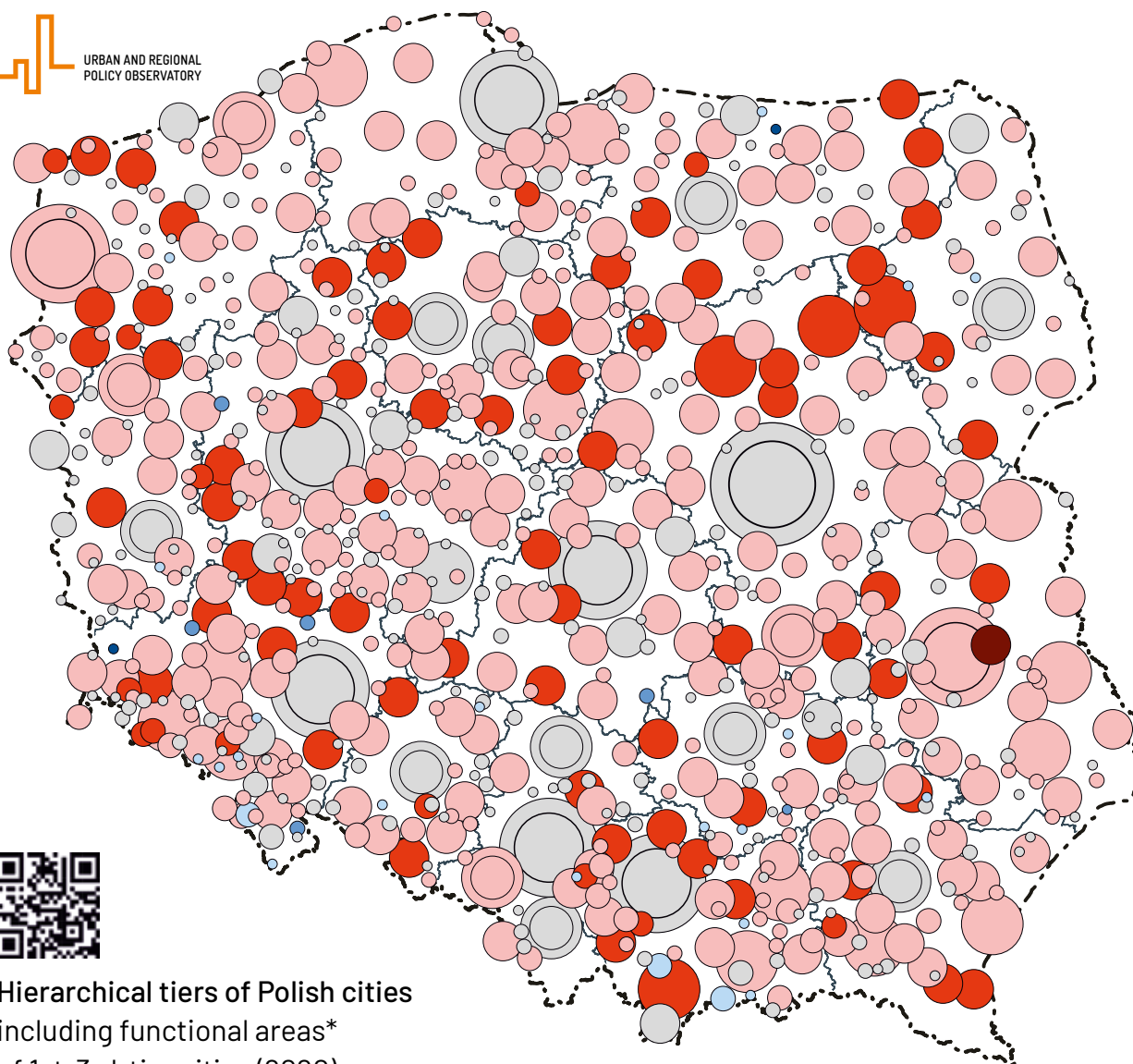


Fig. 16. Change in urban functional hierarchy in Poland in 1990-2020 with consideration of functional areas for 1st- to 3rd-tier centres in terms of capacity to concentrate market services

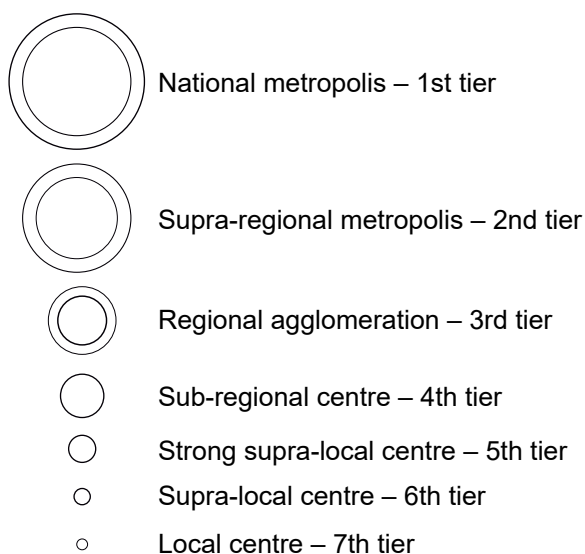
Link to map on Urban Geoportal: <https://tinyurl.com/48vb7ya9>

Attention: *Delimitation of urban functional areas (1st- to 3rd-tier) per: P. Śleszyński and T. Komornicki (2016), in the case of GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poreba and Łazy.

Source: compiled by ©Urban and Regional Policy Observatory



Hierarchical tiers of Polish cities including functional areas* of 1st-3rd-tier cities (2020)



Change in levels of urban functional hierarchy 1990-2020 - non-market services

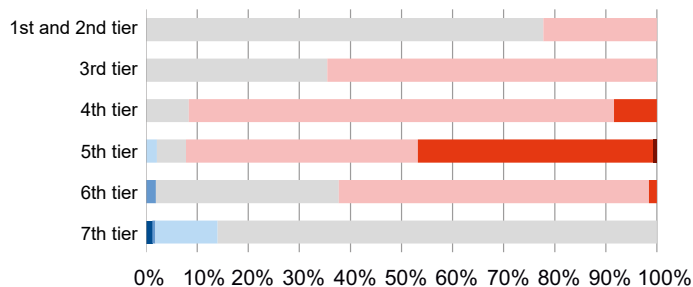
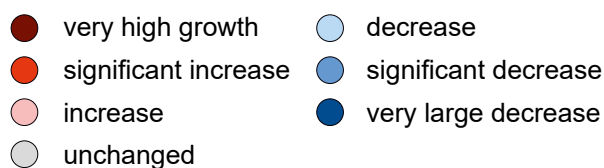


Fig. 17. Change in urban functional hierarchy in Poland 1990-2020 with consideration of functional areas for 1st- to 3rd-tier centres in terms of capacity to concentrate non-market services

Link to map on Urban Geoportal: <https://tinyurl.com/bdz4ea95>

Remark: *Delimitation of urban functional areas (1st- to 3rd-tier) per: P. Śleszyński and T. Komornicki (2016), in the case of the GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

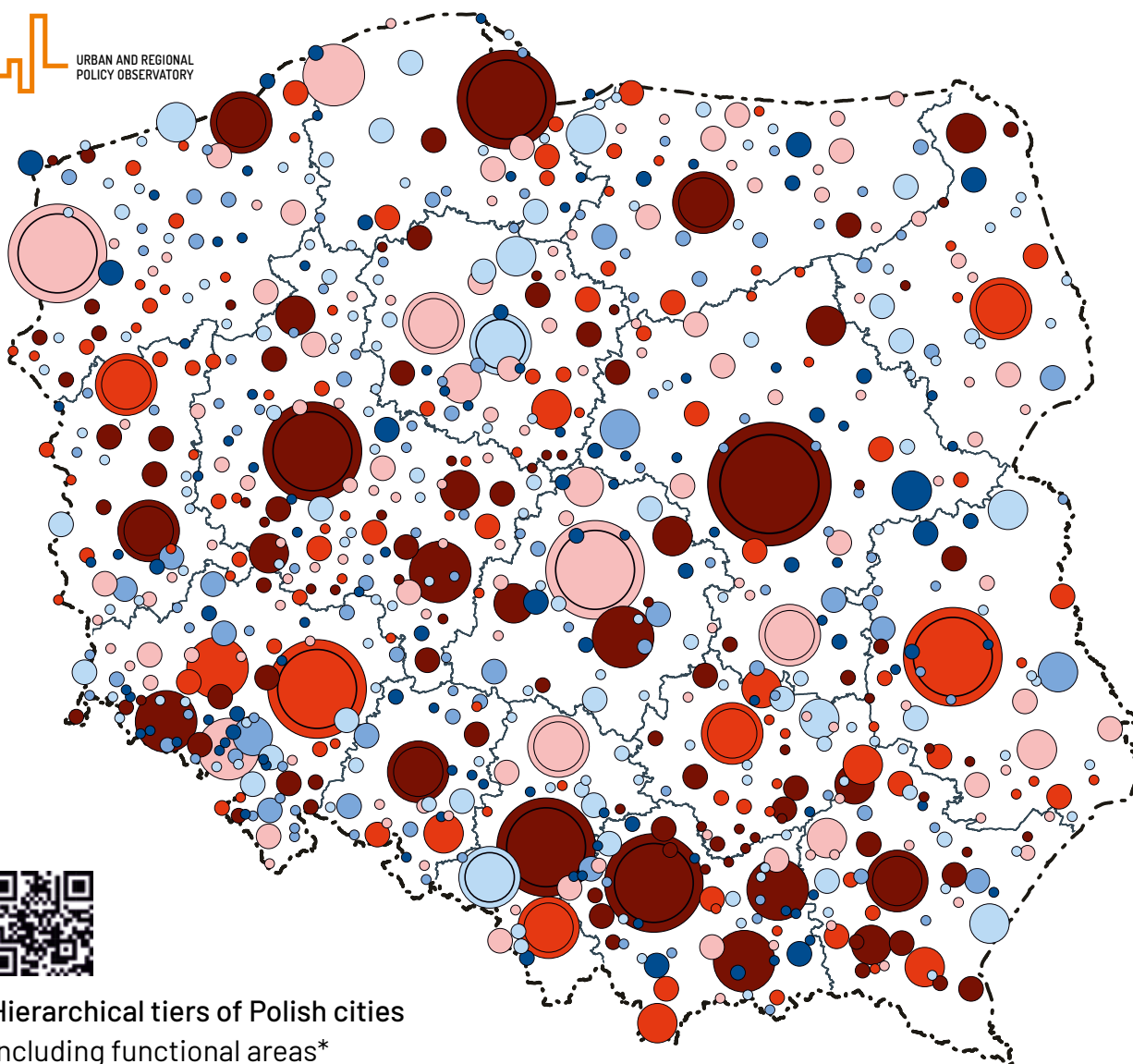
tier centres – mostly sub-regional cities. Examples of cities that were losing their functions are mainly former provincial capitals: Jelenia Góra, Legnica, Wałbrzych, Piotrków Trybunalski, Nowy Sącz or Tarnów.

For the sake of accuracy, however, it should be mentioned that among the sub-regional centres in 2020, there were not only cities losing market functions, but also those advancing in this respect by whole tiers of hierarchy (and not only in terms of the value of a coefficient within a rank). Gniezno, Ełk, Kołobrzeg, Chełm and Głogów are therefore among those 11 4th-tier cities that have managed to attract more market functions despite their administrative degradation. However, this does not change the fact that, starting from the level of sub-regional cities, there are more centres losing market functions than gaining them. In addition, in the case of local centres, i.e., the sixth tier of the hierarchy, as many as 14 cities fall two tiers in terms of market offer.

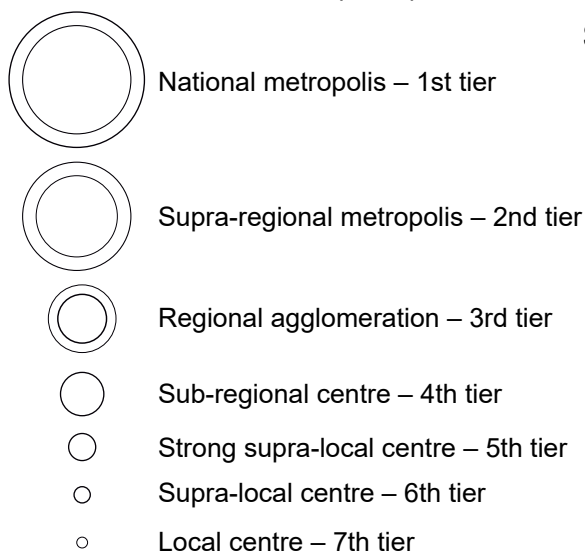
The situation is different when it comes to a dynamic analysis of the development of non-market services in cities. In contrast to market services, non-market services were subject to a more even distribution and growth across Poland (Fig. 17). It is recorded for both 2nd-tier, 3rd-tier and 4th-tier cities. This is also evidenced by the fact that the cities experiencing the highest growth include centres not only from the Mazowieckie Province, but also from the Dolnośląskie, Zachodniopomorskie, Kujawsko-Pomorskie and Małopolskie Provinces. Moreover, a pattern is discernible in which stronger increases occur in cities located at the administrative borders of provinces.

Among the metropolitan areas, Szczecin has improved its positioning in terms of non-commercial services by a whole rank. Within the urban functional areas, i.e., the centres that make up level III of the hierarchy, significant changes have taken place over the thirty years in terms of the level of concentration of non-market services. In other words, compared to 1990, a third of the functional areas were slightly more attracted to the services mentioned. On the growth side are the UFAs: Lublin, Gorzów Wielkopolski, Radom, Koszalin and the Rybnik agglomeration.

In 2020, the rank of cities in terms of non-market services reinforces the position of centres that are classified in the hierarchy as 4th tier, V and VI, i.e., sub-regional centres, strong supra-local centres and supra-local centres. Despite the loss of market potential for a significant proportion of them, the range of non-commercial services is being strengthened. The largest differences between city rank measured by non-market versus market services are characteristic of the former seats of the so-called 'small provinces' located in eastern Poland: Ciechanów, Ostrołęka, Zamość and Biała Podlaska, in addition to some district centres: Pińczów (Świętokrzyskie Province) and Oświęcim (Małopolskie Province).



Hierarchical tiers of Polish cities including functional areas* of 1st- to 3rd-tier cities (1990)



Surplus/deficit of central market services

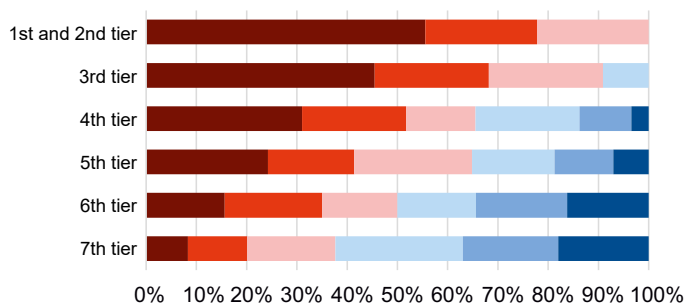
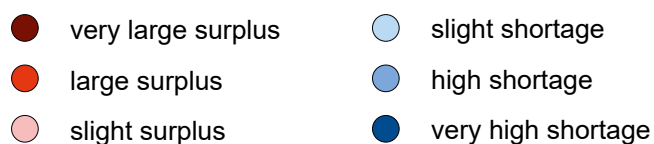


Fig. 18. Urban functional hierarchy in Poland in 1990 including functional areas for 1st- to 3rd-tier centres in terms of surplus/shortage of central services

Link to map on the Cities Geoportal: <https://tinyurl.com/5567f4jw>

Remark: *Delimitation of urban functional areas (1st- to 3rd-tier) per: P. Śleszyński and T. Komornicki (2016), in the case of the GZM+ it is the Katowice MC according to the delimitation of P. Śleszyński and T. Komornicki (2016), which also includes four cities outside the GZM: Jaworzno, Orzesze, Poręba and Łazy.

Changes in the surplus of central market services from 1990 to 2020

Over the period 1990-2020, the surplus ratio of central market services increased only for the metropolitan area of Wrocław and Szczecin, causing the latter to rise from a slight to a large surplus position.

For regional agglomerations (third order of the hierarchy), the surplus coefficient of central market services increased between 1990 and 2020 only for the Toruń UFA, which jumped from a slight deficit in 1990 to a slight surplus in 2020. For the UFAs of Bydgoszcz, Kielce, Częstochowa and Gorzów Wielkopolski, the said coefficient remained unchanged, with either a large or a slight surplus. The ten other regional agglomerations recorded a decrease in the surplus of market services compared to 1990. Most of them (80%) nevertheless had a large or slight surplus in 2020. Only the Radom UFA has seen a decline from a slight surplus to a slight shortfall, and the Rybnik agglomeration has seen a decline from a slight shortfall to a large shortfall in 2020. Particular attention should be paid to the situation of the latter agglomeration in the context of the economic transformation awaiting it in the next two or three decades, which will mean a radical reduction of its dominant economic base related to coal mining. The transition of the Katowice metropolitan area from a surplus in 1990 to a slight deficit thirty years later may also be a cause for concern.

In the group of sub-regional cities (fourth tier of the hierarchy), the central services surplus index has deteriorated in 18 out of 40 cities in this group over the last thirty years and in 16 cases this was the case for former province cities (Suwałki, Jelenia Góra, Piotrków Trybunalski, Tarnów, Sieradz, Ostrołęka, Konin, Skierniewice, Włocławek, Nowy Sącz, Kalisz, Legnica, Wałbrzych, Leszno, Krosno, Piła). Most of these cities were characterised by a slight or large surplus in 2020, despite the decline in the index. Only 4 cities – Inowrocław, Włocławek and Wałbrzych – went from a slight surplus and Suwałki from a very large to a slight shortage. In addition, Grudziądz has moved from a category of mild shortage to severe shortage. In the group of cities that recorded an improvement in the index (35%), the majority moved from a deficit to a surplus, with only Lubin and Gniezno remaining slightly in deficit despite the improvement in the index. Siedlce, Kołobrzeg and Biała Podlaska saw the greatest promotion from a shortage to a high surplus. The remaining 20% of cities showed no change in the index (Słupsk, Mielec, Elbląg, Nowy Targ, Oświęcim, Ostrów Wielkopolski, Ciechanów, Ełk).

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Appendices

Appendix 1. Institutions included in the calculation of the centrality of service centres

Types of institutions	Measures and indices	Type of service		Urban functional hierarchy		Source	Year
		market	non-market	1990	2020		
Administration	Embassies and consulates - number of establishments		NR	x	x	National Telephone Directory, www.gov.pl/web/dyplomacja/misje-dyplomatyczne-urzedz-konsularne-i-organizacje-miedzynarodowe-w-polsce	1990 2020
	Province office (together with the institutions of state administration in the province) - number of establishments		NR		x	www.bip.gov.pl/subjects	2020
	State administration offices - number of establishments		NR	x		All-Poland Telephone Directory, www.gov.pl/web/gov/katalog-jednostek www.bip.gov.pl/subjects	1990 2020
	Marshal's Office (including local offices) - number of offices		NR		x	www.gov.pl/web/gov/katalog-jednostek websites of Marshals' Offices	2020
	District authority - number of establishments		NR		x	www.bip.gov.pl/subjects	2020
	Employment offices - number of establishments		NR		x	websites of province employment offices	2020
	Tax offices - number of establishments		NR		x	www.podatki.gov.pl/media/3411/	2020
	Social Insurance Company inspectorate/branch - number of branches		NR	x	x	National Directory, www.zus.pl/o-zus/kontakt/oddzialy-inspektoraty-biura-terenowe	1990 2020

Types of institutions	Measures and indices	Type of service		Urban functional hierarchy		Source	Year
		market	non-market	1990	2020		
Education	Secondary schools for young people without special schools - number of establishments		NR	x	x	Ogólnopolski Spis Teleadresowy, Statistical Yearbooks of the Provinces, CSO LDB	1990 1990 2019
	Secondary schools for young people without special schools - number of pupils		NR	x	x	Ogólnopolski Spis Teleadresowy, Statistical Yearbooks of the Provinces, CSO LDB	1990 1990 2019
	Art schools - number of establishments		NR	x	x	National Tele-Address Census, CSO BDL	1990 2020
	Institutes, research centres - number of establishments		NR	x	x	Nationwide Phone Directory, Panorama Firm	1990 2020
	Courses, training - number of establishments	R			x	Panorama Firm	2020
	Courses, training, driving lessons - number of establishments	R			x	Panorama Firm	2020
	Language schools and courses - number of establishments	R			x	Panorama Firm	2020
	Higher education institutions (including branches and sub-branches) - number of establishments	R	NR	x	x	Ogólnopolski Spis Teleadresowy, Statistical Yearbooks of Provinces, Data of MEiN, CSO BDL	1990 1990 2020
	Higher education institutions - number of students	R	NR	x	x	Statistical Yearbooks of the Provinces, Data MEiN, CSO LDB	1990 2020
	Counselling and education centres - number of establishments		NR		x	Panorama Firm	2020

Types of institutions	Measures and indices	Type of service		Urban functional hierarchy		Source	Year
		market	non-market	1990	2020		
Finance	Marketing agencies - number of outlets	R			x	Panorama Firm	2020
	Advertising agencies and consultancies - number of outlets	R			x	Panorama Firm	2020
	Banks - number of branches and outlets	R		x	x	Nationwide Telephone Directory, OpenStreetMap	1990 2020
	ATMs - number	R			x	OpenStreetMap	2020
	Accounting offices - number of establishments	R			x	Panorama Firm	2020
	Tax advice - number of outlets	R			x	Panorama Firm	2020
	Loans and financing (excluding bank branches) - number of branches	R			x	Panorama Firm	2020
	Stockbrokers - number of outlets	R			x	Panorama Firm	2020
	Auditors and audit services - number of companies	R			x	Panorama Firm	2020
	Experts - number of companies	R			x	Panorama Firm	2020
Control functions	Largest CIT taxpayers - number of companies	R			x	Ministry of Finance	2020
Trade	Antiquarian bookshops - number of establishments	R			x	Panorama Firm	2020
	Agricultural products - number of establishments	R			x	Panorama Firm	2020
	Computers sales - number of outlets	R			x	Panorama Firm	2020
	Bookshops - number of establishments	R		x		National Telephone Directory	1990
	Real estate - purchase, sale, lease - number of companies	R			x	Panorama Firm	2020
	Luxury fashion brand salons - Cartier, Chanel, Dior, Dolce & Gabbana, Gucci, Hermès, Jean Paul Gaultier, Karl Lagerfeld, Louis Vuitton, Prada - number of outlets	R			x	Websites [accessed 13.02.2020]	2020
	Luxury car brand showrooms - Bentley, Ferrari, Lotus, Rolls-Royce, Maserati, Lamborghini, Bugatti, Aston Martin, Porsche - number of establishments	R			x	Websites [accessed 13.02.2020]	2020

Types of institutions	Measures and indices	Type of service		Urban functional hierarchy		Source	Year	
		market	non-market	1990	2020			
Culture	Libraries – number of establishments		NR	x		Nationwide Telephone Directory, Statistical yearbooks of the provinces	1990 1990	
	Community centres – number of establishments		NR	x		National Telephone Directory	1990	
	Cinemas – number of establishments			x	x	CSO LDB	2019	
	Cinemas – number of seats			x	x	CSO LDB	2019	
	Art galleries – number of establishments	R				x	Panorama Firm	2020
	Museums – number of establishments		NR	x	x	Panorama Firm	2020	
	Newspaper and magazine editors and publishers – number of establishments	R		x	x	Panorama Firm	2020	
	News agencies – number of outlets	R		x		National Telephone Directory	1990	
	Theatres, philharmonics – number of establishments		NR	x	x	Panorama Firm	2020	
Judiciary and legal services	Courts of appeal, district and district courts – number of establishments		NR	x	x	Nationwide Telephone Directory, www.bip.gov.pl/subjects	1990 2020	
	Solicitors – number of law firms	R			x	Panorama Firm	2020	
	Lawyers – number of chambers	R			x	Panorama Firm	2020	
	Bar teams – number of law firms	R		x		National Telephone Directory	1990	
ICT	Databases – provision, processing – number of companies	R			x	Panorama Firm	2020	
	Internet – www (website creation and positioning, web shop design) – number of companies	R			x	Panorama Firm	2020	
Healthcare	Physical therapy – number of establishments	R			x	Panorama Firm	2020	
	Emergency services – number of establishments		NR		x	Panorama Firm	2020	
	Pharmacies – number of establishments	R		x	x	Nationwide Telephone Directory, Panorama Firm	1990 2020	
	Private medical care by insurer – Lux Med, Medicovert, TU Zdrowie, Signal Iduna, InterRisk – number of establishments	R			x	Websites [accessed 17.02.2020]	2020	

Types of institutions	Measures and indices	Type of service		Urban functional hierarchy		Source	Year
		market	non-market	1990	2020		
Other services	Customs agencies and warehouses – number of establishments	R			x	Panorama Firm	2020
	Security agencies – number of companies	R			x	Panorama Firm	2020
	Architectural firms – number of companies	R			x	Panorama Firm	2020
	Design offices – number of companies	R			x	Panorama Firm	2020
	Travel and tourist agencies – number of establishments	R			x	Panorama Firm	2020
	Graphic design and printing – number of companies	R		x	x	Nationwide Telephone Directory, Panorama Firm	1990 2020
	Photographic services – number of establishments	R			x	Panorama Firm	2020
	Surveyors – number of companies	R			x	Panorama Firm	2020
	Courier services – number of companies	R			x	Panorama Firm	2020
	Notaries – number of companies	R			x	Panorama Firm	2020
	Post offices – number of establishments	R		x	x	Nationwide Telephone Directory, Panorama Firm	1990 2020
	Insurance agents – number of companies	R			x	Panorama Firm	2020
	Restaurants – number of establishments	R			x	Panorama Firm	2020
	Gault&Millau restaurants – number of establishments	R			x	Yellow Guide Gault&Millau	2019
	Freight forwarding – number of companies	R			x	Panorama Firm	2020
	Housekeeping – number of companies	R			x	Panorama Firm	2020
	Sworn translators – number of companies	R			x	Panorama Firm	2020
	Publishers – number of companies	R		x	x	Nationwide Telephone Directory, Panorama Firm	1990 2020
TOTAL				25	66		

Appendix 2. Nodality and the demographic trend

		Demographic trend (2001-2021)		
Nodality	growth ↑	unchanged ↔	decrease ↓	
very strong	Warsaw MC (I) Krakow MC (II) Wrocław MC (II) Poznań MC (II) Rzeszów UFA (III)	Opole UFA (III) Limanowa (V)	Bielsko-Biała UFA (III) Krosno (IV) Mielec (IV) Nowy Sącz (IV)	
strong	Tricity MC (II) Zielona Góra UFA (III) Brodnica (V) Garwolin (V) Nowy Tomysł (V) Wolsztyn (V)	Szczecin MC (II) Olsztyn UFA (III) Kołobrzeg (IV) Nowy Targ (IV) Siedlce (IV) Bochnia (V) Chojnice (V) Kościerzyna (V) Płońsk (V) Słubice (V) Wadowice (V)	Katowice MC [GZM+] (II) Kielce UFA (III) Łódź MC (II) Bydgoszcz UFA (III) Koszalin UFA (III) Lublin UFA (III) Toruń UFA (III) Białą Podlaska (IV) Cieszyn (IV) Leszno (IV) Kalisz (IV) Konin (IV) Ostrołęka (IV) Ostrów Wielkopolski (IV) Oświęcim (IV) Piła (IV) Piotrków Trybunalski (IV) Puławy (IV) Tarnów (IV) Zakopane (IV) Zamość (IV) Biłgoraj (V) Bolesławiec (V)	Busko-Zdrój (V) Dębica (V) Gorlice (V) Jarosław (V) Jędrzejów (V) Kłodzko (V) Leżajsk (V) Łęczyca (V) Łuków (V) Miechów (V) Przeworsk (V) Radzyń Podlaski (V) Sandomierz (V) Sanok (V) Słupca (V) Staszów (V) Świdnica (V) Tomaszów Lubelski (V) Turek (V) Węgrów (V) Wieluń (V)

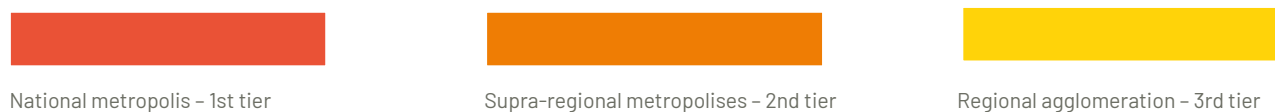
Demographic trend (2001–2021)				
Nodality	growth ↑	unchanged ↔	decrease ↓	
above average	Grójec (V) Mława (V) Ostrzeszów (V) Rawicz (V) Wągrowiec (V) Wyszków (V)	Białystok UFA (III) Brzesko (V) Gostynin (V) Kępno (V) Krotoszyn (V) Namysłów (V) Ostrów Mazowiecka (V) Pleszew (V) Przasnysz (V) Sokołów Podlaski (V) Strzelin (V)	Częstochowa UFA (III) Gorzów Wielkopolski (III) Chełm (IV) Płock (IV) Sieradz (IV) Skierniewice (IV) Słupsk (IV) Ciechanów (V) Dzierżoniów (V) Hrubieszów (V) Jasło (V) Jelenia Góra (V) Kluczbork (V) Koło (V) Końskie (V) Krasnystaw (V) Kutno (V)	Legnica (V) Lubań (V) Lubliniec (V) Łomża (V) Łowicz (V) Nysa (V) Przemyśl (V) Radomsko (V) Rawa Mazowiecka (V) Rypin (V) Sochaczew (V) Stalowa Wola (V) Świnoujście (V) Ząbkowice Śląskie (V) Zduńska Wola (V) Zgorzelec (V) Żary (V)
average strong	Oborniki (V) Polkowice (V) Szamotuły (V) Śrem (V) Środa Wielkopolska (V) Września (V) Ząbki (V)	Suwałki (IV) Tarnowskie Góry (IV) Augustów (V) Hawa (V) Jarocin (V) Kościan (V) Kwidzyn (V) Lębork (V) Szczecinek (V) Świebodzin (V) Świecie (V)	Radom UFA (III) Rybnik agglomeration (III) Elbląg (IV) Gniezno (IV) Grudziądz (IV) Inowrocław (IV) Lubin (IV) Wałbrzych (IV) Włocławek (IV) Bielsk Podlaski (V) Brzeg (V) Chodzież (V) Choszczno (V) Giżycko (V) Gostynin (V)	Gryfice (V) Kędzierzyn-Koźle (V) Kraśnik (V) Lidzbark Warmiński (V) Miedzyrzecz (V) Mrągowo (V) Olkusz (V) Opoczno (V) Starachowice (V) Sierpc (V) Starogard Gdański (V) Szczytno (V) Wałcz (V) Wschowa (V)

Demographic trend (2001-2021)			
Nodality	growth ↑	unchanged ↔	decrease ↓
average weak	Elk (IV) Oława (V)	Pultusk (V)	Bartoszyce (V) Bełchatów (V) Białogard (V) Chrzanów (V) Głogów (V) Grajewo (V) Jawor (V) Kętrzyn (V) Kozienice (V) Malbork (V) Nowa Sól (V) Ostrowiec Świętokrzyski (V) Ostróda (V) Skarżysko-Kamienna (V) Sokółka (V) Stargard (V) Tarnobrzeg (V) Tczew (V) Tomaszów Mazowiecki (V) Zambrów (V) Zawiercie (V) Żagań (V)
weak			Myszków (V)

Note: highlighted in bold is the service index (hinterland population/town population): **in black – strong (≥ 1.25)**, **and in red – very strong (≥ 4.00)**.

Source: compiled by ©Urban and Regional Policy Observatory, demographic trend after K. Piech et al. (2023)

Appendix 3. Key data for cities and functional areas related to position in the settlement hierarchy in 1990 and 2020



Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/decline in the settlement hierarchy 1990-2020	Surplus/deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
National metropolis – 1st tier										
Warsaw MC MAZOWIECKIE	2596047	100.00	I	100.00	I		Very large surplus	x	x	x
Warsaw	1860281	100.00	I	100.00	I		Very large surplus	National capital	National capital	
Piaseczno	51945	7.43	VI	13.7	IV	↑↑	Very large surplus	District town		
Pruszków	65283	10.24	V	13.4	IV	↑	Very large surplus	District town		
Wołomin	36311	7.99	V	11.1	IV	↑	Slight surplus	District town		
Legionowo	53216	6.93	VI	11.1	IV	↑↑	Large surplus	District town		
Żyrardów	39374	8.27	V	10.9	IV	↑	Slight surplus	District town		
Otwock	44524	9.58	V	10.2	V		Slight surplus	District town		
Mińsk Mazowiecki	40467	7.75	V	10.1	V		Large surplus	District town		
Grodzisk Mazowiecki	33708	6.35	VI	9.8	V	↑	Large surplus	District town		
Nowy Dwór Mazowiecki	28651	7.42	VI	8.2	V	↑	Slight surplus	District town		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Ząbki	43740	4.70	VI	8.1	V	↑	Slight surplus	Municipality		
Łomianki	18124	3.14	VII	7.9	V	↑↑	Very large surplus	Urban-rural municipality		
Marki	42252	2.70	VII	7.8	V	↑↑	Slight surplus	Urban-rural municipality		
Józefów	21035	4.06	VII	7.1	V	↑↑	Large surplus	Urban-rural municipality		
Konstancin-Jeziorna	17157	4.66	VI	7.0	V	↑	Very large surplus	Urban-rural municipality		
Piastów	23281	3.49	VII	6.6	VI	↑	Slight surplus	Municipality		
Błonie	12152	4.31	VII	6.5	VI	↑	Very large surplus	Urban-rural municipality		
Sulejówek	21248	3.82	VII	6.5	VI	↑	Slight surplus	Municipality		
Kobyłka	27185	3.03	VII	6.1	VI	↑	Slight shortage	Municipality		
Milanówek	16490	4.19	VII	6.0	VI	↑	Large surplus	Municipality		
Zielonka	18219	3.23	VII	5.8	VI	↑	Large surplus	Municipality		
Ożarów Mazowiecki	14375	2.96	VII	5.8	VI	↑	Large surplus	District town		
Radzymin	14314	4.74	VI	5.7	VI		Large surplus	Urban-rural municipality		
Brwinów	14448	4.30	VII	5.1	VI	↑	Slight shortage	Urban-rural municipality		
Góra Kalwaria	11887	4.62	VII	4.9	VI	↑	Slight shortage	Urban-rural municipality		
Podkowa Leśna	3867	4.44	VII	4.2	VI	↑	Very large surplus	Municipality		
Serock	4959	2.57	VII	4.1	VI	↑	Very large surplus	Urban-rural municipality		
Karczew	9566	2.45	VII	3.7	VII		Slight shortage	Urban-rural municipality		
Tarczyn	4248	2.98	VII	3.6	VII		Very large surplus	Urban-rural municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Halinów	3740	1.51	VII	2.9	VII		Large surplus	Urban-rural municipality		
Supra-regional metropolises – 2nd tier										
Katowice MC (GZM+) ŚLĄSKIE	2155745	65.45	II	56.19	II		Slight shortage	x	x	x
Katowice	285711	41.78	II	33.91	II		Very large surplus	Capital of the province	Capital of the province	
Gliwice	174016	18.44	III	19.45	III		Slight surplus	City with district rights		
Sosnowiec	193660	13.59	IV	16.29	IV		High shortage	City with district rights		A city of declining potential
Bytom	153274	17.12	IV	14.90	IV		High shortage	City with district rights		A city of declining potential
Radzionków	16253			5.81	VI		Slight shortage	Municipality	From 1975 to 1997 the district of Bytom	
Zabrze	158307	20.53	III	14.84	IV	↓	Very high shortage	City with district rights		A city of declining potential
Tychy	124882	13.77	IV	14.37	IV		Slight shortage	City with district rights		
Bieruń	19100			5.01	VI		High shortage	City with district rights	From 1973 to 1991 the district of Tychy	
Lędziny	16530			3.85	VII		Very high shortage	Municipality	From 1975 to 1991 the district of Tychy	
Imielin	9313			2.96	VII		Very high shortage	Municipality	From 1975 to 1977 a district of Tychy. From 1977 to 1994 the district of Mysłowice	
Dąbrowa Górnicza	116930	13.20	IV	13.24	IV		High shortage	City with district rights		
Chorzów	104193	14.38	IV	13.20	IV		Slight shortage	City with district rights		
Ruda Śląska	133793	10.26	V	12.49	IV	↑	Very high shortage	City with district rights		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Tarnowskie Góry	61288	9.28	V	11.36	IV	↑	Slight surplus	District town		
Jaworzno	88998	8.89	V	10.90	IV	↑	High shortage	City with district rights		A stagnant city
Mysłowice	72553	11.24	V	10.07	V		High shortage	City with district rights		
Będzin	55695	13.22	IV	9.25	V		High shortage	District town		
Wojkowice	8604	13.22	IV	3.24	VII	↓	High shortage	Municipality	From 1977 to 1992 the district of Będzin	
Siemianowice Śląskie	64676	6.98	VI	9.07	V	↑	High shortage	City with district rights		City at risk of marginalisation
Mikołów	41266	8.11	V	8.94	V		Slight surplus	District town		
Piekary Śląskie	53017	6.28	VI	7.93	V	↑	Very high shortage	City with district rights		City at risk of marginalisation
Świętochłowice	46494	5.87	VI	6.51	VI		Very high shortage	City with district rights		City at risk of marginalisation
Knurów	36498	5.05	VI	6.47	VI		High shortage	Municipality		
Czeladź	30681	5.93	VI	5.96	VI		High shortage	Municipality		
Sławków	6942	1.16	VII	4.63	VI	↑	Very large surplus	Municipality		
Pyskowice	17394	3.99	VII	4.55	VI	↑	Very high shortage	Municipality		
Łaziska Górne	21592	3.18	VII	4.49	VI	↑	Very high shortage	Municipality		
Orzesze	21631	3.49	VII	3.98	VI	↑	Very high shortage	Municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Siewierz	5635	4.31	VII	3.65	VII		Slight surplus	Urban-rural municipality		
Łazy	6591	2.96	VII	3.41	VII		Slight surplus	Urban-rural municipality		
Poręba	8288	3.07	VII	2.86	VII		Very high shortage	Municipality		
Sośnicowice	1940	1.86	VII	1.82	VII		Slight surplus	Urban-rural municipality		
Krakow MC MAŁOPOLSKIE	907560	55.27	II	52.41	II		Very large surplus	x	x	x
Krakow	800653	55.55	II	54.20	II		Very large surplus	Capital of the province	Capital of the province	
Wieliczka	26599	7.28	V	9.48	V		Large surplus	District town		
Myślenice	18051	8.30	V	8.19	V		Very large surplus	District town		
Skawina	24177	5.71	VI	6.84	V	↑	Slight surplus	Urban-rural municipality		
Niepołomice	15697	3.42	VII	5.67	VI	↑	Slight surplus	Urban-rural municipality		
Krzyszowice	9868	2.61	VII	4.66	VI	↑	Slight surplus	Urban-rural municipality		
Dobczyce	6263	4.30	VII	3.97	VI	↑	Slight surplus	Urban-rural municipality		
Świątniki Górne	2418	2.12	VII	2.88	VII		Large surplus	Urban-rural municipality		
Skała	3834	4.33	VII	2.74	VII		Slight surplus	Urban-rural municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Tricity MC POMORSKIE	954938	48.88	II	48.21	II		Large surplus	x	x	x
Gdańsk	486022	40.78	II	36.5	II		Large surplus	Capital of the province	Capital of the province	
Gdynia	245222	19.19	III	27.7	III		Very large surplus	City with district rights		
Sopot	32962	14.72	IV	16.5	IV		Very large surplus	City with district rights		
Wejherowo	47357	9.52	V	10.0	V		Slight surplus	District town		
Rumia	51879	3.98	VII	8.8	V	↑↑	Slight shortage	Municipality		
Pruszcz Gdański	31582	6.98	VI	8.5	V	↑	Large surplus	District town		
Kartuzy	14204	8.41	V	7.5	V		Very large surplus	District town		
Puck	10868	6.82	VI	6.7	VI		Large surplus	District town		
Reda	28190	3.32	VII	6.4	VI	↑	High shortage	Municipality		
Żukowo	6652	3.68	VII	4.8	VI	↑	Very large surplus	Urban-rural municipality		
Wrocław MC DOLNOŚLĄSKIE	773133	44.95	II	46.54	II		Large surplus	x	x	x
Wrocław	672929	44.47	II	47.91	II		Very large surplus	Capital of the province	Capital of the province	
Oleśnica	35856	9.95	V	8.93	V		Slight surplus	District town		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Trzebnica	13631	7.91	V	7.38	V		Very large surplus	District town		
Siechnice	9957	x	x	5.75	VI		Very large surplus	Urban-rural municipality	Town in the rural municipality of Święta Katarzyna	
Jelcz-Laskowice	15380	3.73	VII	4.94	VI	↑	Slight shortage	Urban-rural municipality		
Oborniki Śląskie	9101	3.74	VII	4.87	VI	↑	Large surplus	Urban-rural municipality		
Kąty Wrocławskie	7176	2.87	VII	4.58	VI	↑	Very large surplus	Urban-rural municipality		
Sobótka	7025	3.52	VII	3.64	VII		High shortage	Urban-rural municipality		
Miękinia	2078	x	x	1.52	VII		High shortage	Urban-rural municipality	Rural municipality	
Poznań MC WIELKOPOLSKIE	686729	48.27	II	45.49	II		Very large surplus	x	x	x
Poznań	546859	48.39	II	46.53	II		Very large surplus	Capital of the province	Capital of the province	
Luboń	33024	4.90	VI	7.83	V	↑	Slight surplus	Municipality	District town	
Swarzędz	29295	3.68	VII	7.34	V	↑↑	Slight surplus	Urban-rural municipality		
Mosina	14511	3.93	VII	5.82	VI	↑	Large surplus	Urban-rural municipality		
Puszczykowo	9470	4.13	VII	4.97	VI	↑	Very large surplus	Municipality		
Kórnik	8246	5.19	VI	4.72	VI		Large surplus	Urban-rural municipality		
Murowana Goślina	10247	4.44	VII	4.56	VI	↑	Slight surplus	Urban-rural municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Stęszew	5964	40.01	VII	4.02	VI	↑	Very large surplus	Urban-rural municipality		
Kostrzyn	9809	3.32	VII	3.97	VI	↑	Slight shortage	Urban-rural municipality		
Buk	5718	2.96	VII	3.91	VI	↑	Large surplus	Urban-rural municipality		
Pobiedziska	9755	3.43	VII	3.90	VI	↑	Slight surplus	Urban-rural municipality		
Nekla	3831	2.45	VII	2.07	VII		High shortage	Urban-rural municipality		
Łódź MC ŁÓDZKIE	869976	44.67	II	41.28	II		Slight surplus	x	x	x
Łódź	670642	42.37	II	40.95	II		Slight surplus	Capital of the province	Capital of the province	
Pabianice	62954	11.39	V	10.06	V		High shortage	District town		
Zgierz	55079	9.24	V	9.22	V		High shortage	District town		
Brzeziny	12117	6.80	VI	6.31	VI		Slight surplus	District town		
Aleksandrów Łódzki	22148	4.74	VI	5.73	VI		Slight shortage	Urban-rural municipality		
Koluszki	12396	4.40	VII	4.94	VI	↑	Slight shortage	Urban-rural municipality		
Konstantynów Łódzki	18960	3.77	VII	4.84	VI	↑	High shortage	Municipality		
Tuszyn	7221	3.32	VII	4.01	VI	↑	Slight surplus	Urban-rural municipality		
Rzgów	3432	2.45	VII	3.48	VII		Very large surplus	Urban-rural municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Stryków	3458	2.96	VII	3.37	VII		Very large surplus	Urban-rural municipality		
Lutomiersk	1569	x	x	1.91	VII		Large surplus	Urban-rural municipality	Rural municipality	
Szczecin MC ZACHODNIO-POMORSKIE	470365	36.72	II	32.40	II		Large surplus	x	x	x
Szczecin	396168	36.49	II	32.84	II		Large surplus	Capital of the province	Capital of the province	
Goleniów	22166	6.35	VI	7.63	V	↑	Slight surplus	District town		
Gryfino	20297	6.91	VI	7.08	V	↑	Slight shortage	District town		
Police	30623	4.96	VI	6.83	V	↑	High shortage	District town		
Nowe Warpno	1111	3.71	VII	1.37	VII		Slight surplus	Urban-rural municipality		
Regional agglomeration – 3rd tier										
Lublin UFA LUBELSKIE	395539	34.89	II	29.69	III	↓	Slight surplus	x	x	x
Lublin	334681	34.48	II	30.21	III	↓	Slight surplus	Capital of the province	Capital of the province	
Świdnik	37884	5.15	VI	7.87	V	↑	High shortage	District town		
Lubartów	20494	9.98	V	7.17	V		Slight shortage	District town		A city of declining potential
Piaski	2480	2.18	VII	3.01	VII		Very large surplus	Urban-rural municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Bielsko-Biała UFA ŚLĄSKIE	317228	28.77	III	26.13	III		Slight surplus	x	x	x
Bielsko-Biała	169089	21.92	III	22.20	III		Large surplus	City with district rights	Capital of the province	
Żywiec	30334	11.85	IV	9.75	V	↓	Large surplus	District town		
Pszczyna	25565	9.37	V	8.74	V		Slight surplus	District town		
Czechowice-Dziedzice	35261	6.39	VI	8.13	V	↑	Slight surplus	Urban-rural municipality		
Kęty	18744	6.22	VI	6.47	VI		Large surplus	Urban-rural municipality		
Andrychów	20260	5.84	VI	5.71	VI		Slight surplus	Urban-rural municipality		
Brzeszcze	11226	3.90	VII	4.05	VI	↑	High shortage	Urban-rural municipality		
Szczyrk	5496	3.32	VII	3.70	VII		Slight surplus	Municipality		
Wilamowice	3164	2.45	VII	2.11	VII		Slight shortage	Urban-rural municipality		
Bydgoszcz UFA KUJAWSKO-POMORSKIE	378155	28.37	III	25.90	III		Slight surplus	x	x	x
Bydgoszcz	337666	28.43	III	27.0	III		Slight surplus	Capital of the province	Capital of the province	
Solec Kujawski	15458	3.97	VII	4.9	VI	↑	High shortage	Urban-rural municipality		
Szubin	9563	3.56	VII	4.3	VI	↑	Slight shortage	Urban-rural municipality		
Koronowo	10974	4.32	VII	4.1	VI	↑	High shortage	Urban-rural municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Łabiszyn	4494	3.32	VII	1.9	VII		Very high shortage	Urban-rural municipality		
Białystok UFA PODLASKIE	328195	29.99	III	25.70	III		Slight surplus	x	x	x
Białystok	294242	29.72	III	27.0	III		Slight surplus	Capital of the province	Capital of the province	
Supraśl	4427	4.22	VII	3.9	VII		Slight surplus	Urban-rural municipality		
Wasilków	12147	3.32	VII	3.6	VII		Very high shortage	Urban-rural municipality		
Choroszcz	5961	3.29	VII	2.5	VII		High shortage	Urban-rural municipality		
Zabłudów	2475	2.45	VII	2.3	VII		Slight shortage	Urban-rural municipality		
Czarna Białostocka	8943	5.28	VI	2.2	VII	↓	Very high shortage	Urban-rural municipality		
Rzeszów UFA PODKARPACKIE	236532	27.55	III	24.15	III		Large surplus	x	x	x
Rzeszów	195871	25.72	III	24.13	III		Large surplus	Capital of the province	Capital of the province	
Łańcut	17768	9.77	V	7.52	V		Large surplus	District town		
Boguchwała	6220	x	x	4.88	VI		Slight shortage	Urban-rural municipality		
Tyczyn	4325	4.29	VII	4.05	VI	↑	Large surplus	Urban-rural municipality		
Głogów Małopolski	10232	3.32	VII	3.31	VII		Very high shortage	Urban-rural municipality		
Błażowa	2116	4.75	VI	2.36	VII	↓	Very high shortage	Urban-rural municipality		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Rybnik agglomeration ŚLĄSKIE	458154	22.46	III	22.59	III		High shortage	x	x	x
Rybnik	133772	13.41	IV	13.99	IV		High shortage	City with district rights		
Racibórz	51257	9.38	V	10.58	V		Slight surplus	District town		
Jastrzębie-Zdrój	85050	9.59	V	9.77	V		Very high shortage	City with district rights		A city of declining potential
Wodzisław Śląski	45949			9.15	V		High shortage	District town		
Rydułtowy	20749			5.14	VI		High shortage	Municipality	From 1975 to 1992 a district of Wodzisław Śląski	A city of declining potential
Radlin	17206	10.05	V	3.79	VII		Very high shortage	Municipality	From 1975 to 1997 a district of Wodzisław Śląski	
Pszów	13295			3.52	VII		Very high shortage	Municipality	From 1975 to 1994 a district of Wodzisław Śląski	
Żory	61823	6.14	VI	9.04	V	↑	High shortage	City with district rights		
Czerwionka-Leszczyń	27014	2.70	VII	4.51	VI	↑	Very high shortage	Urban-rural municipality		
Krzanowice	2039	x	x	1.99	VII		Slight surplus	Urban-rural municipality	Rural municipality	
Toruń UFA KUJAWSKO-POMORSKIE	202382	22.71	III	21.98	III		Slight surplus	x	x	x
Toruń	198273	23.39	III	23.44	III		Slight surplus	Capital of the province	Capital of the province	

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Kowalewo Pomorskie	4109	3.52	VII	3.04	VII		Slight surplus	Urban-rural municipality		
Kielce UFA ŚWIĘTOKRZYSKIE	197260	26.44	III	21.78	III		Large surplus	x	x	x
Kielce	186894	27.34	III	23.1	III		Large surplus	Capital of the province	Capital of the province	
Chęciny	4364	3.07	VII	2.8	VII		Slight surplus	Urban-rural municipality		
Piekoszów	3167	x	x	2.5	VII		Slight surplus	Urban-rural municipality	Rural municipality	
Daleszyce	2835	2.36	VII	2.4	VII		Large surplus	Urban-rural municipality		
Morawica	1723	x	x	2.38	VII		Slight surplus	Urban-rural municipality		
Olsztyn UFA WARMIŃSKO-MAZURSKIE	177701	25.84	III	21.42	III		Large surplus	x	x	x
Olsztyn	170225	26.35	III	22.78	III		Large surplus	Capital of the province	Capital of the province	
Barczewo	7476	5.84	VI	3.49	VII	↓	Very high shortage	Urban-rural municipality		
Częstochowa UFA ŚLĄSKIE	237453	23.68	III	21.01	III		Slight surplus	x	x	x
Częstochowa	213107	23.64	III	21.66	III		Slight surplus	City with district rights	Capital of the province	
Kłobuck	12513	6.14	VI	6.00	VI		Slight surplus	District town		

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Blachownia	9334	3.09	VII	2.86	VII		Very high shortage	Urban-rural municipality		
Olsztyn	2499	x	x	2.51	VII		Very large surplus	Urban-rural municipality	Rural municipality	
Radom UFA MAZOWIECKIE	209987	19.34	III	19.52	III		Slight shortage	x	x	x
Radom	201601	20.05	III	20.80	III		High shortage	City with district rights	Capital of the province	City at risk of marginalisation
Skaryszew	4410	2.45	VII	2.32	VII		High shortage	Urban-rural municipality		
Jedlnia-Letnisko	3976	x	x	2.10	VII		Very high shortage	Urban-rural municipality	Rural municipality	
Opole UFA OPOLSKIE	141667	26.06	III	19.43	III		Large surplus	x	x	x
Opole	127387	26.40	III	20.45	III		Large surplus	Capital of the province	Capital of the province	
Niemodlin	6068	4.53	VII	3.52	VII		Slight surplus	Urban-rural municipality		
Prószków	2544	x	x	2.58	VII		Large surplus	Urban-rural municipality	Rural municipality	
Lewin Brzeski	5668	3.32	VII	2.39	VII		Very high shortage	Urban-rural municipality		
Tułowice	3748	x	x	2.27	VII		High shortage	Urban-rural municipality		
Zielona Góra UFA LUBUSKIE	159972	24.85	III	19.05	III		Large surplus	x	x	x

Area, province	Population [2021]	Urban functional hierarchy [1990]		Urban functional hierarchy [2020]		Growth/ decline in the settlement hierarchy 1990-2020	Surplus/ deficit of central market services [2020]	Administrative status		Medium-sized cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities**
		Synthetic index value – total rank (1-100)	Hierarchy tier	Synthetic index value – total rank (1-100)	Hierarchy tier			2023	1998	
Zielona Góra	140002	24.73	III	19.81	III		Large surplus	Capital of the province	Capital of the province	
Sulechów	16063	6.26	VI	5.12	VI		Slight shortage	Urban-rural municipality		
Czerwieńsk	3907	4.01	VII	2.52	VII		Slight shortage	Urban-rural municipality		
Koszalin UFA ZACHODNIO- -POMORSKIE	115258	22.05	III	17.36	III		Large surplus	x	x	x
Koszalin	105883	22.62	III	18.24	III		Large surplus	City with district rights	Capital of the province	
Mielno	2836	3.74	VII	2.86	VII		Slight surplus	Urban-rural municipality		
Sianów	6545	1.51	VII	2.29	VII		Very high shortage	Urban-rural municipality		
Gorzów Wielkopolski UFA LUBUSKIE	119964	17.60	III	16.92	III		Large surplus	x	x	x

Notes:

* Surplus/deficit of central market services relative to population according to Census 2021.

** **City in crisis** – significant widening of unfavourable gap, bad socio-economic situation;**City of declining potential** – significant widening of unfavourable gap, moderately bad socio-economic situation;**Stagnating city** – moderate widening of unfavourable gap, bad socio-economic situation);**City at risk of marginalisation** – moderate widening of unfavourable gap, moderately bad socio-economic situation.Source: compiled by ©Urban and Regional Policy Observatory, cities losing socio-economic functions according to the Strategy for Responsible Development (SOR) – list of 139 cities (<https://www.gov.pl/attachment/0179d436-5610-42e7-ab44-0337115e357c>)

'The highly positive assessment of the report is due to the reviewer's recognition of the potential of the proposed approach in both the cognitive and implementation dimensions. In view of the increasing dynamics of socio-economic development processes and the need to balance the living conditions of the population, the analysis of the urban functional hierarchy and the directions of its transformation provides tools to meet these challenges in the practice of urban, regional and national policies.'

Professor Iwona Sagan
(Department of Social and Economic Geography,
University of Gdańsk)

'The result of the research carried out for the report is a hierarchical and functional arrangement of a set of all cities in Poland, the stratification of which is based on the rows defined in the study. Importantly, and a significant value of the study, the research (...) refers to two different periods – the beginning of the socio-economic transformation in Poland (1990) and the contemporary period (2020).'

Professor Robert Krzysztofik
(Institute of Social and Economic Geography,
University of Silesia)

'The report is a very valuable and necessary study. I assume that its findings will be taken into account in the programming of development policy interventions in Poland.'

Professor Paweł Churski
(Department of Socio-economic Geography and Spatial Management,
Adam Mickiewicz University in Poznań)

'The presented hierarchy of the urban settlement system is the first such detailed, credible and convincing one in Poland post-1989. The results are very original, in several places very innovative (...). As this issue is central to the spatial organisation of the country, it represents an important advance in expanding knowledge.'

'The presented classification (hierarchy)(...) should enter permanently as a conceptual and methodological model for other applications; the results have a very important practical significance, as they indirectly indicate the degree of alignment of socio-economic as well as administrative-territorial systems. I see applications here for shaping transport systems, locating public services, counteracting and mitigating depopulation.'

Professor Przemysław Śleszyński
(Department of Urban and Population Geography,
Institute of Geography and Spatial Planning,
Polish Academy of Sciences)

'The report is an interesting analysis of the level of hierarchy of urban centres in Poland and its changes over a period of thirty years (1990-2020) and the range of influence of centres of different levels of hierarchy.'

Professor Jerzy Bański
(Department of Rural Geography and Local Development,
Institute of Geography and Spatial Planning,
Polish Academy of Sciences)

The IRMiR Urban and Regional Observatory (OPMR IRMiR) is a long-term research project implemented by the Institute of Urban and Regional Development. We are creating a platform for the exchange of knowledge and experience addressed to all those who care about the fate of Polish cities – citizens, researchers, NGOs and representatives of local and central authorities.

Institute of Urban and Regional Development
Targowa 45, 03-728 Warsaw, www.irmir.pl

Urban and Regional Policy Observatory
www.obserwatorium.miasta.pl