Master Thesis

The Baltic Sea Region City System
The Position of Warsaw

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Abstract

Due to contemporary globalisation processes cities become major concentrations of power, both political and economical. Those best developed become leading actors in the global economy and constitute the highest level of the global urban system. This thesis concentrates on a lower level of the urban system, less oriented towards the global economy. The cities considered in this study are still of large importance, but in the European macro-regional scale. However, first they are placed in the broader context of global system of cities.

The thesis focuses on the Baltic Sea Region and its highest level of urban system. A comparative analysis was conducted, comparing the major cities of this macro-region (its EU part) – the capital cities and Hamburg, with a particular focus on Warsaw. To determine the cities’ positions in the urban system their performances of metropolitan functions such as: knowledge, decision-making, gateway and culture are examined. The aim of the study is to determine the position of Warsaw within the macro-regional city system.

As a result a hierarchy of cities for the macro-region was created. The leading positions in the system were assigned to Berlin, Copenhagen and Stockholm, but Warsaw follows them on the fourth place, overcoming Hamburg, Helsinki and the Baltic States’ capitals. As conclusions appointed are the directions for how Warsaw could improve its position, and the potentials and limitations for achieving it.
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<tr>
<td>APS</td>
<td>Advanced producer services</td>
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<tr>
<td>BBSR</td>
<td>Bundesinstitut für Bau-, Stadt- und Raumforschung [de.] – Federal Institute for Research on Building, Urban Affairs and Spatial Development</td>
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<tr>
<td>BSR</td>
<td>Baltic Sea Region</td>
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<td>BDL</td>
<td>Bank Danych Lokalnych [pl.] – Local Data Bank</td>
</tr>
<tr>
<td>ESPON</td>
<td>European Observation Network for Territorial Development and Cohesion</td>
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<td>EU</td>
<td>European Union</td>
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<td>FT</td>
<td>Financial Times</td>
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<td>FUAs</td>
<td>Functional Urban Areas</td>
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<td>GaWC</td>
<td>Globalization and World Cities</td>
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<td>GDP</td>
<td>Gross domestic product</td>
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<td>ISCED</td>
<td>International Standard Classification of Education</td>
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<td>MEGAs</td>
<td>Metropolitan European Growth Areas</td>
</tr>
<tr>
<td>Nordregio</td>
<td>Nordic Centre for Spatial Development</td>
</tr>
<tr>
<td>NUTS</td>
<td>Nomenclature of Territorial Units for Statistics</td>
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<tr>
<td>PPS</td>
<td>Purchasing power standards</td>
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<tr>
<td>THE</td>
<td>Times Higher Education [World University Rankings]</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
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<tr>
<td>USSR</td>
<td>Union of Soviet Socialists Republics</td>
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<td>VASAB</td>
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Introduction

Throughout the years correlation between urbanization and prosperity has been observed and more and more attention is paid to the cities as they are considered major areas of economic growth. Furthermore, there is a constant population shift towards cities at the global level and currently over half of the world’s population lives in urban areas\(^1\), which makes cities become vibrant centers.

Cities by linking people and companies respond to the need for physical connection. They provide the productivity advantages and support innovation as a result of connecting creative people. It occurs in Europe and America, but this phenomenon is even stronger in developing countries, where cities assume the role of ‘gateways between markets and cultures’ (e.g. Bangalore) (Glaeser, 2011).

The biggest advantage of the cities is connecting people in their density, which allows humans to learn from each other. It provides flows of ideas and information, gained by paying attention to other people’s successes and failures. Despite the influence of modern technologies and the fact that more and more activities become footloose, the proximity factor is still important, as the benefits of technologies become the most effective when combined with the knowledge gained through personal contact (Glaeser, 2011).

As E. Glaeser (2011, p. 15) indicated “[t]he strength that comes from human collaboration is the central truth behind civilization’s success and the primary reason why cities exist”.

Not only has the rapidly increasing urban population caused the rising importance of cities. Due to the globalization processes the major cities are gaining more and more economic and political power and become the main actors in the global economy. They apart from only taking the leading positions in their domestic economies, can function independently to their national economies, as they are widely connected in the urban network.

The scope of the thesis is connected with EU polycentric development objective at the European (macro) level. That is in consequence of the study’s focus on the metropolitan areas within the Baltic Sea Region, which covers the peripheral territory to North West Europe – Scandinavia and Central East Europe. By examining the

\(^{1}\text{In 2012 52.6\% of total world’s population was urban and the annual urban population growth was 2.1\%. data source: The World Bank, http://data.worldbank.org/ (access: 18.03.2014)\)
The aim of the thesis is to define position of Warsaw within the macro-regional urban system. Consequently, conducted is a comparative analysis of the major cities of the Baltic Sea Region (its EU part): Berlin, Copenhagen, Hamburg, Helsinki, Riga, Stockholm, Tallinn, Vilnius and Warsaw. The main research question appointing the focus of the study is: what is the position of Warsaw in the Baltic Sea Region city system?

The thesis comprises of four main chapters. The first one is a theoretical introduction and presents terms such as: system of cities, urban hierarchy, the global cities, urban networking and metropolitan functions. The main idea of the thesis is that cities form a global urban system, within which cities belong to different hierarchical levels. Determining a position of particular city can be achieved by examining the functions that it performs. Therefore, for comparison of the BSR metropolitan regions, the functions performed by the cities standing on the top of the global urban system are extracted and adjusted to the lower level of analysis. Consequently the concept of world and global cities is discussed and the functions that characterize these top level cities are compared with different approaches of defining the metropolitan functions. Based on those two, as a conclusion of the first chapter, determined are four functions: knowledge, decision-making, gateway and culture, according to which the analysis is structured.

The second chapter introduces the Baltic Sea Region and its urban system. The general information about the macro-region is provided and the difficulty with detecting a joined urban system within BSR is appointed. Additionally, what is crucial for the study, a link between the BSR cities’ system and the global cities’ system is determined.

In the third chapter the method – comparative analysis is presented. The operationalization of the hierarchy of cities and metropolitan functions is explained and the constructed model used for comparison is thoroughly discussed. That includes selection of the cities compared, the choice of data type, main problems that arose in the study, and also different approaches on metropolitan functions are discussed. Each of the functions...
is assigned indicators for the comparison, which are explained in detail – their scope, advantages and disadvantages. The chapter is concluded with explanation of the hierarchy creation, which is based on the four functions.

Eventually, in the fourth chapter the analysis is presented. Its focus is kept on the performance of Warsaw. Since all the examined cities were compared and graded respectively to their performance in indicators chosen for the four fields, the rankings of overall positions in each of the functions are presented. Then, the final outcomes of the analysis are gathered in the created hierarchy of cities. Afterwards, the improvement of Warsaw’s position is discussed, particularly what would need to be achieved for becoming a leading city in the macro-region, and which are supporting it potentials and holding it back limitations.

Among the literature used, the main theoretical concepts were taken from following publications. First a concept of ‘levels of analysis’ for cities is introduced in Urban Geography: a global perspective, by Michael Pacione (2009). The book gives a broad understanding of the urban geography of the contemporary world. It describes the expansion of the cities, their dynamics and stresses the importance of global perspective. From the second source, The Polycentric Metropolis: Learning from Mega-City Regions in Europe written and edited by Peter Hall and Kathy Pain, taken was inter alia crucial for this study hierarchy of cities. Despite that the book focuses on polycentric metropolitan regions, it is still relevant for describing current trends in metropolises and their functions. For introducing the world and global cities concepts were used the article The world city hypothesis by John Friedmann (1986), and mainly two books written by Saskia Sassen The global city: New York, London, Tokyo (2001) and Cities in a world economy (2012). Shortly, the former one presents world cities as main places absorbing international capital. While, according to S. Sassen due to globalisation a new spatial economy arose, and the control power is concentrated in global cities as they are sites for post-industrial production and consequently move up to the top of the global urban system.

Regarding the method used, for organizing the structure of analysis apart from previously mentioned sources, the most influential were research by the Global and World Cities Study Group and Network led by Peter Taylor – several articles and a book International handbook of globalization and world cities (2012) edited by Ben Derudder, which explain external relations of world cities, particularly defining the city connections, mostly based on the advanced producer services companies networks. Another source,
providing relevant information on the BSR and studies on its metropolitan regions (e.g. inspirational in case of used indicators) were Nordregio publications, particularly the Report 2008:3, *Exploring the Baltic Sea Region – on territorial capital and spatial integration*. Last, but not least, an important source also was *The Triumph of the city* (2011) by Edward Glaeser, which explains ongoing city dynamics and the process of gaining importance among major cities by presenting their characteristics.

Overall, the thesis starts with introducing the system of the cities, and its highest level – the world/global cities. Then, it moves to the lower – macro-regional level, where the analysed cites belong. Nevertheless, the fact of defining the functions on the global level is important in order to provide relevant information on cities development and allow determining their positions within the system. In relation to the purpose of the study, the analysis is carried out with the focus on Warsaw, which provides a closer view on its position in the system.
1. City system

1.1. Hierarchical system of cities

As the aim of the thesis is to determine the position of Warsaw in the system of cities, in this chapter the theories are used to identify traits of the cities placed on the top of the hierarchy, therefore providing useful information for the evaluation of the examined case – metropolitan areas in the Baltic Sea Region generally and Warsaw specifically.

In this chapter the structure of the system of cities and relations within it are presented. Moreover, the concept of networking is introduced to provide better understanding of the connections between cities in the system. It is assumed that within such a structure the role and position of a city is defined by the functions it performs, which also includes the functional linkages with other cities in the network. On the very top of the system are global cities, which play a main role in global economy. They perform particular functions, which can be also performed by other cities that are lower in the hierarchy, but often at a smaller scale. Therefore, the position of a city in the system can be established by examining the functions it fulfils.

In this section, particular focus is aimed at discussing the concept of city systems. Starting with a definition of a city system, it is further elaborated due to the process of globalization. Two ways of looking upon the system are presented: what different levels of analysis to apply on the cities and the hierarchy of cities.

When talking about cities’ systems an important issue is the change of relations between cities and the countries in which they are located, that has occurred following the globalisation processes. Originally, relations between cities and states have been antagonistic, with power centralized at country level at the cost of cities. Later, cities started having an important part in creating national economies, but as they were dependent on the country, the relations of power were mutual. Finally, the relations have come close to antagonistic again, as due to globalization more and more power is concentrated in the cities, now at the expense of national governments. Furthermore, after these last changes the opportunities of expansion for major cities appear in transnational connections, instead of within the national economies. Such conditions
have enabled the strengthening of ties between the cities and have proven substantial for emergence of a global system of cities (Taylor, 2000).

The concept of ‘system of cities’, as explained by A. Pred (1977), refers to the group of cities economically connected with each other (a city linked with one or more urban areas). At that time, the author considered its existence only on the national or regional level:

[A] system of cities is defined as a national or regional set of cities which are interdependent in such a way that any significant change in the economic activities, occupational structure, total income or population of one member city will directly or indirectly bring about some modification in the economic activities, occupational structure, total income, or population of one or more other set members (Pred, 1977, p. 13).

However, the understanding of the term needs to be more precisely elaborated. Such definition nowadays also describes the global scale, as such interconnections exist between the cities outside the national borders. The processes of globalization introduced changes in all levels of urban systems – local, regional, national and global levels, therefore increasing their interconnections. The factors and processes shaping urban areas influence many levels instead of a separate one, making it far more complex. M. Pacione (2009) refers to the current structure as a ‘global-local continuum’. To explain it he introduces a framework of ‘levels of analysis’ and presents five scales, which interlock each other (hierarchically from the top):

- the world system of cities – world cities as places of concentration of political and financial control;
- the national system of cities – arena of national politics, especially in case of improving national economic development, which strongly influences individual urban areas and the relations between them;
- the region – the case of spreading urban influences into rural surroundings and emergence of concepts such as urban region, metropolis, conurbation or megalopolis;
- the city – the centre of economic production and consumption, location for social networks and cultural activities, and seat of government and administration; its role can be examined in regional, national and international levels;
• the neighbourhood – local scale, usually concerning issues like: revitalisation, social segregation, quality of provided services.

These levels should not be seen separately, as they can all refer to the same city, depending on the scale of discussion. The concept of presented levels should be looked upon as a multi-level interdisciplinary perspective to understand the complexity of urban system in global scale (Pacione, 2009).

For the purpose of this thesis the top level is of particular importance. The world system of cities shows the increasing interdependence of cities and states in the global economy. Such a system includes major cities that are political and financial control centres (Pacione, 2009). At the global level these cities can be identified as “fundamental territorial nodes of the modern global economy, with systematic and frequent exchanges among them helping to shape the world system’s economy” (Smith & Timberlake, 1995, p. 288). Following that approach, the world system consists of broad network of places linked by numerous different exchanges, such as flows of people, capital and ideas. These exchanges are results of individual actions, coming from diverse social contexts, affecting both the character of cities and the world system structure itself (Smith & Timberlake, 1995).

Another approach towards explaining relations within the world urban system is by ranking the cities. A pioneering hierarchy, which referred to allocation of consumer goods and services, and market size in cities, was developed by Walter Christaller in 1933. Christaller referred to a city system on a regional scale in Germany and created a seven-level urban hierarchy, on the top of which were regional centres. The model did not include the possibility of exchanges other than between a city and a higher-order centre e.g. not between the same level cities, therefore ignored relations between major cities. In this model the system was a completely self sufficient and constituted a closed structure. As a result, the model failed to properly express the real situation, and since that time the situation was heavily affected by the processes of globalization (Pred, 1977; Hall & Pain, 2006).

However, based on Christaller’s model and by adding new levels to it, considering the shift of functions or importance between them and broader interconnections P. Hall and K. Pain (2006) presented a hierarchy of cities. It was based also on the work of Globalization and World Cities (GaWC) Study Group and Network at Loughborough
University led by Peter Taylor (further discussed in section 1.3.). This hierarchy is a particularly important concept for the thesis as it classifies cities into levels, of which the second stage of ranking is crucial for the analysis.

On the top of the system are global cities (called by the GaWC group alpha global cities) that have 5 million inhabitants or more and their administrative borders reach to around 20 million within the hinterlands. These cities effectively provide services for vast global territories, the examples of such cities are London, Paris, New York and Tokyo (Hall & Pain, 2006).

Right after them, on the second level are the sub-global cities (beta and gamma global cities) – they usually have between 1 and 5 million inhabitants and up to 10 million in their hinterlands. These cities fulfil very similar functions as the previous group yet for a smaller territory – national and regional, while they can provide some specialized functions on the global scale. For instance, in Europe capital cities belong to this category, with the exception of the former mentioned global cities. Additionally, a few others belong to this group, like cities that provide top political and commercial functions (e.g. Milan and Barcelona) or major regional centers in large countries (e.g. Glasgow, Manchester, Lyon or Hamburg) (Hall & Pain, 2006).

On the next level are regional cities with 250 thousand to 1 million inhabitants, which can in some cases be classified as showing evidence of world city formation and provincial cities with population of 100-250 thousand. This category concerns typical country market towns in rural areas, which provide local services, but also some of the national services. Both of these categories of cities appeared on the two top levels in Christaller’s model. Furthermore, the lower groups in Christaller’s model still function but often they have lost their functions which have shifted to the higher ranked cities – usually regional or provincial cities (Hall & Pain, 2006).

Described shortly, the global city system is a very complex concept that can be analysed from different approaches. The first one presented, by M. Pacione (2009), refers to its interlocking relations in a global-local spectrum, which allows to structure issues from different spatial levels in a framework of ‘levels of analysis’. In the second, P. Hall and K. Pain (2006) concentrate on the hierarchy within the system and grouping cities into ordered levels according to the functions they perform. This is the approach used in the thesis, however in a smaller scale due to the nature of the research area. Nevertheless, both
of the views help understanding the complexity of relations and connections between cities in the global system. In the following section the top level in the urban system – global cities, is discussed.

1.2. The concept of the global city

Global cities are on the very top of the cities hierarchy. In the system they are the most influential and perform the widest range of functions. Accordingly, this concept is closely analyzed, as the later examined cities of lower categories can either partly fulfill some of the same functions as the global cities or do it in a smaller scale. Therefore cities standing on the top of the system are looked upon to identify the most important functions performed by cities, which allow defining position of metropolitan regions in the system.

One of the initial approaches towards cities that have taken into consideration linkage between urbanization and global economy was developed by J. Friedmann (1986) in his ‘world city hypothesis’, which set a framework for research in this field. One of the most important assumptions was that cities can be ranked by the economic power located in them, which meant that they were used as ‘basing points’ for global capital. That showed a spatial organization of markets and production sites, with visible linkages which allowed classifying major cities in a complex spatial hierarchy. J. Friedmann defined a separate category of ‘world cities’ and proposed a list of cities that met several criteria. Those were: major financial and manufacturing centres, major transportation nodes, locations of head-quarters of trans-national companies and international institutions, which also were characterized by rapid growth of business services sector, and large population size. As Friedmann’s hierarchy was based on the fact that cities attract global investment, the position gained by a city should not be seen as permanent and can change due to the possibility of being influenced by external factors, e.g. political change or innovative technologies. What is more, the possibility of adding further order (3rd or even 4th level) cities to his global hierarchy, which would be interesting for this study, was indicated in Friedmann’s research, though did not happen as his interest lied in identifying the cities at the very top of the system (Friedmann, 1986; cf. Smith & Timberlake, 1995).

Another, more comprehensive approach towards world cities was developed by S. Sassen, as she introduced a term ‘global city’. The concept evolved due to globalization of economic activity and was a type of organizational concept. Other closely related terms,
describing the same phenomenon are world cities, supervilles or informational cities (Sassen, 2005).

For introduction of the global city concept, its formation and the functions that it performs, the seven hypotheses assumed by S. Sassen (2001, 2005) are useful. (1) Globalization causes a geographic dispersion of economic activities, but at the same time they are integrated together (cooperation in a network), which strongly supports growth and the significance of central corporate functions. (2) The complexity of those functions increases so much that they are being outsourced by the global firms’ headquarters to specialized service companies (e.g. legal, public relations, accountancy or programming services). (3) The expansion of these service firms connected with their more and more complex actions, their engagement in global markets and increased speed of transactions creates a unique agglomeration dynamic. All the components – combination of specialized firms in diverse fields and talents turns the city into an information centre. (4) With rising number of outsourced functions the localization of headquarters becomes less tied to a particular place. Therefore, the specialized services sector with its networked form becomes the most influential for the global cities production advantages. (5) To function at a global level the specialized service companies have to participate in a network of affiliates or some additional partnership, which causes strengthening of the international linkages between different major cities. This can be seen as an emergence of transnational urban systems. The global cities become more integrated in their international network and the connection with their hinterlands or sometimes even national economy weakens. (6) The increase of high specialization and professionalism causes growing disparities inside the city. (7) As a result of these some economic activities (with lower profit) choose informalization so that they can survive on the market despite competition from high-profit making firms. Such circumstances strongly influence relations inside a city and between urban areas and have led to the emergence of global city concept (Sassen, 2001, 2005).

Therefore, considering that the world economy has a dual nature that combines spatial dispersion and at the same time integration of actions at the global level, it generated a crucial function of main cities in the world system. Additionally to their core position in worldwide trade and banking, they started functioning (Sassen, 2001):
[F]irst, as highly concentrated **command points in the organization of the world economy**; second, as **key locations for finance and for specialized service firms**, which have replaced manufacturing as the leading economic sectors; third, as **sites of production, including the production of innovations**, in these leading industries; and fourth, as **markets for the products and innovations produced** (Sassen, 2001, pp. 3-4).

These new roles gained by the cities influenced significantly both urban structure and international economics. Cities became places of broad assets concentration, meanwhile their social and economic organization got transformed by specialized service industries. Such traits characterize unique kind of city – **the global city** (Sassen, 2001). S. Sassen (2012) estimates the number of current global cities around seventy worldwide. As the leading examples she mentions main international business and financial centers, such as New York, London, Paris, Frankfurt, Chicago, Seoul, Hong Kong, Shanghai, São Paulo, Mumbai, Zurich, Amsterdam, Sydney and Toronto, but also other cities belong to the category of global cities, for instance, Buenos Aires, Shenzhen, Kuala Lumpur, Istanbul and Budapest.

Different cities in terms of culture, history, economy and politics, in distant parts of the world have experienced significant and similar transformations affecting their economic, spatial and social systems likewise\(^2\). This phenomenon can be explained by referring to ongoing global processes and the changes in world economy. However, global cities should not be seen as solely originated by the global economy, when their internal specifics, its spatial and social conditions count as well. Still, the cities are of great importance for comprehension of the global system as main structures of world economy are essentially located in them (Sassen, 2001).

According to this concept cities should be seen more as separate places (connected with each other in a network) rather than be tightly related with their national economies. It can be explained as an emergence of new geographies of centrality that replaces the former division for rich and poor countries. The transactions between them occur mostly through financial markets, flows of services and investment (Sassen, 2012). The global cities and their networks are at the same time place centred – because of their peculiar location; and transterritorial – as they are linking together distant places which simultaneously are closely connected between each other (Sassen, 2005).

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When looking more broadly at concept of the global city, the functions mentioned above are often fulfilled also by other cities in lower scales – at trans- or sub-national levels. That means that equivalents to global cities (of smaller importance) exist at regional level (Sassen, 2012).

What is more, an important aspect as S. Sassen (2012, p. 7) stresses is that “[t]here is no such entity as a single global city”. All of them, both at global or regional level, have to collaborate together in performing their functions, because economic growth of these cities is often a result of the expansion of interurban networks (Sassen, 2012). All these cities are a part of the system, interacting together. To explain these relations more closely, the concept of city networks is introduced in the next section.

The new economic trends and their spatial implications are adopted in divergent patterns in different urban systems. Some of the cities become parts of the transnational networks meanwhile other are set aside, which prevent them from economic growth. In case of European urban systems different trends also appeared, including some of the cities reaching the global level and becoming a part of the urban system at its highest level.

In the European urban hierarchy the top level cities also play key roles in the higher level – the world system of cities. As such are defined: Paris, London, Frankfurt, Amsterdam, Zurich, Madrid and Milan. The next group of cities in the European urban hierarchy is less oriented towards the global economy. They constitute a network of European financial, cultural and/or service capitals, which comprises of cities such as *inter alia*: Edinburgh, Berlin, Dublin, Rome, Stockholm, Prague and Warsaw. They perform either only one or more functions, which influence the organization of European macro-regional scale. This is the group of cities on which the focus of the thesis is concentrated. Then, several cities belong to lower influential levels with various divisions of cities acting in lower scale (Sassen, 2012).

Overall, there is a group of global cities standing on the top of the world urban system, by S. Sassen (2012) estimated as around seventy. The main role that they perform is being control centers in the global economy. However, below the global level, there is a group of cities showing evidence of world cities formation and fulfilling to the lesser extent some of the global city functions. The focus of this study concentrates on cities below the global level, which are less oriented towards the global economy.
1.3. City networks

As the global cities are important in the global economy as a system – not individual cities (due to various flows passing between them), the concept of their networking needs to be presented. To start with the work of M. Castells is presented his definition of spaces of flows and places that well describes the concept of networks. This issue is further discussed in case of global system of cities as different attempts to define the networks between the cities are presented.

M. Castells (2002) made a distinction between ‘space of flows’ and ‘space of places’. In the latter one, electronic flows connect different territories together into an interactive network linking people and activities. The flows have a spatial character – they are not a-territorial, e.g. in the financial- or media- or international production- networks. Those systems are built of separate, distant locations that are related to different hinterlands. Though, they are connected with each other and could not exist separately as their functions and meanings originate in those connections. Therefore, they are not only electronic networks, but places connected by those electronic networks. They form a specific ‘hybrid space’ – the space of flows.

On the other hand, the space of places refers to the organization of experience and actions in the local scale. The cities are formed and restructured by both logics of the two contradictory spaces – of flows and of places. The cities are transformed by a combination of both the electronic communication and physical interaction, or differently saying “by the combination in practice of cities, networks and places but without fully integrating them” (Castells, 2002, p. 554).

As an example of defining city networks, in his research J. Friedmann defined world cities and categorized them into four categories: (1) ‘global financial articulations’ which are: New York, London and Tokyo; (2) ‘multinational articulations’ – e.g. Miami, Los Angeles, Frankfurt; (3) ‘important national articulations’ – e.g. Paris, Zurich, Madrid; (4) ‘sub-national articulations’ – e.g. San Francisco, Barcelona, Munich. To such organized list of cities he referred as to a network, assuming that those cities are interconnected and form a system (Smith & Timberlake, 1995).

D. A. Smith and M. Timberlake (1995) classified the interactions that constitute a network into four categories considering their form and function that they may have. The most important for strengthening or affecting the system were (a) economic flows (such as:
labour migration, commodities, business communications, etc.). But also the other groups of relations were found as influencing the network: (b) political – e.g. treaties, invasions, foreign aid, (c) cultural – e.g. exhibitions, visiting artists and (d) social – e.g. family migration, or remittances.

On the other hand, P. J. Taylor et al. (2002, p. 233) (GaWC Group) in their research see world cities as “«global service centers» within an interlocking network”. According to this approach, the cities interconnections can only be defined by basing the research on the networks of financial and business service firms’ offices. All the flows within city network happen between this office system – exchanges of information, knowledge, ideas and instruction in virtual and material form, so that what forms the network is face-to-face contacts and electronic transmissions. This leads to limiting the world city network to “an amalgam of the offices of global service firms and the flows they generate” (ibid., p. 233). Such definition may seems to be a narrow view on city networking, but on the other hand it allows detailed empirical analysis, based on examining real connections between the cities (companies located in them), which in other approaches are hard to define or need a lot of assumptions and do not present actual relations.

Also, when introducing the subject of city network in a case study of New York, London and Tokyo S. Sassen (2001) focused on economic indicators but in a broader way – examined were those that represent finance and investment. The observed relations between the three cities were beyond competing for business and they were assumed to constitute an economic system combining the three different locations. Particularly, the cities accommodated variety of international markets, great combination of producer services on international level, and of foreign firms, and they were main sites for international property market. Such a concentration of economic activities creates internationalized spaces within these cities as domestic urban areas, so that a systemic connection between them was drawn.

In her later work, S. Sassen (2012) comes to a conclusion that there is a new kind of urban system arising, which functions at global and transnational regional levels. “This is a system in which cities are crucial nodes for the international coordination and servicing of firms, markets, and even whole economies that are increasingly transnational” (Sassen, 2012, p. 58). The coordination or organization function of those cities needs to be stressed

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3 Further discussion on this topic is carried in the method chapter – on the matter of use of attribute and relational data.
as it has a strategic role and should not be mistaken with just consuming of globally distributed goods and services or foreign direct investment. This function is ruled by the global cities. Moreover, the global cities become also strategic sites in an upcoming international cultural and political geography. Several of the global cities evolved in 1990s during the expansion of global economy, when many countries introduced the policies (deregulatory and privatizing) allowing to enter into the global corporate system. Other emerged due to other processes, for instance migration or global culture (Sassen, 2012). Such an approach contributes to the former mentioned division applied by D. A. Smith and M. Timberland.

Still many large cities are mainly functioning in the national context and do not belong to the global network, as one of the characteristics of the global cities is at least partial separation from their national economies. The transnational urban networks can operate over the national borders, the transactions are sidestepping the countries, due to the diminishing importance of ‘the gatekeeping functions’ (Sassen, 2012).

Talking about city networks and hierarchies of cities a lot of attention in academic work is paid to the highest rank of cities, when those below it are often not given that much interest. An attempt to point the cities beyond the commonly acknowledged top level was taken by GaWC Study Group and Network, who created a “Globalization and World Cities inventory” based on the level of advanced producer services in: accountancy, advertising, banking/finance and law. Such a choice was based on the argument by S. Sassen that advanced producer services are a distinctive feature of contemporary world city formation. Cities considered to have world importance in the four fields of advanced producer services were classified into three categories: alpha (10 cities), beta (10) and gamma (35) world cities⁴. The classification relies on the actual inter-city relations that indicate existence of network between the cities examined (Beaverstock et al., 1999).

Described in this section were relations within the city network on the highest level, but it is assumed that position of a city in a network corresponds with its place in the system. Consequently, cities on the top of the hierarchy are the best connected by flows, the same as they perform the widest range of functions. Then the lower position in the system they have, the less connected they become in the network, as they perform

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⁴ Most of the later analyzed cities were ranked as gamma world cities (within this category Warsaw and Stockholm one point above Berlin, Hamburg and Copenhagen), Helsinki were classified as having evidence of world city formation and only Tallinn, Riga and Vilnius did not appear on the list (Beaverstock et al. 1999).
functions poorer. Moreover, the functions performed and the connections in the network overlap and are resultant from each other.

1.4. Metropolitan functions

In this section functions performed by the cities are discussed, starting from those fulfilled by the cities on the top of the global system, moving to those in the lower levels. Based on former presented theories and adjustment to the scale of further conducted analysis – macro-regional level, four general functions are chosen and described.

Regarding the global cities, they can be defined by the functions that they fulfil. As outlined by S. Sassen (2001, 2012), their crucial roles are: being a command point in the organization of the world economy; key location and market place for leading industries (advanced producer services for companies and finance); and being a site of production that also includes innovation. As visible such defined functions are evolved mostly around their role in the global economy. These functions can be partly performed by other cities, either in smaller levels e.g. continental or national scale, or even globally, although then not all of them, but only a specialized one.

However, apart from the functions performed by the global cities, there are a number of roles, not necessarily affecting world economy, but important for a city functioning in a lower level and still affecting its international position. Large cities below the global level host less of the influencing world economy activities and number of other functions (often connected not only with economic activity), which drive the urban development. That does not mean that these functions are not performed by the top level cities, but in the previously presented approaches they were not really taken into consideration as they may not have sufficient influence on transnational networks and global economy, but more on single city hierarchical position in the system. To this issue the earlier presented concept of global-local continuum (Pacione, 2009) is related, as it gathers several levels of factors affecting urban change. Consequently, the lower level functions are present in the global cities, but not paid attention to in studies concerning their global role.

As the aim of the thesis is to discuss city functions at macro-regional level the focus is on the metropolitan functions. The term ‘metropolitan’ should be understood as determining city significance on national or continental (usually European) level,
by referring to particular functional profile and/or distinguished urban structure. This term is related to the cities, which can be equivalents to the global cities at a lower level (in European context they can be referred to as ‘metropolitan regions’ or ‘metropolitan areas’) (ESPON, 2013).

Based on the roles performed by the global cities, and different approaches to performed metropolitan functions (discussed later, in the method chapter, section 3.2) four groupings of functions are chosen. They are related to the functions performed by cities on the top of the hierarchy, but significantly less taken into consideration is the role played in the global economy. Moreover, they were adjusted to the needs of further analysis – performance at a macro-regional scale. However the connection with the roles of global cities is appointed in the functions introduction below.

(1) Knowledge function

Global cities are the places of production of innovations and markets for it (Sassen, 2001, 2012). Consequently, in the focus of the knowledge function the creation of innovation is included. However, it also describes other aspects of knowledge generation. It is related to the broadly understood knowledge base, human capital and potential for innovativeness. Metropolitan regions should be locations for universities and research and development centers as places that create innovation. They should attract talented and skilled people and support exchange of knowledge and ideas. Education implies also better quality of labour force. As E. Glaeser (2011, p. 253) indicates “Education is […] the most reliable predictor for urban growth, especially among older cities. Per capita productivity rises sharply with metropolitan area size if the city is well educated, but not if it isn’t”.

(2) Decision-making function

This function is the most connected with the global city formation. It represents the role of centre of economic power, by including several functions that both J. Friedmann (1986) and S. Sassen describe (2001, 2012). Those are: presence of central corporate functions as headquarters of companies, advanced producer services, particularly the financial centres, which overall influences the role of command point in the global economy. What is more, according to the GaWC research based on the networks of corporations the city networks can be defined.

Additionally, what is included by J. Friedmann (1986) is that not only the corporate control affects being a command centre, but also presence of international institutions.
What is more, included in further analysis is being a national capital, which can introduce a lot of control functions, usually not in global scale, but it is of great significance in international relations, not to mention the position in the country.

(3) Gateway function

This function is related to the connectivity within the city network, which was earlier described in the previous section (1.3.). This can include different type of flows, e.g. electronic as the transfers of data, or movement of people in flight connections. A part of this function is fulfilling the role of a transportation node, which was used as a criterion to define the world cities by J. Friedmann (1986).

Moreover, this role is interconnected with performing other functions, as it is visible in classification of the flows into being economic, political, cultural and social by D. Smith and M. Timberlake (1995). What is more, the data about flight connections or passengers is a relevant indicator to present connections within a city network (ibid.).

For the metropolitan cities this function indicates being a transport node, and reflects the accessibility and connectivity of the cities and their markets. It concerns all types of transport, connections by car, train, air traffic or the ferries. But the most relevant are the flight connections, as they can show relation to world connectivity, especially for cities more peripherally located.

(4) Cultural function

Cultural function is present in the global cities, although is not included among the most important functions influencing the global economy, but D. Smith and M. Timberlake (1995) mention it as one of the types of flows is related to it. Furthermore, with the emerging term of ‘cultural economy’ (further explained in the method chapter) some of the cultural services especially the higher-order can be seen also as the advanced producer services, facilitating control function. Additionally, discussed by Sassen (2012) are various aspects of immigration, the multicultural atmosphere in the global cities, which affects also their cultural offer.

In regard of metropolitan cities, they should be characterized by developed cultural offer, which enhances the cities’ attractiveness and can create a specific identity. Cultural life is a base to attract talented people and tourists. This can also contribute to supporting innovation. The cultural offer should include museums, galleries and theatres, but nowadays a chain of exclusive restaurants can have even a bigger importance, as it is
a sign of well qualified services. For instance, global cities like London or Paris are famous for their restaurants and other cultural services (Glaeser, 2011).

The more thorough discussion on the topic of metropolitan functions is presented in the method chapter. There explained is the way of choosing the functions, operationalization of cities hierarchy, and specific indicators used to define performance in each of the functions, also including their faults and advantages.

Summing up, considering the current globalization processes some cities play important roles within the global economy. They are defined as global/world cities and take the top position in the cities’ system. Their position can be defined by performed functions, which in the global scale are mostly related to being an economic command center. However, in this thesis the concept is applied on a lower level – macro-regional – Baltic Sea Region, to analyse its metropolitan areas. The functions drawn from the global level were for the need of the analysis adjusted to the scale of study. In further part of the thesis the four chosen metropolitan functions (knowledge, decision-making, gateway, and cultural function) are used for assessing chosen metropolitan regions and their positioning within a BSR’s hierarchy of cities.
2. The Baltic Sea Region

2.1. The Baltic Sea Region – introduction

The Baltic Sea Region after tradition of cooperation became the first macro-region in European Union in 2009. Its territory covers the countries surrounding the Baltic Sea: Sweden, Finland, Norway, Denmark, Poland, Belarus, Lithuania, Latvia and Estonia, and parts of Germany and Russia (see map 1). The countries cover approximately 2.5 million km². At the same time the population is low, it is inhabited by 103 million people, with density of around 44 people/km². Most of the land is covered by forests or used for agriculture (Hannel et al., 2000)\(^5\).

Map 1. The Baltic Sea Region


\(^5\) See also: http://www.nordregio.se/en/Metameny/About-Nordregio/Research--Development/Geographical-scope-we-cover/Baltic-Sea-Region/ (access: 24.06.2014)
The history of cooperation within the region dates back to the establishment of the Hanseatic League in XIII century, which supported the trade in the Baltic and North Seas. In fact, the collaboration was established between the market cities based on trade connections between them over the sea. Later the Baltic Sea Region arose as a transnational macro-region in the beginning of 1990s, after the fall of the iron curtain and its subsequent geopolitical changes. The aim was to invent new methods, tools and ways of cooperation for solving shared challenges. The ground work for collaboration in the case of spatial development was set by VASAB (Vision and Strategies around the Baltic Sea) in 1992. Over the years the initiative was explored by the national ministries responsible for spatial development. A common framework was developed for the promotion of transnational cooperation between regions and cities in national spatial development policies and integration of this dimension into the work of pan-Baltic organizations (Schmitt & Dubois, 2008).

Currently the cooperation is guided by the EU Strategy for the BSR, which has four key challenges: sustainable environment, regional prosperity, accessibility and attractiveness, and safety and security. The implementation and financing of the strategy objectives comes partly through the BSR Programme, whose aim is to make the region attractive for investment, work and living. It also points to priority areas, which are: (1) fostering innovation, (2) internal and external accessibility, (3) the Baltic Sea as a common resource and (4) attractive & competitive cities and regions. As visible here fair part of attention is steered towards the urban areas.

2.2. Baltic Sea Region urban system

This section aims to describe the urban system in the Baltic Sea Region. It presents the changes and emergence of cooperation within the region together with a classification of cities in the macro-regional system. Moreover, the connection to the global urban system is drawn. Furthermore, the approach of strategic documents towards the metropolitan regions and their cooperation within the system is looked upon.

The Baltic Sea Region covers a large and diverse territory, meaning that its urban system is dichotomous, a characteristic trait for macro-regions. The BSR urban system can

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6 http://www.nordregio.se/en/Metameny/About-Nordregio/Research--Development/Geographical-scope-website/about/Baltic-Sea-Region/ (access: 24.06.2014)
be described as a specific combination of national systems with connections between its diverse subsystems, rather than one single system. Looking particularly at the metropolitan areas in BSR, they reflect the top level of different national urban systems. As a result, the city sizes within the whole region do not follow the rank-size rule. This implies that a joint urban system has not yet emerged in BSR (Hannel et al., 2000; Hanell & Neubauer, 2005). Therefore, in the thesis the examined metropolitan regions are looked upon as a lower level (macro-regional) part of broader city system functioning in the world, which is further explained later on.

Despite the dichotomous character of the region, some of the cities have a common historical background as a result of cooperation between them. This is especially true for those bordering the Baltic Sea, since they were connected by the Hanseatic League. Moreover, further cooperation occurs between the cities aiming to increase the BSR economical and cultural position in Europe (Hanell & Neubauer, 2005).

Also affected by the globalization processes the cities become more and more interconnected, particularly the metropolitan regions. In the process of gaining importance the major cities in the BSR followed the same pattern as the rest of the world. However, this happened at a later time, in most of the BSR in the second part of 1990s, especially in the post-socialist countries. Primarily the capitals or major cities in the BSR were functioning only as a part of their national urban systems, except for their role of gateways into the national economies. This allowed a more balanced development within a country. Though this trend changed in the 1990s, with high migration into urban areas and growth of economic strength of major BSR metropolitan regions, which indicated an increase in spatial polarization. The capitals and some other major cities became locations for foreign investment, business and personal services, gateways for international trade, centres of tourism, but also organised crime. This strongly influenced the economic development of the metropolitan regions and changed the national urban systems, allowing the growth of importance of the major cities and their functions. Further strengthening of the role of the cities was caused by introduction of new information and communication technology (Hanell & Nielsen, 2002).

Today the cities in the region can be classified into different hierarchical types, considering their functions and position in the system (Hanell & Nielsen, 2002):
• National centres that concentrate high-range functions of production, distribution, circulation and control and also national decision-making functions – in these cities headquarters of big national corporations are located, top branches of international ones and also centres of national business organizations and services, trade unions and political parties. Moreover, they act as gateways for exchanges of commodities, services and information. Such a role is performed in the BSR by the national capitals and also St. Petersburg and Hamburg (except for the national administration and control function in the last two).

• Other big cities that fulfil substantial functions of production, distribution, control and circulation – they have some headquarters of big companies, business services in national scale, they play some role in import, export and transport, and also manufacturing for international markets, for instance, Göteborg, Århus, Kraków or Wrocław.

• Cities that perform large-scale specialized functions in one of the former mentioned areas: production (e.g. Upper Silesian conurbation), circulation (e.g. Klaipeda) or control (e.g. Västerås).

• Cities with specialities – mostly they are middle-sized industrial cities or specialized in higher education. For example, this category is represented by: Rostock – transport, Mariehamn – shipping, Tartu – university.

• Regional centres performing core functions at regional level – they have main role in interregional cooperation and exchanges, especially cities with regional administration belong to this category (Hanell & Nielsen, 2002).

Although it is impossible to define a joined city system within the Baltic Sea Region, it is seen as a regional part of the global urban system. Such an approach is justified especially regarding hierarchical structure patterns visible in the types of cities presented above that reflect the hierarchy of cities in global scale by P. Hall and K. Pain (2006), which was introduced in the first chapter. Such an assumption is essential for the study, which examines the role of cities in the international level. It allows for the indication of connections not only within the macro-region, but also in wider scale.

The attention on the urban system, particularly concentrated on the national centres, also appears in the BSR cooperation programme. That is because the urban system of international importance was established as one of the goals for Baltic cooperation
already in 1992 in the VASAB 2010 vision. The objectives to obtain were: competitive system of cities that attained value from cooperation across BSR and with the rest of Europe, ensured spatial cohesion by the system of the cities, regional economic and environmental balance supported by the links between urban areas and rural hinterlands, and attractive urban environment for inhabitants and investment (Zaucha, 2006). In the revised document VASAB 2010+ the first of the key themes in spatial development action programme is co-operation of urban regions on key issues of sustainable development. The main challenge here is to raise competitiveness of urban regions leading to enhancement of a polycentric urban system. This is to be obtained in three ways: (1) by strengthening the powerful metropolitan regions at the international scale, (2) by catching up by the less dynamic major cities with the more successful ones, and (3) by strengthening medium-sized and not diversified secondary cities to fulfil the role of growth engines for lagging rural regions (Vision and Strategies…, 2001).

It is visible that among many other objectives the role of metropolitan regions plays an important part in the BSR agenda. Considering the international context of the analysis – viewing the cities as a part of global cities system and examination of their positioning within the BSR, the topic of the thesis can correspond with the theme of the objective – to strengthen the powerful metropolitan regions at international scale.
3. Method

3.1. Method introduction

In this chapter presented is the method used for the analysis. That includes way of measuring, data collection, choice of indicators and system of grading which lead to formulation of the hierarchy. In this section the main information are introduced. The choice of the compared cities and data type are justified, and also main problems are appointed. Then, in the following parts, the metropolitan functions with indicators chosen to evaluate them are discussed. In the last section the city positioning and formation of the hierarchy is explained.

The aim of the study is to identify the position of Warsaw in the city system, which required a reference to other cities. Therefore comparative analysis was used as a research method. The focus of the thesis is on the Baltic Sea Region, as that is the territory where Warsaw belongs according to the regional cities’ system. The comparison was conducted in relation to other BSR major cities, mostly capitals. The goal is to determine those cities’ positions, which will result in forming a hierarchy and, based on that, it will be possible to establish the position of Warsaw in the system.

To limit the number of cities examined only EU member countries were taken into consideration and only the top level cities from each country. This limited the number of cities examined to nine, which are the eight capital cities, Warsaw, Berlin, Copenhagen, Stockholm, Helsinki, Vilnius, Riga and Tallinn, and additionally Hamburg. Such a choice was conditioned by literature overview, for instance P. Hall and K. Pain (2006) indicate that all European capitals can act as sub-global cities, mentioning also there a few other metropolis, including Hamburg. The high importance of these metropolitan regions was also recognized by the studies on BSR\textsuperscript{7}. Another issue concerning the choice of cities was if, due to their relatively smaller size, the capitals of Baltic States should be included. However, as capitals they were estimated to be important actors in the macro-regional scale in which the study is carried out so they were included in the analysis.

The main assumption justifying the study, which was based on the reviewed theories, is that, despite it is hard to define a joined regional urban system in the Baltic Sea

\textsuperscript{7} Hanell \textit{et al.}, 2000; Hanell & Nielsen, 2002; Hanell & Neubauer, 2005; Schmitt & Dubois, 2008;
Region, the cities chosen for analysis belong to the global city system and constitute its part in the macro-region – BSR.

Next step, when it comes to the choice of data, there are two ways of measurement for the cities, either based on their individual characteristic (attributes) or connections between them (flows). This indicates use of different type of data, for the former one attributional, and for the latter relational. The attribute data serves well for comparative analysis and ranking objects by certain characteristic from highest to lowest. On the other hand, relational data allows network analysis, examining the connections between the cities, e.g. in a flow matrix. In this method the examined objects need to be linked with each others, form a system, and so are inter-related. Such a condition is not necessary for using attributional data – there the objects can be independent individuals (Taylor, 1997).

For instance, to describe cities’ relative powers rankings organized by a relevant attribute are usually used, e.g. number of headquarters or size of stock exchange. In such an approach the power is measured as a quantity in the cities hierarchical model. But, according to the GaWC research power should be treated as a relation. That indicates that attribute measures can describe the significance of a city in the world economy, but they can not show how well the city is connected (Taylor et al., 2002).

However, looking into the literature, both J. Friedmann (1986) and S. Sassen (2001) focused their research on city attributes. Without the data concerning inter-relations between cities as individual members of the whole system of cities, it was necessary to assume that good performance in a chosen indicator e.g. concentration of high-level services, means that the city is well connected. Popularity of this approach is often caused by the wide variety of attribute data and poor, limited access to relational data (Hall & Pain, 2006).

Such an approach was also followed in this thesis, mostly because of the type of data possible to obtain. Moreover, it also allows investigating metropolitan functions in their broad understanding. Unlike while using relational data, when usually a certain, single function is chosen e.g. advanced producer services and the whole study is focused around it, for instance practiced in the GaWC research. Assuming the attributional approach the aim of the thesis is not to define a city network, but to establish significance of cities in the region by comparing their attributes.
The biggest amount of data for the analysis was collected from the Eurostat database, particularly from the urban audit section. When singular data were unobtainable in the database, they were taken from the suitable national statistics office. Also some chosen indicators and data sources for them were inspired by the documents, especially maps published by Nordregio. The data sources used only for single indicators are mentioned later, when the chosen variables are discussed. Due to the lack of data for some indicators several assumptions and estimations had to be made. That is also further explained in relation to particular indicators.

Effort was made to gather as recent data as possible. Unfortunately not for all indicators the newest data were accessible. That is why the year of origin of some data varies between different indicators, but not within one of them. That was assumed to be an acceptable estimation as the results in examined indicators are affected by long-term processes and do not vary significantly in short distance of time. So that the difference of a few years between separate variables is seen as not affecting the results.

A problem for conducting a comprehensive analysis on the metropolitan regions is that many data, especially gathered on the national level, are often oriented for the needs of the country. That indicates data only for larger units than cities (often NUTS 2 regions), but that is of course variable regarding different countries. However, nowadays the international data systems are improving, e.g. the Eurostat urban audit collects wide range of data on the city level. That facilitates a lot the research on urban areas at the international level.

### 3.2. Different approaches on metropolitan functions

This section concerns different ways of defining and measuring the metropolitan functions resultant in establishing cities’ positions. The overview is given on the different approaches to metropolitan functions that were looked upon and in relations to the functions performed by global cities, contributed to the choice of particular functions. The functions are knowledge, decision-making, gateway and culture, and they were already introduced in the theoretical chapter (section 1.4.). Later they are used to determine the positions of examined cities in the hierarchy.

Defining the metropolitan functions can be problematic, because of not exclusive nature of some of the functions (they can overlap each other) or the issue of finding
relevant indicators to represent them. Many different approaches exist towards this subject and some of them are reviewed in this section.

First of all, one of the most common in EU rating should be reviewed – the approach presented in ESPON project 1.1.1 that assessed functional urban areas’ (FUAs) functions, and led to creation of the Metropolitan European Growth Areas (MEGAs) hierarchy. The typology of FUAs was based on five functions or features characterizing urban areas: population, transport-, tourism-, industrial-, knowledge-, administrative- functions and decision-making centre. Further, following the polycentric development objective, to distinguish the cities of growth that may constitute counterweight to the Pentagon – MEGAs list was created. The MEGAs were top category of urban areas in the FUAs typology. To evaluate them four criteria were chosen, each represented by two variables: mass criteria – population and GDP; competitiveness – GDP per capita in PPS and location of top 500 companies in Europe; connectivity – passengers at airports and multimodal accessibility indicator; and knowledge basis – education level and R&D share of employment. 76 defined MEGAs were classified into five categories, which are presented in table 1 (ESPON, 2005).

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<tr>
<th>Table 1. MEGAs hierarchy</th>
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<td>Category</td>
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<td>Global nodes</td>
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<td>Category 1 MEGAs</td>
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<td>Category 2 MEGAs</td>
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<td>Category 3 MEGAs</td>
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<td>Category 4 MEGAs</td>
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Source: own elaboration based on: ESPON, 2005, pp. 116-117

However, such a division can raise doubts. One of the issues is if the urban functions were thoroughly examined. According to an evaluation of ESPON 1.1.1 Project by E. Korcelli-Olejniczak (2008), the chosen functions for FUAs typology differ regarding their extent, some cover broader information then other and can be more objective. What is more, some of the functions present in different studies, were not used in this typology, e.g. culture and mass media.

Moreover, the MEGAs hierarchy remains unclear, despite the fact that the description of categories is based on the measured variables. That is caused by use of vague concepts, such as being competitive or peripheral and their gradation. As far as the global
nodes are understood as “the largest and most competitive urban systems with high connectivity levels” (ESPON, 2005, pp. 116-117) which indicates the best performance in all the features, the further categories become less clear. Following the definitions of subsequent categories: 1 MEGAs – “large, highly competitive, and possess strong human capital and good accessibility”, category 2 – “relatively large, competitive and often possess strong human capital”, category 3 – “smaller, have lower competitiveness are more peripheral and often have weaker human capital than Category 2 MEGAs”, and category 4 – “smaller, less competitive, more peripheral, and have lower human capital figures than Category 3 MEGAs” (ibid.). Use of the concept of periphery and competitiveness without their explanation seems deceptive. Especially considering the fact that the Pentagon area is perceived as central and most advanced, seems surprising calling cities from the 3rd category such as Luxembourg or Rotterdam “more peripheral”, whereas Stockholm and Helsinki are not.

What is more, the use of mass criteria may lead to miscalculations. Especially the GDP indicator reflects poverty of the state and not necessarily the potential of the city. Also, as indicated later in the same ESPON project, size is not a thorough variable for identifying urban areas as nodes of polycentric development. Although it is influential, as attracting for instance commercial functions and industrial activities, it does not indicate the potential emergence of nodes of spatial development (ESPON, 2005). Therefore, some cities may seem underestimated, for instance cities still influenced by the transition from communist system. The capitals from acceding countries were classified into the 3rd category, together with generally non-capital cities from other countries.

Furthermore, in the analysis no dynamic indicators were used, for instance population trends. That may cause difficulties to identify the most dynamic regional metropolitan areas. Also, when the emphasis is put on the mass and ranking, the profile of the city may not be noticed. For instance, smaller cities that have well developed and specialised only one of the metropolitan functions and can show growth potential in this field (Gløersen, 2007).

Overall, the method of rating the cities and assumed indicators may not present the overall situation in the cities. As E. Gløersen (2007, p. 29) remarks “The classification may indeed rank a major, but lethargic regional capital city higher than a smaller active one with growth over the last decades”. Therefore, alternative approaches should be also considered.
H. H. Blotevogel, who contributed a lot to the concept of metropolitan regions in Germany, identified also four main metropolitan functions that present effectiveness and international connections of cities. These were: (1) decision-making and controlling – described by presence of business and financial centers, and supranational and non-governmental organizations; (2) challenge and innovation – research base and cultural features; (3) gateway – cities being nodes of exchanges and transportation; and (4) symbolic function – exceptional identity, achieved by cultural institutions and events, but also characteristic architecture (Stahl, 2010). This seems a comprehensible categorization and most of these functions have its equivalents in the finally chosen functions for analysis in this thesis.

Another approach, applied by E. Korcelli-Olejniczak (2007) defined even eight of the metropolitan functions, both of economic and non-economic character. The functions are similar to those defined by H. Blotevogel, but differently described and separated into more exact categories. According to them cities can be rated for being (or fulfilling): state capital and political forum, transportation node, corporate control function, cultural center, media and communication center, city of knowledge and innovation (industrial and scientific functions), financial center, gateway-city (in case of economic and political aspects).

Having considered these different approaches and the functions performed by global cities four metropolitan functions were chosen for analysis, due to their importance for urban development in macro-regional scale and possibility of accessing relevant data. Their character was intended to signify city’s importance and prosperity in both the national as well as international scale.

3.3. Chosen indicators

This section is a detailed introduction to the conducted analysis of BSR cities. Use of chosen indicators representing particular functions is here justified; also problems and used estimations are pointed out. That is presented in the order of the chosen four main metropolitan functions. A limitation for the number of indicators per function was imposed – four, fact which is further discussed in the section about hierarchy, as it is related to its creation.
In the beginning of the analysis, before performance in the metropolitan functions is compared, some data providing an overview for cities’ size and economy are presented and discussed. Despite they were not chosen as indicators, some of them can influence the performances in indicators describing the metropolitan functions. The variables are population in city and in metropolitan region, population growth rate over 5 years for cities and metropolitan regions, and GDP of metropolitan regions in million Euros. The part is treated as an introduction to the analysis. Then the analysis is conducted for the four metropolitan functions, which are evaluated as described below.

(1) Knowledge function

Through this function an attempt has been made to identify centres for innovation, research and development. It is complicated to find reliable indicators due to limitations of data accessibility. Because innovation and R&D are hard to measure it is assumed that presence of higher educational services can represent potential in this case. As the analysis is based on the information about higher education system, the results represent mostly the knowledge generation function and not exactly the innovation potential, despite the fact that the latter is connected to the former one.

First the focus is concentrated on the university structures, measured with number of students, which represent the size of education base and can signify the research capacity. However, the problem with number of students is that it often reflects the size of the city and also of the country if the city is an educational centre in national scale. Besides, the field of study also matters, to reflect the research potential e.g. the engineering and technical studies are a favoured choice, whereas the humanities and arts are more related to the cultural function. But the distinction between study fields is not made in case of this indicator.

A problem that aroused during the data gathering for this indicator was the lack of evidence for Riga. The chosen solution was to estimate the value for Riga based on the total number of students of Latvia, by adjusting it according to the average share of total national number of students of Estonia and Lithuania located in Tallinn and Vilnius, as they are cities of closest size and similar background. The estimated figure was used for grading Riga’s performance in the indicator.

As the second variable used was the number of universities mentioned in the Times Higher Education World University Ranking 2013-14, which shows the quality
of education. Of course the use of a ranking brings limitations to the research, but the advantage is to obtain a possibility to compare the quality of higher education institutions by universal criteria referring to global standards. In the ranking for selection of the world leading universities following areas were examined: teaching – giving overview on the learning environment; research – presenting its volume, income and reputation among others; citations – reflecting the research influence; industry income – that mirrors innovation; and international outlook – showing diversity among students (university attracting foreigners) and international collaboration between academics on research projects. Excluded from the ranking were universities that do not educate undergraduates, teach only one narrow subject, or that their research output is lower than 200 articles a year, but with exceptional cases. Among others the main focus of the ranking is on research quality and on spreading new knowledge and ideas worldwide, and also teaching quality is high valued.

One of the faults of use of the ranking might be favouring universities from English speaking countries or other internationally popular languages as graded are inter alia citations. However, such an indicator can show the level of adaptation of a university to globalization, as a use of common language facilitates cooperation and exchanges. Moreover, that is not an obstacle for the study as all of the cities examined are from non-English speaking countries, which can indicate the world-wide importance of the university and provides good reputation for the institution, raising the importance of the city where it is located. Considering that, despite imposing limitations, the ranking is a thorough comparison of higher education institutions in global scale and provides relevant information for this analysis.

Moreover, the universities, apart from the role of knowledge generation, can support urban networking through their cooperation. It is not only the corporate networks that constitute connections within the cities’ systems, also university exchanges can facilitate these linkages, e.g. the Erasmus and other mobility programs (ESPON, 2005). However, it is not deeper analyzed in the study as the data would be hard to collect, but a position in the world top universities ranking should indicate such a role of the institution (strengthening networks between cities).

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8 http://www.timeshighereducation.co.uk/world-university-rankings/2013-14/world-ranking/methodology (access: 14.08.2014)
Additionally, as for innovation creation it is highly important to attract smart people and allow them to work collaboratively, the human capital is explored. To evaluate that, the number of higher educated people and percentage of population with tertiary education (of 5 and 6 ISCED level) are examined. The former variable indicates clustering of smart people, as it is the privilege offered by large urban regions – the concentration of skilled human force and possibility of knowledge exchanges. The latter one, percentage of higher educated people, shows condition of the population in the city. Controversial in such a choice of indicators can be the fact that it is naturally easier for large cities to have bigger number of educated people than for the small ones. However the concentration of people is highly important in case of knowledge base and facilitated exchanges of good practices providing the international importance. What is more, the caused inequality is balanced by the second indicator to which it is easier for smaller cities to perform well.

The fault in these indicators related to higher educated population is that, usually, skilled people have good education, however experience could also provide similar knowledge, and this second part is inconvenient to measure so is not reflected in the study. Moreover, there is also the group of intelligent, energetic entrepreneurs who received little of education, but have a great role in creating innovation (Glaeser, 2011). This aspect is also hard to measure and is not included in the study.

A problematic issue regarding the data for number of people (aged 25-64) with 5-6 ISCED education level in 2011 was an irrelevant figure for Warsaw found in Eurostat database. It was invalid compared to performance of other cities but also compared with number from earlier years. Therefore, the data used for grading was taken from Polish national statistical office. Both figures are shown in the annex 1.

One of the most suitable indicators for the knowledge function would be expenditure on research and development. Unfortunately, in this case data is not accessible for city level. It is only gathered for larger units (usually NUTS 2 regions) and that would not be relevant for the study according to the differentiation of the statistical units division between countries, which often comprise of way larger territory than the city surrounding area.

Therefore, the four indicators chosen can be assigned into two groups. First are higher education services, examined by number of students – its size, and number of universities from THE ranking – its quality. The second one is related to human capital,
analysing the concentration of higher educated people – by their number and the status of population – by their percentage.

(2) Decision-making function

In the used understanding of the decision-making function, it comprises of both (a) national decisive and administrative functions, and (b) corporate control functions. Because the two of them indicate concentration of power, and its origin is not considered to have such a significance for this study that they should be separated into two exclusive functions.

To represent the former one (a) the function of national capital was chosen. That is because the main role of the capital city is being the center of politics in national and international scale, which is caused by holding the seats of government and parliament, and representation of the country. Due to the dependence of decision-making, particularly the politics aspect, on the places of location of its institutions – in capital cities, the capitals become major hubs of international political network of decisions. Therefore they act as important centers in international politics and are the most recognized abroad (BBSR, 2011).

Additionally, being a capital usually indicates having the leading position in national economy. That role is one of factors that support development and stimulate emergence of other metropolitan functions. For many cities it initiated the strengthening of its position in the international area. Especially for the countries going through transformation and peripherally located (in relation to the Pentagon) the national capitals act as gateways to the countries (Korcelli-Olejniczak, 2007).

However, the role of capital is not included as an indicator for creating a hierarchy, because it gives only 2 alternatives (being a capital or not) and therefore is not consistent with the grading system used. But it is described in the analysis.

What is more, the role of capital city does not need to be crucial for the global city formation. It is more of a European trend – the capital cities being most powerful in the country (with exceptions e.g. Berlin). When it comes to European global cities they follow the tendency – both London and Paris, raised in the very centralized countries with vast importance as capitals. But when compiled with situation in the USA a contrast is clearly visible, as there the capitals and global cities differ. For instance, comparing Washington versus New York, or looking at the states’ capitals e.g. Sacramento versus Los Angeles,
it is clearly visible that the role of a capital city is not the most important. Therefore, not using role of capital as an indicator for grading and focusing on corporate function is justified.

Another variable representing the decision making, which was not used for the grading, is location of supranational organisations, such as EU agencies and representatives, Baltic Sea Region related institutions or United Nations’ offices and regional commissions. It was omitted due to its complexity – several organizations and the level of importance of offices can vary so it would be difficult to evaluate, and also because the number of variables per function was limited. Although, it presents another type of power concentration, and despite of not being utilised as an indicator it is described in the analysis based on the information from Nordregio report from 2008 on the Baltic Sea Region.

On the other hand, analysis of the corporate control function (b) constitutes the whole part of decision-making evaluation in the grading system for building the hierarchy. It has a great meaning for defining international importance of a metropolitan region, as it is commonly agreed that world cities serve as command centres for global economy, which indicates as well central position in corporate networks. To observe it, the existence of large companies – their headquarters is examined and then the attention is payed to the advanced producer services.

Because of limited access to data about companies the selected indicators are the number of headquarters of top companies located in the cities defined according to following lists: Fortune Global 500, Financial Times Europe’s 500 and Europe’s 500 growth companies. To broaden the angle of research not only one but a few rankings organized by varying criteria were chosen. However, the obtained view does not present the exact situation as the use of rankings brings a lot of estimation into the study, but gives an overview on location of corporate control function.

For the start, a list was used in order to define top companies in global scale, and then turning the focus into European level. First the Fortune Global 500 list, which is recommended for instance by Alderson & Beckfield (2012), ranks the companies by their revenue. That allows defining the firms successful over the given year.

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9 Alderson & Beckfield, 2012; Friedmann, 1986; Sassen, 2001; Taylor, 1997; etc.
In major cities of BSR not many of the top global companies are located, so that companies of smaller – not only global but also continental importance were taken into consideration. It can provide wider overview on concentration of corporate power in the examined cities. The second list used is the Financial Times Europe’s 500 by market value, which presents the companies that succeed in a long-term distance and allows making estimations for their future. Due to the different criteria of ranking, the list does not repeat the companies mentioned by ranking in global scale (unless they are the best in both criteria), therefore a broader scope is presented. The list shows prosperous companies that in the macro-regional scale can well represent the corporate control function, so they could belong to the sub-global cities category. Besides, in this scale also the Europe’s 500 growth companies list (by job creation) was considered to define the new entrepreneurs and innovative companies, which in broader meaning can indicate potential of the city.

Concentration of largest companies’ headquarters allows defining centers of regulative economic power. However, existence of a large company does not necessarily mean that the city of its location is included in the global division of labour. Though, analyze of the headquarters’ locations can present indications for the urban geography of corporate decision making (Schmitt & Dubois, 2008).

As a next step in evaluating the corporate control, the advanced producer services were analyzed. Following the concept of global city by S. Sassen, one of the most important factors of emergence of global cities was the development of advanced producer services. So that those cities, due to presence of corporations and innovative knowledge clusters, became both markets and production centres for these services, and consequently started to be seen as the organising nodes of economic globalisation. In addition, functioning of the advanced producer services is not limited only to the global cities, but they operate through office networks in numerous cities around the world. For instance, law firms usually have their offices in a large number of cities, hundreds in case of advertising agencies, and big accountancy firms reach even thousands of different cities. Therefore, the servicing of global capital concerns not only the global cities but also spreads lower in the city system through the network relations. Particularly, the advanced producer services connect the nodes of the network – cities. The flows of knowledge, information, guidance and recommendation in planning and strategic work across the offices constitute worldwide inter-city relations (Taylor et al., 2013).
According to GaWC research the advanced producer services comprise four sectors: accountancy, advertising, banking/finance, and law. In order to represent them banking services were chosen. Using this variable indicates focus on international financial centres, however financial services play only a part in the world city formation. The variable is number of headquarters of the largest European banks located in the city, ranked by assets.

An indicator that firstly was on the agenda but was afterwards removed is presence of top accountancy firms’ offices. The indicator would broaden the view of corporate control network, as their offices are broadly spread around the world (Taylor, 2000). The specified indicator was number of location of regional offices and partners of the big four accountancy firms: Deloitte, PwC, Ernst & Young and KPMG. Although it did not bring relevant information to the study, as the figures were very similar for each city and did not bring much differentiation. That indicates that all the cities belong to the corporate control network, but does not specify their positions, therefore was not useful. Besides, between capital cities or important regional centres it is easily obtainable to have a partner office of such kind. That indicator was considered in the beginning as it was also used by Nordregio (see Schmitt & Dubois, 2008). Decision to exclude such a variable was taken also due to the assumption of limiting number of indicators per function to four.

Therefore, for the grading the decision-making function is represented by indicators belonging to corporate control. Even more specified, the variables comprise of major companies headquarters and financial aspect of advanced producer services – banks. Such combination, despite covering only some of the services that could be included, gives an overview on concentration of the corporate control function.

3 Gateway function

This function evaluates if the examined cities are centres of transfers basing on their accessibility of services, knowledge, information and ideas. So that, the city needs to be a transportation node in its broad sense – indicating flows of people, products, data, etc. The function shows accessibility, connectivity and also openness of the market (Stahl, 2010).

The transport part is relatively easy to measure as it depends on existing transport infrastructure network, which is often believed to be a determinant of economic potential.

http://www.big4accountingfirms.org/big-four-accounting-firms/ (access: 09.08.2014)
of urban agglomerations. Airline data was selected to represent this function, because it gives useful approximations about how the temporary movement of people is linking cities together and provides information about concrete flows between them. Such data is meaningful as flights are the most common means of transportation in the global scale. Also the infrastructure – big airports can indicate the openness of the city for international connections. However, in airline data studies some problems appear, they concern: complications caused by the stopovers which unable defining both origin and destination of the whole trip, and inability to define the type of travel (tourist or business). So that tourist destinations and cities with intermediary airports will show higher scores according to this variable (Smith & Timberlake, 1995; Derudder & Witlox, 2008).

The exact indicators chosen are passengers per airport in international flights inside and outside EU, presenting European and intercontinental connections. That indicates analysis on two levels of inter-linkages: in a continental and global scale. Naturally, the estimation is made that according to high score in attribute data – large number of passengers per airport, the city is better connected.

Another indicator chosen to represent transportation and approachability of the market, is multimodal potential accessibility, comprising also other means of transport – road and train connections. It is often used in studies led by ESPON and that is from where the data were gathered. Nevertheless the term needs closer clarification. It “is defined as the number of people that can be reached by all modes […], where the attractivity of destinations is defined by their population size, subject to the travel time to reach them. The individual car, train and plane travel times are summed up as logsum, to derive the overall multimodal accessibility potential”\(^\text{11}\). It is utilized for measuring the market potential and a potential of location of a city.

Additional often taken into consideration means of transport are ferries, which constitute an influential freight shipment connection. Although, that is not examined in the study as it does not concern all of the analyzed cities, it functions only in those cities who are located on the cost of the Baltic Sea, e.g. not Warsaw or Berlin.

The fourth indicator for gateway function is number of trade fairs. It is supposed to show openness of the market and exchanges of knowledge, ideas and best practice. Looking more closely at this variable, trade fairs are identified as having an important role

\(^{11}\) http://www.espon.eu (12.09.2014)
in inter-city competition at the international scale. That is caused *inter alia* by their features: extraordinariness – happening outside of the economic routine, enabling exchange and communication, and concentration of economic activity in one place (Rubalcaba-Bermejo & Cuadrado-Roura, 1995). These advantages are well described by the definition of a fair – “that extraordinary economic space, in which suppliers and purchasers concentrate together in a coordinated, organised fashion seeking to exchange goods, services and information” (*ibid.*, pp. 383). The fairs in a limited space and time period enable and facilitate knowledge circulation and creation to take place. Such events perform several functions, not only such as trade, advertising, communication, economic, and cultural functions, but also provide information about global developments in markets and technologies. Thanks to that, through the companies they bring to their host cities economic benefits, innovation, trade, tourism, and support general urban and regional development (*ibid.*; Bathelt, 2012).

Moreover, leading international fairs can be defined as temporary clusters. By gathering together participants from all over the world they set up space for presentation and interaction, which stimulates information circulation. The fairs encourage interactive learning, knowledge generation and formation of international networks (Bathelt, 2012).

What is more, it is characteristic to locate trade fairs in large metropolitan areas. Most global cities possess big trade fair facilities that are used for hosting various trade fairs and by this manage and develop vital international connections (*ibid.*).

Because of its many functions, it is difficult to classify trade fairs as an indicator for a particular metropolitan function. However, it has significant meaning for the study on metropolitan functions and city positioning. It was assigned to the gateway function regarding the fact that this is the function, which trade fairs represent in the work of H. H. Blotevogel and Nordregio studies. The used indicator is the number of internationally oriented fairs organized in the city according to AUMA trade fair database. This source of data was recognized as relevant, as is used in the studies by Nordregio (see Schmitt & Dubois, 2008).

Summing up evaluation of this function, it is mostly represented by transport related indicators: flight connections and multimodal potential accessibility. But also
is embodied by trade fairs, which show exchanges with other hubs of the city network and opening up of markets.

(4) Cultural function

Culture is assumed to be a part of urban life, especially when it comes to global cities. Nowadays this function became connected not only with art but also entertainment. Cities are considered to be concentration points of museums, galleries, theatres. But apart from fine arts culture covers many other activities, like film, music, television or new media. It also gathers wide range of services such as part of food industry – various restaurants and coffeehouses, or fashion. With the population getting richer the broadly understood cultural and entertainment services are expanding. Examples of this can be various exclusive restaurants in London, trendy boutiques and luxurious department stores in New York. Even a term ‘cultural economy’ was raised to describe the economy of cultural products and services. It can be argued that partly cultural economy is interconnected with the advanced producer services sector. What is more, the cultural function is particularly performed in bigger extent by metropolitan areas and the cultural sector has a great role in the urban and international economies (Glaeser, 2011; Pratt, 2012).

As a function, culture is often underestimated as it can be seen as reflecting the economic strength. Nevertheless it has a big significance for the city, it works as factor increasing attractiveness. Well developed cultural function can also provide specialization of a city, which can lead to gaining international importance of particular aspect. Looking for a proof among internationally recognized cultural centers the examples can be: fashion in Milan, entertainment industry in Los Angeles, film industry in Mumbai (Bollywood), or humanism and liberalism in Amsterdam.

To measure the cultural function the following indicators were chosen. First, two representing the arts presence, they are number of theatres located in the city and number of museum visitors per year. Out of many variables possible to illustrate the art, these ones were chosen because the data was available in Eurostat database. Additionally, what seems more important for broader scope of comparison, the latter represents also the touristic inflow, although it can not be distinguished from the local museum attendance. Furthermore, the weakness of this indicator is that it can be affected by number of population (better performance in bigger city), but looking at the data collected such
a correlation is not that influential. The indicator is particularly useful if a smaller city has a large museum attendance, as it indicates then a well developed touristic function.

The third indicator is number of exclusive restaurants, which is supposed to mirror high level of entertainment industries. Because such a variable is hard to measure, the source of data chosen was the ranking of restaurants by Guide Michelin, which is a commonly recognized authority. For instance, it is used by a German study on European metropolitan areas, although to determine the travel destinations, not restaurants (see BBSR, 2011). It leads to a regular international ranking of restaurants, which is not easy to obtain otherwise, as different national rankings would not be compatible with each other due to distinct criteria. Also, being placed in this ranking gives the restaurant cosmopolitan splendor, therefore corresponding with the international level of analysis and aim to define higher-order functions. On the other hand, in cities in transition with developing cultural sectors, the emerging restaurants with potential and good regional or national reputation are omitted.

The last, fourth indicator determining performance in cultural function is international atmosphere in the city, which is measured through international immigration. To start justification of such an indicator, the fact that global cities act as magnets for immigrants needs to be looked upon (cf. Sassen, 2012). When looking at immigration as a phenomenon appearing in top global cities, it was considered to be an appropriate measure of city position. It is not usually used to verify the metropolitan functions, but the issue appears a lot in the literature reviewed\textsuperscript{12}, therefore was chosen. The exact indicator used is percentage of foreigners in population. However, several problems are related to such a variable, mostly because of the vagueness of the term foreigner. The question is how exactly the term is defined, except being based on the nationality, it depends a lot on the national restrictions towards immigration, and how easy and how attractive is it to change the nationality. Nevertheless, the data was collected from Eurostat database so it is assumed to be a comparable and relevant indicator.

It is believed that the cultural function is highly influenced by immigration. With the incoming international immigrants, diversity of cultures within the city increases, widely enriching cities’ cultural offer, and resulting for instance in rising number of international restaurants. Moreover, immigrants are one of the crucial forces connecting cities with other parts of the world (Glaeser, 2011). They can strengthen the city networks

\textsuperscript{12} E.g. Friedmann, 1986; Glaeser, 2011; Sassen, 2001, 2012; Smith & Timberlake 1995;
by transnational cross-border relations and influence politics. Additionally, they make possible arising of transnational identity and strengthen global civil society (Sassen, 2012).

Immigration may affect different metropolitan functions, e.g. apart from culture, it may support the innovation creation (which is later discussed), also it can signify being a part of city network. The flow of people indicates existence of also another exchanges (money, etc.), meaning that the city is interconnected (Smith & Timberlake, 1995). Consequently an assumption can be made that larger number of immigrants signifies bigger amount of various transfers between countries or cities.

Besides immigration being a visible trait of global cities and boosting the cultural function, it can also have an influential role for the innovativeness in the city, connected with income of highly skilled manpower from many different countries. As J. V. Beaverstock (2012, p. 240) claims “highly skilled international labour migration, weather permanent or sojourn, is an essential pre-requisite for world cities to remain competitive in a global urban hierarchy or world city network”. It helps accumulate capital, build networks, make connections and allows companies to keep up with the processes of internationalization. For instance, in Singapore part of the strategy to maximize competitiveness on global level was attracting foreign highly skilled and talented workers (Beaverstock, 2012).

That is because, a diversified, multinational labour market is considered to promote encounters, strengthen potential connections and enlarge knowledge production. Some companies use cultural mixing as a form of ‘knowledge capital’ and an important business asset. That is because international employees can bring ‘freshness’ into the company, facilitate flows of knowledge between countries and enable developing more global approaches. The major cities have the highest or sometimes even only concentration of highly skilled international labour force in the region. A good example is Amsterdam, which is the only city in Randstad with substantial international highly skilled workforce, for instance in sectors such as advertising, finance or architecture (Hall & Pain, 2006).

Considering the last mentioned arguments, the number of higher educated immigrants, demonstrating highly skilled man power, would be a highly relevant indicator for evaluation of the knowledge function – broadening of the human capital aspect. Unfortunately because of lack of data about education level of the immigrants, at least for some cities use of such a variable was not possible.
For cultural function, the two first indicators reflect the fine arts, including the second one which can partly show touristic function. The number of restaurants signifies higher developed entertainment services, as a part of cultural economy. The fourth one, percentage of foreigners, presents international ambiance in the city and indicates presence of connections in the urban network.

Overall, 16 indicators describing different aspects of metropolitan functions were chosen. In the next chapter they are used in a comparison of the major BSR cities. Such a choice of variables was selected with conviction that they will appropriately mirror the significance of the cities in the system. Also to complement the overview, based on this a hierarchy was built.

3.4. Formation of the hierarchy

After the analysis of functions based on the mentioned indicators, the results were ranked and a hierarchy of cities was created. In this section the method for forming the hierarchy is explained. At the beginning the understanding of concept of hierarchy is discussed and then attention is directed at the grading system.

First of all, the understanding of the term hierarchy needs to be explained. In relation to use of attribute data, it is impossible to show the structure of a hierarchy of interconnected cities. The actual relations between the cities can not be explained by the collected data. Therefore the created hierarchy functions as a ranking list, not a full meaning hierarchy that shows complex relations within city system. To achieve the last mentioned relational data would have to be analysed (cf. Taylor, 1997).

For a better explanation, a hierarchy based on corporate networks is looked upon. Firms by expanding with branches and subsidiaries around the world connect places through a network of ownership, hierarchy and control. The command and control centres on the highest level are clustered in a few locations, assumed that in the top level cities. Then by following the connections from such a centre to other branches at lower and lower levels the organization of the companies is visible, which allows to rank cities according to their importance as a location in the corporate network. In this case, the city hierarchy simply reflects the relations and structure in the companies. Such approach is possible as the world cities are considered to be concentration of command centres. This kind
of hierarchy is impossible to achieve when using attribute data, and is not the goal of this thesis (Alderson & Beckfield, 2012).

Focusing on the analysis conducted in this study, before describing the grading system some rules that were applied need to be presented. To begin with, all functions are graded equally, as they were chosen based on the theories presented and reflect features of the cities leading in the global urban system. Furthermore, each of the functions is represented by 4 indicators. Therefore, all variables have equal importance and none of them gains more power than others for influencing the city position.

Additionally, in the analysis first a ranking of performances is made for each function and then, all the overall positions of cities, based on scores from the four functions gathered together, are presented in the final hierarchy. Already all the indicators chosen for each function were introduced in the last section, but in order to give a better overview on building the hierarchy and what in this study influences a city’s position, they are gathered together in table 2.

To determine the city position in the hierarchy a few steps were taken. Firstly, data for single indicators was graded. It was done according to the order of the values among others – position of performance for an indicator was ranked. The highest value was assigned 8 points, the lowest – 0. A problematic issue with such a way of grading is that the points assigned do not reflect the differences between the values – if they are similar or very distant. They only show the position of the performance among other cities. That is because any intervals for evaluating the data were not assumed.

Secondly, the points granted for performance in indicators were summed for each function. Then the performance of a city in particular function – the number of added points from indicators, was graded the same way as for the variables earlier, again in 0-8 scale. The advantage of grading the sums of points for each function is that the differences caused by performance in single indicators are evened in case of the whole function. In this system a good performing city with a low value in only one indicator is less discriminated than it would be if only all the indicators were summed together. Similarly, it is hard to get a good position for a low performing city with a high value in only one indicator.

Thirdly, the points granted for performance of the four functions are summed and treated as a final score, based on which the positions of cities in the hierarchy are assigned. The whole grading is presented in annexes 6 – for indicators and 7 – for functions.
Table 2. Indicators used for grading performances in metropolitan functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Indicators</th>
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<tbody>
<tr>
<td>Knowledge</td>
<td>Number of students in higher education (5-6 ISCED level) in 2011</td>
</tr>
<tr>
<td></td>
<td>Number of universities from THE ranking 2013-14</td>
</tr>
<tr>
<td></td>
<td>Persons (aged 25-64) with 5-6 ISCED education level in 2011</td>
</tr>
<tr>
<td></td>
<td>Proportion of population (aged 25-64) qualified at level 5-6 ISCED in 2011</td>
</tr>
<tr>
<td>Decision making</td>
<td>Number of headquarters located in the city of companies recognized by Fortune Global 500 Companies ranking in 2013</td>
</tr>
<tr>
<td></td>
<td>Number of headquarters located in the city of companies recognized by Financial Times Europe’s 500 Companies ranking in 2013</td>
</tr>
<tr>
<td></td>
<td>Number of headquarters located in the city of companies recognized by Europe’s 500 Growth Companies ranking in 2013</td>
</tr>
<tr>
<td></td>
<td>Number of headquarters located in the city recognized by Largest European Banks ranking in 2013</td>
</tr>
<tr>
<td>Gateway</td>
<td>Total passengers on board in intra-EU flights in 2012</td>
</tr>
<tr>
<td></td>
<td>Total passengers on board in extra-EU flights in 2012</td>
</tr>
<tr>
<td></td>
<td>Multimodal potential accessibility by NUTS 3 region in 2006</td>
</tr>
<tr>
<td></td>
<td>Number of international fairs in 2013 according to AUMA database</td>
</tr>
<tr>
<td>Culture</td>
<td>Number of theatres in 2011</td>
</tr>
<tr>
<td></td>
<td>Number of museum visitors (per year) in 2011</td>
</tr>
<tr>
<td></td>
<td>Number of restaurants starred by Guide Michelin in 2014</td>
</tr>
<tr>
<td></td>
<td>Foreigners as a proportion of population in 2011</td>
</tr>
</tbody>
</table>

Such constructed hierarchy is an outcome of the analysis and based on that the positions of cities compared are discussed. The biggest flaw of the positioning is that it is done based on grading cities in relation to each other – the score of their performance depends on how the others perform. Therefore it allows estimating only the importance among cities analysed in this study and it is not comparable to any other.
4. Analysis

4.1. Background information

In this chapter the analysis of the four metropolitan functions was conducted, examining each of them in a separate section. The focus while examining each function is kept on the performance of Warsaw, so a better overview can be given on its position and specialization. The analysis is concluded with the overall city positioning, and a hierarchy of the examined BSR metropolitan regions is created based on their performance according to all of the functions.

To start with, in this section some introductory data is presented, giving an overview on the size and economy of the cities. Such background data are affecting performance of the earlier defined metropolitan functions. Yet these data were not chosen as the indicators in order to avoid discrimination of any city because of its smaller size or location in a poorer country.

Except of the introductory role of the data presented in this section (provision of basic information), the variables can also indicate the economic strength of the city. As a part of the globalisation processes, it occurs that cities gain importance because of their size and economy. This influences not only their impact on the surrounding territory, but more importantly their role in the city network. That is because size of the economy can reflect existence of relations – larger economy indicates more transfers occurring between the city and other economies. So that the international influence of a city depends on its size and economy.

Looking back to the cities hierarchy by P. Hall and K. Pain (2006) they estimate the size of sub-global cities around 1-5 million inhabitants, up to 10 million in their hinterlands. As it is visible in the table 3, this condition is fulfilled only by 3 cities when it comes to the city area: Berlin, Hamburg, and Warsaw – the third mostly populated city and the second metropolitan region. Meanwhile when considering the area of the metropolitan region (specification based on the agglomeration, including the commuter zone around the city\textsuperscript{13}) the limit is easily reached in most cases, with only Tallinn and Vilnius not reaching it.

\textsuperscript{13} http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/metropolitan_regions (access: 31.08.14)
### Table 3. Introductory data – economic strength

<table>
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<tbody>
<tr>
<td>Indicator</td>
<td>Berlin</td>
<td>3,501,872</td>
<td>5,097,712</td>
<td>2.05</td>
<td>1.75</td>
<td>131,892.2</td>
</tr>
<tr>
<td>Indicator</td>
<td>Copenhagen</td>
<td>559,440</td>
<td>1,909,612</td>
<td>7.69</td>
<td>4.05</td>
<td>94,591.1</td>
</tr>
<tr>
<td>Indicator</td>
<td>Hamburg</td>
<td>1,798,836</td>
<td>3,228,054</td>
<td>1.51</td>
<td>1.36</td>
<td>125,195.2</td>
</tr>
<tr>
<td>Indicator</td>
<td>Helsinki</td>
<td>595,384</td>
<td>1,549,058</td>
<td>4.72</td>
<td>4.4</td>
<td>69,173.4</td>
</tr>
<tr>
<td>Indicator</td>
<td>Riga</td>
<td>649,853</td>
<td>1,018,657</td>
<td>-6.80</td>
<td>-7.2</td>
<td>12,073.9</td>
</tr>
<tr>
<td>Indicator</td>
<td>Stockholm</td>
<td>881,235(^1)</td>
<td>2,091,473</td>
<td>8.78(^2)</td>
<td>7.28</td>
<td>103,796.7</td>
</tr>
<tr>
<td>Indicator</td>
<td>Tallinn</td>
<td>407,534</td>
<td>529,898</td>
<td>1.78(^3)</td>
<td>1.27</td>
<td>8,553.1</td>
</tr>
<tr>
<td>Indicator</td>
<td>Vilnius</td>
<td>533,279</td>
<td>806,935</td>
<td>-4.04</td>
<td>-4.85</td>
<td>10,620.6</td>
</tr>
<tr>
<td>Indicator</td>
<td>Warsaw</td>
<td>1,715,517</td>
<td>3,271,938</td>
<td>0.34</td>
<td>2.5</td>
<td>62,702.5</td>
</tr>
</tbody>
</table>

Own elaboration; data source: Eurostat database (access: 03.03, 12.08, 26.08, 31.08.14), complementary data:  
1 Statistik om Stockholm (access: 05.03.14), 2 Statistiska Centralbyrån (access: 13.08.14),  
3 Statistics Denmark (access: 27.08.14), 4 Statistics Estonia (access: 27.08.14)

Also most of the cities examined experience a growth process (even if it is not very dynamic in some cases), which facilitates reaching the estimated criteria. While in Warsaw the population growth rate is low but positive, Stockholm and Copenhagen are the most rapidly growing. Similarly big increase of population was noted in Helsinki. On the other hand, in Vilnius and Riga population is declining, especially the latter one is facing an intensive loss of inhabitants. When examined population growth rate in the metropolitan regions, the outcomes are similar to those of the previous variable. The main trends stay the same, for instance with Stockholm having the leading position, or the very same negative rate for Riga and Vilnius. Moreover, most of the cities have bigger population growth rate in the city area. However, Warsaw is an exception among those examined as it has a higher growth rate when considering the metropolitan region. That indicates a bigger inflow of people in the surrounding territories – the commuter belt than the core city and may indicate suburbanization processes. Nevertheless, such differences may also appear as a result of differences in the delimitation of metropolitan regions across countries.

Despite the size differences, all cities chosen are considered to be relevant, comparable cases to examine the BSR city system and international roles of its cities. Such a decision is supported amongst other things by the fact that P. Hall and K. Pain (2006) indicate that all European capitals and some additional cities can be considered to be sub-global cities.
Next, when looking at the gross domestic product (GDP) in million Euros seeking to appraise cities’ overall economy size, the differentiation is striking. However, it is first needed to draw the attention to the importance of obtaining comparable data, which can be a complicated matter because the division into statistical units varies between countries. For instance, concerning most of the examined cities, the NUTS 3 regions comprise of the bigger administrative unit around the city borders, whereas in case of Warsaw it is only covering the city. By using such division it is hard to compare them and causes inequalities as some cities would be seriously overrepresented. Therefore, the metropolitan regions were chosen as comparative units, as they more precisely limit the territory actually connected with the city, thus bring less discrimination to the comparison. However, this is not a perfect solution as rules for delimitation of metropolitan regions may vary between countries, but they definitely do so in a smaller degree than the NUTS classification. What is more, when it comes to faults of the indicator, it needs to be noted that, in the countries not using Euro as a currency, the GDP depends on the exchange rates. Likewise, the GDP indicator reflects the wealth of the country in which the city is situated, turning it into a not independent variable. However, having the location in a richer or poorer country has a huge impact on the city development and its potential. Moreover, the data was updated latest in 2010, and since then the performance of the cities could have slightly changed.

Coming to the comparison of economy size, Warsaw has the sixth position, with GDP of 62 702,5 million Euro in 2010. What needs to be highlighted is that the economy of the metropolitan region reflects two factors: size of the region and wealth of the nation. The leading cities, with clearly larger economies than Warsaw, are Berlin, Hamburg and Stockholm, with a GDP over 100 000 millions Euro, and Copenhagen coming close behind them. Then, following at greater distance, Helsinki and, right after, Warsaw appears – the former one slightly above 50% of the GDP of Berlin and the latter a little under this value. Between these and the rest of the cities exists another large gap, as the Baltic States’ capitals account for less than 10% of Berlin’s GDP. According to the previous information, cities can be clearly classified into three groups with respect to their economy size separated by the two gaps in the GDP values, among which Warsaw belongs to the middle one.

Overall, looking at all the collected data, big differences appear between the cities concerning all examined indicators. The trends reflect in most cases a good performance of Scandinavian and German cities and a poor one of the Baltic States’ capitals, meanwhile
Warsaw is in the midway between the two groups. In order to be more specific, the cities were ranked according to the two most important of compared variables: the size – population in the metropolitan region, and economy – GDP in million Euros. Here the cities’ importance in case of economic strength is presented in the following list, in table 4.

<table>
<thead>
<tr>
<th>Rank</th>
<th>City</th>
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<tbody>
<tr>
<td>1</td>
<td>Berlin</td>
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<tr>
<td>2</td>
<td>Hamburg</td>
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<tr>
<td>3</td>
<td>Stockholm</td>
</tr>
<tr>
<td>4</td>
<td>Warsaw</td>
</tr>
<tr>
<td>5</td>
<td>Copenhagen</td>
</tr>
<tr>
<td>6</td>
<td>Helsinki</td>
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<tr>
<td>7</td>
<td>Riga</td>
</tr>
<tr>
<td>8</td>
<td>Vilnius</td>
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<tr>
<td>9</td>
<td>Tallinn</td>
</tr>
</tbody>
</table>

In economic strength Warsaw is ranked fourth. The position is owed mainly to its large number of inhabitants, contrasting with the top scoring cities which either have high scores in both indicator or justify their place through a high GDP in millions Euro. Clearly better performing than Warsaw are Berlin and Hamburg – standing on the top, which are cities from an influential and wealthy country, both having large economy and population. Next, still better than Warsaw but closer in the performance appears Stockholm, favored due to its big economy although having less population. Behind Warsaw, but within a similar score is placed Copenhagen, which has a comparable trend to Stockholm – gains its position due to its economy size. Following is Helsinki with slightly higher GDP than Warsaw, but noticeably smaller population. Lagging behind are the Baltic States’ capitals, due to their distinctly lower performance in both indicators, which is conditioned by their location in small and poorer countries.

In such a ranking is visible the weaker performance of transitioning cities, especially Tallinn, Riga and Vilnius, meanwhile Warsaw gains its position mostly due to big population. It is clearly shown that poorer countries have poorer cities. The best example on the influence of the wealth of the country is Riga, which has comparable
population size to Helsinki and Copenhagen – bigger in the city, smaller when it comes to metropolitan area, but a remarkable difference in GPD.

Focusing on the performance of Warsaw, its position indicates potential coming from its size. Having a bigger economy than the Baltic States’ capitals, it still lags behind the other cities. As the low GDP of Warsaw matches with that of Poland, its location in a relatively poor country brings several obstacles for becoming a competitive partner to other cities. Even more, the relatively small economy size shows smaller number of transfers into the city and prevents it from gaining larger international importance. On the other hand, the development of the city could be supported by its dominant position within the country and its urban system.

The discussion of the economic strength of the cities is not the only focus of this analysis, and despite economic strength is considered the basics for formation of global cities, the attention will now be drawn to other aspects, as in the thesis it is believed that cities perform more functions than only being economic centers. This section on economic strength is treated as an introduction to the analysis of different metropolitan functions, which will be addressed in the following sections.

4.2. Knowledge function

This section covers the topic of science and knowledge base as a resource of development. It is an important factor for the competitiveness of the city in order to generate knowledge and apply it to broad range of products, services and processes.

The classification of the knowledge function is based on four indicators (former discussed in the method chapter): number of students, presence of universities from the Times Higher Education Ranking, number of higher educated people and percentage of population with higher education. Classified according to them, the cities form the list presented in table 5.

First of all, looking overall at the ranking might be surprising the position of Warsaw on the top, as it is not commonly recognized as a knowledge center. Its position here is owed to having the biggest number of students among compared cities and the second among higher educated people, with good performance also in other indicators. Berlin scores very closely to Warsaw; while Warsaw gained 24 points in the knowledge
function, Berlin has 23. Afterwards, the difference with respect to the other cities is more substantial.

**Table 5. Ranking of cities for the knowledge function**

<table>
<thead>
<tr>
<th>Rank</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Warsaw</td>
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<tr>
<td>2</td>
<td>Berlin</td>
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<tr>
<td>3</td>
<td>Helsinki</td>
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<tr>
<td>4</td>
<td>Stockholm</td>
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<tr>
<td>5</td>
<td>Vilnius</td>
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<tr>
<td>6</td>
<td>Copenhagen</td>
</tr>
<tr>
<td>7</td>
<td>Hamburg</td>
</tr>
<tr>
<td>8</td>
<td>Tallinn</td>
</tr>
<tr>
<td>9</td>
<td>Riga</td>
</tr>
</tbody>
</table>

Own elaboration; Data for the knowledge function are presented in annex 1, and grading of the indicators in annex 6.

Looking at particular indicators, in the first one – students in tertiary education (5 and 6 ISCED levels), which is supposed to present knowledge generation, the dominance of Warsaw is outstanding. It had 345 203 students in 2011, which is 210% of the figure of the holder of the second place, Berlin, and 426% of the value for Vilnius, who takes the third place. However, any concern would not be justified, as a similar trend is also recognized for post graduate student attainment in the Nordregio report regarding several polish metropolitan areas (Schmitt & Dubois, 2008). Such a large number of students can be explained first by the big size of the city, and second by the fact that Warsaw is one of the major centers of higher education in Poland, therefore the figure is also reflecting the size of the country, with many people choosing Warsaw for their studies. The phenomenon is more intensified as in Poland there are only a few tertiary education centers of good national reputation such as the knowledge base one in Warsaw. On the contrary, in Germany the system of higher educational institutions of good reputation is distributed between more cities, e.g. as it is visible on THE ranking.

With regard to this topic, a relevant question appears concerning if the large number of students is relevant for knowledge generation, and if it can actually signify the existence of attractive knowledge base and research facilities. Unless the popular study programmes respond the market needs and support development, it is considered that the
high value is not influential. However, among such a large number of students there is certainly a share of them taking the required courses for creation of innovation and development, which still could indicate a large number. Otherwise, it is also possible that the education is more directed to cultural development if the most common study fields are humanities or arts. Such an issue would be likely to be closer examined instead of providing only speculations, problem that arises also for other cities.

Besides, it needs to be noted that a high total number of students can benefit the metropolitan region and its competitiveness only if that educated people remain in the city after graduation and work in the field. Therefore, the phenomenon of brain drain needs to be reduced (Schmitt & Dubois, 2008) which deals with the attractiveness of the city and its functioning as a magnet for creative people. In case of Warsaw, this issue would have to be more closely looked upon, but it can be hypothesized that in the national scale the city offers broad career opportunities as it is the biggest labour market within the country. However, despite of being a magnet on the national level, the city does not reach yet international attractiveness.

The second indicator – number of universities appearing in the Times Higher Education ranking of 400 top universities in the world, graded by presence of such an institution in the city, is supposed to show the quality of knowledge and its international reputation, which indicates also advanced research facilities. In case of Warsaw only one of these institutions is present – University of Warsaw, which makes the city rank in the fourth place in this indicator, along with Copenhagen. The best performer is Stockholm, which has 3 of such institutions, then being on the second position Berlin and Helsinki with 2 each.

Although the presence of one of the top 400 universities worldwide is an important factor, the rank of these educational institutions also matters though it was not included in the grading. It represents the international reputation of the institution better than just an appearance on the list. In this case, Warsaw takes also a rather low position in relation to the other cities being subject of study, as its university is mentioned on an unspecified position among 301-350. Whereas Stockholm, Berlin and Helsinki host universities ranked among the top 100, and also among the second hundred appear the universities from Stockholm and Copenhagen. Only one of the institutions located in Helsinki holds
the same position as the University of Warsaw\textsuperscript{14}. Based on the described distribution of rating, Warsaw has the poorest performance among the cities whose universities were mentioned in the ranking, being its performance only better than that of Hamburg and the Baltic Sea States’ capitals.

However, this indicator shows the significance of the educational role of Warsaw inside the country, as University of Warsaw is the only polish university that made it into the world top universities list. And, although it is ranked lower than universities from other examined cities, it still has an international recognition, which is not that common among the Central and Eastern European countries. This certifies the high rank of function performance in the country and can justify the attraction of a large number of students presented in the first variable.

Additionally, the above discussed national top position in performance of a function is important as it affects the data for single indicators and can influence the position amongst other examined cities. A top performing city in the national scale has bigger chances to be also influential on the international level. First example is in Estonia, whose only university mentioned in the list is not in the capital, Tallinn, but in another city – Tartu. It is the second city of Estonia and is specialized in knowledge and cultural function, so that Tallinn seems not to have top performance in this function at the national level and performs lower in the hierarchy. Another example representing the importance of national scale is the small number of students in Stockholm, which is related to a more spread educational function in the country. More precisely, several Swedish universities were mentioned in the world universities’ ranking, most of which were not located in the capital. Also, Stockholm is not the main university center in Sweden, which ‘title’ would go to Lund or to the closely to Stockholm located city Uppsala, which has the oldest Swedish University. Such distribution of the educational function determines the low position of Stockholm in the first indicator.

The last two variables examined for this function are connected with human capital and the quality of labour market. The first of them, number of people with higher level of education is normally reflecting the size in population of the city, consequently Warsaw

\textsuperscript{14} Universities from THE ranking by city, with position in brackets: Berlin – Freie Universität Berlin (86), Humboldt-Universität (94); Copenhagen – University of Copenhagen (150); Helsinki – University of Helsinki (100), Aalto University (301-350); Stockholm – Karolinska Institute (36), Stockholm University (103), KTH Royal Institute of Technology (117); Warsaw – University of Warsaw (301-350); Data source: http://www.timeshighereducation.co.uk/world-university-rankings/2013-14/world-ranking (09.08.2014)
has the second position. The city is only placed below Berlin, although the difference in figures between the two is significant. The overall number of 460 741 tertiary educated people from Warsaw constitutes around 63% of those in Berlin. The German capital leads clearly because of its large total population – again the percentage of inhabitants of Warsaw is almost 49% of these from Berlin. This difference in the percentages can indicate better condition of Warsaw’s population with respect to the educational level, fact which is confirmed in the next indicator.

When it comes to the fourth variable, percentage of higher educated people in working age population, smaller cities take the scoring lead, and Warsaw holds the fifth place. The two leading cities are from the Baltic States – Vilnius (with outstanding 56,14%) and Tallinn (49,03%). The next in the line is Helsinki (47,01). All of them, plus Stockholm, Warsaw and Copenhagen are above the average of 43,87%. Despite Warsaw’s rather low position (although still better than 4 other cities), it should be noticed that it is the best performing in this variable among the three most inhabited cities (with over 1 million people in the city area). Furthermore, at least in the case of Hamburg, its poor performance concerning the knowledge function can be justified by the industrial tradition in the city. Differently, when compared to Berlin, who performs second best in this function, higher value in this indicator can be considered an achievement for Warsaw.

As a conclusion, Warsaw’s high overall performance in knowledge function is justified by its large number of students, a university of worldwide reputation, and big amount of higher educated labour force, constituting over 45% of working age people. Moreover, the knowledge function is the best performed by the city among the four roles analyzed in the study.

Regarding the figures for all four indicators, the strongest and weakest points were appointed. The biggest asset of the Polish capital is its large students’ number. However, a good performance in this variable does not necessarily imply city’s top competitiveness, but in case of Warsaw this is combined with presence of a high quality educational institution and with broad labour market, so that all these together can be considered a potential for development of the city.

On the other hand, the biggest weakness is the low percentage of higher educated people in working age population, although it is still above the average among cities examined. Furthermore, this finding needs to be contrasted with the fact that Warsaw holds
the second biggest concentration of higher educated labour force, which makes the former look less deficient. In addition, the percentage of educated working force may increase considering the trend of attaining higher education shown in the indicator of the large number of students, although such a possibility is just a speculation. Another weaker aspect is the presence of only one ranked university, indicating that, despite a large number of students, the quality of education might be lower than in other cities.

There is also a general statement which arose during the analysis with respect to the knowledge function which needs to be highlighted. A city’s specialization or historical trends influence its performance in the functions. Such observation was based on the example of Hamburg which, having industrial roots, does not perform well in the knowledge function. Similar statement can be assumed in the case of Stockholm regarding the educational services (to be more specific, when looking at the number of students – size of service, not at the quality of education), which are not that broadly developed due to the proximity of a typical university city like Uppsala.

As for the overall observations in the knowledge function, the higher education services are the biggest in Warsaw and Berlin, however the best quality of education is located in the Nordic cities and Berlin. When it comes to the amount of human capital, the largest cities perform the best – Berlin, Warsaw, Hamburg and Stockholm, although in case of criteria like the status of population’s education, the smaller cities, i.e. Vilnius, Tallinn and Helsinki, score better.

4.3. Decision-making function

As it was already described in the method chapter, the decision making function covers two distinguished areas: (1) national decisive and administrative, and (2) corporate control functions. First the role of a national capital as an important hub for politics is discussed. In this respect also presence of supranational organizations is appointed. Then the ranking list of corporate control function based on presence of headquarters is presented and discussed.

Capital cities play an important role in national and international scale considering decision-making as they host the politics related institutions. That is because concentration of this function is geographically determined by location of its institutions, so that the
capital cities constitute main hubs of global political network of decisions (BBSR, 2011). That applies to almost all of the cities included in the study.

The criterion of being a capital city is fulfilled by all the examined ones except of Hamburg. However, the importance of the capital may vary between each other. Often the capital is connected with dominance within the country in more functions than just the political one. Such phenomenon occurs especially when the national urban system is highly centralized. The latter indicates being more than only a political center, therefore holding a leading position in case of size, economy and most of performed functions. This trend is followed by most of the examined capitals. Also in Poland, whose urban system is considered to be quite polycentric, a visible gap exists between Warsaw and second tier cities. But, for instance, the case of Berlin is debatable as it comes from a federal country, where the power in more evenly spread among the cities. The regional centers were given part of the competences concerning the public decision making, which in unitary states is located in the capital. Therefore, for Berlin being the capital is equivalent with the seat of government and international representation, but not automatically any other functions as it is common in regard of other capitals. At the same time, the competences of Hamburg as a regional center are higher than those of second tier cities in unitary countries. Despite being the only city not complying with the criterion of being a capital, the importance of Hamburg as a regional center in Germany should be noticed, and the city should not be discredited.

Another influential aspect connected with politics, is the presence of supranational organizations’ offices. Such issue is more interesting as for the location of these institutions the capitals are usually chosen. In the study this aspect is treated as additional information, though important for decision making function, but it was not counted as one of the indicators and was also not included in the rating. Only a quick overview presenting most important locations is given on this topic, as all the information was gathered based only on the Nordregio report (Schmitt&Dubois, 2008) and not own data collection as in other cases.

Looking at the presence of organizations, Warsaw is a central location in the BSR for United Nations related institutions, which are the most internationally oriented from those appearing in the region. Besides, their offices are also in Copenhagen and Hamburg. Next, the Polish capital hosts also EU related offices, but they are more specifically concentrated in Copenhagen, Stockholm and Helsinki. Then, Warsaw has low macro-
regional decision-making position as none of the BSR related institutions are located there. Those were established mainly in Copenhagen, Stockholm and Riga, and in smaller concentration also in Helsinki and Hamburg, where some other international institutions are also found. As a conclusion, Warsaw is not hosting several of the organizations present in BSR, however can undertake global connections as a center for the UN related offices. Copenhagen covers the broadest scope of supranational organizations, meanwhile the other Nordic capitals seem to attract EU and BSR institutions. None of the analyzed institutions when it comes to most important offices appeared in Tallinn, Vilnius or surprisingly Berlin (Schmitt&Dubois, 2008).

Here observable is the non central position of Berlin within Germany (despite being a capital), as it does not follow the pattern of locating top supranational institutions in the capital city that is visible in all the other examined countries. Similarly, all the most meaningful international organizations which were taken into consideration in the study are located in the former German capital Bonn (Schmitt&Dubois, 2008). Such an indication of lowered power in Berlin, may be an advantage for Warsaw’s position as Berlin is its closest located competitor in the macro-region.

Now the analysis will focus on the second aspect of decision-making – the corporate control, which, unlike the previous function, was used for the ranking. The cities were graded for presence of top companies’ (in global and European scale and also growth companies) and largest banks’ headquarters defined according to recognized rankings: Fortune Global 500, Financial Times Europe’s 500, Europe’s Growth Companies, Largest European Banks. The list resultant from the grading is presented in table 6.

This function seems not that well developed in Warsaw, as it ranks on the fifth position among other cities. This is due to the fact that it only has companies appearing in 2 indicators: second score in top European companies’ headquarters in one, and a growth company in the other. Four other cities perform better than Warsaw, having companies of more than 2 indicators, although with respect to the overall number of headquarters, Warsaw holds the second position.
Table 6. Ranking of cities for the decision-making function

<table>
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<tr>
<th>Rank</th>
<th>City</th>
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<tbody>
<tr>
<td>1</td>
<td>Hamburg</td>
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<tr>
<td>1</td>
<td>Stockholm</td>
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<tr>
<td>3</td>
<td>Copenhagen</td>
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<td>4</td>
<td>Berlin</td>
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<td>5</td>
<td>Warsaw</td>
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<td>6</td>
<td>Helsinki</td>
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<td>9</td>
<td>Riga</td>
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<td>Tallinn</td>
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<tr>
<td>9</td>
<td>Vilnius</td>
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</tbody>
</table>

own elaboration; Data for the decision-making function are presented in annex 2, and grading for indicators in annex 6.

The two leading cities, which have a significantly stronger position than Warsaw in this function, are Hamburg and Stockholm, although their performances differ between each other. The former one is placed on the top of the ranking due to holding all kinds of headquarters – one of each for every indicator. Whereas, Stockholm has the biggest number of headquarters altogether\(^{15}\) – significantly more than other cities. It performs best in case of number of global and European top companies and largest European banks, and definitely better performing than Hamburg, but suffers from a lack with respect to the growth companies’ indicator. Therefore it takes the first place together with Hamburg. In such a situation the grading system is of great importance, and according to it the positions could vary. Another two cities have still higher positions than Warsaw, with better, more diversified, corporate control, being these Copenhagen and Berlin. The former holds the same situation as Stockholm – lacking only growth companies, but it has smaller number of headquarters than the Swedish capital, while Berlin only lacks a bank headquarter.

Turning now to the performance in particular indicators, the major BSR cities do not have many of the companies of global importance, and Warsaw is clearly lagging in this case. The headquarters of these major companies are located only in Stockholm – 2,

\(^{15}\) Taking into consideration the fact that some of the companies are repeated in used rankings
and Berlin, Copenhagen, and Hamburg – one in each city\textsuperscript{16}. As there is a significant similarity between hosting global headquarters and GDP of the metropolitan region (table 3), such a distribution of central offices is assumed to be positively correlated with the city’s economy size.

On the other hand, concerning decision-making at global level, supporting for Warsaw is the fact that the only Polish Fortune Global 500 company PKN ORLEN has its headquarters located in Płock, which is a smaller city of provincial importance in the same region (mazowieckie – NUTS 2), and its other coordinating offices are located in Warsaw\textsuperscript{17}. This shows the role of mediation that Warsaw fulfills also in regard of corporate control, because of its importance in the region and country, indicating that some transfers, instead of directly, pass through Warsaw, which could be regarded as well as a role of gateway.

Furthermore, the performance of Warsaw increases considerably when taking into account headquarters of companies with European meaning. The only city that has more of this kind is Stockholm, which hosts even 23 of those, the highest number by far. Warsaw has much less – 6, better performing than Helsinki and Copenhagen – 5 headquarters each, and Berlin and Hamburg – 1 each\textsuperscript{18}.

Additionally, Warsaw is one of the only 3 cities in BSR that posses the European growth companies. Those are Berlin – 2, Hamburg and Warsaw – 1 each\textsuperscript{19}. This is the only category where Warsaw overcomes the performance of Stockholm, which is a clearly leading city in the corporate control function. In case of the polish capital, possessing a growth company can be related to the fact that it is a city in transitioning economy. As a consequence of lagging in development and the current process of catching up, a lot of dynamics are happening in the Polish economy. This can be regarded as an advantage connected with promising potential, but the evolution in the future is unknown, so it could be a positive aspect only if the current trends continue.

On the other hand, a significant disadvantage is the underdeveloped financial sector in Warsaw, represented by the lack of any of the largest European banks’ headquarters.

\textsuperscript{17} http://www.orlen.pl/EN/Contacts/Pages/default.aspx (access: 07.09.2014)
\textsuperscript{18} List of the companies presented in annex 3.
Benefiting for Warsaw is the fact that only few headquarters of this type are located within the region, so that in relation with other cities it does not represent that much backwardness. Nevertheless, Warsaw is outnumbered in this indicator by 3 cities, as Stockholm performs best – having 4 major banks, followed by Copenhagen with 2 of them, and 1 located in Hamburg\(^{20}\).

However, it needs to be pointed out that differences appear because of using various rankings. Namely, not only the largest European banks ranking, which takes into account the assets, but also FT Europe’s 500 (taking into account revenues) includes banks, which leads to further differentiations. Not all the banks mentioned by one ranking appear in the other and vice versa. Particularly 3 Polish banks from FT ranking are not classified as largest in Europe, but also similar situation is occurring with a bank from Copenhagen and another from Hamburg, which although supposedly are among the largest in Europe, they do not make it into the top Europe’s companies. Only 4 banks with headquarters in Stockholm and one in Copenhagen appear on both lists. As a consequence, the choice of criteria is crucial and possibly the results could have slightly varied if other rankings would have been chosen. Thus, Warsaw does not have any of its three headquarters appearing on both lists therefore it might be discriminated regarding the banking services. However the same case applies to Hamburg and Copenhagen in regard of top companies.

The overall types of headquarters held by Warsaw may signify potential and dynamics as it has one of the so called growth companies and relatively many (among other cities) companies of European importance. Regarding banking services, they appear in the companies of European importance list, although they are not recognized by the ranking of largest banks. Therefore, as the biggest weakness it can be defined the lack of companies of global importance, showing the limited significance of the city. On the other hand the biggest asset is the relatively big number of European companies. This can indicate continental importance in the corporate control network, or at least higher significance than that of many of the cities compared.

Summing up the performance of Warsaw, the decision making function (particularly corporate control) is not so well developed yet. However, it is needed to take

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into account that its position in the ranking might have been slightly underestimated due to the grading system used. Since it does not have headquarters of all indicators, its role is limited. But considering the overall number of headquarters mentioned – 7, it has the second biggest value after Stockholm (24), which as it has been stated above is by far the leader.

Supportive are also the dynamics in the development of the country and city itself. Poland was for a long time a disadvantageous location due to being under the influence of Soviet Union, which held Warsaw back from development. Nowadays, as belonging to a transitioning economy, some potential can arise as a lot of changes and development are happening. Supported by its dominant position within the country Warsaw has a chance to improve its international connections, particularly when it comes to the corporate control function. In this case the role of capital city truly influenced its current position and domination in the national scale as it functioned (and still does but to lesser extent) as a gateway to the country.

A question that arises while looking at this ranking concerns the extent of how much of the performance in corporate control function is related to the size of economy. The resemblance seems quite high. The three cities with top overall scores in this function have also high positions concerning size of economy (measured by GDP in million Euros). Only Berlin, despite its highest GDP, ranks fourth in case of the decision making, though that might be explainable by historical reasons, such as its background as a divided city. Warsaw appears next in this function, closely followed by Helsinki both with similar level of GDP. Finally, the Baltic States’ capitals confirm the trend of lagging behind in both categories. Therefore, when looking at the ranking for this function, which is often in the literature put above the others\textsuperscript{21}, the assumption of economic strength being basics for global city formation can be confirmed.

Another issue noticed while examining the presence of internationally recognized companies is the influence of the city’s position in the country. Higher concentration of headquarters appears in leading cities of more centralized countries. The German case can be presented as a major example. Among the large number of companies mentioned in the lists coming from Germany, only a few were located in Berlin (actually, the same number as in Hamburg), whereas several headquarters are located in other German cities,
for instance Munich or Frankfurt. The weak position of Berlin is related to the division of the city and the influence of the Soviet Block. On the contrary, the development of other German cities was undisturbed, so they could gain competitive positions. The opposite example to Berlin is Stockholm, where most headquarters of numerous Swedish companies are concentrated. Even another case can be found in Poland, where among the few Polish companies appearing in the country, many of them are located in Warsaw. As the whole country was backward in the development, other cities did not manage to get as competitive as in Germany. Therefore, it can be said that three conditions seem to have influence on location of headquarters in a city – development and wealth of the country, dominance in the national economy, and development undisturbed by historical accidents.

   Overall, the major BSR cities fulfill the conditions to perform the decision making function, at least its political aspect. When it comes to corporate control, the performance is more diversified. Most of the cities have some of the internationally recognized companies (pointed out by the rankings), to which exceptions are only the Baltic States’ capitals. The best performers are Stockholm and Hamburg, for which corporate control function is also the best performed role. Meanwhile, Warsaw takes a fifth position which can be considered as low, better only than Helsinki and the Baltic States’ capitals. What is more, for the polish capital the decision-making is one of the poorest performed functions.

4.4. Gateway function

The main goal of the gateway function is to verify wether the examined metropolitan areas are centers of exchanges. Being a hub of transfers requires highly developed transport infrastructure. But the gateway function comprises more than just transportation; it includes also providing access to services, information, knowledge and ideas. It is a very important function for participation in international and global trade and in order to strengthen connections with other nodes of the system.

   Due to the already presented limitations of measurement the ranking is based mostly on transportation indicators: flight connections inside and outside EU, and multimodal accessibility. But the ranking also includes trade fairs, representing exchanges of information and knowledge, and the openness of the market as they can be seen as platforms of communication. Based on such criteria the ranking shows
the connectivity and accessibility to the metropolitan region. According to that, cities were classified in the order presented in table 7.

Table 7. Ranking of cities for the gateway function

<table>
<thead>
<tr>
<th>Rank</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Berlin</td>
</tr>
<tr>
<td>1</td>
<td>Copenhagen</td>
</tr>
<tr>
<td>3</td>
<td>Helsinki</td>
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<tr>
<td>4</td>
<td>Warsaw</td>
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<tr>
<td>5</td>
<td>Stockholm</td>
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<td>6</td>
<td>Hamburg</td>
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<td>7</td>
<td>Riga</td>
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<td>8</td>
<td>Vilnius</td>
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<tr>
<td>9</td>
<td>Tallinn</td>
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</tbody>
</table>

own elaboration; Data for the gateway function are presented in annex 4, and grading of indicator in annex 6.

Regarding the overall performance in the gateway function Warsaw is located in the fourth place. This is caused by its diversified performance, as it has below average number of passengers in air transportation (both indicators), but many trade fairs (2\textsuperscript{nd} score) and good multimodal potential accessibility.

For a clearer distinction to the quality of performance, in this function cities can be assigned into four groups based on the differences in scores. When looking upon it in such perspective, Warsaw has relatively good position, as it is assigned into the second class. The groupings are: (1) Copenhagen and Berlin on the top, (2) Helsinki, Warsaw and Stockholm – good performance, (3) Hamburg and Riga – poorer acting, and (4) Vilnius and Tallinn – the weakest position.

Clearly better performing than Warsaw are the two leading cities – Copenhagen and Berlin. The top position of the Danish capital is related with highest score for air transportation, both at the European and global scale, and good performance in other indicators. On the other hand, Berlin takes a top place because it scores high in all indicators, showing a regular pattern with respect to its positions (only 2\textsuperscript{nd} and 3\textsuperscript{rd}), with particularly big number of passengers in extra-EU flights and high multimodal potential accessibility.
Comparing performance in particular indicators, in the first two – the capacity of flight connections (by number of passengers by airport), Warsaw has 5,506,805 intra-EU and 2,575,683 extra-EU passengers, which in both indicators stands below the average and places the city in the fifth and sixth places respectively. Although the intra-EU flight connections are better developed, they still constitute only 38% of the top score of Copenhagen. The relation is similar in case of the extra-EU flights only 37% of Copenhagen’s value. The figures in these two indicators are very close to Hamburg’s performance. Such comparison may be looked upon differently: poor as it is only at the level of a regional city in Germany, and Warsaw is the capital and major air transportation hub in Poland; or high, as it is similar to the one of the major cities in the Pentagon area (which is considered a highly developed and prosperous territory). Such a choice is not to be resolved in this discussion. However, it should be noticed that the performance of Warsaw in the international air transportation indicators, compared with other cities examined here is clearly better only when compared to the Baltic States’ capitals, which do not show well developed connections.

Attention needs to be drawn to Copenhagen, the leading city, whose performance leaves Warsaw far behind. The passenger flow in Kastrup airport, both in intra- and extra-EU flights, is visibly outstanding. It definitely constitutes the main hub of air transport in the BSR, and it is assumed to be the best connected. Its top position can be partly related to being a connection hub between origin and destination places of passengers. However, such cases arise the possibility for those travelers to stay in the city for some time (one day or a few), commonly due to touristic reasons. Therefore, stopovers on flight routes can bring advantages to the city itself and can influence the need for services offered in the city.

Also with a much better performance than Warsaw, Stockholm and Berlin follow Copenhagen in the 2nd and 3rd positions, definitely being strong regional centers for air transport and having large capacity of flights. This also shows a good connectivity, Stockholm performing better inside EU, and Berlin when it comes to intercontinental connections. Having compared the figures, it strikes that Warsaw is clearly weaker linked regarding the air transport function than the majority of the cities being subjects of study, which can cause poorer connections in other aspects. However, in the smaller scale – regional or national, Warsaw is still the major transportation hub.
On the other hand, the growth of passenger number in Warsaw can also indicate an improvement of the air transport. Despite there was no significant long-term change in the capacity of intra-EU flights\textsuperscript{22}, the case of extra-EU connections effectively shows that the number of passengers increased 7.1\% over 5 years (2008-2012)\textsuperscript{23}. This indicates development of global connections, which can influence the city’s position in supra-national scale in a positive manner. However, this referred increase of flight connections capacity is also taking place in other major polish cities, which depending on their improvement pace may lead to a reduction on Warsaw’s domination in the national scale.

With respect to the variables that improve Warsaw’s performance in gateway function, there are two indicators that need to be mentioned: multimodal potential accessibility and number of international trade fairs. The first one shows the accessibility to the market. In this case Warsaw holds the third position, after Berlin and Hamburg. In the BSR only 5 cities overcome the EU NUTS 3 regions average – the 3 already mentioned plus Copenhagen and Riga, leaving Warsaw with a relatively good performance as its value constitutes 144\% of this average. However, the low performance of many of the examined cities in general has an explanation related to the peripheral location of the whole macro-region – outside of the Pentagon.

The poor air connections of Warsaw contrasts with the good position the city holds when it comes to multimodal potential accessibility, fact that can indicate well developed road and rail connections. Or, on the contrary, it may be a result of the fact that the access to other examined cities is limited, for example due to Copenhagen’s location on an island, which significantly decreases the number of directions from which the city can be reached by rail or road. Other examples are Stockholm or Helsinki, which are peripherally located in relation to the center of Europe and are also hard to access by rail and road.

With the previously presented information, the important question is if geographical location matters and whether in the grading system peripheral cities should be, as a consequence, lower rated. On the other hand, disadvantageous location for these cities

\textsuperscript{22} During the 7 recent years that data was accessible for the intra-EU capacity varies. There was a sudden emergence of the intra-EU flights’ passengers number in 2007 (over 700 000 passengers more), which lasted for 2 years and dropped in 2009 to the similar number as before. Since then till 2012 it was slowly increasing. The growth rate between 2006-2012 is 1.1\%, however between 2009-2012 3.3\%.


\textsuperscript{23} Own calculations based on data from Eurostat: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database (access: 09.09.2014)
is counterbalanced with higher need for and greater number of flight connections, allowing them to have better performance in previous two indicators analyzed.

Switching the focus now to the last indicator – number of trade fairs, they are particularly important for rising economies, because they facilitate the access to new markets. Here, Warsaw has the second best performance with 20 fairs hosted in 2013, far below Helsinki’s exceptional performance of 34 trade fairs, but far above and outstanding the rest of the cities (the following value is 12 for Berlin).

It is surprising that trade fairs’ indicator does not seem to be related to the decision making function. This is particularly visible in the case of Hamburg, and to a lesser extent in Stockholm, Helsinki and Warsaw. In this regard, no correlation with the scores in corporate control function was noticed. This observation is unexpected especially because trade fairs can be used to determine economy related functions. For instance, a German study on metropolitan areas in Europe (BBSR, 2011) treated fairs (understood as exhibition capacities) as reflecting special services for companies in this case for demonstration of their products and establishing business contacts, which clearly is related to the corporate control function.

In an overall look at the figures for Warsaw, the city scores quite good in the gateway function with respect to the other cities. Its biggest weakness is the relatively low air transport capacity, which is a typical indicator examining intercity connections, so that it can indicate poor linkages in the city network. However, the low accessibility by air can be evened out by good multimodal accessibility, although at larger scales such as the intercontinental level it could seem irrelevant.

The biggest advantage is its large number of trade fairs, resulting in a more opened market and bigger chances for catching up with development. In case of Warsaw this is an important issue due to the years behind the iron curtain, which restricted city’s openness. Moreover, good multimodal potential accessibility is also an advantage for expanding the market. Therefore, these variables show that the position of the city can be improved in the future.

Summing up, in the analysis of gateway function, the main centers of exchanges in BSR were Copenhagen, Berlin and to lesser extent Helsinki. Warsaw also has a good performance, close in score to Helsinki. This is the second best performed function by Warsaw after the knowledge one.
4.5. Cultural function

The cultural function can be treated as a soft location factor raising the attractiveness of a city. However when it comes to metropolitan functions it becomes highly important as the cultural life is concentrated in the cities. In this study, culture is perceived as a combination of art, entertainment and international atmosphere in the city. The first aspect is represented by two indicators: number of theatres and number of museum visitors per year, while the other two are symbolized by one variable each: entertainment – number of restaurants starred in Guide Michelin, and international atmosphere – foreigners as a proportion of population. The list arranging the cities by mentioned criteria looks as presented beneath (table 8).

Table 8. Ranking of cities for the gateway function

<table>
<thead>
<tr>
<th>Rank</th>
<th>City</th>
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<tbody>
<tr>
<td>1</td>
<td>Copenhagen</td>
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<td>2</td>
<td>Berlin</td>
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<tr>
<td>3</td>
<td>Stockholm</td>
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<td>4</td>
<td>Hamburg</td>
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<td>8</td>
<td>Riga</td>
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<tr>
<td>9</td>
<td>Vilnius</td>
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</tbody>
</table>

Own elaboration; Data for the cultural function are presented in annex 5, and grading of indicators in annex 6.

As visible above, Warsaw is placed at the fifth position. Situation is similar as in the previous examined gateway function – varying Warsaw’s results among different aspects of the function. The city has good performance in the art related indicators (3rd and 4th places) and poor in the other ones, particularly being the worst its proportion of foreigners. Nevertheless, Warsaw’s overall score is rather low, as four examined cities perform much better.

Among those higher in the ranking, Copenhagen outstands with a clearly superb performance in this function. It has exceptional number of theatres and restaurants from Guide Michelin, and also high number of museum visitors and percentage of foreigners.
On the following position, Berlin overall score is pretty close, but it leads only in number of museum visitors, though its performance is good in all the other indicators.

Furthermore, concentrating on the art related indicators, Warsaw scores good, having the fourth position with 32 theatres. Its result is close to Berlin (36), and then far above is Stockholm (49), and again Copenhagen with an extraordinary performance (105). All the others except perhaps Hamburg (24) perform visibly poorer and no significant values for the comparison were noticed in that group.

With regard to the second indicator connected with art – the number of museum visitors, it indicates both interest in culture among population, as well as, which can be even more important, the touristic inflow of people to the city. Unfortunately it is not possible to undertake a separate analysis on them, so no distinctive conclusions can be made in this area.

In this indicator Warsaw has the third place, with over 3,9 million visitors. However the difference with respect to the leading cities is significant, as the value for Warsaw is only a 50,6% of the one for Stockholm, which is on the second position with over 7,8 millions of visitors, and far away, 25%, of the clearly best performance of Berlin, with over 15,7 millions people attending per year. Copenhagen also has a value around the 3-4 millions, while for the rest of the cities the number varies between 1 and 2 millions of visitors per year, even lower in the case of Vilnius and Riga.

The high value for Warsaw could probably be mainly related to its large population, with the tourists contributing in a smaller way. Whereas, when looking at Stockholm and Copenhagen, which are smaller cities with higher museum attendance, it can be assumed that it is due to the higher touristic inflow in the cities. It might be harder to speculate for Berlin as it is the largest city in the macro-region, despite the fact that, considering the data, a well developed touristic function can be estimated.

As a conclusion for the part of cultural function connected with art, it is possible to state that Warsaw has a good overall performance, better than several cities. However, there is still a huge difference with respect to the top performing cities, i.e. Copenhagen, Berlin and Stockholm.

Turning now to the other two aspects of cultural function, regarding the number of restaurants starred in Guide Michelin, Warsaw has only 1, being the lowest score among the cities that possess any of the starred restaurants. The clearly better performing cities are
Copenhagen on the top, which is well known worldwide for the quality of its restaurants, with 15, then Berlin with 13, Stockholm and Hamburg – 10 each, and Helsinki – 6. Warsaw occupies the next place.

An attention-grabbing issue about this indicator is that, apart from reflecting entertainment (regarded as free-time activities) and existence of higher level services and luxury goods, it also shows the existing market demand for them. This can be noticed as cities with transitioning economies have a very limited number of them: Warsaw only 1 and none of them in the Baltic States’ capitals. In case of the former, the first restaurant in the Guide Michelin could have a positive impact and act as a starting point or basis for further development of the local market, although the city still has a long way to go in order to be able to compete with others at this level. Another example of the new and growing market needs could be the opening of the luxurious goods and services brand Louis Vuitton boutique in Warsaw in 2013, the first in the whole Poland.

Moving forward to the last indicator, foreigners as a proportion of population, Warsaw is the city with the lowest percentage – only 0,52%. Its total number of foreigners is truly low – 8 872 in 2011, whereas in Tallinn, the leading but also smallest among the cities studied, the number reached 82 545\textsuperscript{24}. The difference in percentage between Warsaw and the top performing cities is tremendous, as their foreigners rate reaches: 20,58% in Tallinn and 16,52% in Riga\textsuperscript{25}.

However, such high scores have a correlation with the large number of Russians in the Baltic States, especially high in Estonia and Latvia. So the indicator is not showing only immigration, but the fact that history matters. It is still a current consequence of belonging to the USSR, and in their case it does not necessarily lead to an international ambiance in the cities or reflects their attractiveness. There are also other minorities present in those cities although they do not constitute a significant percentage of population. For instance, in 2012 in Tallinn 36,8% of population was Russian, while Estonians were 54,8%. For the case of Riga, the Russians are more than one fourth (27,6%) of the whole population of Latvia\textsuperscript{26}. Based on these examples, it is visible how

\textsuperscript{24} Data source: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database (12.08.2014)

\textsuperscript{25} In case of Riga the position is uncertain. Problem was caused due to lack of data and the rate for the whole country was assumed. As a result the actual data for Riga probably differs from the used in the comparison. However regarding the fact that immigration usually concentrates in the largest cities the number was assumed to reflect the capital’s rate, but possibly the number is underestimated.

\textsuperscript{26} The figures mentioned differ from those presented in annex 5, because they were collected from Estonian and Latvian national sources – Statistics Estonia and Latvian Institute, and not Eurostat. However, the
immigrants within a city or country can reflect historical events, and influence ties and transfers between countries. The exception among the Baltic States’ cities is Vilnius, with only 1.4% of international population. The rest of the cities have values in the range within 7 and 15%.

It is still important to specify the origin of the immigrants, despite their low percentage in Warsaw. In 2011 in the NUTS 2 region mazowieckie\textsuperscript{27}, to which Warsaw belongs, the biggest minorities were: Ukrainians – over four thousand in the region, which is 23.3% of all foreigners, Vietnamese – noticeably smaller being 11.2%, Russians – 7.5%, and Belarusians and Chinese constituting only around 5% of foreigners each\textsuperscript{28}. Therefore in this case it also indicates strong connections in the eastern direction, particularly with Ukraine. Furthermore, it shows for whom polish labour market is attractive.

Another interesting issue in relation to the cultural function, although it has not been taken into account for the ranking, is if the cities have been granted the title of European capital of culture as a way to show top performance of the cultural function within the country. Whereas most of the cities compared in the study have received the award\textsuperscript{29}, Warsaw and Hamburg are the only exceptions. In their cases, other cities in their respective countries might have better cultural performance. In case of Poland these were Kraków and Wrocław\textsuperscript{30}.

Furthermore, while evaluating the overall performance in the cultural function, a possible correlation between gateway – particularly transport function, and culture has been noticed. The observation was particularly clear on the example of Copenhagen, but it can be true as well for other cities, like Berlin or Warsaw, which seems to confirm the pattern, having a rather poor performance in both functions (transport, especially by flights, and culture). The general conclusion could be that the better accessible the city is the better developed cultural function it has, in relation with satisfying the needs of incoming people, often tourists. However, the same statement could also work the other way around, and occur due to the fact that a well developed cultural function in a city variation does not bring any difference for the scores in the rating. Data source: http://pub.stat.ee (access: 10.09.2014); http://www.latvia.lv/library/ethnic-minorities-latvia (access: 10.09.2014)

\textsuperscript{27} Data about the nationalities for the city area or metropolitan region was not found, so it is assumed that data for NUTS 2 region concerning the former can be extrapolated.

\textsuperscript{28} Data presented is for the NUTS 2 region, because couldn’t be found for Warsaw, but it is assumed that most of the immigrants concentrate in the city. Data source: http://stat.gov.pl/bdlen/app/stona.html?p_name=indeks (access: 27.08.2014)


\textsuperscript{30} http://ec.europa.eu/culture/tools/actions/capitals-culture_en.htm (access: 10.09.2014)
makes it a more attractive tourist destination, increasing the transportation towards it. Despite the general character of the statement the possibility of correlation is important for the functions’ development.

Summing up the performance of Warsaw, it reaches good scores with respect to what can be called traditional culture, like fine arts, which can be recognized as its biggest cultural asset. Among other major BSR cities it has relatively big number of theatres and museum visitors.

On the other hand, the performance in higher entertainment services can be regarded at the same time as a weakness or as an advantage. The performance of the city is weak, better only than the Baltic States’ capitals, but it has started to show a process of development and, if the trend continues, Warsaw has chances to become more competitive in regard of luxurious entertainment cultural services, especially when considering the frequent underdevelopment of the Eastern countries. On the contrary, it is not really possible to find international ambiance in the city according to the low percentage of foreigner population observed. Besides, what is also weakening Warsaw’s position are the indications that it may not be the strongest cultural center in Poland.

In general, the top cultural roles in the BSR are performed by Copenhagen, Berlin and Stockholm. Meanwhile, Warsaw has a medium performance although on a significantly lower level than the leading cities, and having similar results as Hamburg and Helsinki.

4.6. Hierarchy

As the aim of this study is to determine the examined cities’ positions, with a special focus on Warsaw, in this section the results of the conducted analysis on metropolitan functions are gathered together. An attempt to point out the hierarchical tendencies among the most important cities in the macro-region, with particular interest in the leading positions, is also presented here. To achieve that, the cities’ performances in analyzed functions were graded, and that resulted in the creation of a hierarchy, which is presented in table 9 and discussed below.
Table 9. Hierarchy of cities

<table>
<thead>
<tr>
<th>Position</th>
<th>City</th>
<th>Overall score</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Berlin</td>
<td>27</td>
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<tr>
<td>2</td>
<td>Copenhagen</td>
<td>25</td>
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<td>3</td>
<td>Stockholm</td>
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<td>Hamburg</td>
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<td>Helsinki</td>
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<td>Vilnius</td>
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<td>Riga</td>
<td>3</td>
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<tr>
<td>8</td>
<td>Tallinn</td>
<td>3</td>
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</tbody>
</table>

own elaboration; The grading is presented in annexes 6 – for indicators, and 7 – for metropolitan functions.

It needs to be stressed that such formed hierarchy is a result of the functions, indicators, and grading system that have been chosen for this analysis. Moreover, the results were also influenced by the limitations of research (e.g. accessibility of data). However, based on the theories presented in the first chapter and the justification of the method (3rd chapter), the hierarchy is believed to be a relevant estimation of cities positioning. The thorough explanation of creation of the hierarchy is presented in the method chapter – section 3.4.

Looking at the positions achieved by the cities and the divergences in performance, it can be concluded that there is not much variation between the cities that are on the top of the hierarchy. The difference between the scores of the four top cities is low, only 2 points between each position, and respectively before the fifth 3 points. Therefore, between the leading cities clear distinctions can not be made, as their scores could easily vary with differences in the grading system. In any case, it is visible that the dominant 3 cities are Berlin, Copenhagen and Stockholm. Following are Hamburg and Helsinki, although with visibly lesser developed metropolitan functions. With respect to Warsaw, it is located between these two groups, however it is hard to determine to which of them the city is closer. In the bottom of the hierarchy, one can find, evidently lagging behind, the Baltic States’ capitals.

The fourth place hold by Warsaw in the final hierarchy is owed especially to the top performance it achieved in the knowledge function, scoring also well in the gateway function and, to a lesser extent, in the decision-making and culture functions.
In several cases, when comparing the position of Warsaw with other cities’ performances, areas where the city can improve can be identified. Based on the examples of the leading cities in the BSR, it can be estimated what Warsaw would need (from the traits that they possess) to improve its position. Further discussion on this topic is provided below, taking into account city potentials and obstacles for fulfilling the needs that are here defined.

The needs

In the knowledge function, despite its top performance Warsaw could still improve. That is because it obtained the highest score mostly due to the size related variables – large knowledge base and concentration of smart people. But the quality indicator still needs improvement. In particular, looking at the example of Stockholm, which has highly appreciated knowledge base, Warsaw should improve the quality of the education regarding that it has only one recognized university, which is also ranked lower than the others from compared cities. A better recognition in the ranking means good international reputation and more students interested in the university. It can be assumed that these recognized universities are more interconnected and can exchange knowledge and best practices especially when it comes to research. Therefore cooperation between universities is desired as it facilitates research and innovation creation. At the same time, exchanges created between universities also facilitate city networking – with more connections city gains more importance.

Regarding the decision making function, Warsaw does not belong to the leading centers of the region. It particularly lacks global connections in corporate control. The best performing examples in the BSR are Stockholm and Hamburg. However, they represent different ways to achieve a well developed corporate control. The former one has a large number of strong and recognized companies of importance in the global economy. Between the overall number of headquarters from the rankings localized in Warsaw and in Stockholm is a big gap of values – showing the need of Warsaw to improve. On the other hand, looking at the performance of Hamburg its biggest advantage is diversification – presence of various headquarters. This case shows that not only strong, stable in the market, long established companies, but also new, innovative, fast growing ones are important. That is as they facilitate dynamics, which supports growth and development in the corporate control function. Both of the cities have also corporations supporting
functioning of the companies – APS. For Warsaw improvement in this function would help for better participating in the corporate control network, whose connections constitute also a part of the city network.

In case of the gateway function, Warsaw has a good position related to openness and accessibility of the market, but the connectivity by air transport is on the low level. The need of improvement is appointed by performances of Copenhagen and Berlin, which have much higher capacity of international flights than Warsaw. The air transport connections are important as linkages between cities in the system and large flight capacity indicates strong and various (with several destinations) interconnections. Flights’ passengers comprise of people traveling for different reasons, therefore this function can facilitate performance in the other ones. For instance, it provides connections for: knowledge exchanges – e.g. transport to conferences; decision-making – e.g. business trips related to transactions between different companies and also within one company network, from headquarter to regional offices; cultural – tourism, accessing the attractive cultural points, but also connected with immigration – moving to another country and connection with the homeland. Therefore, for Warsaw an improvement of the connectivity can support better performance in other functions.

Concerning the cultural function, Warsaw could again follow the performance of Copenhagen and Berlin. To be competitive in this function better developed luxurious services and more attractive culture are needed, in order to gain popularity as a touristic destination. Particularly important for the last mentioned aspect is connectivity, i.e. the need of improving transportation connections.

Summing up, the highlighted needs concern mostly the improvement of connections with other cities. They either indicate demand for linkages or characteristics that would support appearing of such. The main goal is reaching better connectivity and cooperation, which will provide a better performance in the city system.

Overall looking at the cities leading in the created hierarchy two strategies to gain importance can be recognized. Either the city has high performance in all functions, like in Berlin, with high score in the knowledge, gateway and cultural functions, and a bit lower only in the decision-making one. Or the city can be specialized, as shows the example of Copenhagen, which owes its position to its extremely well developed (in the macro-regional scale) culture and also gateway (particularly transport) functions.
In table 10 the strengths and weaknesses of Warsaw’s performance, earlier discussed in the analysis of particular functions, are recapitulated. They partly influenced the definition of the needs, but particularly important are in case of determining the potentials and limitations of gaining importance by the Polish capital city. When gathered together they show that Warsaw has a growing potential but in many aspects the metropolitan functions are not well developed enough to be competitive and reach the top performance among BSR metropolitan regions.

Table 10. Strengths and weaknesses of Warsaw

<table>
<thead>
<tr>
<th>Function</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic strength</td>
<td>- large population</td>
<td>- small economy</td>
</tr>
<tr>
<td>Knowledge</td>
<td>- large number of students</td>
<td>- not well recognized quality of education</td>
</tr>
<tr>
<td></td>
<td>- concentration of higher educated people</td>
<td>- rather low rate of higher educated people in working-age population</td>
</tr>
<tr>
<td>Decision-making</td>
<td>- many headquarters of companies</td>
<td>- lack of globally meaningful companies’ headquarters</td>
</tr>
<tr>
<td></td>
<td>continentally important</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- a growth company</td>
<td></td>
</tr>
<tr>
<td>Gateway</td>
<td>- large number of trade fairs</td>
<td>- low air transport capacity</td>
</tr>
<tr>
<td>Culture</td>
<td>- well developed art related cultural services</td>
<td>- lack of international atmosphere in the city</td>
</tr>
<tr>
<td></td>
<td>- point of departure for development of luxurious cultural services</td>
<td>- weak luxurious cultural services</td>
</tr>
</tbody>
</table>

own elaboration

The potentials

The conditions supporting the appointed needs were defined as potentials for Warsaw. The first one, is its big size and large population, as well as being representative of a big country. One of the biggest advantages is the high concentration of people, which facilitated exchanges of knowledge and ideas inside the city, in the way that even the well developed distance communication that technologies allow cannot provide. Also, Warsaw’s domination role in the national scale is seen as a potential.

Secondly, a strong asset is the large knowledge base owned, meaning concentration of skilled people. That indicates existence of good research environment. The quality has
chances for improvement and adding more universities to international recognition lists. However, it is also possible that some of other higher education institutions, despite good quality of knowledge generation, do not respond to the international criteria, according to which the ranking used was organized, fact that can underestimate its performance. In any of these cases the adaptation to the international standards can cause better prospering.

Another advantage comes from the decision making function. The performed corporate control function has importance at the European scale, emerging from the 2nd position in the number of headquarters after Stockholm. The indicator does not say exactly how well the function is fulfilled, but it shows the existence of international corporate connections. Likewise, this can stand as potential for further improvement, for the corporate function, the presence of growth companies is an advantage, because it shows positive dynamics in this field. Besides, supporting in this case is the preponderance of Warsaw within Poland through the domination of the national economy, as well as the concentration of the corporate control in Warsaw.

What is more, in regard of the gateway function, it has been observed that the market became more opened, shown by the large number of trade fairs. This indicates that the city is in process of or at least ready for establishing new connections, which as it has been argued before is an important advantage for a transitioning economy.

Last but not least, with rising wealth of population the consumer markets inevitably grows, which was identified through the entrance of luxurious services to the market. This indicates improvement of the quality of life of the inhabitants in Warsaw, as they are now able to afford more and higher-order goods and services. Such a progress shows ongoing changes in the economy.

The limitations

On the other hand, the limitations constitute obstacles for fulfilling the needs earlier appointed. The main one, causing different barriers, is the historically centrally planned economy until 1989. A result of that economic model is the current underdevelopment of the country and city. Besides, as transformation is a process of slow pace, the backwardness is still present nowadays, and despite the ongoing changes, it will still take time to move forward.
Consequently, Warsaw is not as competitive as the cities on the top of the hierarchy, because of its smaller economy, which will not significantly improve unless the whole Polish economy follows such a pattern. Therefore, this is a powerful barrier holding back Warsaw’s development.

Furthermore, Warsaw does not reach the global level of corporate control, as its participation in it is poorly developed. As a consequence, the city is less connected than other cities, which can be noticed also because of e.g. the lack of developed air transportation. Fulfilling the global economy related control function is highly significant in order to reach international importance, not only at the macro-regional scale but also in a broader one like the continental or global. Worldwide connected cities gain importance and a stronger position, so unless Warsaw can manage to improve its global connections it will not be possible to reach the top performing cities in the hierarchy.

Another problem is the low attractiveness of the city in the international arena. This is observable in results of many variables, especially in much lower number of foreigners than other cities, and low flight connections capacity, or not being a popular touristic destination – factors which can show the low power of attraction of the city, for example with respect to foreign skilled manpower. Such issue is reflected by the polish labour market. As it was shown, the highest numbers of foreigners are Ukrainians, therefore implying that Warsaw attracts only workers from less developed countries. Likewise it could also imply that the city has an unfriendly character for foreigners. Therefore, an international working and research environment is missing, which in other cities contributes to the urban development.

Additionally, if the Polish economy grows it is highly probable that the second tier cities within the country will gain more power, which depending on their pace of development may result in Warsaw at least partly losing its importance in the national scale, as then the concentration of the economic activity would be more spread. For Warsaw itself the concentration of growth in the capital would be better, instead of having several strengthening regional centers to compete with. This is a typical controversy in polycentric development, which can either be achieved at the international level – developing major cities as international growth poles, or at the national with a more balanced development within the country.
In regard of existing obstacles, particularly the slow pace of growth of the economy, they do not allow a significant and simultaneous development of the metropolitan functions described. Therefore, the specialization in one or some of the functions can be regarded as a possibility for development.

The overall conclusion is that, according to the study, Warsaw was granted the fourth position in the urban hierarchy of the BSR. Such a performance can be described as average, although the score could be regarded as close to the group of the top three cities. Warsaw’s fulfillment of metropolitan functions could be improved, for which the main directions – needs were pointed out, but the city is considered to be on its way. However, it is needed to take into account that certain limitations for growth exist, constituting strong barriers for the development of Warsaw.
Conclusion

Summing up, as the research was related to the global level of performing functions by the cities, the chosen indicators should well represent the performances of the metropolitan areas when it comes to their positioning. When looking at the outcome of the study – hierarchy of BSR cities, the appointed leading cities, Berlin, Copenhagen and Stockholm were not surprising. Partly unexpected was the dominance of Copenhagen over Stockholm, which was gained in the last two functions – gateway and culture. However the results are not exact, due to the assumed grading system.

Regarding the fourth place of Warsaw it was hard to predict, especially the fact of overcoming Hamburg and Helsinki, the more that in several functions the three cities had similar results. Clear and easy to estimate was better performance than Riga, Tallinn and Vilnius, who are discriminated in relation to their size and economy – both for the cities and their respective countries. Looking at different city rankings the position of Warsaw in relation to other compared cities varies. For instance, in the in the MEGAs categorization, classified into the 3rd MEGAs category Warsaw was two classes lower than most of examined cities, one lower than Helsinki, and better only than the Baltic States’ capitals also by one class (ESPON, 2005). On the other hand, according to the ranking composed by GaWC group Warsaw’s position was relatively good as it was classified among gamma world cities with Stockholm, Berlin, Hamburg and Copenhagen, when Helsinki were classified one level lower (Beaverstock et al., 1999). Regarding the scores differences in carried here study the results are more similar to the latter mentioned list.

Overall, the fourth position of Warsaw in the hierarchy can imply that over the last 25 years (assuming till 2014 although the data collected were from earlier years) a lot of dynamics has been happening. That can be observed since 1989, until when Warsaw was included in Polish centrally planned economy that strictly limited openness of the city. Comparing the metropolises nowadays, when Warsaw in relation to some cities whose development was undisturbed (e.g. Stockholm, Copenhagen, Hamburg or Helsinki) takes the fourth position in the hierarchy, positive changes are noticed.

For further research interesting would be deeper analysis of presented here functions, especially if it could overcome the limitations of this study. For instance, in the knowledge function could be included the actual research centers or innovation and research expenditure – not only higher education related indicators. What is more, students
could be classified by the faculties, which would give more exact information about which metropolitan function they can contribute to – the innovative part of knowledge, or culture. Regarding the decision making function, the advanced producer services could have been more looked into as they have strong influence on global city formation and urban networking. Additionally, some indicators related to politics could have been set, e.g. the presence of only described in this study supranational organizations. In case of gateway function, examined could be the data transfers. For cultural function evaluation, it could give a broader overview on arts, e.g. music or film festivals; also indicators related to tourism could be included, for instance sites classified by UNESCO as World Heritage. Moreover, an issue that could change the outcomes of this study would be assigning different weights for grading the metropolitan functions in relation to their importance for development.

Besides, as an alternative proposition the actual connections that Warsaw has could be examined – trying to appoint the network to which it belongs, based on the relational data as the research of GaWC study group. That would allow determining if Warsaw is actually oriented towards the Baltic Sea Region urban system or better connected with other cities.

Nevertheless, due to the limited possibilities of research in this study, the outcomes are not specific and depend to a large extent on the assumptions and estimations made. Despite that the results are still considered relevant as the model used for analysis was constructed based on appropriate literature sources and appreciated theories. Considering further studies, in regard of cities becoming main power concentrations in the global economy and their general gaining of importance also in lower levels of the system, the topic of this thesis is believed to be important for development of cities in the BSR and interesting for further studies.
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BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung im Bundesamt für Bauwesen und Raumordnung [de.], 2011, Metropolitan areas in Europe, BBSR-Online-Publikation 01/11


ESPON, 2005, ESPON 1.1.1 Potentials for polycentric development in Europe. Final Report


*Vision and Strategies around the Baltic Sea 2010: Conference of Ministers for Spatial Planning and Development*, 2001, Planco, Essen


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http://www.big4accountingfirms.org/big-four-accounting-firms/ (access: 09.08.2014)


http://www.timeshighereducation.co.uk/world-university-rankings/2013-14/world-ranking/methodology (access: 14.08.2014)

**Data sources**


ESPON database: http://database.espon.eu/db2/search (access: 28.08.2014)

Annexes

Annex 1. Data for the knowledge function

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Number of students in higher education (5-6 ISCED level) in 2011</th>
<th>Number of universities from THE ranking 2013-14</th>
<th>Persons (aged 25-64) with 5-6 ISCED education level in 2011</th>
<th>Proportion of population (aged 25-64) qualified at level 5-6 ISCED in 2011</th>
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<tbody>
<tr>
<td>City</td>
<td></td>
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<td></td>
</tr>
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<td>731 400</td>
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<tr>
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<td>67 565</td>
<td>1</td>
<td>147 749</td>
<td>45,34</td>
</tr>
<tr>
<td>Hamburg</td>
<td>70 134</td>
<td>0</td>
<td>326 300</td>
<td>31,71</td>
</tr>
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<td>Helsinki</td>
<td>67 757</td>
<td>2</td>
<td>161 672</td>
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<tr>
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<td>103 856</td>
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<td>3</td>
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<td>Tallinn</td>
<td>38 278</td>
<td>0</td>
<td>109 140</td>
<td>49,03</td>
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<td>Vilnius</td>
<td>86 254</td>
<td>0</td>
<td>168 383</td>
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</tr>
<tr>
<td>Warsaw</td>
<td>345 203</td>
<td>1</td>
<td>460 741</td>
<td>45,51</td>
</tr>
</tbody>
</table>

*own elaboration; data source:*
1. Eurostat database: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database (access: 04.03, 17.03, 12.08.14),
2. own calculations based on data accessed from Eurostat,
3. http://www.timeshighereducation.co.uk/world-university-rankings/2013-14/world-ranking (09.08.14)
4. data for the whole Latvia
5. value estimated based on average share between Tallinn and Vilnius of students number of the country in the capital, used for grading
6. invalid data from Eurostat; complimentary data from BDL:
   http://stat.gov.pl/bdlen/app/strona.html?p_name=indeks (access: 17.03.14)

Annex 2. Data for decision-making function

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Number of headquarters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
</tr>
<tr>
<td>City</td>
<td></td>
</tr>
<tr>
<td>Ranking</td>
<td></td>
</tr>
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<td>City</td>
<td>Fortune Global 500 Companies</td>
</tr>
<tr>
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</tr>
<tr>
<td>Copenhagen</td>
<td>1</td>
</tr>
<tr>
<td>Hamburg</td>
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</tr>
<tr>
<td>Helsinki</td>
<td>0</td>
</tr>
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<td>Riga</td>
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</tr>
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<td>Stockholm</td>
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<td>Tallinn</td>
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<td>Vilnius</td>
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</tr>
<tr>
<td>Warsaw</td>
<td>0</td>
</tr>
</tbody>
</table>

*own elaboration, data sources:*
Annex 3. Companies of European importance with headquarters in compared cities

<table>
<thead>
<tr>
<th>City</th>
<th>Financial Times Europe’s 500 Companies in 2013 whose headquarters are located in the city</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin</td>
<td>Axel Springer, A.P. Moller-Maersk Group, Danske Bank, Carlsberg, TDC, TrygVesta</td>
</tr>
<tr>
<td>Copenhagen</td>
<td>Beiersdorf</td>
</tr>
<tr>
<td>Helsinki</td>
<td>Sampo, Wartsila, Metso, UPM-Kymmene, Stora Enso</td>
</tr>
<tr>
<td>Warsaw</td>
<td>PKO Bank Polski, Pekao, PZU Group, PGNiG, PGE, BRE Bank</td>
</tr>
</tbody>
</table>

own elaboration; data source: http://im.ft-static.com/content/images/9228fd16-f2c3-11e2-a203-00144feabdc0.pdf (access: 05.03.2014)

Annex 4. Data for gateway function

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Total passengers on board in 2012</th>
<th>Multimodal potential accessibility by NUTS 3 region in 2006</th>
<th>Multimodal potential accessibility standardised by NUTS 3 region in 2006 [%]</th>
<th>Number of international fairs in 2013 according to AUMA database</th>
</tr>
</thead>
<tbody>
<tr>
<td>City</td>
<td>by airport</td>
<td>in extra-EU flights b</td>
<td>in extra-EU flights b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in intra-EU flights a</td>
<td></td>
<td></td>
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<tr>
<td>Berlin</td>
<td>Tegel and Schönefeld airports</td>
<td>11 698 736</td>
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<td>Copenhagen</td>
<td>Kastrup airport</td>
<td>14 545 282</td>
<td>6 960 269</td>
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<td>Hamburg airport</td>
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<td>Vantaa airport</td>
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<td>Riga</td>
<td>Riga airport</td>
<td>3 311 297</td>
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<tr>
<td>Stockholm</td>
<td>Arlanda, Bromma and Skavsta airports</td>
<td>12 764 768</td>
<td>4 706 588</td>
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<td>Tallinn</td>
<td>Lennart Meri airport</td>
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<td>Vilnius Intl airport</td>
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<td>Warsaw</td>
<td>Chopin airport</td>
<td>5 506 805</td>
<td>2 575 683</td>
<td>85 847 960</td>
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</table>

## Annex 5. Data for cultural function

<table>
<thead>
<tr>
<th>City</th>
<th>Number of theatres in 2011&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Number of museum visitors (per year) in 2011&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Number of restaurants starred by Guide Michelin in 2014&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Foreigners as a proportion of population in 2011 [%]&lt;sup&gt;4&lt;sup&gt;e&lt;/sup&gt;&lt;sup&gt;e&lt;/sup&gt;&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berlin</td>
<td>36</td>
<td>15 791 060</td>
<td>13</td>
<td>14,1</td>
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<td>Copenhagen</td>
<td>105</td>
<td>3 344 635</td>
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<td>14,2</td>
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<td>24</td>
<td>1 699 043</td>
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<td>11</td>
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<tr>
<td>Riga</td>
<td>9&lt;sup&gt;cd&lt;/sup&gt;</td>
<td>(2 544)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0</td>
<td>16,52&lt;sup&gt;e&lt;/sup&gt;</td>
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<td>32</td>
<td>3 950 644</td>
<td>1</td>
<td>0,52</td>
</tr>
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</table>

*own elaboration; data sources:<sup>a</sup> Eurostat database: [http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database) (access: 04.03.14, 12.08.14);<sup>b</sup> Guide Michelin (data from the period presented in the guide at the day of access): [http://www.viamichelin.com/web/Restaurants](http://www.viamichelin.com/web/Restaurants) (access: 12.08.14);<sup>c</sup> Latvijas statistika: [http://www.csb.gov.lv](http://www.csb.gov.lv) (access: 13.08.14);<sup>d</sup> in case of lack of data, own calculations on data from Eurostat, BDL: [http://stat.gov.pl/bdlen/app/strona.html?p_name=indeks](http://stat.gov.pl/bdlen/app/strona.html?p_name=indeks), Statistics Estonia: [http://www.stat.ee](http://www.stat.ee) (access: 27.08.14);<sup>e</sup> data for the whole Latvia<sup>f</sup> data presents museum attendance in the whole Latvia, it was extracted from Latvian Statistical Database, however it is seems irrelevant compared with figures for other cities, therefore it was put in brackets; for grading Riga is assumed to have the lowest number.
Annex 6. Grading of the performances in the indicators

<table>
<thead>
<tr>
<th>Function</th>
<th>KNOWLEDGE</th>
<th>DECISION-MAKING</th>
<th>GATEWAY</th>
<th>CULTURE</th>
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<td>A B C D</td>
<td>E F G H</td>
<td>I J K L</td>
<td>M N O P</td>
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<td>7 4 8 0 19</td>
<td>6 7 7 6 26</td>
<td>6 8 7 5 26</td>
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<td>Copenhagen</td>
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<td>7 4 7 6 24</td>
<td>3 4 8 0 15</td>
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<td>Helsinki</td>
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</tr>
<tr>
<td>Riga</td>
<td>2 0 1 2 5 0 0 0 0 2 2 4 3 11 0 0 0 7 7</td>
<td></td>
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<tr>
<td>Stockholm</td>
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<td>8 8 0 8 24</td>
<td>7 6 1 5 19</td>
<td>7 7 6 3 23</td>
</tr>
<tr>
<td>Tallinn</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vilnius</td>
<td>6 0 4 8 18</td>
<td>0 0 0 0 0 1 0 2 3 6 3 1 0 1 5</td>
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<td></td>
</tr>
<tr>
<td>Warsaw</td>
<td>8 5 7 4 24</td>
<td>0 7 7 0 14 4 3 6 7 20</td>
<td>5 6 3 0 14</td>
<td></td>
</tr>
</tbody>
</table>

own elaboration

A – Number of students in higher education (5-6 ISCED level) in 2011
B – Number of universities from THE ranking 2013-14
C – Persons (aged 25-64) with 5-6 ISCED education level in 2011
D – Proportion of population (aged 25-64) qualified at level 5-6 ISCED in 2011
E – Number of headquarters located in the city of companies recognized by Fortune Global 500 Companies ranking in 2013
F – Number of headquarters located in the city of companies recognized by Financial Times Europe’s 500 Companies ranking in 2013
G – Number of headquarters located in the city of companies recognized by Europe’s 500 Growth Companies ranking in 2013
H – Number of headquarters located in the city recognized by Largest European Banks ranking in 2013
I – Total passengers on board in intra-EU flights in 2012
J – Total passengers on board in extra-EU flights in 2012
K – Multimodal potential accessibility by NUTS 3 region in 2006
L – Number of international fairs in 2013 according to AUMA database
M – Number of theatres in 2011
N – Number of museum visitors (per year) in 2011
O – Number of restaurants starred by Guide Michelin in 2014
P – Foreigners as a proportion of population in 2011
Annex 7. Grading of the performances in the metropolitan functions

<table>
<thead>
<tr>
<th>City</th>
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<th>Decision-making function</th>
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own elaboration