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Metropolitan areas in Europe

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Study background and structure

Study objectives: redefining metropolitan functions, depicting their spatial distribution in Europe, defining and classifying metropolitan areas.

The structure of the study is based on the gradual analytical steps according to which the metropolitan areas in Europe were defined:

- In Chapter 1, the topic will be introduced and the history of metropolitan regions in the fields of spatial research and spatial planning, forming the background of this study, will be presented.
- In Chapter 2, metropolitan functions, the main analytical categories of metropolitan areas, will be discussed in theory and newly derived. It thus provides the theoretic basis for the empirical analysis.
- In Chapter 3, the redefined metropolitan functions will be operationalised, i.e. indicators will be assigned to them. In addition, the measurement concept used for the empirical analysis will be presented.
- Chapter 4 will present the analytical results of each metropolitan function and will give an overview of the distribution of metropolitan functions in locations in Europe.
- In Chapter 5, the study's main step will be taken: analytically defining metropolitan areas in Europe based on location-related metropolitan functions as well as comparing and classifying them in terms of their significance. In doing so, the metropolitan areas were for the first time consistently defined for the whole European territory with the BBSR Accessibility Model.
- In Chapter 6, conclusions for the German and European spatial development policy will be presented and open questions will be discussed in terms of further research activities.

Metropolitan areas = analytical areas
Metropolitan regions = programme areas

The study distinguishes between metropolitan areas and metropolitan regions.

Metropolitan areas according to this study are those areas or places in which a large variety of metropolitan functions are densely concentrated. They are thus analysis-based territorial units and not established territorial study units (such as large city regions, agglomerations).

Metropolitan regions, however, represent a policy concept. Especially in Germany, the term “metropolitan region” has gained a policy meaning through initiatives and stipulations of the Federal Government, the federal states and local authorities. It mostly represents voluntary local associations or cooperation within or of regions aimed at dealing with self-organisation and governance issues, developing strategies or executing projects. Generally, it represents a new spatial category which has emerged as a result of a bottom-up process based on territorial-administrative structures.

1 Metropolitan regions – an evidence-based policy programme

The phenomenon of metropolitan regions – whether called global city, world city or metropolitan area – has already been much investigated and “planned” in many key policy programmes although it has not yet been comprehensively analysed from the spatial point of view and operationalised.

This is where the current study starts by discussing from the outset the issue of metropolitan functions. What turns areas into metropolitan areas? Do they represent economic key functions within a globalised economy or do historical, political and cultural factors also play a role?

The study therefore first focuses on redefining metropolitan functions beyond classical explanatory models. For that purpose, theories and patterns from the fields of social science and regional economics will be analysed. Secondly, metropolitan functions and their spatial distribution in Europe will be analysed. The result is an analytically and theoretically substantiated, comprehensive view of European metropolitan areas.

Globalisation and metropolisation – a tandem

It is obvious that more and more economic and production processes are fragmented, executed based on international division of labour and reintegrated. The control of production is often decoupled from the site of production. But not only large enterprises and financial centres act on a global scale nowadays. Important scientific, cultural and tourism centres also focus their attention on activity in an international, often even worldwide scale. In Europe, this trend is completed by many political, economic, cultural and also private activities that have been “Europeanised” as a consequence of the European integration, the Single Market and the related freedom of movement.

All these processes are arranged and integrated within worldwide networks. Metropolises and metropolitan regions form hubs within these networks and are of central importance within these international relationships. Within these areas and regions, local and regional interact with supraregional and global functions increasing their importance.

However, only few places in the world are not involved in worldwide networks. This phenomenon has been described by Thomas L. Friedman as the world becoming increasingly “flat”, in which, in the light of the spread of technical opportunities to communicate, more and more cities and regions are involved in global exchange processes.¹ However, this world, which has become more “flat”, nevertheless has jutting “peaks”, as stated by Richard Florida in “The World Is Spiky.”² These “peaks” stand for metropolitan regions of worldwide importance which form the basis of the globalised world and thus mean those areas which experience and promote current economic, social and cultural globalisation processes.

The global networks and hubs of different global stakeholder groups – e.g. politicians, brokers or aircraft captains – principally differ and stand out from each other. In terms of interaction, they are very similar though, even if there are specialised hubs within these networks which are of worldwide importance only for a few stakeholder groups or functional areas. One can refer to a purely metropolitan region as a place which accumulates functions with a large or even global scope. Scope in this context means how a function is entwined with an area in the regional or supraregional context, especially in the global context.

Besides the capacity to concentrate various organisational, control and gateway functions of global and European importance and to act as hubs in worldwide networks, metropolitan regions are also of national and regional significance. They are agglomerations concentrating people, institutions, businesses and industries and are thus a formative element of the morphological spatial structure. They can also be considered as central places with the highest level of centrality because as large cities or agglomerations they assume service functions for a large surrounding area and also beyond this area.

This is why German spatial planning politicians discuss the question whether, in the context of central places policies, metropolitan regions should be classified as the new highest level of centrality above the established Christaller level of high order centres. Irrespective of the political discussion whether there should be a specific policy for metropolitan regions, considering metropolises and metropolitan regions primarily – or even exclusively – as new special high order centres or metropolitan centres and defining them by their supply function regarding central place-related goods and services would contradict their character from a scientific-analytical point of view.³ The supply function of a regional catchment area, which in the case of metropolitan regions is very large, is not the typical feature distinguishing a metropolis from other central places. Rather the concentration of metropolitan or supraregional functions in such areas, establishing worldwide networks, is a typical feature.

Why this study – what is new?

Despite good progress, research on metropolitan regions is still necessary. This is especially true in terms of identifying the theoretical background of metropolitan functions and classifying them systematically, updating their empirical bases, analysing the places investigated on a European wide basis and selecting them more carefully. In addition, a European wide regionalisation, based on common criteria, is still missing.

The current analysis is new because it identifies metropolitan areas on the basis of an analysis of the distribution of metropolitan functions across Europe and not just in cities and regions. 8.480 locations will be investigated Europe-wide on the basis of 38 indicators. The strategy enables us to compare the spatial distribution of metropolitan functions in the overall area both between individual locations and between metropolitan areas themselves. For the first time, one can see for the whole European territory, which

metropolitan functions or functional areas are highly concentrated in metropolitan areas and which ones exist in a dispersed form outside metropolitan areas.

There are some other features in which this study differs from previous analyses:

- It covers the whole European territory, including not only the current EU member states but also the non-member states.
- It is based on a new structuring of metropolitan functions and their integration into a theoretical background.
- It is based on a new analytical and standard European approach of regionalisation, which is not bound by existing administrative structures.

The analysis within the study is carried out in processes and its results are open-ended, i.e. the metropolitan functions are depicted in gradual analytical steps. Coherent metropolitan areas as spatial clusters of metropolitan functions only become visible at the end of the analysis. In the beginning, their shape is open and depends on the distribution of functions in each location. It would therefore be astonishing if these analytical metropolitan areas actually coincided with politico-administrative units, whether cities and city regions or the metropolitan regions mentioned above.

Metropolitan regions in the context of spatial research and spatial planning

In the context of German and European spatial development policy, metropolises and especially metropolitan regions have increasingly gained in importance. They are regarded as the engines of social, economic, social and cultural development.

Globalisation and European integration: new priorities of spatial development policy

For about twenty years, a number of political and scientific, national and European discussions about metropolitan regions in Germany and Europe have been entwined with each other. As is known especially since the studies of Thomas Kuhn were published in the 60s and 70s⁴, consolidated paradigms of the world are developed in political and scientific discussions and, if successful, are established as new patterns against rival patterns largely dominating and settling political and scientific discussions. If new paradigms are established, they have an impact, if not directly on the world then at least on science and politics with new topics, methods, research approaches and political programmes becoming accepted which could not be established before. Or in the words of Thomas Kuhn: "Though the world does not change with a change in paradigm, the scientist afterwards works in a different world."⁵

Within urban and spatial development policy, such a change of paradigm seems to have existed since the end of the 80s and continues. Both in Germany and in Europe, spatial

development and regional policy traditionally had a balancing objective and thus focussed on especially economically and geographically disadvantaged areas. Rural-peripheral areas more attracted attention than urban-central regions; economically backward regions in need for support rather than “economic driving forces”. For about twenty years, however, this focus has become weaker and has made room for a more comprehensive view of the overall area and its subareas. As a consequence, political and scientific attention not only in Germany, but also in Europe and internationally is increasingly paid to metropolises and large urban growth areas of international importance.

Various political and economic transformation processes and new technologies of the last twenty to thirty years have played a part in this change of focus – e.g. the Internet, trade agreements, lower transport costs or the strong economic growth of China and India. In this study, only some milestones are briefly outlined which deal with European integration and the related impetus for the European spatial development policy:

- In 1986, the member states of the European Union adopted the Single European Act and two years later the Maastricht Treaty which came into effect in 1992 and completed the Single Market with its four freedoms. For the then new member states Greece, Portugal, Spain and Ireland, the European regional and structural policy was considerably expanded to counteract the adjustment problems expected when being integrated into the European Single Market. A policy for the strongly growing regions became less necessary.
- Other measures of integration and raising efficiency as well – for example expanding Trans-European Networks – were agreed upon in the Maastricht Treaty. Topics and issues on winners and losers, on the relationship between increased efficiency and balancing, on the centre and periphery in Europe suddenly became the centre of the political and scientific attention. All parties agreed that the economically strong cities and regions – headed by the global metropolises London and Paris as well as the European metropolis Brussels – would count among the economic winners of European integration. Meanwhile, topics such as competitiveness of cities, city marketing or branding became more and more important.
- In 1989, the ministers responsible for spatial planning of the EU member states met for the first time and agreed upon the necessity to cooperate and to work out a joint spatial development concept. Ideas and political options about a polycentric urban system in Europe were not only an important element of the European Spatial Development Perspective (ESDP)⁶, adopted in 1999, but also gave impetus to both national discussions and scientific analyses. German spatial development policy-makers reacted with the concept of strengthening “European metropolitan regions” in Germany laid down in the “Political Framework for Regional Planning” (“Raumordnungspolitischer Handlungsrahmen HARA”) of 1995.⁷

- In 1989 as well, the fall of the Berlin Wall and the collapse of the Eastern Bloc led to a phase of pan-European integration culminating in the overcoming of antagonisms following the Second World War. The following enlargements of the EU and thus of the Single Market brought forward the discussion about European networks and their outstanding hubs.
- Following the depression of 1999/2000, the European Council with the Lisbon Strategy adopted measures to increase the European competitiveness and capacity for innovation so that attention was again paid to economic driving forces and centres of innovation. These approaches were – although in different ways – taken up within the “Concepts and Strategies for Spatial Development in Germany”⁸ in 2006 and within the “Territorial Agenda of the European Union”⁹ in 2007.

Because of these trends, metropolitan regions in Europe as well as at the national level in most member states have become established as an important strategic element of the political discussion both in terms of competitiveness and spatial balance. Depending on the national settlement structures, the impact and character of a policy for metropolitan regions in Europe is very different. The polycentric settlement structure in Germany underlines the strengthened position of metropolitan regions (and their wider hinterland) while the French spatial structure centralised to Paris emphasises the strengthened position of secondary centres. Because of the extremely sparsely populated regions in northern Scandinavia, priority there is given to stabilising small and medium-sized towns. All these different national initial positions – combined with data and methodical problems – have thus so far complicated considerably scientific and political efforts to achieve a picture of the European urban system and of European metropolitan regions on which agreement can be reached. Some results of European research are briefly outlined in the following section.

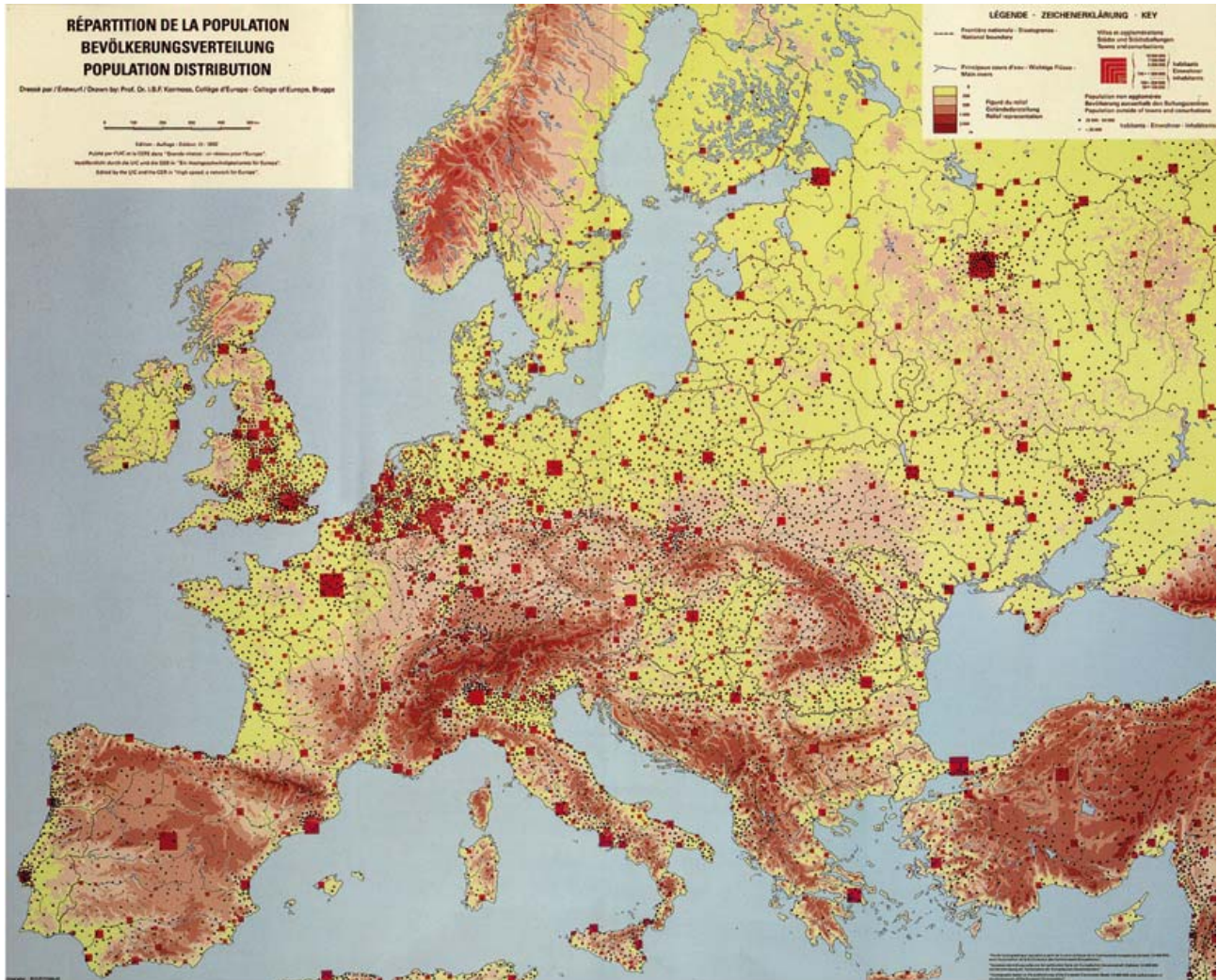
Research on metropolitan regions in Europe: from urban studies to European stereograms

In Europe it is nowadays nearly a matter of course that stereograms are based on analytical foundations. Since the political decisions to establish a European Spatial Planning Observation Network (ESPON) in 1994 and the Dutch Council Presidency in 2002 at the latest, evidence-based planning has become a substantial part of European spatial planning policy. In the meantime close relations have been established between research activities and political discussions on European urban and spatial development.¹⁰

Before 1980, pan-European illustrations of the urban system were rare. Earlier illustrations of Kormoss, who, shortly following the end of the Second World War, executed studies on the European spatial structure and urban system, can be considered milestones (cf. a new version in Fig. 1).¹¹ These approaches, however, were mainly limited to population figures and size ranges of cities. Even today, such urban data still are important, often the only information to describe urbanisation processes – especially in the international context –

and have an impact on thinking. Accordingly, in 2008, for the first time more than half of the global population was living in cities according to a UN study. Europe counts among the mostly urbanised regions in the world. The share of the urban population there is around 70%, in Germany 72% (Fig. 2).¹²

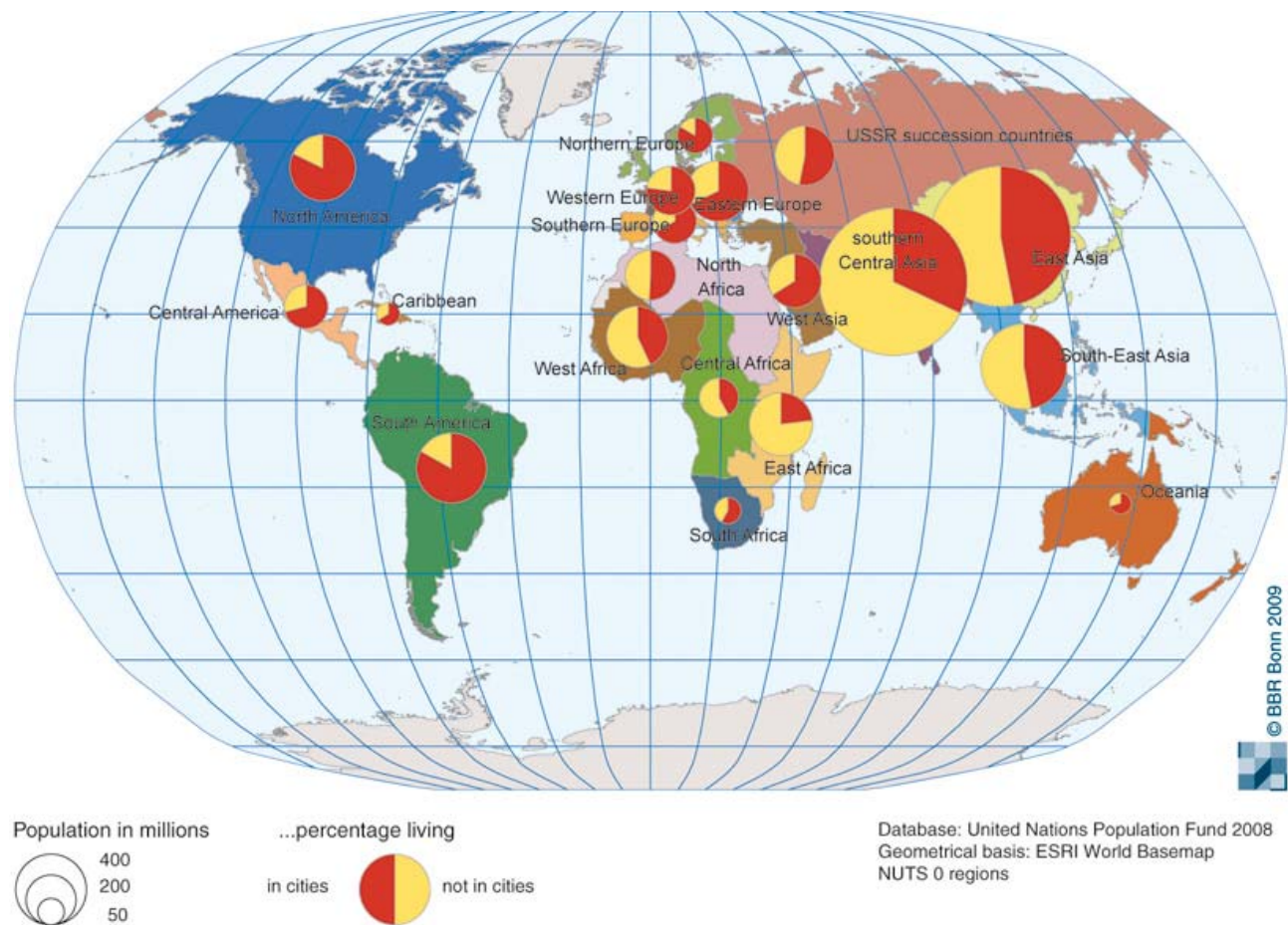
Figure 1:
Population distribution in Europe



Source: Kormoss, I.B.F.: Répartition de la population – Bevölkerungsverteilung – Population distribution. In: Grand vitesse: un réseau pour l'Europe. Publié par Union Internationale des Chemins de Fer (UIC) et Communauté des Chemins de Fer (CCFE) - s.l. 1992

For about twenty years, more detailed analyses on the European urban system have, however, increasingly been carried out. With their first ground-breaking analyses on the European urban system, Cheshire and Hay, for example, identified 229 city regions, in which more than two-thirds of the population of the European Community lived, and demonstrated their importance by way of various indicators.¹³ The EC document “Europe 2000” took up such Europe-wide analyses of cities and – based on a slightly different definition of city – discovered a share of the urban population of 80%.¹⁴ Global urbanisation and metropolitanisation has always been and remains associated with globalisation, agglomerations and metropolitan regions – often not clearly distinguished.

Figure 2:
Urban population in regions all over the world



Source: United Nations Population Fund (ed.): State of world population 2008. Reaching common ground: culture, gender and human rights. – New York 2008; mapping: BBSR

Analyses of cities and city regions – mostly based on population figures – have therefore formed the empirical basis for metropolitan research. In the last twenty years, metropolitan researchers thus used to analyse the urban system in a first step and to define the subgroup of metropolises in a second step.

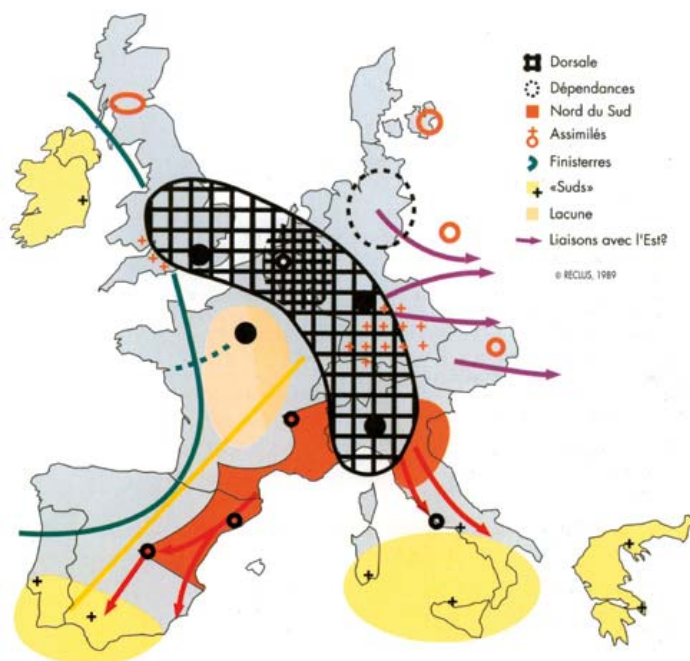
Since the beginning of the 80s though, another conceptual view developed especially represented by the English school around Sir Peter Hall. According to this view, the new quality of metropolises – at that time called global cities or world cities – was linked to the concentration of functional areas, which became increasingly important for the networking of the global economy. Metropolises were especially characterised as agglomerations of advanced producer services for the globalised world and as hubs within the global network. Empirical work within this tradition concentrated on analysing these functions and networking activities to the point of internal networking activities of mega-city regions – sometimes with the requirements of completely recording trends worldwide, but often in the context of detailed case studies. One example is the Metronet study carried out in the INTERREG cooperation area North-West Europe.¹⁵

This was the beginning of a period of intensive and often exhaustive data research lasting until today and of a continuous dialogue between the scientific and the political sector. Since the end of the 80s, a number of empirical studies describing the European urban system have been launched in Europe, partly initiated by the European Commission or by national governments. Following the fall of the Iron Curtain in 1989 and the EU enlargements of 2004 and 2007, the pan-European perspective became accepted although many studies were published by the late 90s and partly until this decade which solely focused on Western Europe.

The French study “Les villes européennes” (European cities)¹⁶ was one of the first and most influential studies of European cities. It was issued in 1989 by Roger Brunet on behalf of DATAR, a French authority responsible for spatial development. In the study, 165 Western European agglomerations with more than 200,000 inhabitants were investigated. A total of 16 indicators on various topics such as population, economy and (multinational) enterprises, research, finances, transport and communication hubs, cultural institutions etc. were analysed. They were depicted and classified, separately showing the functional specialisations of agglomerations and through an aggregate index in table and cartographic form.

One element, which was more influential than the individual statistical results of the study and which was derived from them, was the “Blue Banana” stereogram (Fig. 3). It represented a political warning and request addressed to the French Government, which can be summarised as follows: In France there is the metropolis of Paris but apart from that the dynamic European cities – going from London, the Dutch Randstad and Brussels, the Ruhr Area and the “Rheinschiene” (region along the River Rhine), the Alps and Milan to Genoa and the Mediterranean – avoid the country. The message behind is clear and neatly ties in with the credo of French discussions about spatial development: France requires stronger “second-row” cities besides Paris that are competitive within Europe and form the basis of a balanced spatial structure in France. This requirement was later operationalised and politically implemented by the urban network approach – cities were to get stronger by networking with each other. Because of the polycentric structure of its urban system, this approach also played a significant role in Germany and was supported by various

Figure 3:
The “Blue Banana” (“Tissus de Villes”)



Source: Brunet, R.: Les villes européennes. Rapport pour la DATAR. – Paris 1989, p. 79

demonstration projects of the Federal Government. It is still an element of the current discussion about metropolises.

The perception and discussion of the “Blue Banana” outside France was necessarily different. There the focus was not on the absence of polycentrism in the French urban system and its missing links to the close-by ribbon of cities from London to Genoa but on the concentration of cities on the European core area and thus the relationship between centre and periphery on a European scale. The most popular counterpart of the “Blue Banana”, the polycentric “Bunch of Grapes” model, was presented by Kunzmann and Wegener (Fig. 4).¹⁷ But whether “Banana” or “Grape”, both stereograms are ultimately based on the same philosophy according to which a polycentric structure of the European spatial and urban system has to be reached. The “Grape” can, however, be understood as a positive, the “Banana” - not only from the French point of view – as a negative scenario.

The negative picture of economic concentration in the “Banana” was later on¹⁸ advanced by the Federal Office for Building and Regional Planning (now Federal Institute for Research on Building, Urban Affairs and Spatial Development) into the European “Pentagon” in the centre of Europe with London, Paris, Milan, Munich and Hamburg as corners (Fig. 5). In 1999, at the time of the EU-15, it numerically covered 20% of the EU territory, 40% of its population and 50% of its economic performance. The Pentagon was also considered in the European Spatial Development Perspective.¹⁹ In fact for political reasons, it was not visualised in the document but in a following scientific paper.²⁰ Ten years later, within an enlarged EU, it still dominates the spatial structure of Europe. Anyhow, further cities and metropolitan areas have in parts developed very dynamically in

Figure 4:
The polycentric “Bunch of Grapes” model



Source: Kunzmann, K.R.; Wegener, M.: The pattern of urbanisation in Western Europe 1960–1990. – Dortmund 1991, p. 64

Figure 5:
The European “Pentagon”

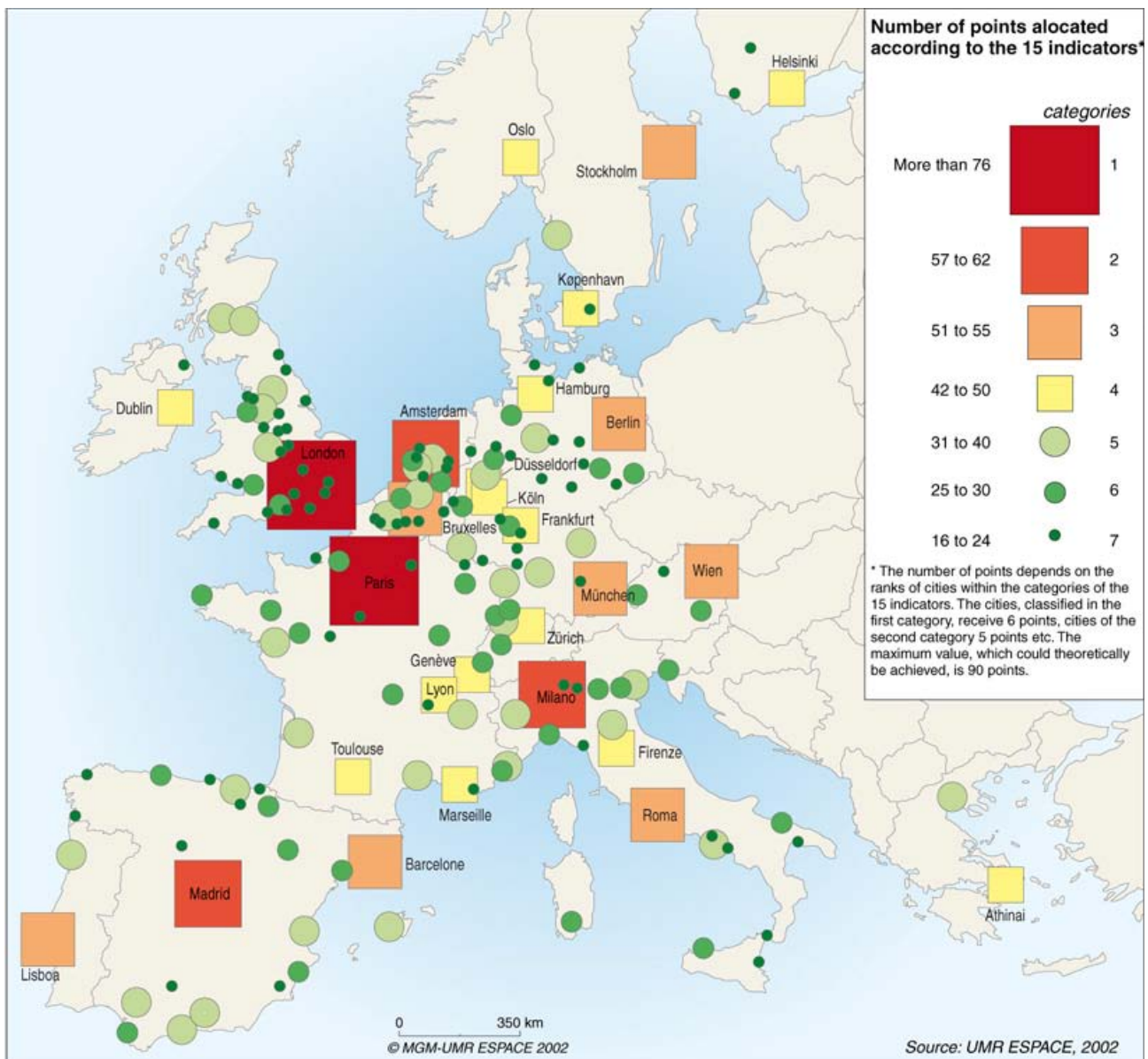


Source: Schön, K.P.: Das Europäische Raumentwicklungskonzept und die Raumordnung in Deutschland. Einführung. Informationen zur Raumentwicklung (2000) issue 3/4, p. IV

the meantime thus contributing to a more spatially balanced urban system in the EU.²¹

Fifteen years after the study of Brunet, DATAR commissioned a follow-up study. It was submitted by Céline Rozenblat and Patricia Cicille. A German translation was also published in 2004.²² Tying in with the criteria of Brunet of 1989, this study covered 178 agglomerations of the then EU-15 as well as of Switzerland and Norway and analysed them based on 15 indicators. The areas were classified according to seven categories leading to the overall picture in Figure 6.

Figure 6:
Classification of cities in Europe



Source: Rozenblat, C.; Cicille, P.: Die Städte Europas. Eine vergleichende Analyse. – Bonn: BBR 2004. = Forschungen, issue 115, p. 44

Scientific research and political advice and European cooperation in the field of spatial and urban development have promoted each other within this process. Already since 1994, the EU ministers responsible for spatial development pursued the establishment of a

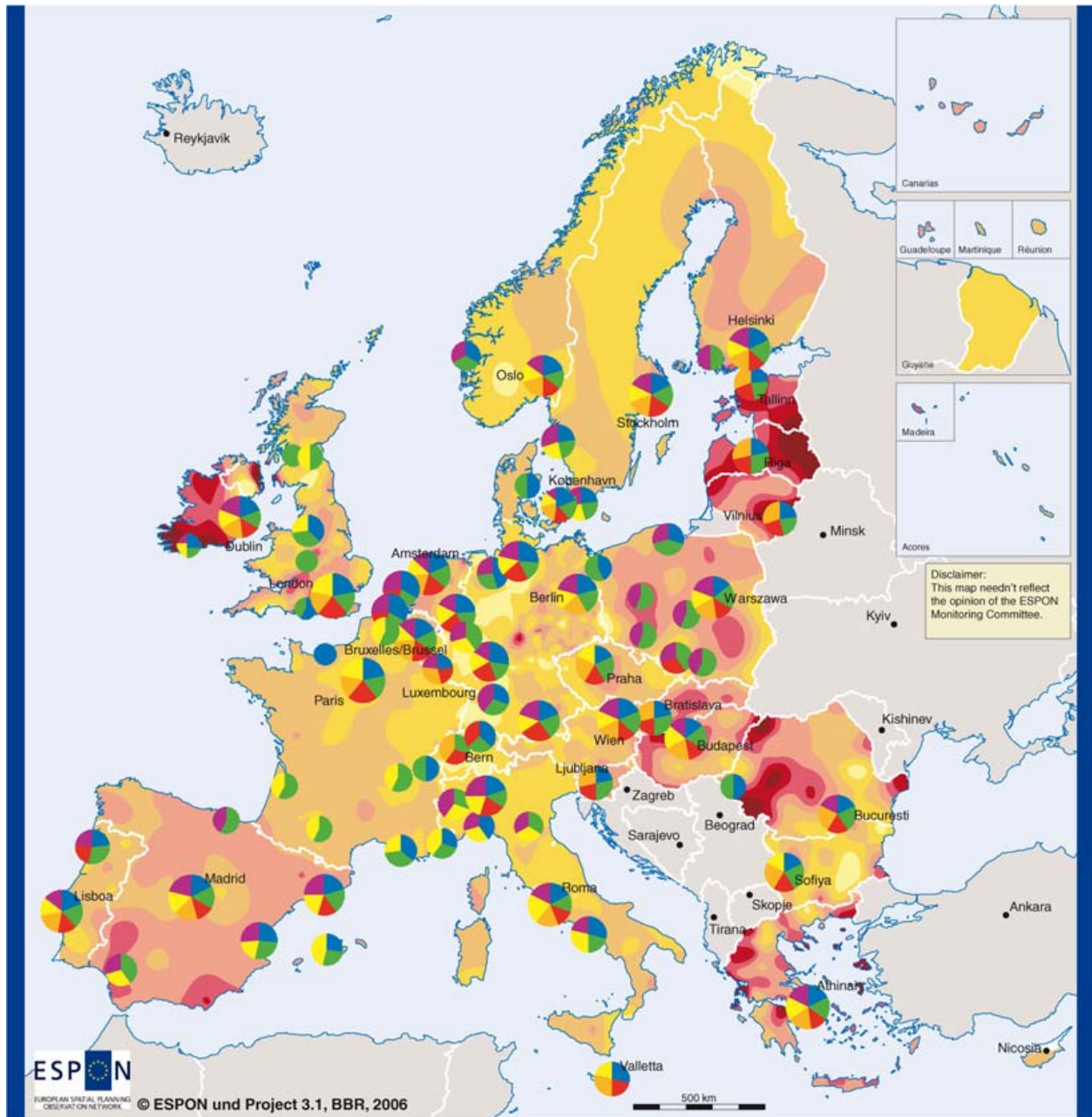
European observatory aimed at supporting the political process based on research. Such a European spatial monitoring system was institutionally established in 2002 with the ESPON programme in the European Structural Funds. Since then, ESPON has dealt with the analysis of the European urban system through several projects.

Especially ESPON Project 1.1.1 “Potentials for polycentric development in Europe”²³ essentially helped on the related discussion in Europe. But it also pointed up the deficits of European databases, which were especially revealed when defining European city regions as “Functional Urban Areas (FUAs)”: Comprehensive and comparable Europe-wide data, such as commuter zones, normally used for this definition, were then and even now not available. The project partners therefore felt impelled to combine different national approaches – partly official approaches, partly based on expert evaluations –, which definitely did not serve the traceability and comparability of the results. And they exposed the results to arguments linked to political preferences. 1,595 FUAs with more than 20,000 inhabitants were identified in Europe (EU-27 plus Switzerland and Norway) in this way, 44 of them having between 1 and 5 million inhabitants, three having more than 5 millions (London, Paris, Madrid). The FUAs were analysed according to seven functional areas (population, transport, tourism, industrial production, knowledge, decision-making functions in the private sector, decision-making functions in the public sector), five (without tourism and decision-making functions in the public sector) of them finally being combined into an aggregate index. The 76 FUAs with the highest index values were then separately classified as so-called Metropolitan European Growth Areas (MEGAs). In Figure 7 they are presented according to their functional areas based on regional economic development data.

In ESPON follow-up studies, deficits of Project 1.1.1 were removed and additional data were collected (ESPON Study 1.4.3 “Study on Urban Functions”), related topics were analysed in more detail (ESPON Study 1.4.1 “The role of small and medium sized towns”), the problem with regional territorial units (NUTS) was investigated (ESPON Scientific Support Project 3.4.3 “The modifiable areas unit problem”) and possibilities to analyse networks in addition to structures were checked (ESPON Study 1.4.4 “Study on Feasibility on Flows Analysis”).

At present, investigations on the European urban system are continued within the ESPON 2013 project FOCl (Future Orientation for Cities, lead partner: IGEAT, Brussels University). It focuses on analysing the situations, trends and development perspectives of the largest European cities and agglomerations in the context of the growth and employment objective of the Lisbon Agenda and the sustainable urban development objectives as developed in the Territorial Agenda of the EU and the Leipzig Charter. The final report will be presented by December 2010.

Figure 7:
Functional significance of the Metropolitan European Growth Areas (MEGAs)

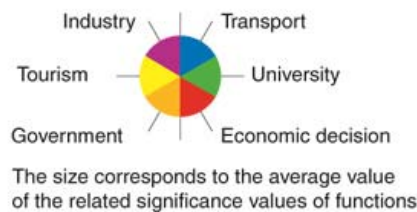


Average annual change of the GDP per inhabitant in Purchasing Power Standards in per cent in 1995-2003*



* Romania 1998 to 2003

Metropolitan European Growth Areas (MEGA) according to functional significance at the global, European, national and transnational level



Geometrical basis: EuroGeographics Association
 Territorial unit: NUTS 3
 Data bases: GDP: Eurostat;
 MEGA: Nordregio, ESPON 1.1.1
 Cyprus: Data available only for the area controlled by the national government

Source: ESPON Database

Source: ESPON: Territory matters for competitiveness and cohesion, ESPON Synthesis Report III, results by autumn 2006. – s.l. 2006, p. 41

Metropolitan regions as a concept of the German spatial development policy

The European discussions about the emergence of an integrated European urban system and its consequences for national urban systems have also considerably stimulated the discussion in Germany. The Germans also had lively discussions in the 90s about the role of globally oriented German cities and city regions and the challenges they faced.

In the context of the Standing Conference of Ministers responsible for Spatial Planning (MKRO), the German Federal Government and the federal states ("Länder") jointly developed a nationwide metropolitan region concept and made it a main element of the concepts for spatial development. This is why metropolitan regions have been of special importance for spatial research and spatial planning policy for over ten years. They have become a matter of analysis in spatial planning reports of the Federal Government and the Länder and were considered in land-use plans and recommendations for action.

In this way theory and practice of the concept of metropolitan regions have developed dynamically.

The origins can be found in the Political Framework for Regional Planning (HARA) of 1995²⁴, where the spatial planning concept of *European metropolitan regions in Germany* was laid down and defined as follows: "The Standing Conference of Ministers responsible for Spatial Planning considers European metropolitan regions to be spatial and functional locations whose outstanding functions on an international scale have an impact beyond national borders. As engines of societal, economic, social and cultural development, they are to maintain the efficiency and competitiveness of Germany and Europe and to contribute to speeding up the European integration process".²⁵

Apart from a large population and high population density, substantial economic power and external economic significance – criteria to define such metropolitan regions in Germany were primarily qualitative, spatially relevant functional features, including for example:

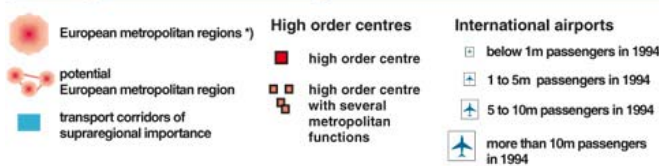
- political and economic decision-making centre with registered seats of internationally important authorities, of large companies, umbrella organisations,
- service and financial centre with fair, media enterprises and international logistics companies,
- research and innovation centre with internationally important institutions in the fields of research and development, science and teaching,
- large transport hub with a very favourable location within the European transport and communication network, international airports, seaports and connection to trans-European networks,
- internationally oriented cultural supply in the private and public sector.

Based on these criteria, seven European metropolitan regions were for the first time established in Germany: Berlin/Brandenburg, Hamburg, Munich, Stuttgart, Rhine-Main, Rhine-Ruhr as well the Halle/Leipzig Saxon Triangle as a potential metropolitan region.

Two years later, in 1997, the HARA concept was formalised as a decision of the Standing Conference of Ministers responsible for Spatial Planning and combined with the following plannings and measures (Fig. 8):²⁶

- grouping of functions and cooperation in the field of infrastructure,
- improving the international connection quality,
- closer networking within and between European metropolitan regions and working out cross-border development concepts,
- ensuring and developing a high environmental quality,
- networking with regions and cities within the catchment area,
- regional marketing.

Figure 8:
European metropolitan regions in Germany (1997)



*) The external frame of symbols does not represent the area of metropolitan regions. A relation between high order centres and metropolitan regions cannot be derived from this strongly schematised picture.

Source: BMBau: Entschlüssen der Ministerkonferenz für Raumordnung 1993–1997. Bonn 1997. Page 51 et seq. – Bedeutung der großen Metropolregionen Deutschlands für die Raumentwicklung in Deutschland und Europa (Beschluss vom 3. Juni 1997)
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The Federal Office for Building and Regional Planning's Spatial Planning Report 2005 for the first time intensively dealt with this new spatial development concept, that is by analysing the metropolitan functions of German cities based on indicators.²⁷ This led to the updating of the spatial development concepts and of the HARA in an analytical way.

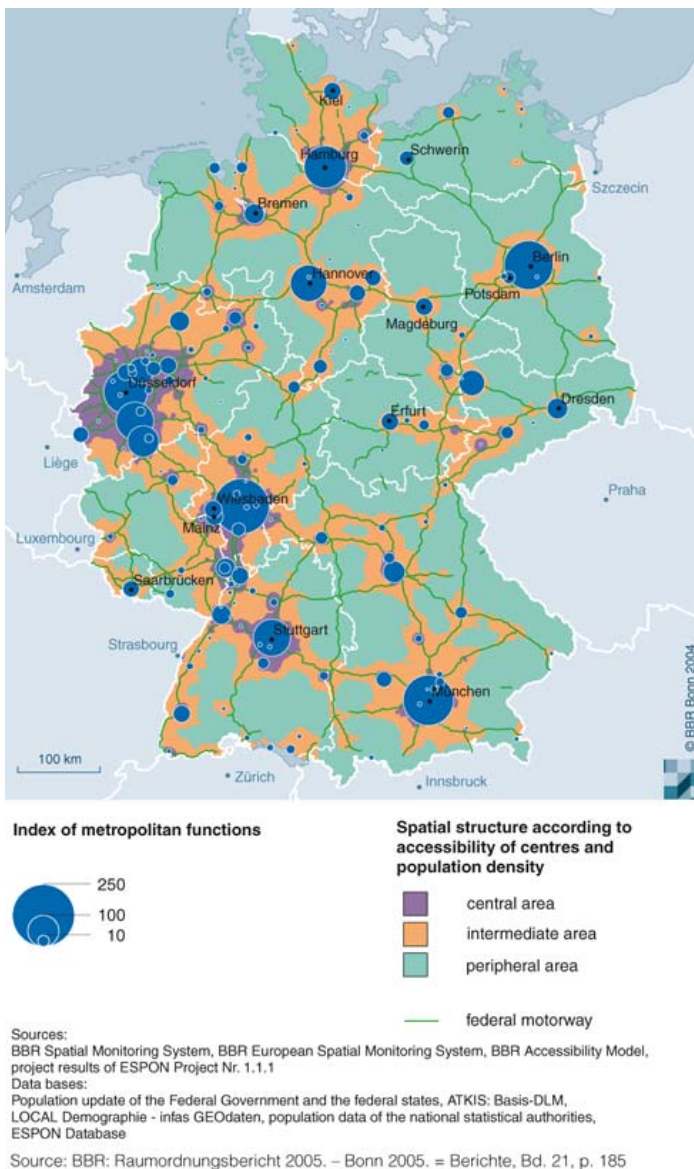
According to the state of the scientific discussion on concepts to measure the metropolitan functions of cities at that time,²⁸ the three functional areas *decision-making and control function, innovation and competition function and gateway function* – were distinguished and underpinned with indicators:

- The decision-making and control function served to measure the significance of a city as a political and economic centre of power of supraregional importance in which important political and economic

decisions, partly of global importance, are taken. Relevant indicators were seats of governments, registered offices of large enterprises and other important institutions, e.g. advanced producer services, banks, stock exchanges or insurance companies.

- The innovation and competition function showed how important a city could be for science and research and for creating so-called creative environments. The importance was measured by the number of scientific and research institutions or by the availability of top-quality cultural institutions.
- The involvement of a city in the international and intercontinental transport network was demonstrated by the gateway function measured by a high-quality transport infrastructure, good international accessibility and opportunities to exchange knowledge and information, i.e. conventions or fairs.

Figure 9:
Metropolitan functions in Germany (2005)

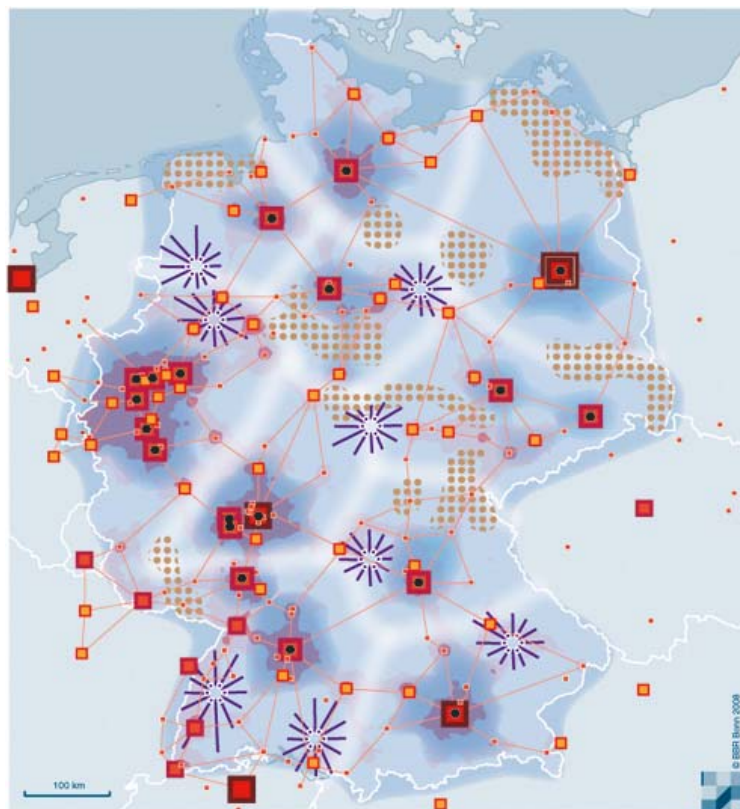


All in all, the three metropolitan functions were underpinned with 24 indicators. All indicators were identified by depicting locations based on exact local coordinates, then unweighted according to each functional area and finally combined in an aggregate index. The result at that time clearly showed the spatial concentration of metropolitan functions in Germany into several city regions, seven of the metropolitan regions identified by the Standing Conference of Ministers responsible for Spatial Planning being very well represented. In addition, the areas around Mannheim-Ludwigshafen, Nuremberg-Fürth-Erlangen, Hanover-Braunschweig-Wolfsburg and Bremen-Oldenburg showed the first signs of metropolitan regions (Fig. 9).

The results of these comprehensive analyses of the Spatial Planning Report 2005 were integrated in the new “Concepts and Strategies for Spatial Development in Germany” adopted by the Standing Conference of

Ministers responsible for Spatial Planning in 2006.²⁹ They established eleven European metropolitan regions in Germany: Berlin-Brandenburg capital city region, Hamburg, Bremen-Oldenburg, Hanover-Braunschweig-Göttingen, Rhine-Ruhr, Frankfurt/Rhine-Main, Rhine-Neckar, Stuttgart, Nuremberg, Munich and Halle/Leipzig Saxon Triangle.

Figure 10:
Growth and Innovation concept




Metropolitan areas

 cores of the capital region and of existing European metropolitan regions

 other locations with metropolitan functions

 suburban metropolitan regions


 catchment areas of metropolitan regions including rural areas

 transition zones between suburban metropolitan regions and catchment areas of metropolitan regions

Stabilisation areas



Spatial structure

 very densely populated central area

 densely populated intermediate area



Growth areas outside suburban metropolitan regions

The map visualises the concept and does not represent a particular plan.

Source: Ministerkonferenz für Raumordnung – MKRO (2006): Leitbilder und Handlungsstrategien für die Raumentwicklung in Deutschland. Beschluss der 33. Ministerkonferenz für Raumordnung am 30. Juni 2006 in Berlin, p. 13

The metropolitan region concept of the new Concepts clearly focuses on cooperation and joint responsibility not only in suburban metropolitan regions but especially in catchment areas of metropolitan regions and in the cross-border context as well. This expansive approach is designed to intentionally integrate subareas with different structures, i.e. economically strong and weak, rural and urban, peripheral and central subareas, into one development strategy. The Federal Government has therefore supported such supraregional partnerships³⁰, that means city-regional cooperations in larger catchment areas of metropolitan and cross-border regions³¹, since 2007 under the research programme “Demonstration Projects of Spatial Planning”. The aim is to test the approach of large area communities of shared responsibilities based on the concept of metropolitan regions in Germany in 10 cooperation areas, similar in terms of area and size to the “catchment areas of metropolitan regions” in the “Concept map” (Fig. 10), and ideally to give it an innovative direction.

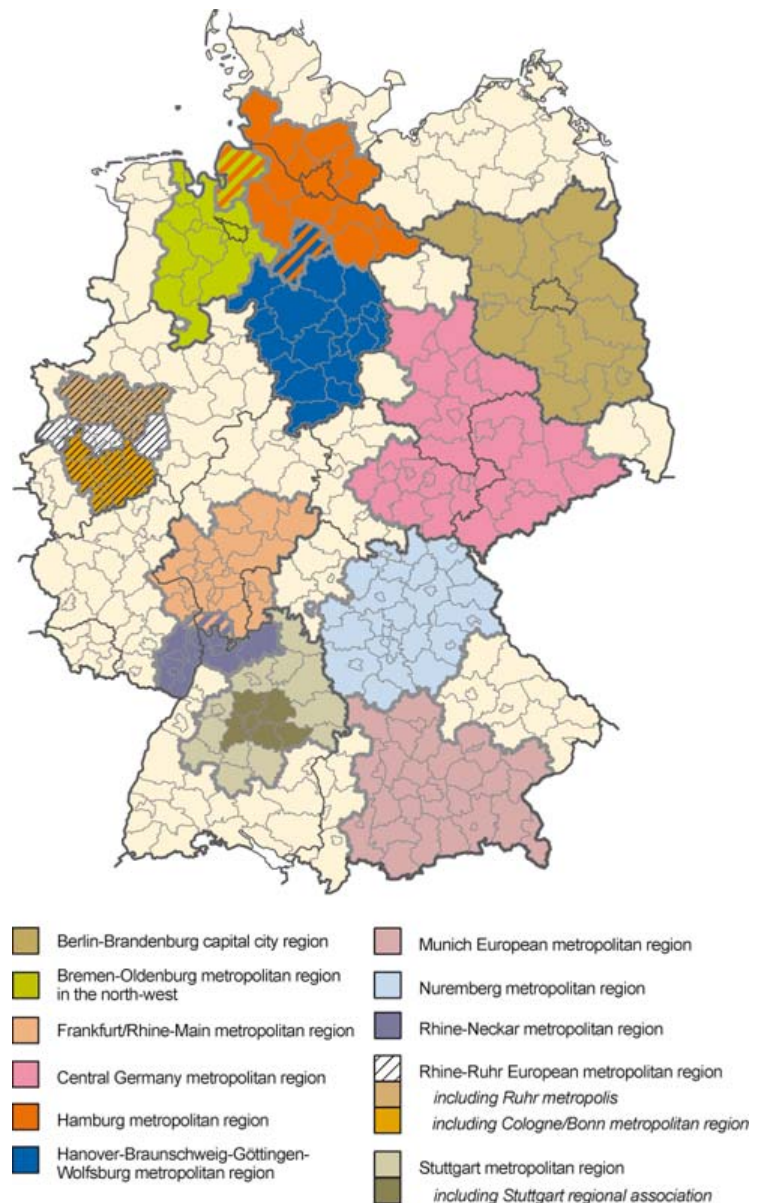
The whole discussion in the fields of spatial research and spatial planning policy on the relevance of metropolitan regions as a new spatial planning category in Germany has also

been largely discussed and reviewed by a working group of the Academy for Spatial Research and Planning (ARL).³²

Metropolitan regions as autonomous stakeholders

Metropolitan regions in Germany have in the last ten years increasingly become stakeholders themselves. They are not just elements of higher-ranking overall analyses and concepts anymore. Inevitably, differences between analysis/concept and regional perspective and, in addition, between regions become evident. This has had an impact on individual organisation and governance concepts and especially the spatial definition. In terms of analytical and political definition, two basically different approaches can be distinguished: An *analytical* definition is based on functional criteria, spatial interrelations and areas of activity and is developed for the whole study area according to a standard procedure (as e.g. in the Spatial Planning Report 2005). A *political* definition of metropolitan regions – based on various criteria and motives – is based on administrative units (municipalities, counties, regions) willing to cooperate under the label “metropolitan region”. In the ideal case, both trends influence each other. This applied to the German metropolitan regions where the development of regions was significantly influenced by the analyses of the Spatial Planning Report 2005 and by the research programme “Demonstration Projects of Spatial Planning”.

Figure 11:
European metropolitan regions in Germany
(as at 1 July 2010)



Database: Data of Initiativkreis Europäischer Metropolregionen in Deutschland IKM
Geometrical basis: BKG, counties, 31.12.2008

Source: BBR/IKM: Regionales Monitoring 2010 – Daten und Karten zu den Europäischen Metropolregionen in Deutschland

Since 2001, all the eleven European metropolitan regions in Germany have been cooperating within the "Initiativkreis Europäische Metropolregionen in Deutschland (IKM)"

(initiative committee for European metropolitan regions in Germany) (Fig. 11).³³ Together, they want to present themselves as large growth- and innovative regions and to position themselves within the European context. This has been done in close cooperation with the private and the scientific sector, with local and federal state authorities, the Federal Government and ultimately with the EU. Since then, forms of organisation and strategies have been developed by lively exchange, projects implemented and occasionally difficult debates on the relationship of this new policy model to established actors and concepts tackled. The initiative committee has also actively joined the discussion about the integration of metropolitan regions into the new Concepts and Strategies for Spatial Development. It has also improved the acceptance of metropolitan regions on the European level and thus considerably influenced their perception within policies, programmes and discussions of the European Commission and other institutions.

2 Metropolitan functions – the key towards analysing metropolitan areas

Deriving metropolitan functions based on the systems theory and on regional-economic theories

Research on metropolitan functions is still required especially in identifying the theoretical background of metropolitan functions as well as carrying out empirical analyses. This important theoretical basis will be reviewed and newly established in this study – moving away from the “conventional” classification of metropolitan functions into decision-making and control function, innovation and competition function and gateway function. Instead, the systems theory and regional-economic models will be identified as two important theoretical approaches and new areas of metropolitan functions will be defined.

2.1 Metropolitan functions: theoretical backgrounds and models

How can metropolitan areas be described and which specific functions do they assume compared to other types of areas? This question has intensively occupied spatial scientists and politicians for a long time – caused by globalisation involving a large transformation of the worldwide urban system.

The “state of the art” in metropolitan research

The beginning of all discussions about metropolises is based on two findings. First of all, new forms of spatial division of labour emerge – deconcentration tendencies in the context of the production of goods are accompanied by concentration tendencies in the field of high-quality business services and in the financial sector. These tendencies go along with changing hierarchies within the urban system. Secondly, the “balance of power” between metropolises (also called “global cities”, world cities“ or ”key cities“) and national states has shifted as especially economic control potentials have been enormously concentrated in leading cities worldwide. These metropolises have gained such a strong control of industrial productions, financial flows and information that their weight has become much stronger than that of national states.

This was followed by a debate at the spatial planning level of how changes within the urban system should be reacted to. This is also the context in which the spatial research on metropolises is carried out and which has an impact on its point of view – focussing its attention mainly on the capacities and functions of metropolises. But how can these capacities and functions be derived or justified in a scientific or theoretical way? Empiricism and theory must be strictly connected if the capacities and functions of metropolitan areas are to be integrated in a sound theoretical context. This is all the more important if they are to be operationalised and measured.

This strategy becomes notably apparent in the famous essay “The world city hypothesis” of 1986³⁴ by John Friedmann, which has especially provoked the Anglo-American urban research sector to focus its analyses to changing political-economic framework conditions and their repercussions on the global urban system. Mr Friedmann basically refers to the spatial organisation of a new international division of labour, which leads to profound changes for the global urban system, but also for certain cities. His main thesis is that “key cities” emerge as hubs for the international capital within the spatial organisation and linking production and related markets. World cities consequently represent the most important places concentrating and accumulating international capital.

Important impetus to the current debate was given by Saskia Sassen with her book “The global city” (1991)³⁵ according to which global cities are characterised by strong decision-making and control functions and a strong presence of post-industrial production especially in the financial and service sector. Global cities are considered the leading national and international market places of these sectors. According to Ms Sassen, globalisation implies a new spatial economy exceeding the regulation capacities of individual states. Because of the decision-making and control power located in global cities, they move to the top of the global urban system and therefore detach themselves from national territorial contexts. The increasing expansion of enterprises promotes the concentration of central functions in headquarters and business service companies in a few locations, which again entails an increasing concentration of economic decision-making and control functions in these global cities.

The scientific debate in Germany considers metropolitan areas as hubs within a network of global flows of goods, capital, information and persons that becomes closer. This leads to a classification of metropolitan functions which is largely acknowledged in the field of spatial science. Four functional areas exist:³⁶

- decision-making and control function,
- innovation and competition function,
- gateway function,
- symbol function.

Systemising these functional areas gains scientific recognition based on the fact that it meets with the requirements of parties interested in spatial planning policy and provides an applicable definition for each context. Against this background, the traditionally criticised theoretical deficit remains an accepted constraint.

Nevertheless, the theoretical context of metropolitan functions has to be newly investigated; it is imperative when executing empirical analyses.

Findings will be achieved in three steps: In the first step, metropolitanisation (i.e. metropolitan features) has to be identified. For this purpose, the actual object of investigation, metropolitan functions, will be disregarded and attention will be paid to the

systems theory with its original orientation towards societal theories. In the second step, regional-economic theories will be assessed in terms of their explanatory power concerning metropolitan areas and functions. In the third step, the functional areas of metropolitan areas will be derived on this basis although they will be very different from the above-mentioned four classical areas.

First theoretical approach: systems theory

Various social systems assume specific tasks and organise communication and interaction. In metropolises and metropolitan areas, concentrated communication and interactions can be found within and between these systems.

An important element to describe metropolitanisation and to derive and operationalise the functional areas is provided by the social systems theory of Niklas Luhmann – in short: systems theory.

This sociological theory considers the modern world society to be a functionally differentiated, boundless global society which, within an evolutionary process, has detached itself from originally hierarchical and spatially organised social systems. These systems have been replaced by specialised systems of social functions, e.g. politics, economy, science, law, religion, education, of which each assumes specific tasks.³⁷

According to the systems theory, these social systems organise communication and sequences of communication and distinguish a system from its environment. They act based on specific media of communication and according to related individual meanings. They are not hierarchically organised; none of the systems is dominant within the society. The functional system “politics” is not more important than the functional systems “economy” or “religion” – although this might sometimes be in contrast to everyday views. The theory also shows that no functional system can be replaced by another.³⁸ The economy for example cannot fulfil the tasks of politics and vice versa. However, this does not mean that, under special circumstances, e.g. the current banking crisis, a functional system cannot encroach on another, sometimes massively. In the end, however, politics and economy remain separate functional systems.

As already mentioned, the spatial dimension is no relevant component of the social systems theory, which is due to the orientation of the systems theory towards communication theory. According to the latter, communication within a system does not stop at geographical borders and can in principle exceed any borders, that means spread all over the world. System operations such as payments within the economic system can, due to modern global communications media, be made at any time almost everywhere without problem. This phenomenon is symbolised by the picture of the global village.

The idea of a functionally differentiated global society does not result in a global standardisation of all possible functional patterns. Regional differentiations are not only

possible but most likely as regional conditions, traditions or historical trends shape functional patterns without counteracting the orientation of functional systems towards universalism and specification.³⁹ Politics in Germany is thus different from that in the USA although the basic functions of the social system of politics are similar. Despite all regional models, the global society dominates, whether in the old industrialised regions of Europe, emerging economic centres of China or sparsely populated regions of Scandinavia. Economy, politics or science – conceived as social systems – work everywhere according to the same patterns.

Although the spatial dimension is no fundamental part of the social systems theory, there is a distinct note of it. The difference between global and regional is only one aspect. Vicinity and distance as well as frequency and contact opportunities are also important elements of social systems, for example if interactions exist.⁴⁰ This can also be observed in practice: Despite decentralisation tendencies, concentrated interactions in certain places can be observed in all systems of social functions.⁴¹

Metropolitan areas are those areas where concentrated interactions can be found. They are susceptible to modernisation pushes in social systems since, because of various coexisting social contexts and high interaction densities, they facilitate the information transfer between social systems. They thus represent a special kind of structural connection of social systems,⁴² which means that intersystem relations are more likely and diverse in metropolitan areas than in other types of regions. This is the basis for metropolises being considered as hubs in worldwide networks.

The social systems theory perceives the area within a further dimension. It always represents the environment of social systems. If spatial structures in the environment of social systems activate a communication in the systems to build on, they start up communication processes which will be continued within a system and will lead to results, for example a location decision. Location factors can have different relevance depending on the functional system and become significant in different contexts. When establishing new production sites, scientific centres or when planning large sporting events, for example, a variety of location factors can be taken into account. They will, however, always be involved in the communication structures of a social system and “assessed”, i.e. checked in terms of their applicability. This leads to a system-specific selectivity in handling spatial and location-specific contexts.

Conclusions from the systems theory for the analysis

- (1) It is necessary to overcome the economic reductionism which has so far dominated the relevant literature – especially in terms of the global city approach. A first reason is that the multidimensionality of the globalisation process is ignored. Secondly, the idea of the global society as the most comprehensive social system is only partly taken into account and reduced to its economic component. Although the concepts of world, key or global cities detect a transformation process on the level of urban systems – thus considering the spatial aspect -, they do not take the range and complexity of the globalisation process into account. This involves far more social transformations than just the high concentration of economic steering and control functions in a few important cities, on the one hand, and the global integration of markets and productions, on the other hand.
- (2) Specific combination patterns of functional systems emerge in regions. The existing potential of interaction implies different chances for communicative processes. They are the best in metropolitan areas so that a strong increase of such processes can be expected there. These areas are thus predestined for innovations and phases of modernisation.
- (3) Spatial-architectural structures – whether the Champs d’Elysées as commercial address or the Burj Khalifa skyscraper in Dubai as a landmark – can be counted among the environments of social systems. They become relevant if they become important for the internal communication of a system and produce spatial semantics providing a social system with a meaning and influencing decisions as well as operations. Spatial semantics, which means significances attached through signs and symbols become increasingly important especially in the context of competing metropolitan regions. They also include efforts to improve and present the image of metropolitan regions.
- (4) Functionally differentiated social systems vary in their meaning and the medium based on which communication is organised. Politics functions differently from the economy and the economy functions differently from science. It is therefore important to consider these differences when attaching metropolitan functions by distinguishing political from economic or scientific aspects.

Second theoretical approach: regional economy

Self-reinforcing effects – caused by supply and demand as well as externalities – often play an important role in regional economic theories. Metropolises and metropolitan areas provide the appropriate environment for them.

Although this study is intended to highlight the multidimensionality of the globalisation process and of metropolitanisation and to overcome economic reductionism, regional economic theories can help to explain the spatial and hierarchical organisation of the

urban system, all the more because there is a stronger spatial reference than within the systems theory. Regional economic theories furthermore do not just focus on economic aspects. They concentrate on explaining the economic development of regions often involving soft location factors, e.g. relations between economic activities and the transport situation or the impact of political decisions. This shows that the economic development of regions can always be explained or modelled with aspects related to metropolitan functions.

The variety of parameters explaining the economic development in regions brings about that there is no overall regional economic concept in terms of a “grand theory” modelling all – or at least many – relevant aspects. Rather does a variety of partial models exist explaining the context between economic development and a few other aspects. Thus there is no location or growth theory providing the theoretical basis explaining the emergence of metropolitan areas. But taking all these partial theories into account enables us to derive both hypotheses and possibilities of operationalisation serving to roughly explain existence and function of metropolitan areas. The empirical coverage of metropolitan functions and their spatial distribution is thus based on two different perspectives – a socio-scientific and a regional economic one.

When illustrating the theories, it becomes apparent that, within one concept, there is a distinction between explanatory and explained aspects. This clear distinction can, however, not be found if all partial theories are taken into account. Rather there are impact cycles – self-reinforcing effects – which lead to locations or location areas with special qualities, i.e. metropolises or metropolitan areas. Therefore, metropolitan functions as well can be a copy of locational qualities being location factors for economic growth processes, on the one hand, and a result of such growth and differentiation processes, on the other hand.

The finding of self-reinforcing spatial processes has last but not least existed since the *polarisation theory* of Myrdal (1957) and the growth pole concepts of Perroux (1964) and Boudeville (1972). Thinking consistently ahead, regional economic location and development theories may thus help to explain the special development and importance of metropolitan areas within the spatial and settlement structure in more detail. As already mentioned, these partial theories complement each other so that they cannot be separately handled but only altogether.

Important indicators for the emergence of metropolises can be derived from the *concept of externalities*: spatial vicinity and density imply urbanisation effects. This means that the economic development is positively influenced by a variety of location factors and contact opportunities within a defined area – a city, a city region or a region. This approach, which has also been described above with the systems theory, had already been discussed in the thirties of the last century.⁴³ Apart from entrepreneurial services, it might include all kinds of infrastructure – whether physical, social or cultural. A large labour and sales market were also understood as positive urbanisation effects, which already implies a

circular causal relationship or a self-reinforcing effect: Certain infrastructures, e.g. large stadiums or international airports can only be used to capacity in those places where many people live who use them. Demand for this infrastructure determines supply and supply is a positive location factor for new enterprises thus attracting new inhabitants. This is why headquarters of companies are mainly located in centres.⁴⁴

The behavioural science-oriented approach, however, reveals that businessmen or innovators do not only look for a location for their enterprise but also for a residential location in their capacity as individual person or household meeting their personal requirements.⁴⁵ Criteria to search for an economically favourable and appropriate individual environment thus coincide and are difficult to distinguish. Highly skilled employees for example make special demands on the quality of life and infrastructure of their regional environment, which cannot be met everywhere.⁴⁶ This again is a reason why more or less appropriate environments exist promoting the development of economic centres in different ways. One example is Munich, which, due to high interaction potentials, is a good location for companies but the attractive landscape with lakes and mountains is also a good reason why it is preferred as a place of business and residence by executives.

Favourable location factors do not only need to be spatially concentrated and close to economic activities even though this would be an advantage. Within the global competition it is also important that such location factors can be quickly reached from other places. Within a post-Fordist economy, which is characterised by flexible adaptation to changes, a high importance of networks and by meeting a very differentiated and specialised demand, the existing *transport infrastructure* is of special importance. Networking important transport hubs through high speed rail lines and international air connections is essential here. In addition, communication is based on a good data infrastructure, i.e. effective Internet exchange points. As a consequence, those areas, first reached by innovation and ideas, have a permanent advantage over other regions reached by the diffusion later on. The settlement structure thus reflects the spatial and temporal achievement of innovations.⁴⁷ Congresses and fairs for example offer such a chance of exchange and rapid absorption of ideas from outside. The same applies to the functional system "politics" where information and its exchange provide the bases for decisions.

However, globalisation and global trade also imply a high goods mobility. The capacities of sea- and airports in handling passenger and goods transport are important metropolitan functions showing the efficiency of areas. According to a main thesis of the "new economic geography" approach, low *transport costs* lead to a concentration of economic activities.⁴⁸ Low transport costs and very good cargo handling opportunities thus strengthen metropolitan areas in terms of global trade.

Exchanging ideas and information also promotes *technical progress*. If regions offer good opportunities to exchange ideas, to coordinate decisions and to quickly absorb ideas and also provide excellent universities or entrepreneurial research capacities, this helps encourage technical progress. This factor has been important at least since the

neoclassical growth model and the polarisation models of the 50s had been advanced. Technical progress leads to growing productivity, salaries may increase accordingly⁴⁹ which implies an increased demand for consumption opportunities. Certain expensive offers are again related to metropolises – for example luxury shops with a high-quality offer, galleries or top-class events in the fields of music and visual arts.

This is how relations to *creative environments* are developed: A certain environment, being innovative in many areas and not only absorbing new trends but also creating them, is often perceived as a form of urban quality of life and at the same time attracts creative areas. This again can produce self-reinforcing effects.

Creative environments lead over to the *human resources* factor. Human resources are an important driving force of economic development and were especially underlined by Romer in his theoretical analysis.⁵⁰ Their focus is on research and development as well as further training. The “Learning Regions” concept also highlights the special fact that stakeholders have to be able and ready to organise learning processes and to form and use networks of research and private sectors. This is also the background of regional centres of excellence which highlight the possibilities of various economic, research and political actors to interact.⁵¹ They can for example be “science-led”, which means their innovations can emanate from universities and be used by the private sector. They can be “industry-led” if entrepreneurial research creates new products in cooperation with universities. They can finally also be “policy-led” if cooperation between the business and the scientific sector are particularly promoted by the political sector. It thus shows the close interlocking of different social systems, which can then lead to special results if related interaction densities are spatially concentrated. Such intersystem relations can ensure that innovations are transferred from one social system to others, the spatial concentration of opportunities – i.e. of various social systems – always playing an essential role as it speeds up the transfer of information. In economic terms such relations can lead to production effects due to internal and external cost savings. This innovation potential again means that new products are developed in metropolises again and again. In this way, the economic basis of metropolitan areas is quasi permanently renewed so that it can be considered as a stable and also dynamic element of the urban system.

Storper and Walker describe this process of permanently reinventing and producing oneself by “industries produce regions”.⁵² Growing industrial sectors are said to be able to create their required innovative regional environments on their own because growth and innovation in regions attract similar enterprises along value chains. This leads to clusters reducing transaction costs and mutually promoting innovations. This phenomenon, which had already been described by Marshall⁵³ in 1890, still exists today. Another process with similar results but different related attitudes was shaped by the Groupe de Recherche Européen sur les Milieux Innovateurs (GREMI) at the beginning of the 90s. According to them, the existence of innovative environments with networks is considered to be a precondition for the development and growing number of innovative enterprises. Both approaches are justified as they are self-reinforcing processes. The question is rather

where the observation starts – whether from the general conditions or from the economic result. This leads back to the aspect described in the beginning of this second theoretical approach: Even if economic processes play a central role in regional economic theories, there is hardly any model disregarding non-economic influences.

Conclusions from regional economy for the current analysis

- (1) Regional economic theories may contribute to describing metropolises, their functions and efficiency, the idea of self-reinforcing effects being important as many factors involve each other.
- (2) The theories principally focus on economic aspects but other aspects as well, especially science and education, transport and contact opportunities as well as quality of life, are addressed. The political area is less well analysed.
- (3) The spatial proximity of various factors to each other fosters efficiency as potentials of interaction can be better used. What is also important is a good accessibility of complementary factors as the globalisation process involves a new spatial division of labour.
- (4) This complementarity emphasises the mutual involvement of and relationship between various location factors. This again leads back to the analysis of functional systems of which each is autonomous but also forms the environment of another and which influence each other.
- (5) Although metropolises and metropolitan areas do not necessarily have higher economic dynamics than other areas, their economic strength is at least the result of a previously more rapid growth.

2.2 Redefining metropolitan functions

New BBSR classification of metropolitan functions:

- politics
- economy
- science
- transport
- culture

The theories and models discussed reveal causalities on an abstract level irrespective of concrete areas. They set the theoretical framework for selecting and operationalising metropolitan functions which will then be analysed in terms of quantity by means of indicators and together form the index of metropolitan functions. In no case is it possible to directly implement theory into practice. Theory remains theory and always maintains a more guiding character. Because of a lack of data, it is also not possible to optimally define indicators so that best possible approximations have to be sought in a pragmatic way.

Defining metropolitan functional areas

First of all, those functional areas are to be defined which then will be analysed in terms of quantity by means of indicators. Certain incompatibilities between the theoretical frameworks described for metropolitan functions and the four classical functions defined – the decision-making and control function, the innovation and competition function, the gateway function and the symbol function – cannot be ignored. This classical classification of metropolitan functions therefore cannot provide a satisfactory basis for the study on hand, which can be shown by three examples:

1. In the related literature so far, the *decision-making and control function* only refers to politics and the economy – and this within one functional area. In the scientific area as well, budgets and topics will be treated, i.e. decisions will be taken and control exercised. However, decision-making processes in the fields of politics, economy and science are differently structured and have different impacts on an area and its development.

2. *Innovations* are not only produced by the scientific sector and by development divisions of companies, as described in the classical approach. Such a close assignment of innovations to a selected system ignores that all systems may produce innovations. It also disregards the interaction between stakeholders and institutions in different systems being an important factor promoting innovations.

3. In the literature, the *symbol function* is often put on a level with the external effect of a city or region.⁵⁴ It is in fact not an independent metropolitan function but covers all social systems. National capitals for example are characterised by a special architecture expressing sovereignty and their country's view. In the same way, headquarters of companies mostly have a representative architecture. Performances of popular musicians during their tours or Olympic Games as well are more than one event at a specific date. They even shape the image of metropolises beyond their duration. Furthermore, UNESCO World Heritage Sites do not only give evidence of the time at which they were created, they also represent an own label outweighing any artistic or technical aspects: The Eiffel Tower is the landmark of Paris. At its bottom or on its platform a visitor really gets the feeling to be in the capital of France – independently of his or her knowledge about the engineering achievements of Gustave Eiffel.

The three examples mentioned above highlight some shortcomings of the classical approach. It is therefore not used to derive metropolitan functions. They can be more effectively derived by means of the functional systems to be investigated – based on the concept of the functional differentiation of social systems and on the findings from regional economic theories.

According to the concept, the global society is differentiated into various social systems such as politics or economy. These social systems are again subdivided into subsystems

which partly exist temporarily as interaction systems or permanently through established organisations.

In this context, selecting the functional systems is based on three criteria to the degree to which

- (1) they have created organisations or structures facing worldwide or Europe-wide competition,
- (2) they produce events of global or European importance,
- (3) they have created infrastructures promoting global or at least transnational networking.

Politics nowadays meets these conditions without doubt. It can hardly be limited to a national context. United Nations Climate Change Conferences and Group of Twenty meetings and also the United Nations show how much this system is today incorporated in a global context. National state governments as well are interdependent and – even if they can only act on their own territory or in their national contexts – are so much involved in international contexts that autarkic action is hardly possible.

Similarly as with *capital*, there are no limits to *production, trade and markets* within a globalised economy anymore – which is symbolised by the so-called “global player”. This is why globalisation stands for worldwide economic integration in which context production, trade and financial relations cannot be imagined anymore within the close limits of regions or nations. It clearly shows the spatial complexity of economic activities and the complex network of various economic relations which have developed in the context of globalisation.

Science has also become largely internationalised, which is not only expressed by the fact that English is increasingly becoming the language of science but also by international research activities or scientific institutions such as CERN financed on a supranational level. The scientific sector has produced globally comparable patterns, publication standards, citation indices and last but not least very symbolic events such as the Nobel Prize. Meanwhile, rankings also allow us to compare universities on a worldwide level.

Logistics and information transfer have become main areas of social functioning and interaction. The accessibility of people, markets and ideas is mostly influenced by contact opportunities. Transport hubs within the global network are always privileged, which can be seen as an important impetus toward development. A very good networking promotes the exchange of ideas, an excellent transport infrastructure the individual accessibility of other people and the sales of goods.

In the same way, various *cultural and sporting events* have become international events. Not only the Olympic Games have already reached a public of over a billion people via television and Internet, other sporting events as well attract attention all over the world. The Chinese pianist Lang Lang reaches his audience and fans worldwide via Internet and

gives concerts around the globe. In the field of pop music, world tours are common practice. Art auctions provide a forum to bidders from all over the world and opera performances sometimes have supporters around the world.

A variety of other functional systems could be mentioned, e.g. law, education, religion or health care. But they all do not or hardly fulfil the three criteria mentioned above being important for selecting functional systems. Certain cases such as law are difficult to adapt to the concept of the study. The law system is closely related to other functional systems – especially politics and economy – so that these functional areas cannot be clearly distinguished. Although in terms of theory, these areas can be clearly differentiated, organisations can be found on the investigation level which belong to the law system, on the one hand, but provide services to the economy, on the other hand – for example international law firms.

The example also shows that deriving functional areas cannot be exclusively based on theory. Rather empirical studies must take operationalisation instruments into account which restrict these activities in terms of definition and contents but also because of a lack of data.

Conclusion for the analysis:

In order to restrict the complexity of the study concept, differentiating the metropolitan functions is concentrated to five functional areas:

- politics
- economy
- science
- transport
- culture

Together they form the BBSR index of metropolitan functions.

3 From theory towards empiricism: metropolitan functions – indicators and measuring concept

Indicator requirements

- covering the whole European study area
- independent of national conditions or criteria
- high quality
- based on local data
- high-quality character

Operationalising metropolitan functions for an empirical analysis required a certain pragmatism. This means that compromises had to be found especially when selecting indicators since not all statistical information were suitable and not all indicators required were available. In practice, many gaps still remain to be filled.

Selecting indicators

In a first step, altogether 38 indicators were assigned to the five metropolitan functions politics, economy, science, transport and culture and classified in indicator groups (Fig. 13, for further information on indicators see Annex 1).

In order to be suitable for analysis, the indicators despite all compromises had to meet the following minimum requirements:

- Spatial coverage: Only data are used which are available for the whole study area – from Iceland to the Ural and the Asian part of Turkey to the Azores.
- Congruence of contents: The indicators have for all countries been defined according to consistent criteria to ensure comparability. The indicator “five star hotels” for example could not be considered as the stars are awarded based on national criteria which are very different within Europe. Many other examples – from universities to high-speed trains – could be mentioned.
- Qualitative standard: The information comes from unofficial statistics. Official data are missing as Eurostat does not provide any data for this large study area, which partly goes beyond the EU. There is also a lack of official statistical data that can provide any further information on this specific topic which is why alternative data sources had to be found. Especially for unofficial data, however, objectivity issues, i.e. whether the institution collecting the data is independent, and validity issues, i.e. whether the data refer to the right issues, are of main importance.
- Proper geocoding: The official statistical data were also not sufficiently qualified for the analysis because they referred to administrative units – mostly NUTS 3. This spatial

reference is not differentiated enough and the NUTS 3 regions are too differently defined from country to country. The analysis on hand solves this problem by being based on small territorial unit data. All data collected were at least based on local administrative units, sometimes even on exact local coordinates, which allows a strong spatial differentiation and very good international comparability.

- High-quality character: The best possible character of a fact is to be illustrated. As an example, not all educational institutions were registered and not every university – whether possible at all in a European context – but only the world's best universities. This meant that, apart from surveying a fact, a quality criterion had to be found representing this fact by illustrating its high-quality character. This has not always been possible – for instance in the case of museums and theatres – but for most indicators such criteria could be found.

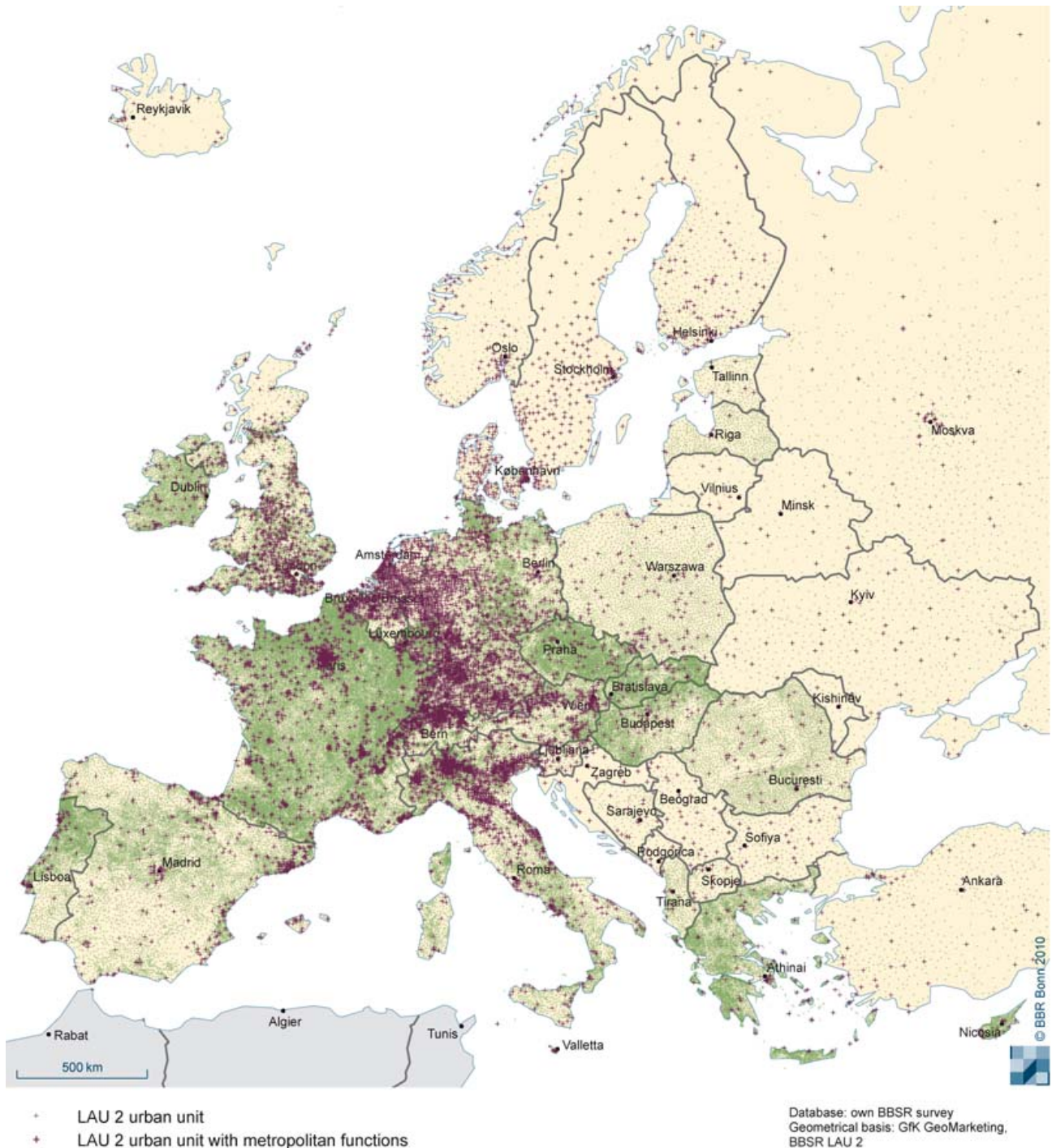
Spatial reference of data

Data for the whole European territory were collected (Fig. 12). They refer to all locations where a spatial indicator could be measured, which applies to 8,480 locations. Differently from previous studies on metropolitan functions, in which subareas to be investigated were preselected, this index depicts the metropolitan functions with their actual spatial distribution on an empirical basis. It is based on the idea that high-ranking locational clusters of metropolitan functions are produced by the concentration of many functions and locations and form high interaction densities. However, this does not mean that metropolitan functions do not exist in other locations outside these clusters. Headquarters of large enterprises do not necessarily have to be located in large cities. Important cultural or sports facilities or events can also be found in peripheral regions. Relevant infrastructures such as airports are often established far away from agglomeration centres on purpose. Analysing patterns of spatial distribution from various perspectives only becomes possible through this broad based research concept.

Also the results are not affected by any spatial structuring due to administrative specifications as the metropolitan functions were measured in their related locations and were then aggregated to the LAU 2 level. LAU is the abbreviation for Local Administrative Unit forming the basic components of the NUTS regions. The second LAU level, in Germany the level of the municipalities, covers around 120,000 municipalities or similar units in the 27 EU member states and adjacent countries. In a few cases, in which strongly differentiated inner city units are covered by the LAU 2 level, the measurement system is already adapted on the level of the locations. This system is for the time being applied to some large cities in France, Poland, Ireland, Russia and the Ukraine and to some single cases such as Brussels, Vienna, Belgrade, Skopje and Budapest. The adaptation becomes more complex in the United Kingdom, where the LAU 2 units comprise over 10,000 electoral wards. In very densely populated agglomerations, they only have very small areas as they only contain 5,500 inhabitants on average. Inner London alone for example covers more than 300 wards and all other larger cities in the United Kingdom as

well are subdivided in this way, for example Glasgow with 83, Edinburgh with 58 or Birmingham with 39 wards. For the 85 cities affected in the United Kingdom, an additional level above the LAU 2 level can be created with the help of higher administrative units such as unitary authorities or metropolitan districts, here called LAU 2 urban units. For other European countries, for which no LAU 2 category is existent, a similar category was added on the local level.

Figure 12:
Spatial distribution of locations of metropolitan functions



Summary and indexing

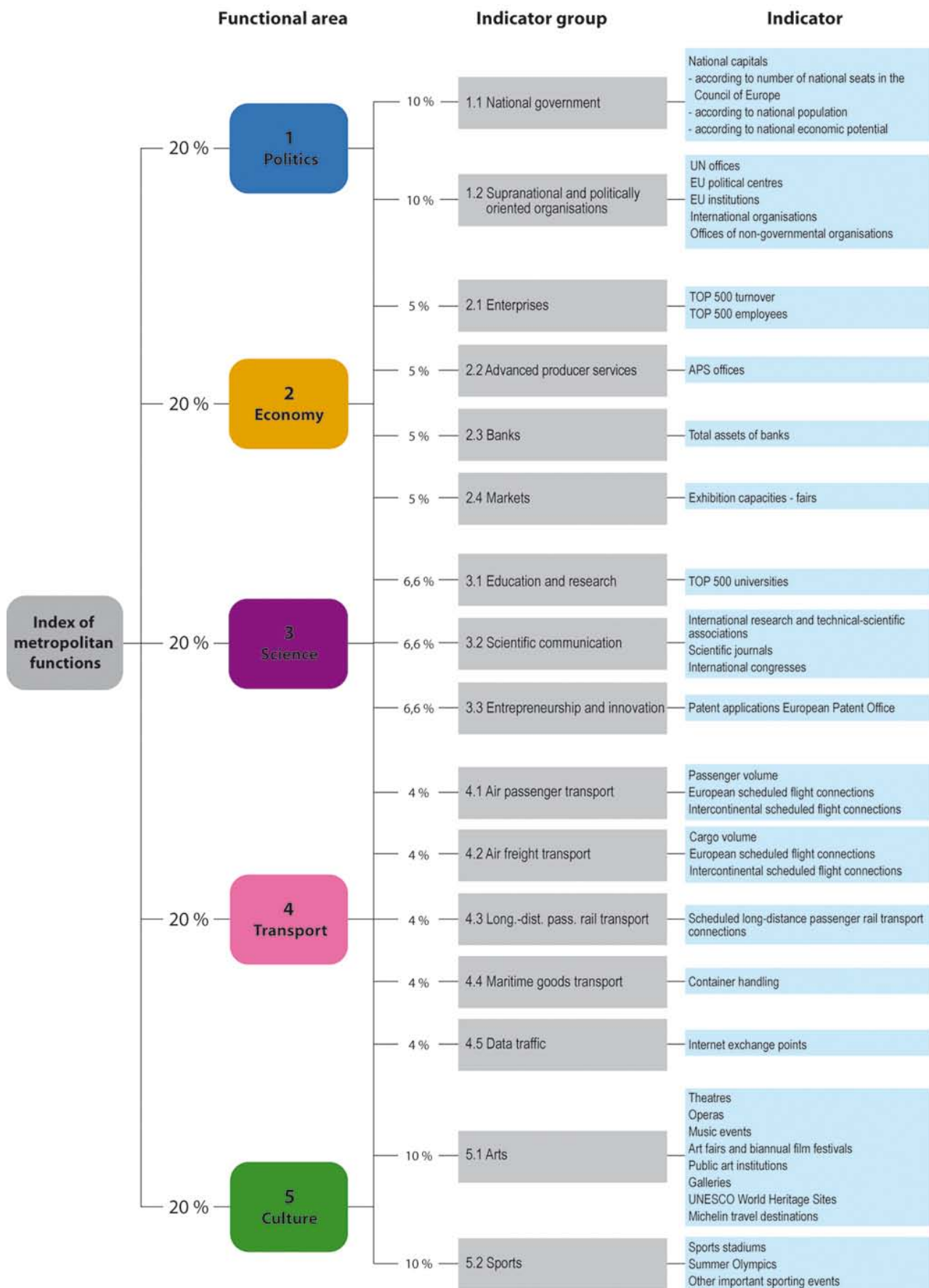
In Figure 13, the five functional areas are subdivided in the indicator groups mentioned: In the same way as every functional area is considered with the same weight of 20% in the aggregate index, every indicator group is equally weighted within each functional area. However, as the number of indicator groups in the functional areas is different, the latter are considered in the index with different weights, i.e. 0.5 with two indicator groups per functional area, 0.25 with four groups etc.

Assigning each indicator to an indicator group and finally to a functional area may in some cases be difficult. Does for example an international congress belong to science or transport? Depending on the classification, the scientific or the communicative aspect is stressed. Should entrepreneurial patents rather be assigned to economy or science? In the same way might fairs be understood as a communication platform and thus be integrated in the area of transport. Hence there are various possibilities to form indicator groups although they should not be arbitrarily arranged. Rather should they include aspects assuming an intermediary role between the functional systems.

The 38 indicators were combined via an additive composition. First of all, all indicators were standardised to their maximum value so that the range of all indicators is between 0 and 100. This prevents indicators with large ranges from dominating those with small ranges. Within a group of indicators, all indicators were considered with the same weighting. A different weighting of indicators from different indicator groups is a result of involving different amounts of indicators in a group value.

Weighting indicators is repeatedly discussed by scientists, e.g. when calculating rankings.⁵⁵ One question is whether all indicators considered in the analysis are equally weighted or whether various weightings have to be taken into account. Another question is whether the number of company seats in a metropolitan region is more important than the number of scheduled links of long-distance passenger railway transport. Or should the number of galleries be differently weighted from exhibition capacities of fairs? It is principally problematic to create rankings based on complex indicator sets. Bases for measuring indicators, objectivity and validity of the measurement as well as indexing procedures are notable aspects just as the transparency and traceability of the approaches and methods selected.

Figure 13:
Operationalising the functional areas by indicators



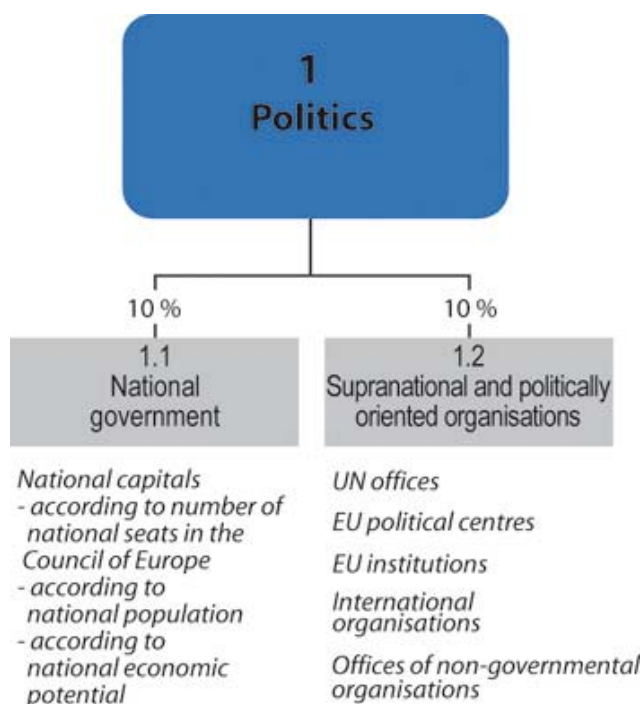
4 Locations and spatial distribution of metropolitan functions in Europe

The five metropolitan functions – politics, economy, science, transport and culture – will be presented in the following with their indicators and indicator groups and especially with their measurement results. The data will be analysed on the level of the locations in which the metropolitan functions will be measured – altogether even 8,480 locations.

For each functional area, the results will be illustrated by way of their spatial distribution and interpreted, which will help to draw comparisons between the functional areas and to lay open differences. Finally, an overall analysis and assessment of each functional area will be done. The chapter will be closed with an overall analysis of all functional areas.

4.1 Metropolitan function “politics”

Figure 14:
Indicator groups of the metropolitan function “politics”



Politics has an essential impact on the social framework conditions as it seeks to achieve its social objectives through government and through legal and financial instruments. In the context of the classical classification of metropolitan functions, this aspect was assigned to the decision-making and control function⁵⁶; in the new classification established with this study, politics forms a separate functional area.

As politics is geographically localised by its institutions, especially capitals play an important role in the national and international context. They represent the main hubs within the global political network of decisions. But the functional area “politics” cannot only be depicted by the indicator of national capitals (or governments) as it is too complex. It also

covers political parties, social movements, lobby groups and various non-governmental organisations with their impacts on state, society and political decisions. International organisations and their institutions under international law performing supranational tasks also are among this category. Examples are the United Nations or the European Union.

Metropolitan functions are thus found in those places where such national and international institutions of the political system are located. As a consequence, this

functional area is depicted via two indicator groups: “national government” as well as “supranational and politically oriented organisations” (Fig. 14).

4.1.1 National government

Capital, weighted

Capitals are normally the national political centres of power and seats of governments and parliaments in general. But they also stand for a country's inward and outward representation. They thus play an important role for the international political environment and are also perceived abroad. If a capital in a country is not the seat of national governments and parliaments at the same time, the seat of government is used for the BBSR index of metropolitan functions.

In order to depict the international weights of countries – which often vary between large and small or economically stronger and weaker national states – three indicators are used within the indicator group “capital”: (1) capital, weighted by the number of seats in the Council of Europe, (2) capital, weighted by the population, (3) capital, weighted by a country's economic strength.

Seats in the Council of Europe: A first weighting of the capital function is based on the number of a country's delegates in the Parliamentary Assembly of the Council of Europe. In the case of this indicator, countries with a smaller population are given stronger weighting as they send a relatively larger number of delegates to the Council of Europe than large countries. Andorra for example with just under 84,000 inhabitants sends two delegates while France with 65 million inhabitants, Germany with 82 million inhabitants and the Russian Federation with 142 million inhabitants only send 18 delegates each. Belarus is a candidate country.

Population: A country's population represented decides upon the significance of a national capital. With the Lisbon Treaty of the European Union defining the majority situation for votings in the Council of the European Union, this criterion has become up-to-date. According to the Treaty, majority decisions based on double majority voting will from 2014 on only come into effect if they are supported by 55% of the member states and if these countries also represent 65% of the EU population. This shows that large quantities have an important impact on the decision-making function of national capitals. The capital function within the BBSR index of metropolitan functions will thus be weighted based on the population.

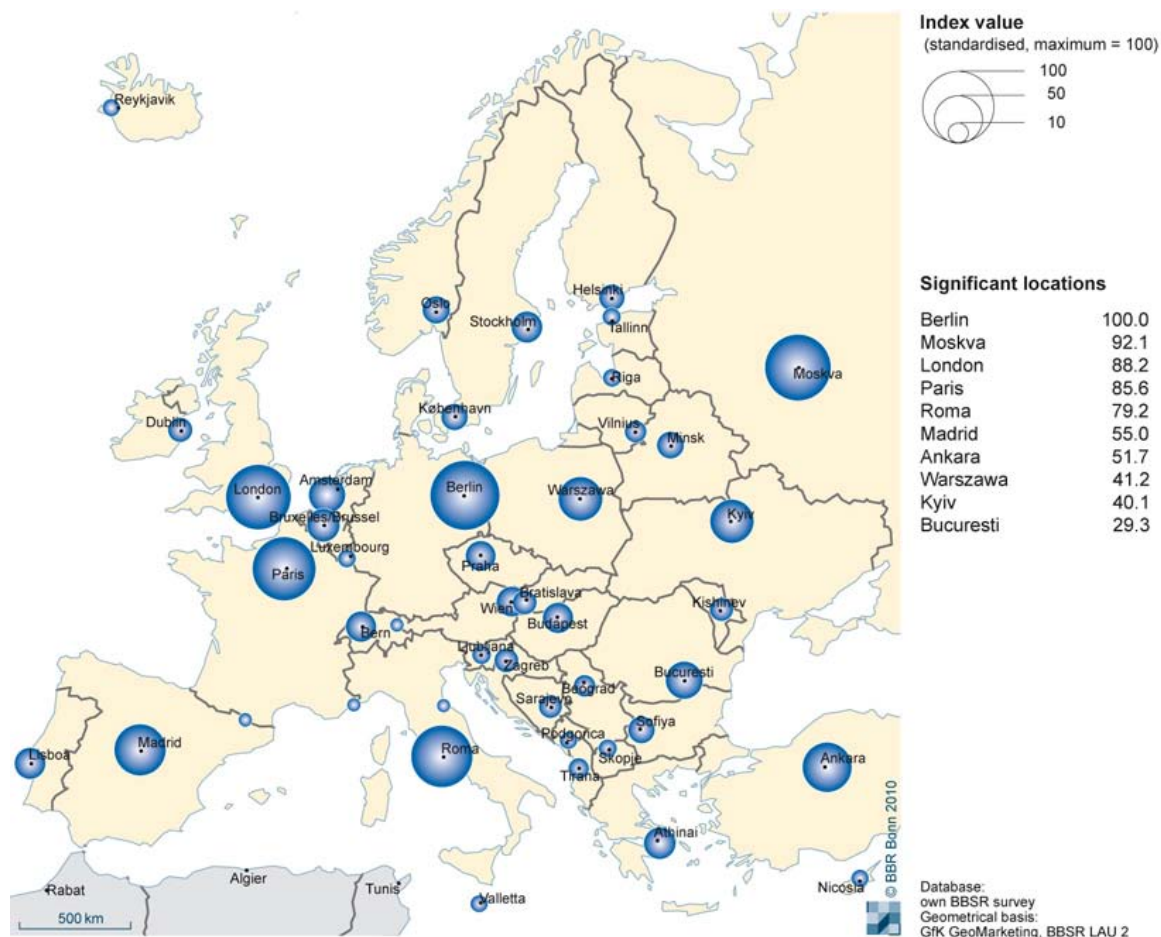
Economic strength: Not only the population but also the economic strength of a country is important for the weight of political decision-makers in political discussions. Small countries as well may thus have a high economic strength and their decisions high international weight. For the BBSR index of metropolitan functions, the capital function is weighted based on the gross domestic product in purchasing power parities.

In all countries, governing activities naturally can be found both on the national level and on the levels below, which is why the governing function should be regionally differentiated and the regional political level also be represented. The BBSR index of metropolitan functions unfortunately does not make a regional differentiation although this level is of special importance especially for federal systems such as the Federal Republic of Germany. The reason is that the competences of regional decision-makers – for example in the German or Austrian federal states, in the French “régions” and the Swiss cantons – are so different that it is impossible to operationalise them consistently not to mention that they would lead to any useful results. Weighting Düsseldorf as capital of the federal state of North Rhine-Westphalia with the population indicator for instance would show the same significance as in the case of Vienna, weighting with the gross domestic product indicator would even reveal more significance than in the case of Ankara (according to Eurostat, the GDP in 2006 for North Rhine-Westphalia is 501 billion euros, the one for Turkey 491 billion euros). As the decision-making competence of Düsseldorf is, however, borne on a lower level than that one of Vienna or Ankara, these methods of weighting would distort the results.

Finding

The metropolitan function “national government” is normally limited to a small number of cities in Europe, that means to capitals or seats of government themselves (Fig. 15).

Figure 15:
Spatial distribution of the indicator group “national government”



4.1.2 Supranational and politically oriented organisations

Not only countries may perform sovereign tasks but also international organisations. They may at least assume supranational, government-like duties based on international law. Examples are the United Nations (UN) and the European Union (EU). Numerous non-governmental organisations (NGO) as well are from the national to the global level and in various areas involved in political decisions or even have an official share in political discussion or implementation processes. This is why this group is represented by five indicators.

UN offices

The United Nations form a global network of political action. In cities with UN institutions there is a large number of institutionalised international exchange activities. The internationally important function of UN cities is even stressed by their restricted number as important activities are often concentrated there. With their various international meetings and events they also symbolise a particular cosmopolitanism. Apart from the headquarters in New York, the UN has three permanent seats: Nairobi, Geneva and Vienna. There are other cities with seats of selected UN organisations, in Europe especially Rome, The Hague and Bonn.

EU political centres

The Lisbon Treaty (Protocol No 6) lays down the seats of the main and of some important institutions of the European Union, for example the seat of the European Parliament in Strasbourg, the seat of the European Court of Justice in Luxembourg or the seat of the European Central Bank in Frankfurt. The locations mentioned in the Treaty thus form the “urban network of the European governance function”. From the European perspective, these cities reveal a particular functional significance. Due to their political European “capital function” they have developed a particular European internationality forming a microcosm of European diversity.

EU institutions

Besides the political centres of the EU there are various other institutions and agencies of the European Union in the member states. Examples are the European Environment Agency in Copenhagen or the European Aviation Safety Agency in Cologne. Important political functions are concentrated in these locations. The urban functions in these locations are thus enriched by a European orientation.

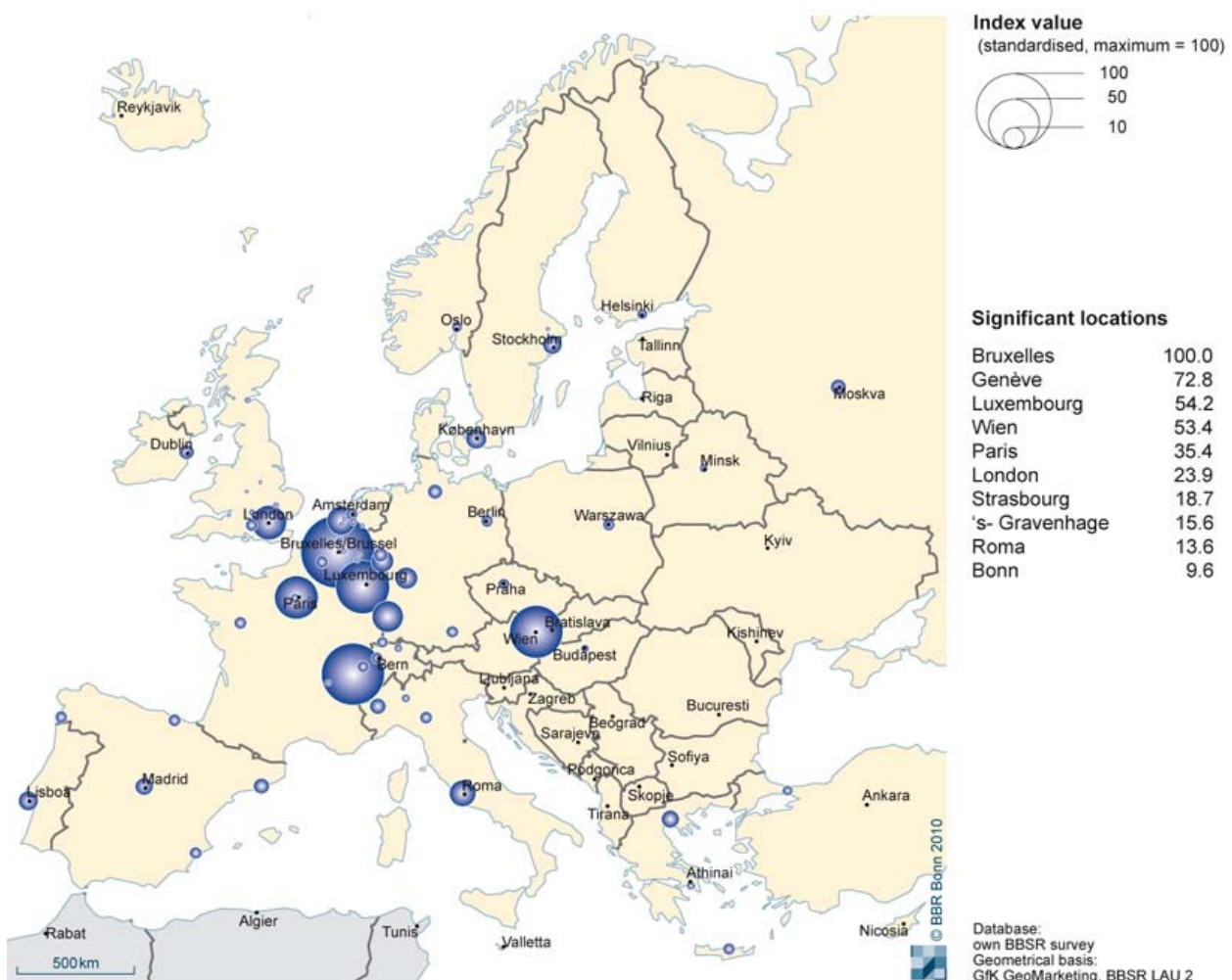
International organisations

International organisations, which are often based on international law and perform supranational tasks, follow the functional system of seats of government in terms of tasks or orientations – whether formulated on an intergovernmental or non-governmental level. Examples are the Organisation for Economic Co-operation and Development (OECD), the Organization for Security and Co-operation in Europe (OSCE) and the European Patent Office. Whether on a national basis, like the OECD, or based on interest, like the International Committee of the Red Cross (ICRC), they follow and are oriented towards the political decision-making function and add to or shape the functional character of cities.

Institutions of non-governmental organisations

The permanently increasing number of non-governmental organisations (NGOs) is an expression of growing globalisation as it requires action beyond national borders irrespective of national institutions and intergovernmental agreements – for instance in the field of environmental protection or human rights. It is also an expression of an internationally organised civil society. Apart from well-known examples such as Amnesty

Figure 16:
Spatial distribution of the indicator group “supranational and politically oriented organisations”



International or Greenpeace, there are many organisations pursuing very special interests and hardly appearing in the medial public. There are altogether 15,405 non-governmental organisations in Europe, 3,045 of them being located in Brussels, 1,923 in Paris and 1,564 in London.

Finding

The indicator group “supranational and politically oriented organisations” is highly concentrated in terms of spatial distribution, as shown by Figure 16. Apart from a few outstanding centres, there are hardly any other locations in Europe emerging to a minor degree.

4.1.3 Overall analysis of the functional area “politics”

The metropolitan function “politics” is highly concentrated in terms of spatial distribution.

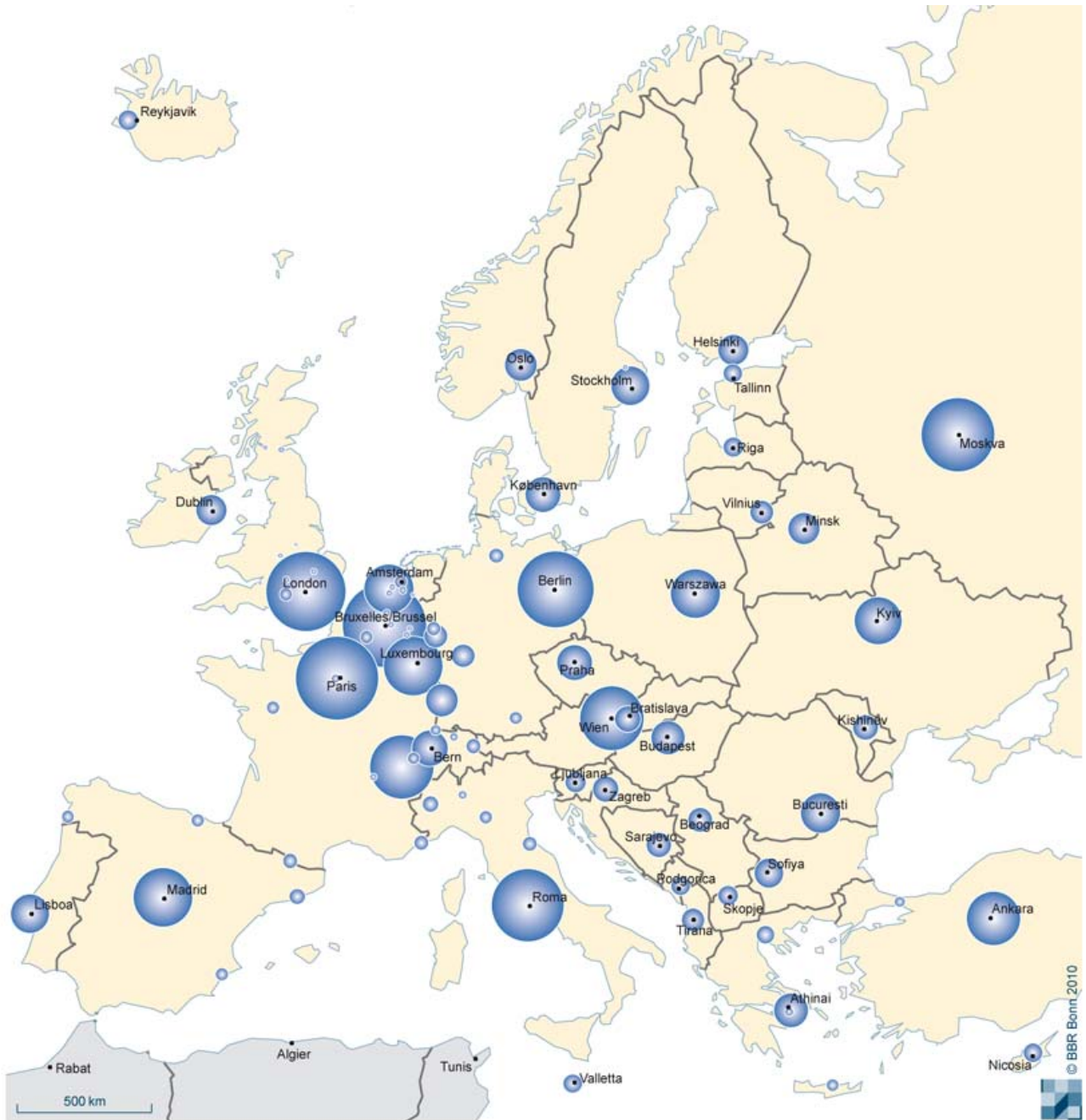
As shown in Figure 17, the functional area “politics” is highly concentrated in terms of spatial distribution as only national capitals and a few other locations score in connection with this function.

Due to the fact that the number of seats in the Council of Europe, population and economic power are considered when analysing the capital function and due to different figures of local UN and EU institutions and non-governmental organisations, some cities have different significances within the system of locations, national capitals being outstanding though. With official UN offices in Europe, Geneva and Vienna have gained special importance. Brussels, Luxembourg and Strasbourg, as seats of the most important EU institutions according to the Lisbon Treaty, also stand out. Especially in the European central area many centres can be found completing the network of capitals in this functional area. Examples are The Hague, Frankfurt and Bonn.

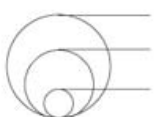
4.2 Metropolitan function “economy”

Metropolises are not only political but also economic centres as shown by the concentrated, mostly impressive offices of large companies and established firms. Corporate headquarters and headquarters of insurance companies, financial institutes, stock exchanges and advanced producer services can be found there – and they all impressively demonstrate economic power and strength. Against the background of increasing economic engagements, especially metropolitan locations, i.e. world or global cities, represent spatial hubs within the increasing global networking. Activities of global players, whether of the real economy or the monetised economy sector, are concentrated there and produce a unique world-economic interaction density.

Figure 17:
Spatial distribution of the functional area “politics”



Index value
 (standardised, maximum = 100)



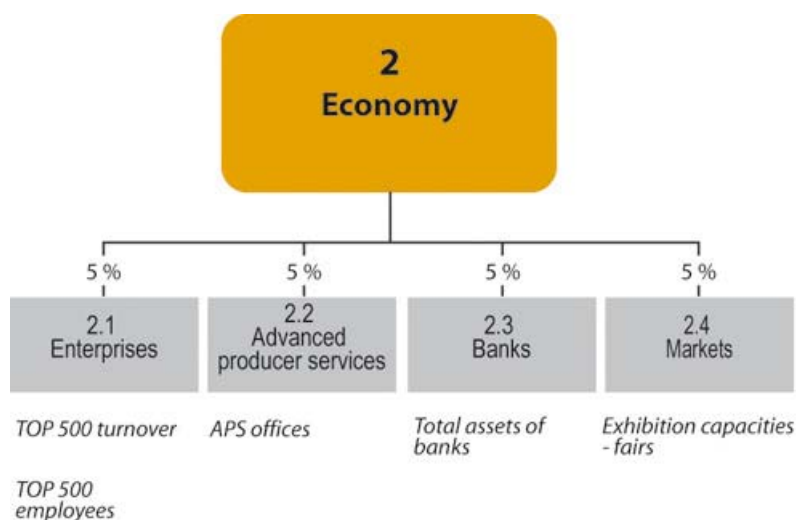
Significant locations

Bruxelles	100.0
Paris	98.1
London	90.9
Berlin	83.4
Moskva	78.8
Roma	75.4
Wien	59.2
Genève	59.1
Luxembourg	49.8
Madrid	49.7

Database: own BBSR survey
 Geometrical basis: GIK GeoMarketing,
 BBSR LAU 2

The economic system is depicted via four indicator groups: *enterprises*, *advanced producer services*, *banks*, *markets*. On the one hand, they directly illustrate the business and financial sector, which is why data concerning the largest European companies and important banks are used. On the other hand, banks and enterprises need special services to advance and optimise their economic activities as well as platforms to demonstrate their services and products and to establish business contacts. Indicators are advanced producer services (APS) and exhibition centres (Fig. 18).

Figure 18:
Indicator groups of the metropolitan function “economy”



4.2.1 Enterprises

Turnover and employees of top TOP-500-companies

Metropolitan locations are preferred as seats of large companies with international business relations. In these places, usually their headquarters, those decisions important for the development of their company are taken. Concentrating on the 500 largest companies in the BBSR index of metropolitan functions is to ensure that as many indicators of outstanding significance as possible are incorporated in the analysis – in the same way as only national capitals, the world’s best universities, World Heritage Sites etc. are considered in other functional areas, which is to assure Europe-wide comparability.

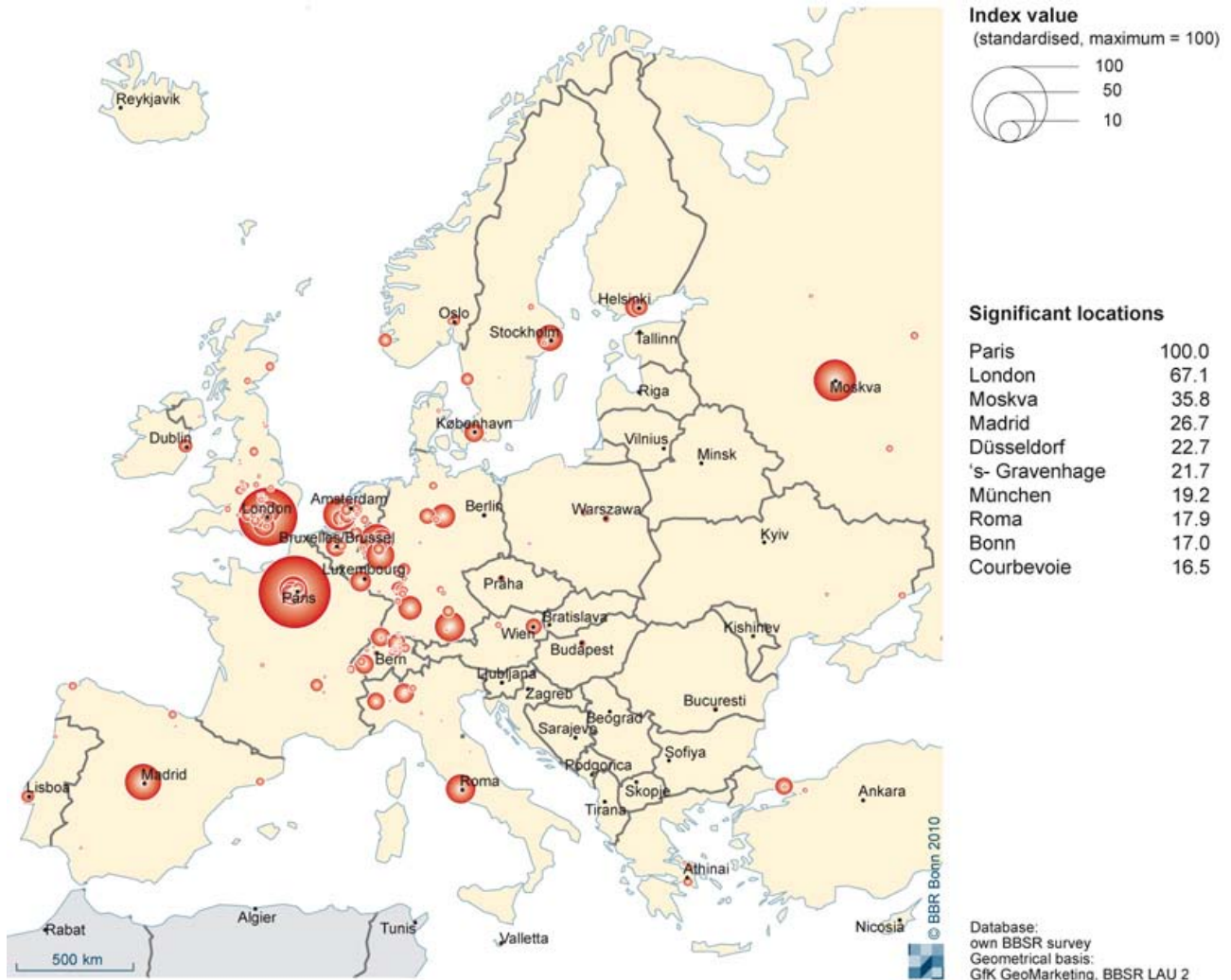
A survey of the 500 largest listed European companies is provided with the annually published ranking of the German business journal "Handelsblatt". In order to avoid distortions, both the number of employees and the turnover of companies was analysed and both values were combined for a relevant location. Due to a lack of comparability, financial companies were not considered.

Finding

Despite some exceptions, this indicator is highly concentrated in capital cities or in traditionally economic centres such as Milan, Turin and the “Rheinschiene” (region along

the River Rhine) (see Fig. 19). Paris and London by far show the strongest concentration among large European companies and therefore largely stand out from other European locations. In Benelux and Germany, the company seats are distributed to various locations while in Eastern Europe – apart from a few exceptions – hardly any significant headquarters are to be found due to the historical development. Apart from Moscow, no Eastern European location belongs to the leading group.

Figure 19:
Spatial distribution of the indicator group “enterprises”



4.2.2 Advanced producer services (APS)

APS offices

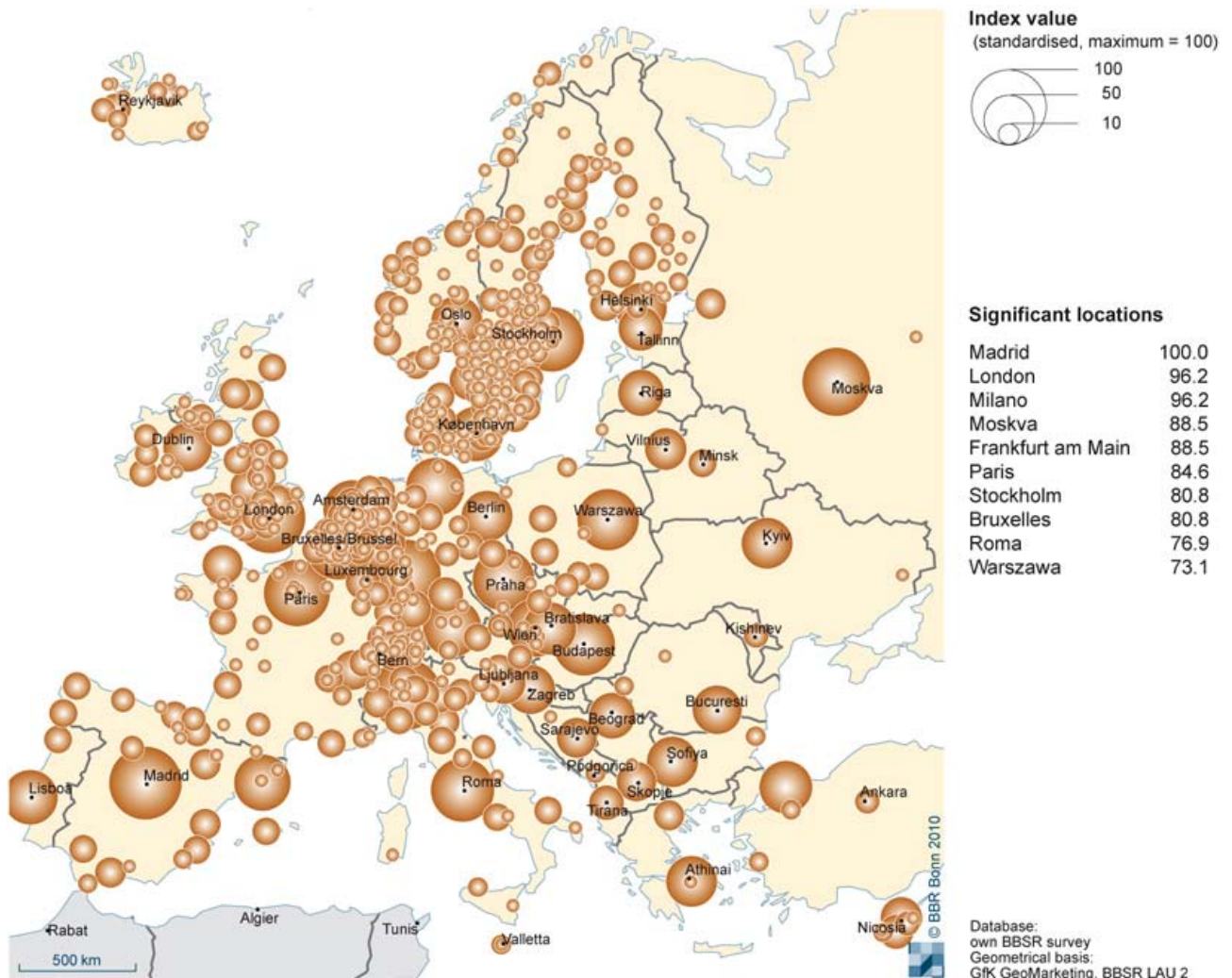
In the context of globalisation, advanced producer services (APS) have become a key sector of the economy. Normally, skill-intensive service companies in the fields of legal and tax advice and management consultancy, auditing as well as market and opinion research are counted among this heterogeneous economic sector. They may also include rating agencies. Especially companies from the manufacturing sector might in cooperation with these companies use resources and competences worldwide, which they only have in

a small number, and expand worldwide on this basis. Such service companies are part of a global network and choose their locations with customers in mind. They thus act as push and pull factors within the spatial organisation of globally active firms and increase the importance of a location the more of them establish there. This is why the branches of 26 leading, worldwide active companies within this sector were incorporated via Internet research.

Finding

These leading service providers are mainly and in large amounts located in capitals and economic metropolises such as Milan or Frankfurt/Main. Large amounts are also represented in South England, Belgium, the Netherlands, along the River Rhine up to Northern Italy (Fig. 20). In Scandinavia, especially in Sweden and Denmark, it is noticeable that some related branches are also situated outside centres, which suggests a specific local locational policy of some companies within this sector.

Figure 20:
Spatial distribution of the indicator group “advanced producer services”



4.2.3 Banks

Total assets of banks

Banks without doubt play a central role within the economic system. They provide companies and joint stock companies with the capital needed, act as creditors or even co-owners and play an important role in conducting transactions in the context of national and international money transfers. In the past years, the financial sector has shown a very dynamical development and supported the integration of national economies into the global economy to a considerable extent. The economic significance of a city can therefore be derived from the banks located there.

The relevant parameter to describe the banking sector is the balance sheet total, i.e. the sum of all assets (use of funds) or liabilities (source of funds). The related indicator describes the sum of balance sheet totals of all banks in a location, which has to be the headquarters of a bank. Related information is provided by the Bankers' Almanac annually publishing the balance sheet totals of more than 3,000 banks worldwide. The data are from 2003, i.e. they refer to a period before the banking crisis. Despite all upheaval caused by this banking crisis, it can be assumed that there have not been any important changes in the spatial distribution of the banking system. Due to a lack of a Europe-wide reliable source, the importance of various bank branches is not taken into account.

Finding

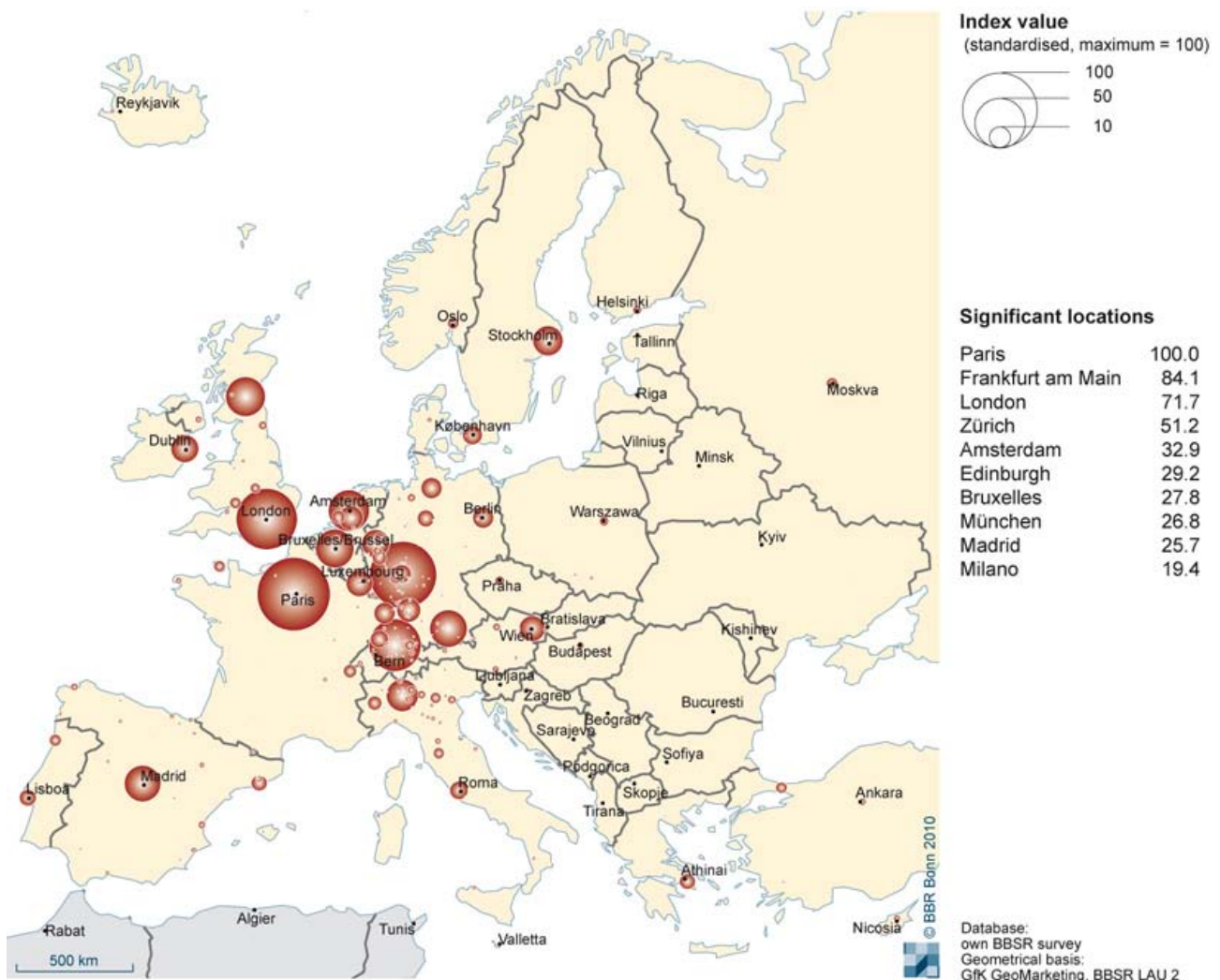
In the European area investigated, there are 1,925 banks in 556 locations (Fig. 21). With balance sheet totals of USD 4,334, 3,644 and 3,108 billion, Paris, Frankfurt/Main and London are the most important financial centres in Europe. Zurich, Amsterdam, Edinburgh, Brussels, Munich and Madrid have balance sheet totals of more than USD 1,000 billion. Most locations, 409 in number, have balance sheet totals under USD 10 billion, 156 of them being under USD 1 billion. It thus becomes apparent that the middle of Central Europe is of high importance for this indicator. Outside this central area, significant locations, e.g. Madrid, Stockholm, Vienna, Edinburgh and Dublin, can only be sporadically found.

4.2.4 Markets

Exhibition capacities of fairs

At fairs, manufacturers and service providers present new offers, if possible they also directly contact customers or persons interested. There are, however, public fairs with a high number of visitors, on the one hand, and pure trade fairs addressing a specialised, limited number of visitors, on the other hand. Indicators counting the number of fairs or fair visitors are therefore only to a small extent significant.

Figure 21:
Spatial distribution of the indicator group “banks”

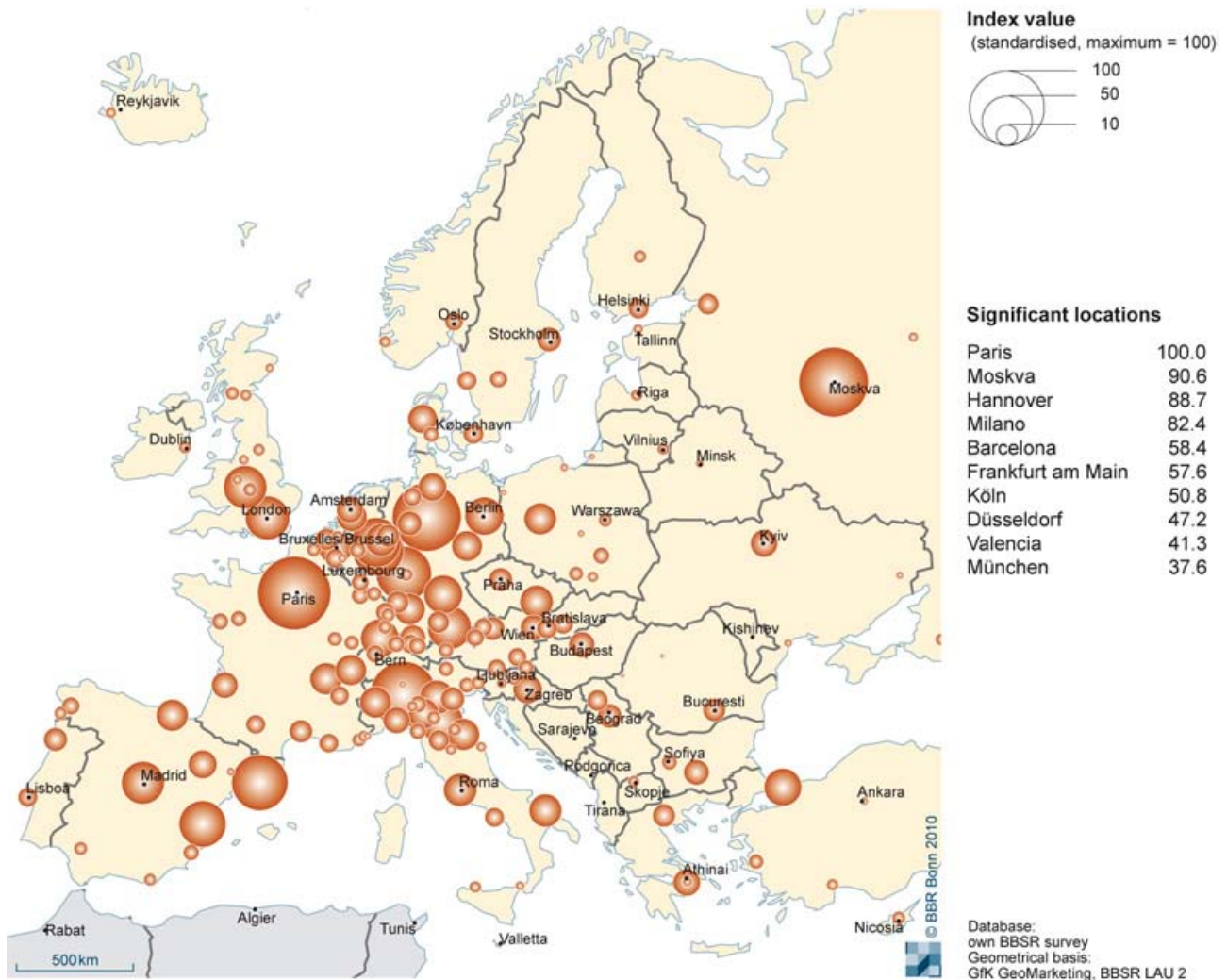


The availability of exhibition halls does therefore provide a better indicator showing the potential of an exhibition centre. Although it does not give any information on the efficiency of this infrastructure in the form of the number of fairs or visitors and on the degree of internationalisation of an exhibition centre, the indicator puts public and trade fairs on a comparable level thus providing information on the significance of an exhibition centre in the international context.

Finding

Paris is the exhibition centre with the largest gross hall area (Fig. 22). The 15 most important exhibition centres include seven German cities. All in all, Germany assumes a leading role in the field of fairs.

Figure 22:
Spatial distribution of the indicator group “markets”



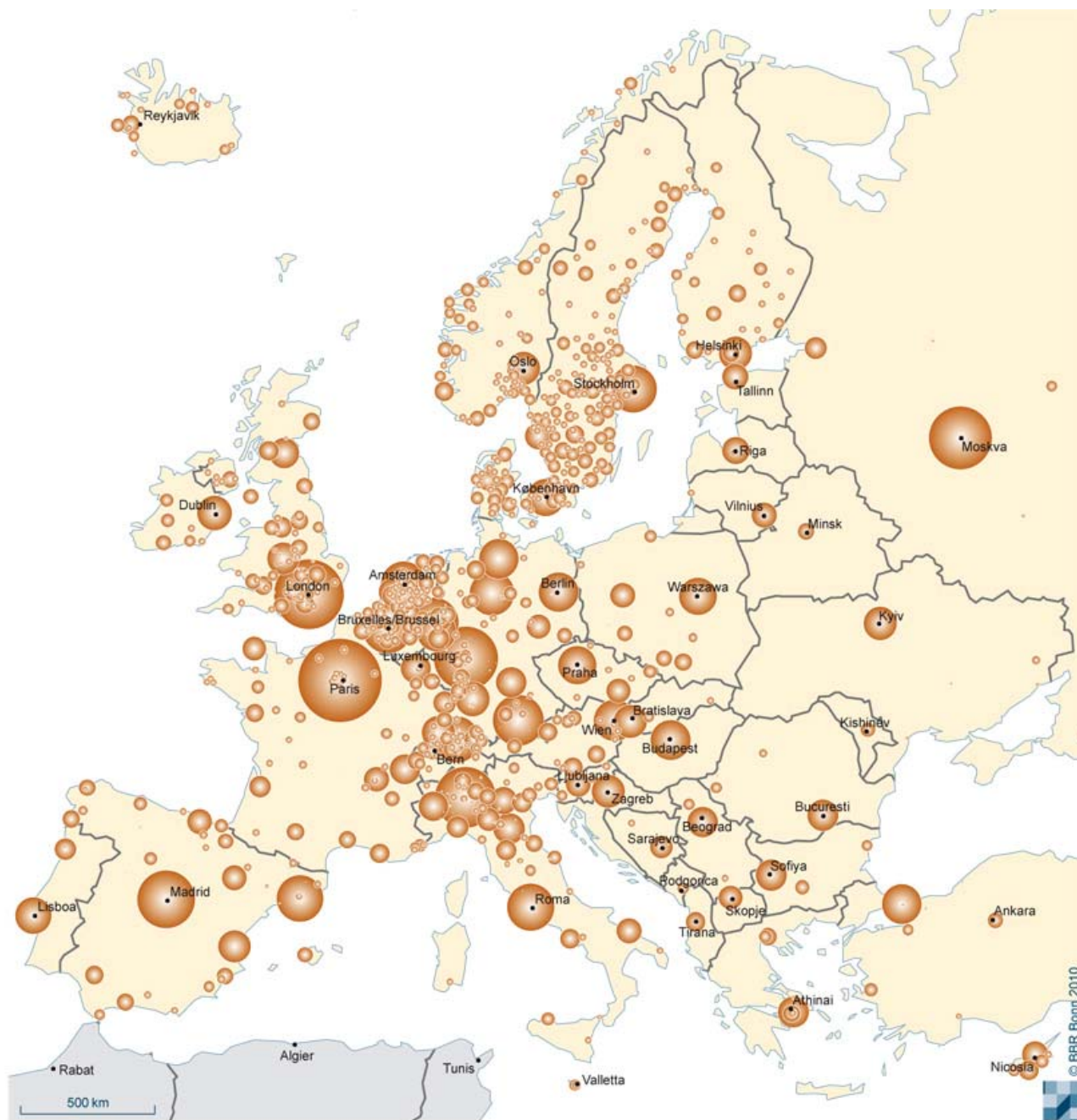
4.2.5 Overall analysis of the functional area “economy”

The metropolitan function “economy” is rather largely spread and is highly concentrated in the European core area.

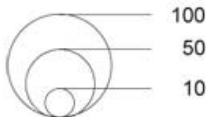
An overall analysis of all four indicator groups in the functional area “economy” reveals a comparably high spatial spreading (Fig. 23). Economic centres can be found in all European countries, even though with lower densities in Eastern Europe. They are often the capitals of their countries, i.e. the economic and political centres coincide. Exceptions are Italy and Turkey. When having a look at the high concentration of economic centres from Great Britain along the River Rhine to Northern Italy, this metropolitan function as well forms the image of the “Blue Banana”. Within this functional area, Paris and London are the most important centres in Europe and stand largely out against other locations.

Furthermore, special features become apparent – for example in the case of advanced producer services. In Scandinavian and BeNeLux countries, the number of their locations is comparably high and they are dispersed, which indicates a different spatial pattern in some countries.

Figure 23:
Spatial distribution of the functional area “economy”



Index value
(standardised, maximum = 100)



Significant locations

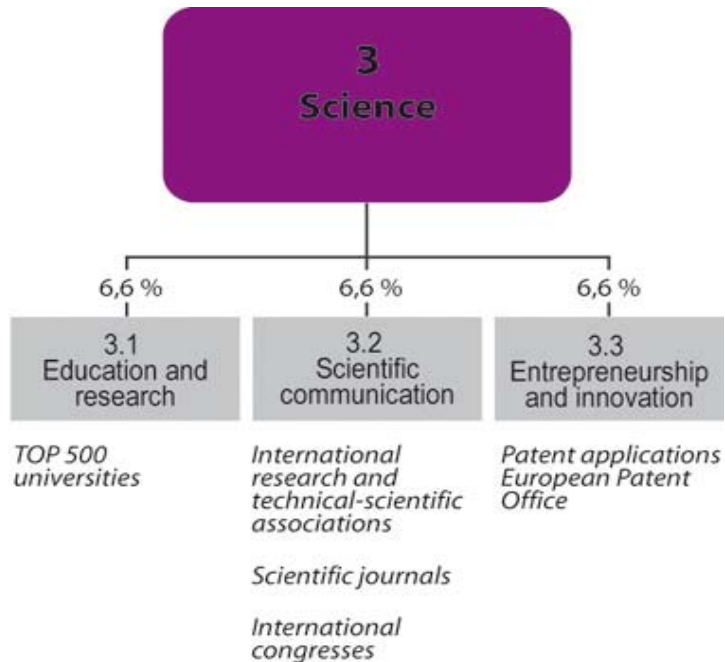
Paris	100.0
London	70.5
Frankfurt am Main	59.9
Moskva	56.6
Milano	53.7
Madrid	48.9
München	38.7
Bruxelles	36.2
Düsseldorf	35.9
Barcelona	32.9

Database: own BBSR survey
Geometrical basis: GfK GeoMarketing,
BBSR LAU 2

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4.3 Metropolitan function “science”

Figure 24:
Indicator groups of the metropolitan function “science”



In many current regional-scientific discussions and regional-economic theories, knowledge as a resource is said to be very important for the value of a location and the development prospects of cities and regions (cf. Chapter 2). High relevance is attributed to the potentials and capacities generated in the field of science – and thus to innovation potential.⁵⁷ Besides innovation-oriented framework conditions, existing research institutes, universities and their chance to network with companies are therefore of high importance within this functional area.

The functional area “science” is illustrated via the three indicator groups “education and research”, “scientific communication” and “entrepreneurship and innovation”. It is based on altogether five single indicators: top Top-500 universities, international research and technical-scientific associations, scientific journals, international congresses, patent applications (Fig. 24).

4.3.1 Education and research

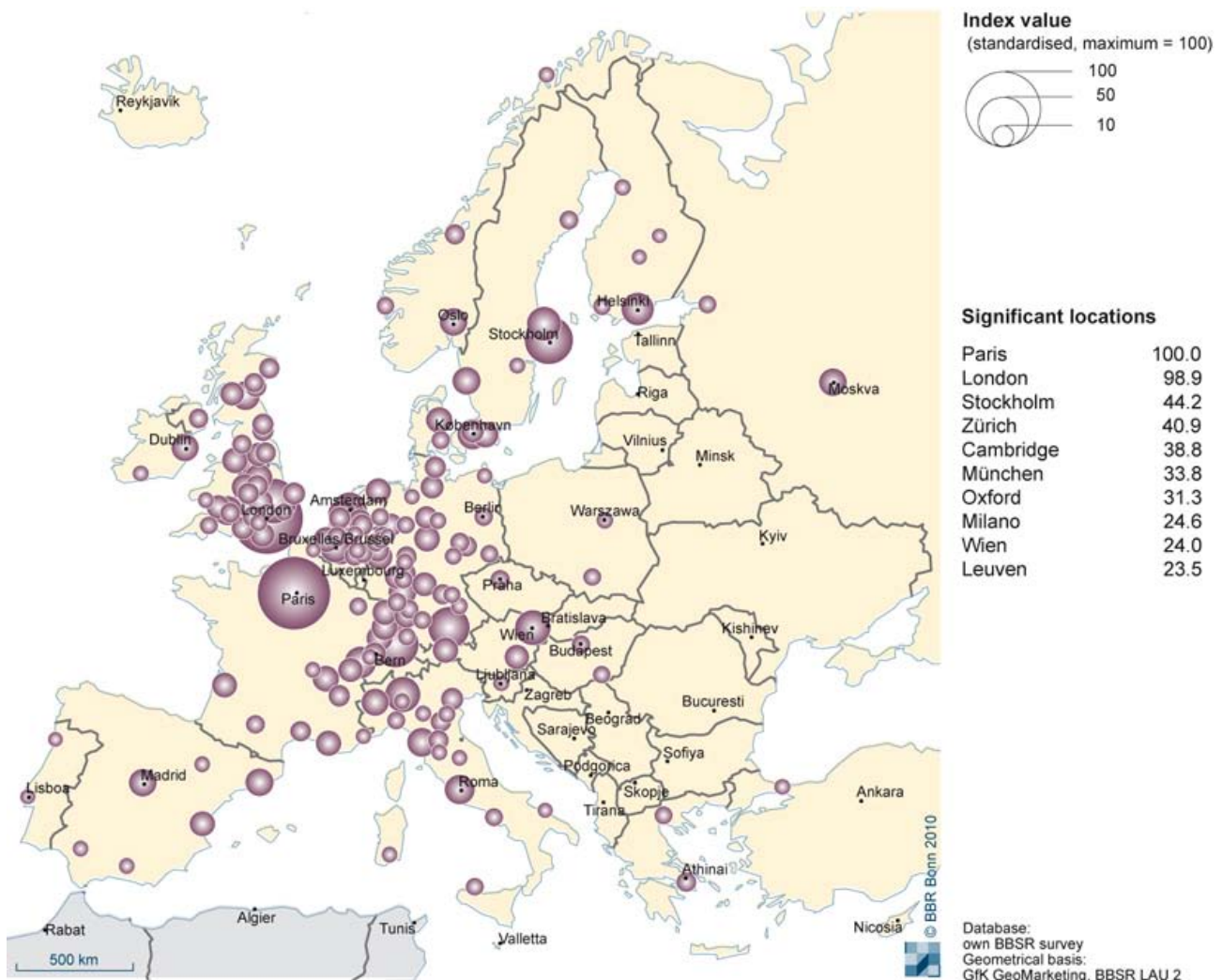
Top-500 universities

Universities are an essential part of the education and research scene. The BBSR index of metropolitan functions, however, does not take all university locations into account. It is thus not possible to compare the size of universities simply with the help of student figures as national university scenes are strongly shaped by the related national educational policies and show very different structures.

The indicator rather takes the international reputation of a university into account, which is reflected by periodical, national comparative university rankings – in Germany e.g. provided by the journals “Focus”, “Der Spiegel”, “Handelsblatt” or “Karriere”. However, only two established university rankings with a certain continuity exist: Since 2004, an annual World University Ranking is published in the “Times Higher Education Supplement (THES)” and the „Academic Ranking of World Universities“ of Shanghai Jiao Tong University. Both rankings mainly use citation indices and reputation assessments of

lecturers. The BBSR index of metropolitan functions uses the Shanghai Ranking as it covers more universities – apart from having a longer tradition. The current Shanghai Ranking 2008 e.g. considers 500 universities worldwide, 211 of them being situated in Europe and Turkey, whereas the Times Ranking is based on only 200 universities worldwide, 103 of them being in Europe.

Figure 25:
Spatial distribution of the indicator group “education and research”



The Shanghai Ranking shows the significance of universities based on various indicators depicting four relevant criteria: educational quality, staff quality, research output and size of institution. The assessment clearly focuses on research. Besides the number of Nobel Prizes and other important awards to lecturers and graduates, especially publications in important journals and their frequency of citation are considered in the assessment.

Finding

The spatial distribution of high-quality university locations is definitely concentrated on the European core area (Fig. 25). Accordingly, the University of Cambridge is at the forefront in Europe with 69 points. It is followed by the University of Oxford (55 points), the

University College London (43 points) and the Swiss Federal Institute of Technology Zurich (42 points). The Ludwig-Maximilians-Universität Muenchen and the Technische Universität Muenchen are the best German universities and with 30 points each on ranks 13 and 15.

If several well ranking universities are situated in one city, e.g. in Munich, the points of the universities are summed up to an aggregate value. This spatial level is led by Paris with a cumulative value of 177 points, followed by London with 175 points. They are by a wide margin followed by Stockholm, Zurich, Cambridge, Munich and Oxford.

Very few institutions with an international reputation can be found in Eastern European countries. Only eight university locations are depicted: Moscow, Saint Petersburg, Warsaw, Cracow, Prague, Budapest, Szeged and Ljubljana. But only Moscow with a cumulative value of 29 points on rank 15 is listed among the 100 most important locations.

4.3.2 Scientific communication

The indicator group “scientific communication” is operationalised by three indicators: international research and technical-scientific associations, place of publication of scientific journals and international congresses. In times of Internet-based communication, these three different media still are of high importance for the scientific sector.

International research and technical-scientific associations

International research and technical-scientific associations are decisive for the networking of research institutions and innovation activities within a region, but especially with similar institutions outside a region. They promote international cooperation, expand the scientific exchange of experts thus supporting the knowledge-based regional development to a large extent. It were the headquarters of such associations which were taken into account as they form hubs within the network of research institutes.

The locations of those international associations and organisations were considered where a larger number of people work in the technical-scientific sector and which do not just represent secretariats. Examples are the European Space Agency (ESA) in Paris with more than 1,000 staff members or the European Molecular Biology Laboratory (EMBL) in Heidelberg with more than 1,100 staff members. In addition, the headquarters of pure umbrella organisations and secretariats were taken into account as they assume an important intermediary function, as they have a share in organising the scientific exchange and as results are published e.g. via journals of such organisations. Examples are the European Association of Research and Technology Organisations (EARTO) in Brussels or the International Commission for Optics (ICO) in Madrid.

Finding

The 104 research associations are concentrated in 61 places in Europe, Brussels and Paris with twelve associations each showing the by far highest densities. Important for both kinds of associations are both their situation within Europe in connection with accessibility on a large distance and their proximity to research institutes, universities and industrial enterprises. Important as well – e.g. for their own lobby activities – is the contact to political and administrative decision-makers and lobbyists. This is reflected by the spatial distribution of the locations for these organisations are concentrated in Brussels and Strasbourg.

Scientific journals

In spite of new ways of distribution, scientific journals still provide an important platform to spread scientific findings. Although their publishing houses are not necessarily bound to scientific locations, traditional locational partnerships between publishing houses and universities or research institutes may definitely exist. Furthermore, the usual microeconomic criteria, e.g. accessibility or infrastructure, have an impact on the location of a publishing house. The number of scientific journals insofar does not so much reflect the intensity of research in a related location but rather the locational quality for related publishing houses. The calculation of this indicator is based on the Thomson Scientific Master Journal List, which worldwide includes more than 15,000, Europe-wide about 7,300 scientific journals.

Finding

Scientific journals in Europe are spread to 886 locations of publishing houses. The highest concentration can be found in London, where 620 journals are issued, followed by Oxford with 582 and Amsterdam with 455 journals.

International congresses

International congresses offer a forum for specialised exchange on a certain topic. They gather experts from the political, the economic and the scientific sectors as well as the specialist public and, depending on the public interest, they are attended by the media and by interest groups. The criteria for selecting the congress venue differ among organisers and cannot be standardised within a generally accepted catalogue. It may, however, be assumed that international accessibility, the existing congress infrastructure, overnight stay offers and the locational image play an important role. The related indicator therefore measures three dimensions: First of all, it measures the quality of a location for the international scientific exchange, secondly shows the international accessibility and thirdly reflects the cultural and touristic locational attractiveness.

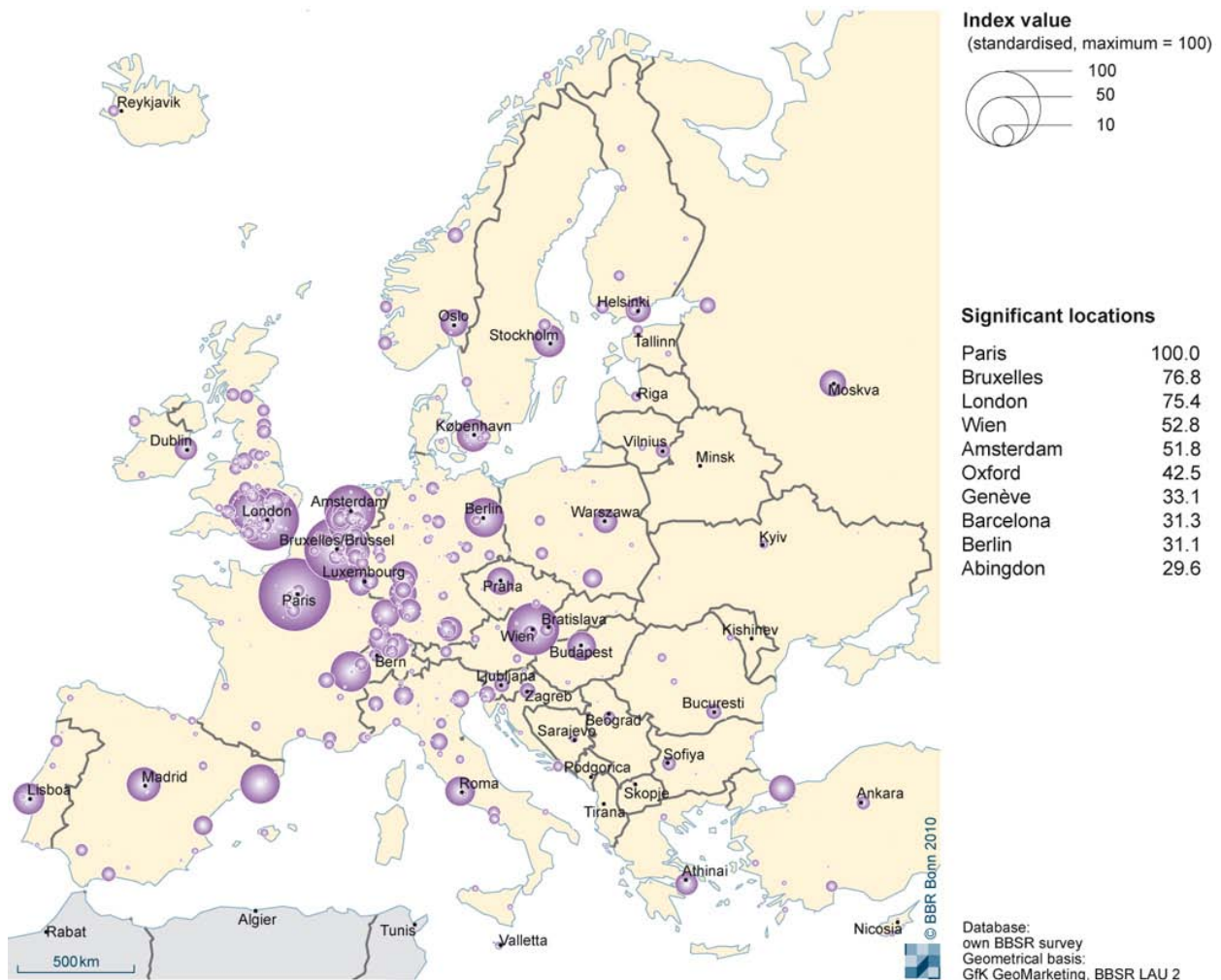
A reliable, even though incomplete source for such congresses is provided by the Yearbook of the Union of International Associations. All events carried out by its member organisations, regional ones as well, are registered. It can be assumed that this large and important organisation as well as its member associations give a representative picture of really existing associations and that the spatial distribution of international congresses will not be considerably distorted. The indicator should thus provide a sufficient picture of congress activities in Europe.

Finding

For 2007, the current Yearbook records 4,627 congresses within Europe and Turkey spread to 260 different places. With 315 events, Paris is the leading congress venue – followed by Vienna with 298 and Brussels with 229 congresses. They are by a wide margin followed by Geneva, Barcelona, Amsterdam and Berlin.

Overall analysis of the indicator group "scientific communication"

Figure 26:
Spatial distribution of the indicator group "scientific communication"



The overall analysis of all three indicators within the group “scientific communication” shows a very high concentration of locations in the London-Amsterdam-Paris triangle (Fig. 26). With London, Paris, Amsterdam, Brussels and Oxford, five of the six most important locations within this indicator group are situated in this area. Outside this area, some larger capitals are significant as well, e.g. Vienna, Berlin, Madrid, Copenhagen, Stockholm and Lisbon, but especially Geneva and Barcelona.

Position, accessibility on a large distance and proximity to research institutes, political and administrative decision-makers, universities and industrial enterprises are reflected in the spatial distribution of the locations of this indicator group within Europe. The existing congress infrastructure, a sufficient offer for overnight stays and finally the locational image also play an important role.

4.3.3 Entrepreneurship and innovation

Entrepreneurship and innovation in the form of new products or procedures provide the basis for companies to sustain their position on the market. They require research and development or invention – mainly in the companies themselves – and are normally protected against the competition by patents. Patent applications thus do not only allow a conclusion to be drawn about structures and trends of economic and technical-natural scientific activities but also enable to record the research and development activities as well as the innovation potentials and activities in a location quantitatively.

Patent applications

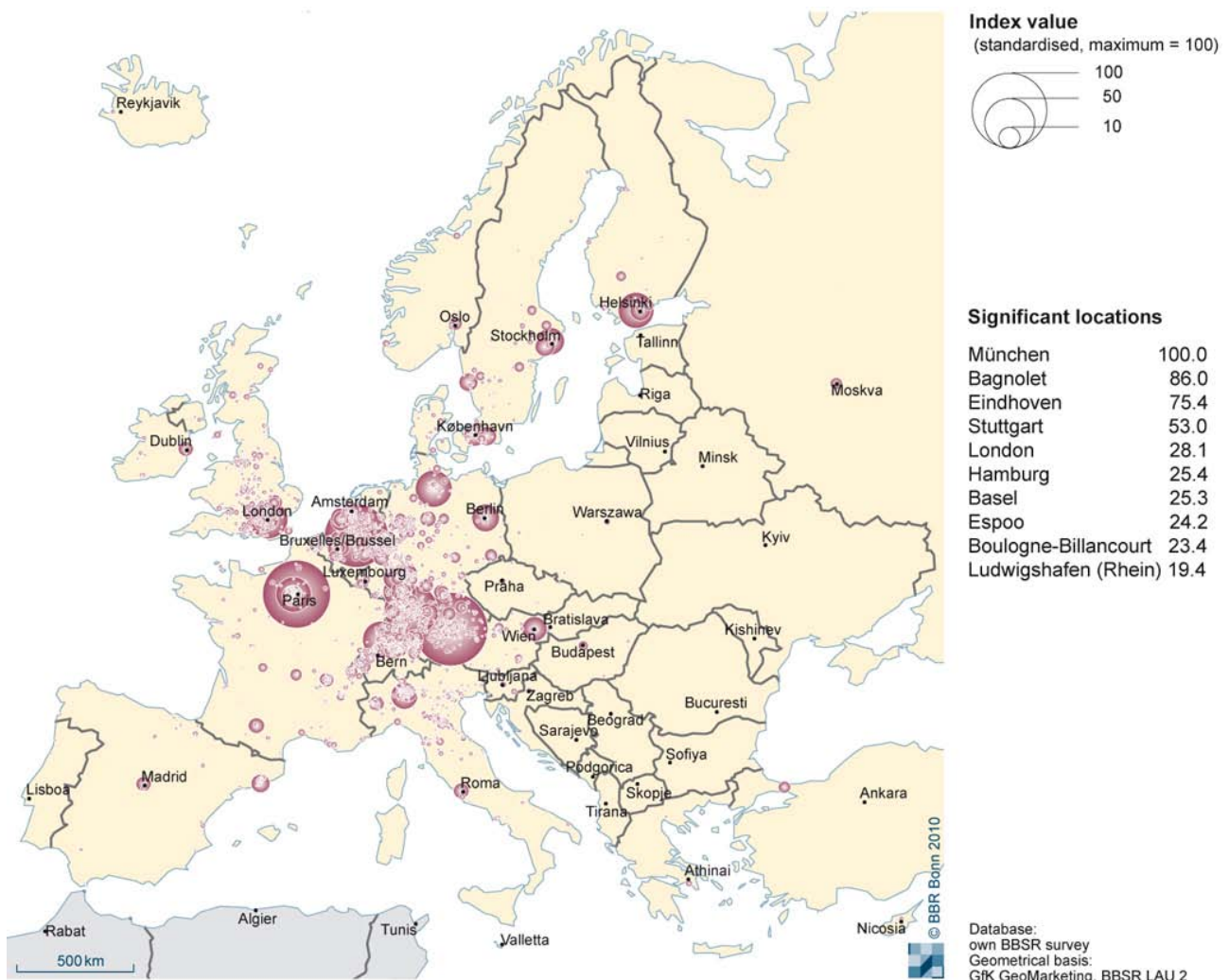
The indicator shows the number of patent applications to the European Patent Office in the place of application. The majority of the more than 58,000 patent applications was filed by the related companies and the person registered just represents the applicant. In the case of around 4,200 patents only, applicant and inventor are identical; they are mainly private persons, i.e. amateurs. Companies mostly file patent applications at their headquarters, at a subsidiary or a national representation. This is why the research and innovation centres, in which inventions were made, are mostly not taken into account. In general, the spatial distribution of patent applications is determined by large firms which have comprehensive research and development activities and normally turn patents into new products thus considerably contributing to the importance of cities.

For small firms with only one location it can be assumed that inventors live near the place of patent application and that the economic value added of the invention will also be created there. But for large enterprises as well, individual surveys (BASF, Bayer, SAP, L’Oreal, BMW, Nokia, Siemens) have revealed that the majority of inventors lives around the place in which the patent application was filed.

Finding

The altogether around 58,000 patent applications are distributed to over 6,200 places in Europe (Fig. 27). This indicator by far shows the largest spatial spreading of all indicators of the BBSR index of metropolitan functions. Unlike seats of research associations or universities, where every location already represents a cluster due to its importance to science, such outstanding locations of patent applications only become visible if they form large concentrations.

Figure 27:
Spatial distribution of the indicator group “entrepreneurship and innovation”

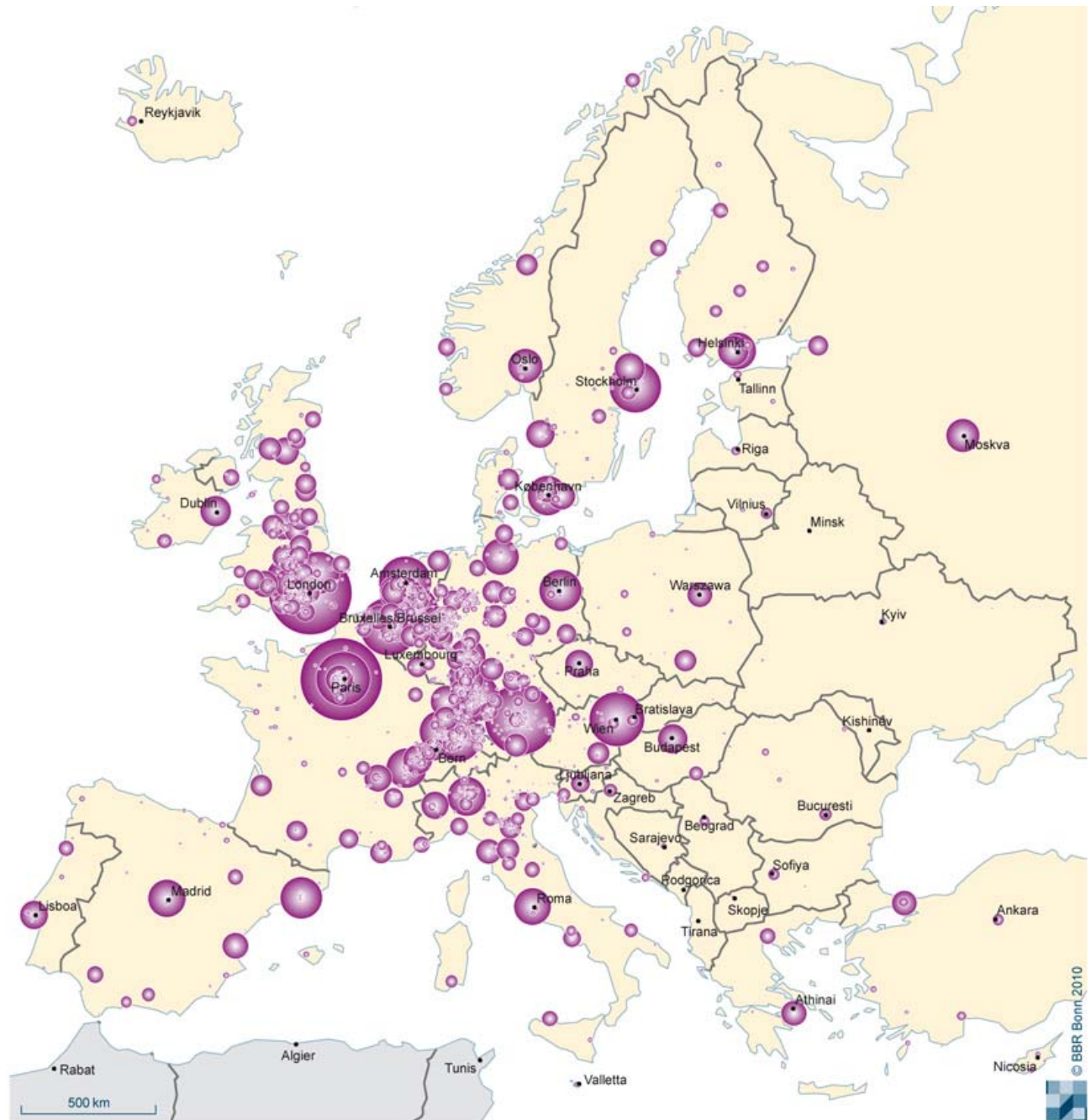


Besides a high concentration from the south German area to Switzerland, higher concentrations can also be found in the Amsterdam-Brussels-Rhine-Ruhr triangle and in Greater Paris and Greater London. These areas cover about three quarters of all patent applications. Among single locations, Munich with approx. 3,200, Paris-Bagnolet with around 2,700, Eindhoven with approx. 2,400 and Stuttgart with about 1,700 applications are leading.

4.3.4 Overall analysis of the functional area “science”

The metropolitan function “science” reveals a clear core-periphery divide.

Figure 28:
Spatial distribution of the functional area “science”



Index value
(standardised, maximum = 100)



Significant locations

London	100.0
Paris	99.3
München	72.4
Bruxelles	49.8
Wien	44.0
Bagnolet	42.5
Eindhoven	42.1
Amsterdam	40.0
Stockholm	39.7
Oxford	37.2

Database: own BBSR survey
Geometrical basis: GfK GeoMarketing.
BBSR LAU 2

With regard to some indicators used, it should be mentioned that university rankings to an extreme extent incorporate e.g. English-speaking publications and also Nobel Prizes awarded long ago. Similarly, patent applications are not completely comparable on the international level as, especially in Germany, many minor patent applications are filed. 40% of the European patents come from Germany. But nevertheless, a sound picture of the scientific and innovation scene in Europe can be drawn due to the large amount of indicators used, as shown in Figure 28.

Among the cities within the functional area “science”, London and Paris reign supreme. They are followed by a wide margin by Munich, which again is way ahead of the cities of Brussels and Vienna. Among the most important 15 positions, specialised locations in the field of science can also be found with Eindhoven, Cambridge und Oxford. With Heidelberg and Darmstadt, Germany has another two scientific locations among the first 50 ranks and is with altogether 20 cities quantitatively very well represented among the first 100 ranks. Eastern and South-Eastern European cities, however, are hardly found among the 100 most significant locations.

What is noticeable is the large spatial distribution of locations. It mainly results from the very large spreading of patent applications. The reason is that in most of the more than 6,600 locations on the LAU2 level showing a value in the functional area “science” only this indicator is represented. In only 147 locations, values for all three indicator groups – “education and research”, “scientific communication” and “entrepreneurship and innovation” – can be identified and in around 390 locations for at least two of the three indicator groups. This means that not only patent applications are incorporated in the index value but also publishing houses for scientific journals, congresses, technical-scientific associations or high-quality universities.

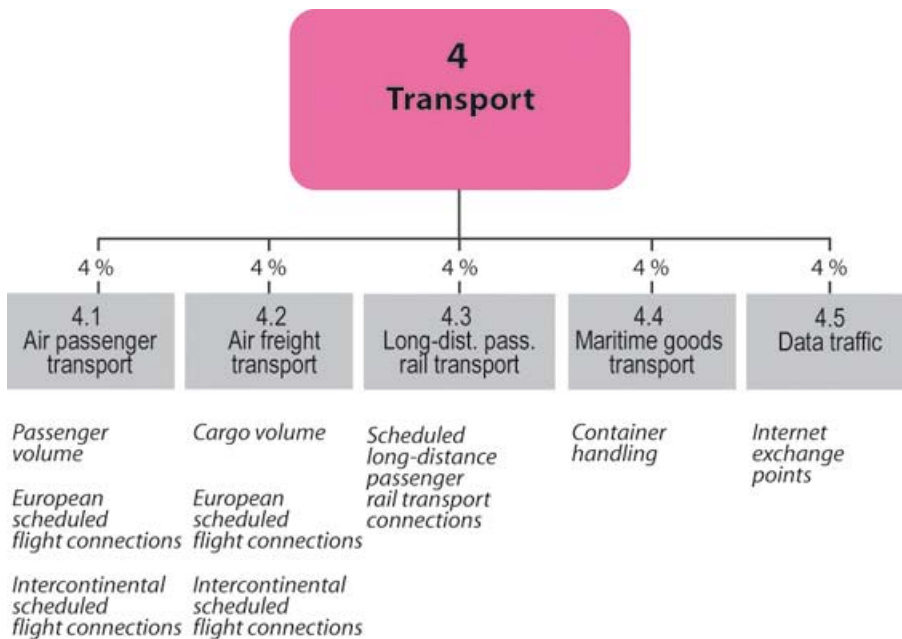
4.4 Metropolitan function “transport”

Increasing global exchange processes, division of labour and networking require that cities and regions are involved in a high-quality transport and telecommunication infrastructure. With passenger and freight transport as well as data traffic, the functional area “transport” within the BBSR index of metropolitan functions exactly reflects these classical hard location factors. It is subdivided into various transport modes so that it consists of altogether nine indicators in five indicator groups (Fig. 29). Fairs, congresses and scientific publishing houses are, however, not covered by the gateway function but partly by the functional area “economy” and partly by “science”. The BBSR metropolitan function “transport” thus largely differs from the classical gateway function.

As in the case of the other metropolitan functions, all indicator groups are involved in the transport index with the same weighting. As the air transport sector is subdivided into a passenger and a freight sector though, it is of double significance, which seems to be justified owing to its special importance for international accessibility. Maritime passenger

transport though is less able to show the significance of a metropolis and with the databases on hand the freight rail transport cannot be illustrated for the whole European territory. Although road transport bears most of the traffic volume, it also does not seem to be so much relevant for the significance of a metropolis. The reason is that the road infrastructure nearly covers the whole study area and has been built in line with demand and does not have to be considered as a special extensive locational advantage.

Figure 29:
Indicator groups of the metropolitan function “transport”



Regional, national and global gateways

The gateway function is measured by mass and interrelations of a metropolitan area. As pointed up by the following example, they reveal various phenomena: Measured by the number of passengers, Shinjuku railway station in Tokyo is said to be the largest passenger railway station in the world. It is used by up to 4 million passengers per day. Despite its large number of passengers, it is a pure railway station used by commuters as it mainly tackles the commuter traffic between Tokyo and its suburbs. This underlines the fact of Tokyo being one of the largest agglomerations in the world. Something similar applies to Haneda Airport in Tokyo. With almost 70 million passengers, it ranks four among the world airports. Nevertheless, it is not of worldwide importance but mostly used in a national context, which again underlines Tokyo's central role within the Japanese urban system but not its global function as a metropolis. Compared with that, Narita Airport, Tokyo's and Japan's most important international airport, with approx. 30 million passengers per year “only” ranks 25 among the world airports. This fact, however, shows that Tokyo is one of the most significant metropolises in the world. The three indicators thus describe three totally different aspects of a metropolitan region – a regional, a national and an international to global aspect.

4.4.1 Air passenger transport

This indicator group is subdivided into three indicators: passenger volume, European scheduled flight connections and intercontinental scheduled flight connections. The related data were collected for all 338 international airports in 324 European cities.

Passenger volume

Several aspects are relevant for the significance and function of airports and thus the passenger volume: their own international image, the demand potential for an airport city and the role of an airport within the international air transport system. This is where the hub and spoke principle comes into effect: How high is the importance of an airport as a “hub” and how important is its distribution function as a “spoke” within the regional air transport and within the national and regional context? In the last two decades, the strategy of airlines to concentrate air passenger transport to a few hubs – i.e. to expand these hubs – resulted in the fact that certain airport locations surpassed the potential of their actual catchment area.

Finding

Especially with regard to the passenger volume, the locational system of international airports is hierarchically structured and in Europe as well organised according to the hub and spoke principle. The “hub” is formed by a few very large airport locations, the four largest in Europe serving over a quarter of the whole air passenger transport and together with eleven other airports bearing more than a half of the whole passenger volume of all 338 airports, which are about 1.15 billion passengers. Compared with that, the passenger volume of most airport locations – the “spokes” within that system – is less than 1 million passengers per year.

The development of the passenger and cargo volume of airports normally depends on their capacities or technical infrastructure as well as on the economic but also demographic development of their catchment area. Exceptions are e.g. the tourist airports in Palma de Mallorca, Antalya or Malaga.

European and intercontinental scheduled flight connections in the field of air passenger transport

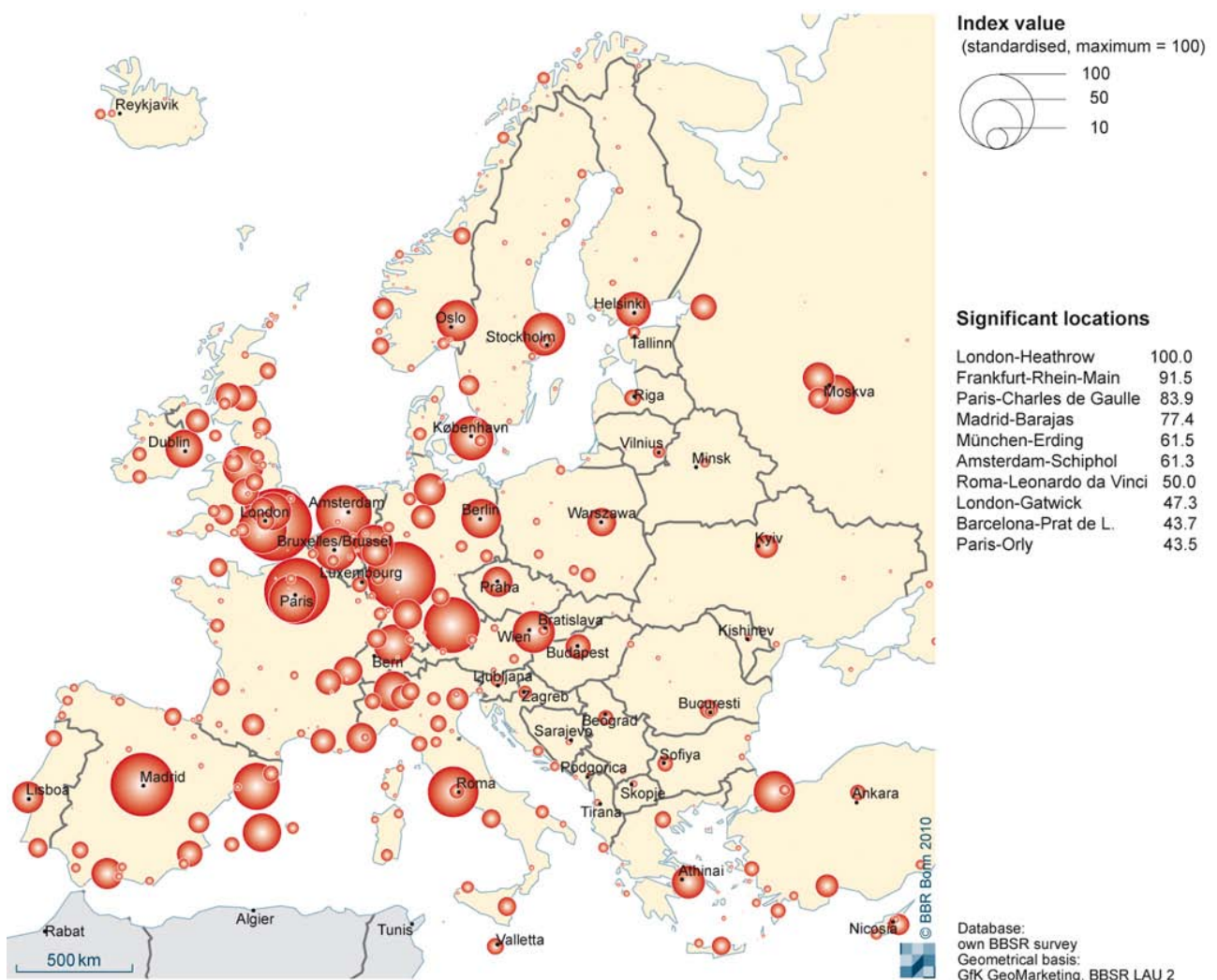
In addition to the passenger volume, the number of flight connections in the field of the European and intercontinental air passenger transport shows the significance and accessibility of an airport and thus of the related city and region made accessible in this way. In order to illustrate the European scheduled flight connections, all non-stop connections between European airports were counted based on the flight plans. Double counting because of the so-called code sharing was avoided. The intercontinental scheduled flight connections were registered by counting the connections between

European and non-European airports served at least once per working day during the week of 21 April 2008.

Finding

Among the European and intercontinental passenger flight connections only important hubs become evident which are concentrated in capital regions and large agglomerations, e.g. London, Frankfurt/Main, Paris, Madrid, Munich, Amsterdam and Rome (Fig. 30).

Figure 30:
Spatial distribution of the indicator group “air passenger transport”



4.4.2 Air freight transport

Cargo volume

The cargo volume of airports shows how intensively cities and regions are involved in the international division of labour as goods dispatched by air freight are either high quality or

have to be quickly transported from one place to another. Cargo airports thus reflect the gateway function of a location. The growing specialisation and concentration of locations within the air freight sector, which results in a few concentrated hubs, also has to be considered. It enables the use of larger aeroplanes on main routes.

Finding

The four European airports with the largest cargo volume are identical to the four most important locations of passenger transport but are altogether less different than the latter. The four airports together handle just under 15 million tons of air freight, which is about half of the total European volume. The leading group of the 15 most important cargo airports together even handles more than 75% of the total volume. Compared with the most important passenger airports, some new names such as Luxembourg, Liège and Cologne appear which might for example benefit from limited capacities or legal restrictions of other airports, especially from bans on night flights.

European and intercontinental scheduled flight connections in the field of air freight transport

Analogous to the passenger connections and in addition to the cargo volume, the scheduled flight connections in the field of air freight transport are depicted by means of two indicators: scheduled direct flight connections in the field of the European and intercontinental air freight transport. The data are based on the connections being served at least once per working day during the week of 21 April 2008, which applies to 75 European airports.

Finding

Compared with the passenger transport, the air freight transport is much more concentrated in the European core area within the urban quadrangle of Amsterdam, Frankfurt/Main, Paris and London (Fig. 31). Only a few other capital city regions and large agglomerations outside this quadrangle emerge – for example Moscow, Milan, Vienna or Budapest.

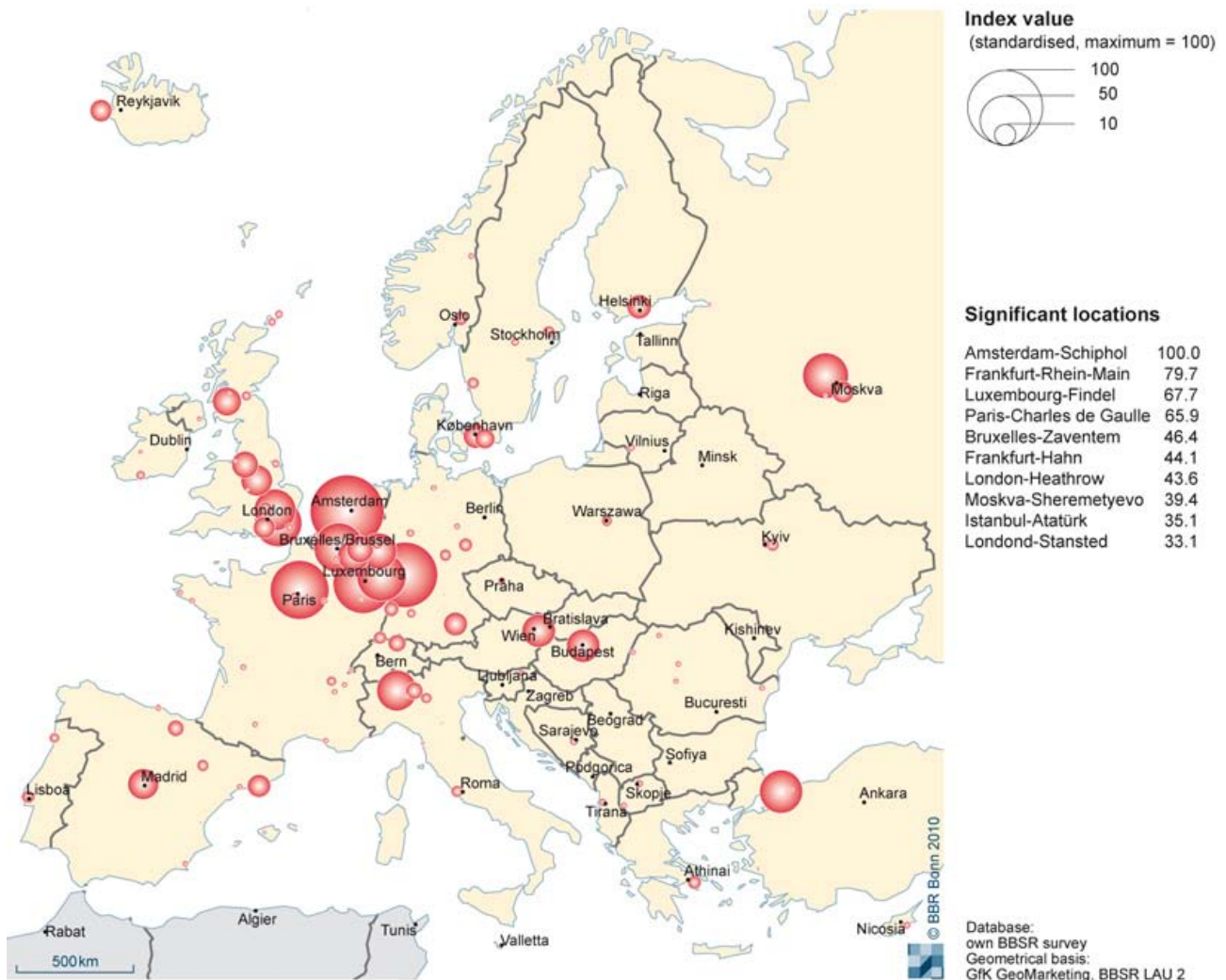
4.4.3 Long-distance passenger rail transport

Scheduled long-distance passenger rail transport connections

As already mentioned in the beginning, highest values are to be measured within each metropolitan function. Due to data limits, this principle cannot always be maintained, for example in the case of the rail transport. It would have been desirable to illustrate e.g. only the high-speed train connections. However, they are not comparable across Europe according to standardised criteria which is why the total of departures in the field of long-

distance rail transport was analysed. Direct long-distance connections with a journey time of at least 60 minutes to the terminus were counted involving only railway stations with more than fifty of such departures per working day. The frequency of departures suggests that there are long-distance connections into several directions at least every hour which again shows a good integration in the railway network.

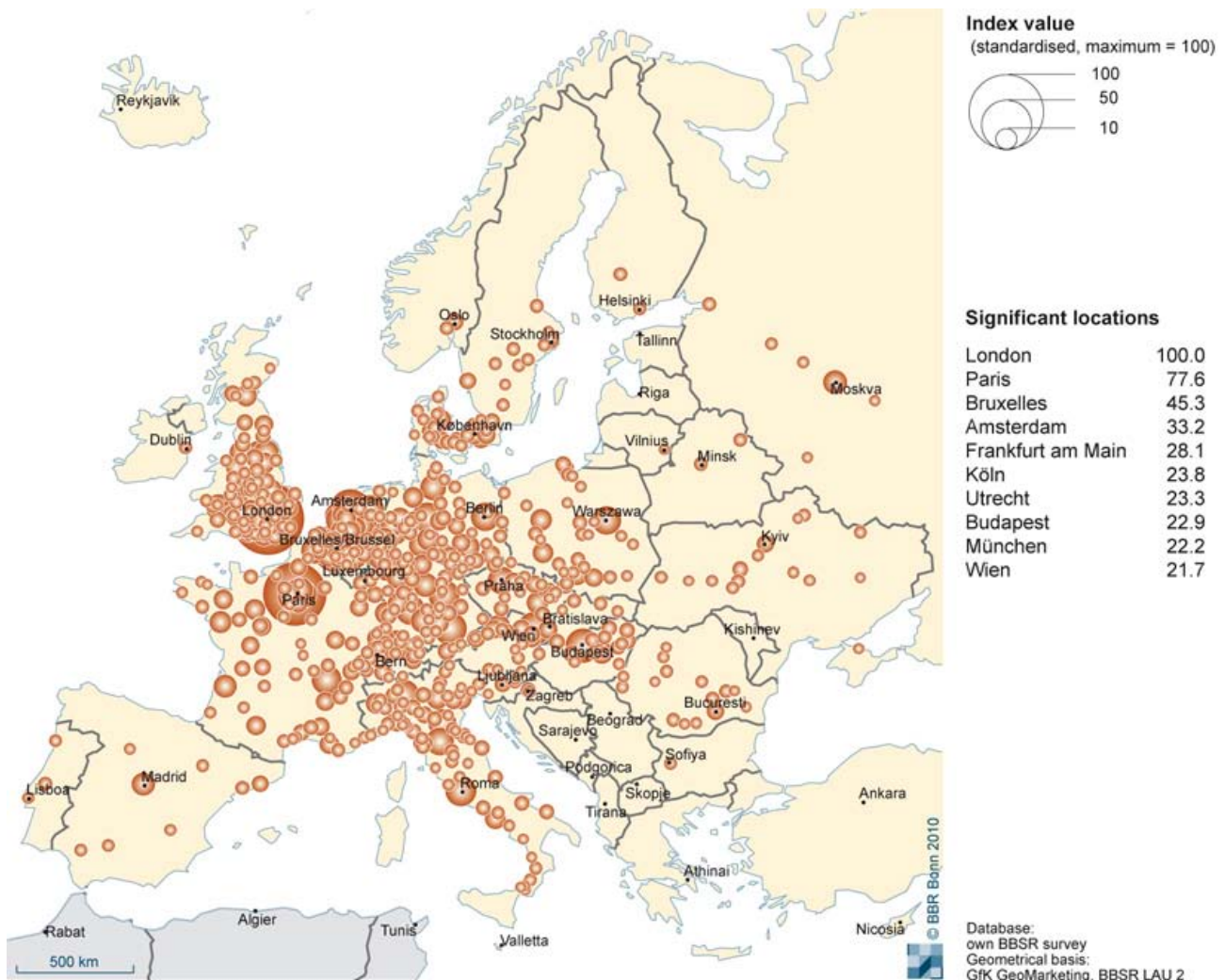
Figure 31:
Spatial distribution of the indicator group “air freight transport”



Finding

The most important European long-distance railway stations are important hubs within the long-distance passenger rail transport and distinguish themselves by several hundred departures per day (Fig. 32). Countries with a dense railway network, such as the United Kingdom, Germany, the Netherlands or Switzerland, show many long-distance departures while in some Eastern European countries they are concentrated to a few main lines and hubs. In some countries without an efficient long-distance rail transport infrastructure, no railway station meets with the criteria of this study, for example in Greece, Turkey, Estonia and Lithuania.

Figure 32:
Spatial distribution of the indicator group “long-distance passenger rail transport”



4.4.4 Maritime goods transport

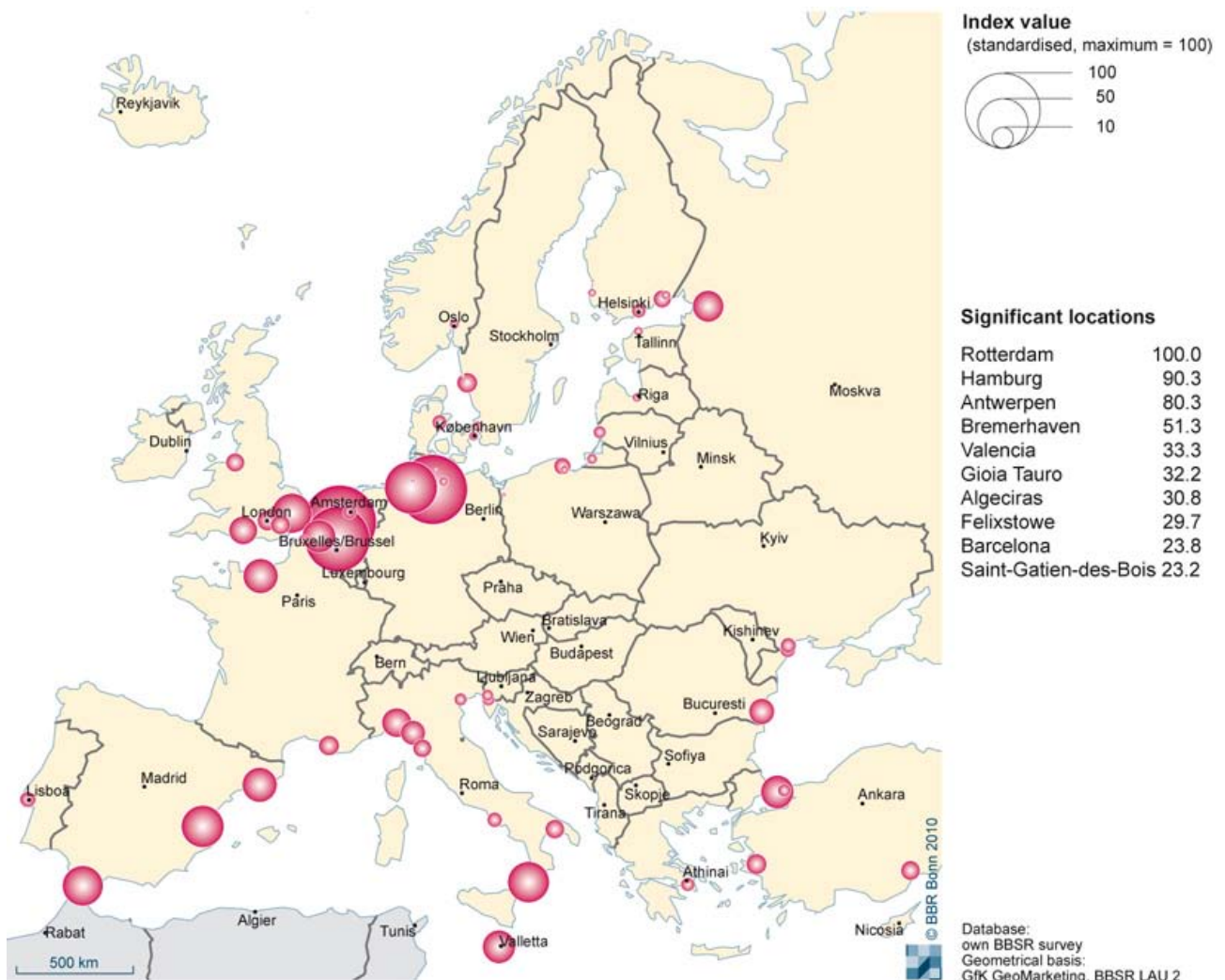
Container handling

Seaports are important transshipment centres for the international goods transport and have in history often been called “gateway to the world”. They reflect another specialised aspect of the gateway function of cities and regions. Most annual two-digit growth rates in the field of maritime container transport also show the growth of global connections. Seaports or at least the proximity to them still today represent an important locational and competitive advantage to cities and regions. Even the whole economic development in many port cities and their hinterland is closely linked to the trade in related seaports. The significance of seaports is measured by the container handling in TEU (twenty foot equivalent units). The dataset considers 53 locations with a container handling of at least 20,000 TEU.

Finding

As expected, the most significant European seaports are situated on the coast (Fig. 33). This is why coastal areas compared to inland areas clearly benefit from the maritime container transport. Among these areas, Rotterdam has for years been keeping a leading position before Hamburg not only in the field of goods transport but also of the whole maritime transport. These two cities stand seventh and eighth among the world's greatest container ports. Together with Antwerp they transship 58 million TEU every year thus handling one-third of the whole European container handling volume in the field of maritime transport. In the 15 largest seaports, over 80% of the container handling activities are concentrated.

Figure 33:
Spatial distribution of the indicator group “maritime goods transport”



New ports have recently emerged far away from cities and agglomerations. Examples are Gioia Táuro in Italy or Marsaxlokk in Malta. They represent important hubs in the worldwide shipping traffic without this having promoted the economic development of their related hinterlands.

4.4.5 Data traffic

Internet exchange points

Not only the worldwide exchange of persons and goods represents an important metropolitan function but also that one of knowledge and information. In the same way as airports, seaports and railway stations provide access to and are hubs of the physical worldwide network, Internet exchange points (IXP) provide access to the virtual worldwide web, which can be geographically traced, and to the technical Internet infrastructure.

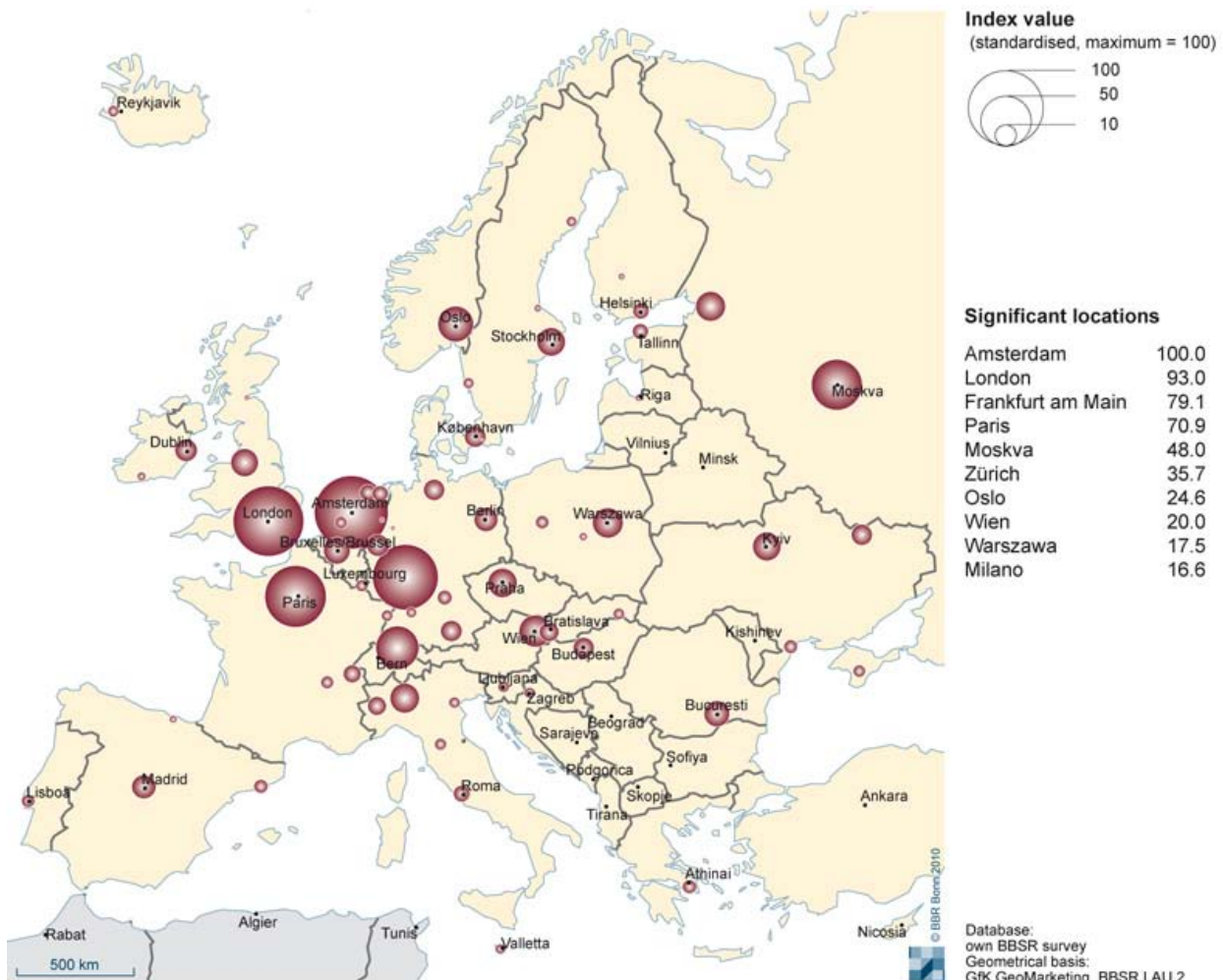
IXP are spatially concentrated owing to their function which is to concentrate data packages and to avoid data going a long way round. By the mid-90s, emails for instance even had to cross national borders or the Atlantic Ocean if the sender and the recipient were in the same place but participated in the data traffic via different Internet providers. In the meantime, IXP have been established where several Internet providers are active in the same region. This is to ensure that the local Internet traffic will remain local thus improving the network flow, minimising delays and avoiding long and expensive communication paths.

IXP were established in technically, geographically and topologically useful locations where they provide the appropriate network infrastructure and locations for the ports of local providers or network operators. Each provider creates a leased line connection to the IXPs, installs its router and connects it to its leased line as well as to the joint exchange infrastructure. The demand-oriented selection of IXP locations is concentrated in places where many and important Internet-oriented customers have their seats and where large data packages are exchanged. Such places are regions of large economic significance and with a large population. Some centres such as Amsterdam and Frankfurt are even connected by own gigabit connections so that customers immediately benefit from this direct connection.

Finding

The IXP are clearly concentrated in the business centres of the Central European core area, centres being London, Amsterdam, Paris and Frankfurt/Main, outside this core area Moscow as well (Fig. 34).

Figure 34:
Spatial distribution of the indicator group “data traffic”

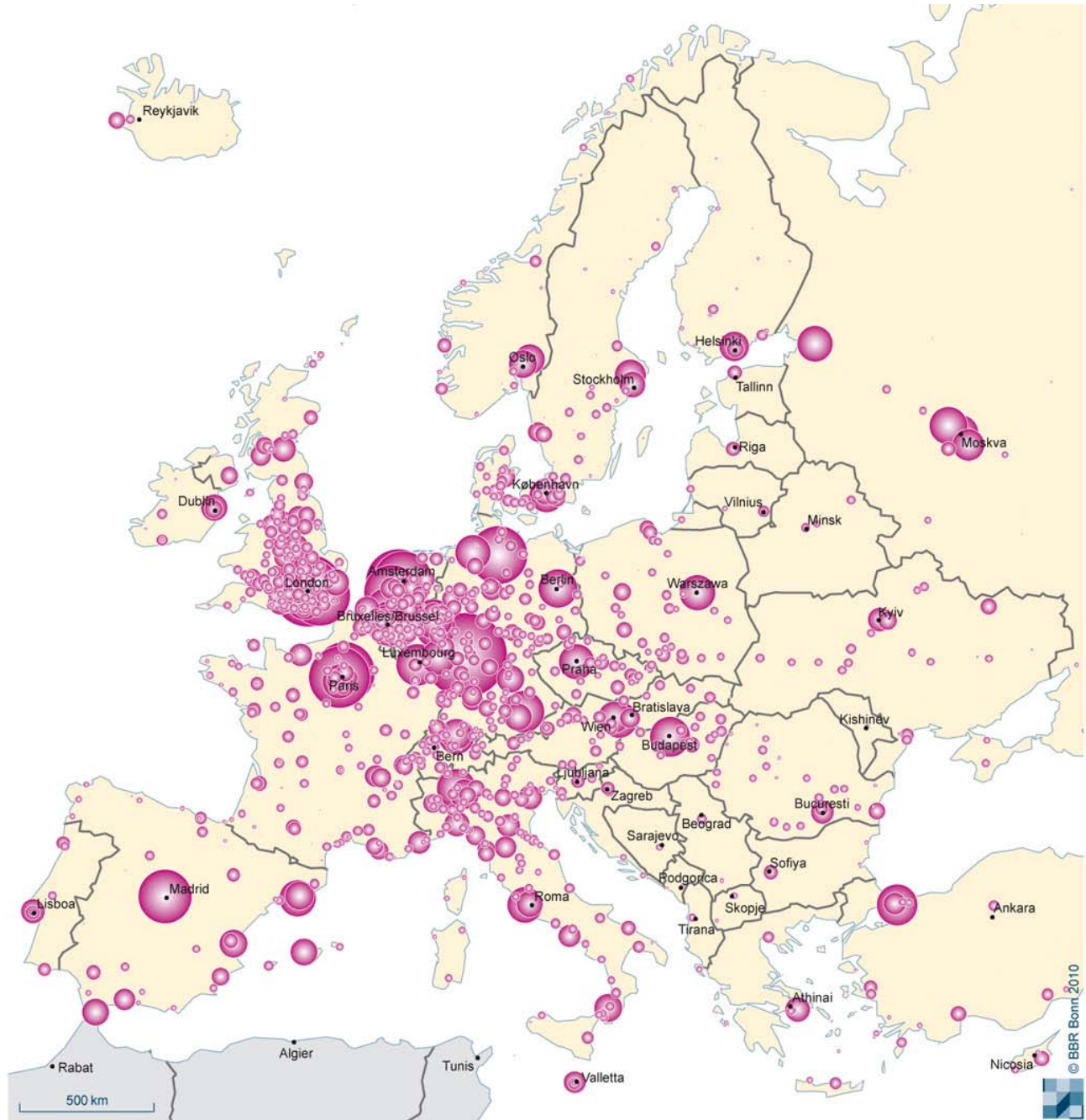


4.4.6 Overall analysis of the functional area “transport”

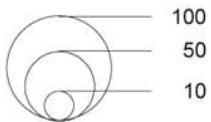
The metropolitan function “transport” reveals a large spatial spreading across Europe.

As expected, the locations with the highest values in the functional area “transport” are spread all over Europe. The values are, however, highest within the European core area and strongly decrease towards the periphery, especially towards the north and the east. The high-quality transport offered is especially geared to the highest demand potentials in agglomerations in which population and jobs are concentrated.

Figure 35:
Spatial distribution of the metropolitan function “transport”



Index value
 (standardised, maximum = 100)



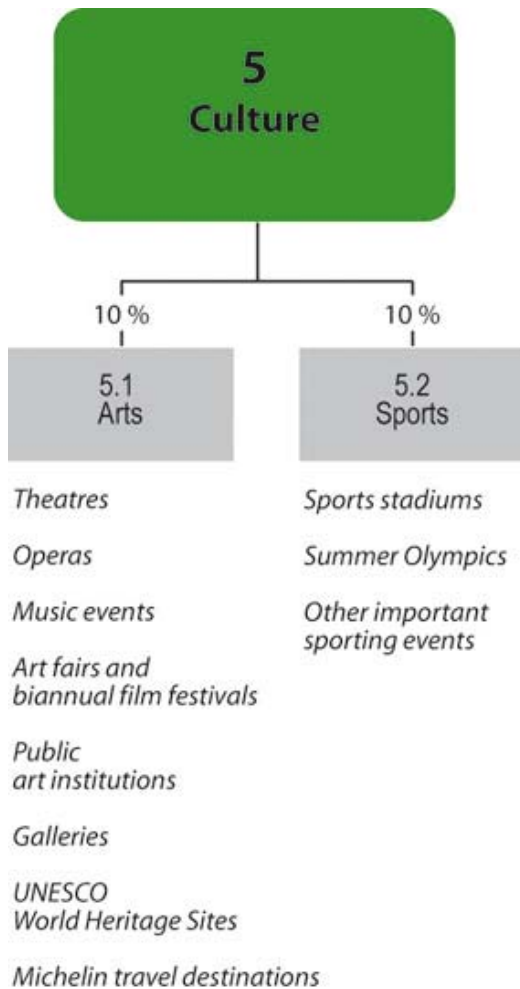
Significant locations

Frankfurt am Main	100.0
London	74.5
Amsterdam-Schiphol	63.6
Paris-Charles de Gaulle	53.8
London-Heathrow	53.6
Paris	53.4
Amsterdam	49.3
Hamburg	48.3
Rotterdam	43.2
Madrid	42.2

Database: own BBSR survey
 Geometrical basis: GfK GeoMarketing,
 BBSR LAU 2

4.5 Metropolitan function “culture”

Figure 36:
Indicator groups of the metropolitan function “culture”



Culture is of special importance to metropolises. Cultural offers for instance bring about important destinations for the international tourism because unique collections in museums or top-class events take place in large cities. They also reflect the cultural life in these cities. As a soft location factor, they can increase the attractiveness of these cities and increase their quality of life. This is why this functional area is closely related to the symbol function often mentioned in literature.

In the BBSR index of metropolitan functions, the metropolitan function "culture" is depicted with altogether eleven indicators, eight of them belonging to the indicator group “arts” (theatres, operas, music events, art fairs and biannual film festivals, public art institutions, galleries, UNESCO World Heritage Sites, Michelin travel destinations), three to the indicator group “sports” (sports stadiums, Summer Olympics, other important sporting events). In the case of “arts”, which includes various areas, it was important to take the areas of music and performing arts, visual arts and architecture into account.

4.5.1 Arts

Theatres and operas

Large theatres and operas with impressive buildings are not only evidence of a cultural high-quality infrastructure but are also the result of a city’s ambitious and dedicated cultural policy for which a lot of money is invested, if necessary. A representative infrastructure normally goes along with highly valued representations often involving prominent figures thus providing a city with a certain image. Culturally interested people are attracted by such cities, they often come from all over the world. Europe- or worldwide cultural tourism thus also means international city tourism – it follows the image of cultural events and the image of the city.

Finding

The spatial distribution of theatres, on the one hand, and of operas and music theatres, on the other hand, shows quite different pictures.

Theatres count among the basic cultural institutions, are widespread and can often be found in smaller towns. Nevertheless, they are concentrated on national capitals and large cities, which is obvious owing to their higher population and related demand. What is striking in the context of this indicator is the comparably high significance of capitals of smaller countries, which might be due to the large tradition of literature and theatres. Athens for example has the second highest number of theatres after London and before Rome and Paris. Budapest, which has more theatres than Berlin, and Prague as well are outstanding compared with their related country sizes.

Operas, whose construction and especially maintenance is very expensive, are not as widespread as theatres. On the one hand, they are concentrated in capitals in which the monarchs already in former times showed off as cultural patrons. On the other hand, their spatial distribution clearly follows music-historical patterns and is therefore closely related to the places of living and working of famous composers, conductors, directors etc. It is therefore not astonishing that besides London, Vienna and Prague also show a high importance with regard to this indicator, and Berlin as well.

Music events

Important music events, that means every kind of major concerts, are organised where large concert halls or stadiums exist and can be filled with a large audience or many fans. They normally are to be found in large cities and cultural centres which, with such major events, promote their cultural capacities. In order to cover a broad range of music styles, the tour dates of various interpreters, orchestras and bands were collected: the Rolling Stones, Madonna, Sting and Bon Jovi standing for the rock and pop sector, Anna Netrebko, Anne-Sophie Mutter, the Vienna Philharmonic and the New York Philharmonic Orchestra standing for classical music. In addition, the venues of the musical "Cats" from the beginning of its production and annual international jazz festivals were involved.

Finding

Comparing current tour dates with former ones, whether those of pop or classical interpreters, mostly reveals the same venues. They are mostly situated in potential metropolises. London, Paris and Berlin are typical "scene cities" for such music events. An exception are especially jazz festivals, which are also performed in smaller towns, e.g. Willisau, Wiesen, Saalfelden, Pori or Juan-les Pins.

Art fairs and biannual film festivals

In the field of visual arts, art fairs and biannual film festivals are important indicators to measure the cultural significance of a location or a region respectively. Art fairs, e.g. art.fair, Art Cologne or Art Basel, always involve special exhibitors and mostly a large but nevertheless manageable circle of visitors – mainly a professional audience out of art lovers and collectors. Art fairs provide an art forum for an international audience and an art market for the international art trade. Compared with that, top-class public art shows like the Venice Biennale, triennials or the Documenta Kassel, which even only takes place every five years, do not only have a different regular cycle but also a slightly different character. Their international importance or image is even larger and their event character even more important than that of art fairs. As a consequence, they have an even higher number of visitors and an even more international audience. In the case of both, art fairs and shows, more than or even several 100,000 visitors are not unusual.

Finding

Only a few cities organise art fairs or art shows, whether one or several times per year, whether only once or at regular intervals. Cologne, London and Berlin, thus again cities within the European Pentagon, maintain a leading position here. Northern Europe and the Iberian Peninsula are less significant while no art fairs or biannual film festivals at all are listed in large parts of Southern, South-Eastern and Eastern Europe.

Public art institutions

This indicator mainly includes public art museums and galleries, furthermore non-profit or private art clubs, art foundations and associations, art archives and related libraries and last but not least art colleges or universities teaching art, cinematic art, photography, design and graphic arts. It thus includes three different variables: (1) the amount of activities and public sector investments in the field of advanced culture of international importance, (2) relevant networks, occurrence and significance of the “free” art scene (private or non-profit art clubs, foundations etc.), (3) the importance of places for artistic training and as innovation and research centres in the fields of art and design.

Finding

Within the Pentagon including Berlin, a dense concentration of art institutions can be found. With 53 institutions, Cologne plays a special role. Apart from Moscow, the significance of capitals as art centres in the national and partly European context is reflected by the spatial distribution. Number and density of locations and institutions considerably decrease towards South-Western, Southern and Eastern Europe. But in these areas as well, art institutions can mostly be found in the political and economic centres of each country.

Galleries

Galleries stand for the art market or art trade. As from a certain level on, the latter has an international character, galleries show the actual importance of a city within the global art scene. But the number of galleries in a location also shows its international importance so that galleries also have a symbolic function.

Finding

Concentrations of galleries can be found in a variety of outstanding centres, the majority can be found in capitals, exceptions being Rome and Bern. In general, the majority of galleries can be found in Central and Western Europe: More than half of the European galleries – after all around 2,800 – are situated within the Pentagon which, in that case, beyond Hamburg, would have to be extended by Berlin. The reason is that Berlin together with Paris and London plays an outstanding role as a gallery location although Paris and London alone already cover one-third of all galleries.

UNESCO World Heritage Sites

The cultural function of a metropolis can also be identified by the degree to which UNESCO World Heritage Sites, the “first league” of heritage sites, can be found there. On the one hand, World Heritage Sites are attractions to tourists, on the other hand, they shape the cityscape and show its long historico-cultural importance to be maintained for mankind. They considerably improve the image of a city – for example the Colosseum in Rome or Cologne Cathedral – but also that one of whole landscapes – for example castles in the Middle Rhine region or the Pont du Gard close to Avignon. These cities and regions are shaped in an extraordinary and unique manner by these testimonies of the past. Some World Heritage Sites such as the Limes in Germany or the Metéora monasteries in Greece cannot be exactly geocoded as they consist of several objects or because they cover a rather large area. This is why in such cases the geographical centre, the most important location or the nearest location were used as a reference.

Michelin travel destinations

The Michelin Guide for Europe classifies cities and regions as well as places of interest according to one to three stars. Relevant criteria are the existence of historic old towns, walls or squares and streets as well as of cultural heritage sites (cathedrals, castles, special buildings, parks, museums etc. of European importance). One star means “interesting”, two stars “worth a detour” and three stars “worth a journey” (based on several top-class attractions). Similar as the star classification of restaurants and hotels, this ranking enhances the international image of a city and might provide it with the status of an important destination of the international urban tourism.

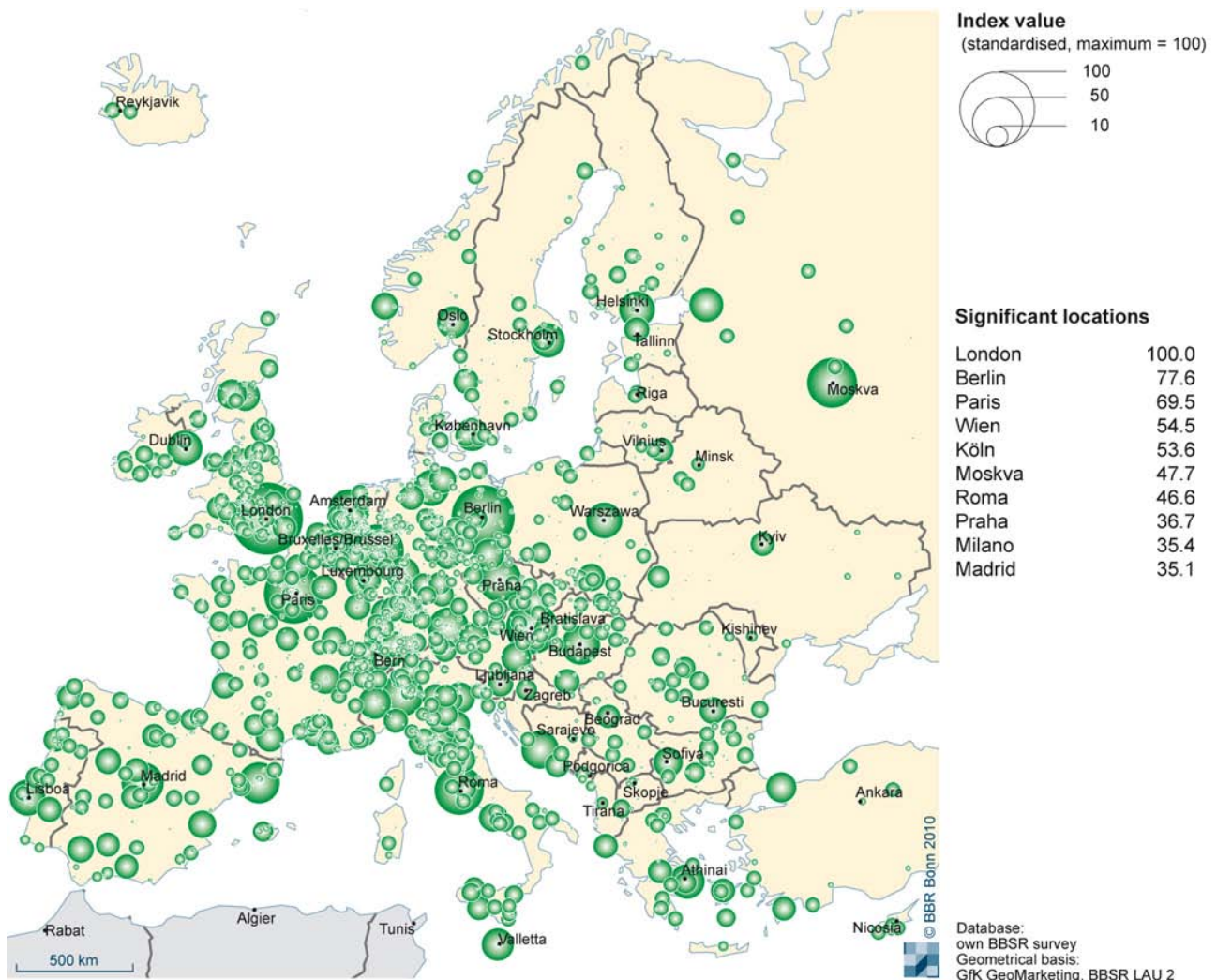
Finding

Top-class destinations are widely spread in Europe. The highest ratings with three stars are nevertheless largely to be found among cities considered as classical metropolises. Exceptions are e.g. Rothenburg ob der Tauber, Santiago de Compostela, Carcassonne, Delphi, Assisi or Lucca.

Overall analysis of the indicator group “arts”

Not only large cities are important in terms of the “culture” function. They even show a very large spatial spread compared with other metropolitan functions. Small cities in rural and peripheral regions as well may score in terms of cultural importance – mostly due to their significant cultural past. Large centres, e.g. London, Berlin, Paris, Vienna, Cologne, Moscow, Rome, Prague, Milan and Madrid (Fig. 37) nevertheless dominate, which is based on the fact that many theatres, art fairs or music events are concentrated there.

Figure 37:
Spatial distribution of the indicator group “arts”



4.5.2 Sports

The relatively homogeneous area “sports” is depicted via stadiums as a structural precondition for sporting events, on the one hand, and via international sporting events, on the other hand. The symbol function as well should not be ignored. Top-class sporting events improve the image of venues and stand for sportive metropolises. This is why the indicator group “sports” as well is closely related to the symbol function of metropolises.

Large sports stadiums and arenas

Large sports stadiums are an important element of the infrastructure of central places. Apart from their actual function as venue for sporting events, modern stadiums become increasingly multifunctional. Improved comfort through complete roofing, boxes or large gastronomic facilities turn modern stadiums into arenas allowing for various kinds of large events. Owing to their often spectacular architecture, they support the image building of metropolitan regions thus being an important element of locational marketing. This is also expressed by the fact that large well-known enterprises support these arenas and give them their names.

Summer Olympics

The Summer Olympics in fact are a worldwide event. Although they take place in only one place, the opening ceremony of the last Olympics in Beijing, for instance, were watched on television by approximately three to four billion people. Accordingly, the selection of venues and the extension of the Olympic infrastructure take a long time. The Olympics are characterised by representative architectures such as lastly the “Bird's Nest” in Beijing and the underground in Munich, constructed for the Summer Olympics in 1972, has nearly become a symbol for their infrastructural sustainability. The venues therefore regularly use the Olympics to present themselves and their performance to the world.

Large sporting events

Large sporting events such as World Cups or European Football Championships, large international athletic or swimming competitions or tennis tournaments attract the world's or Europe's attention and thus turn it to their related venues. They are also used by cities to demonstrate organisational efficiency and to reflect a certain image.

Finding

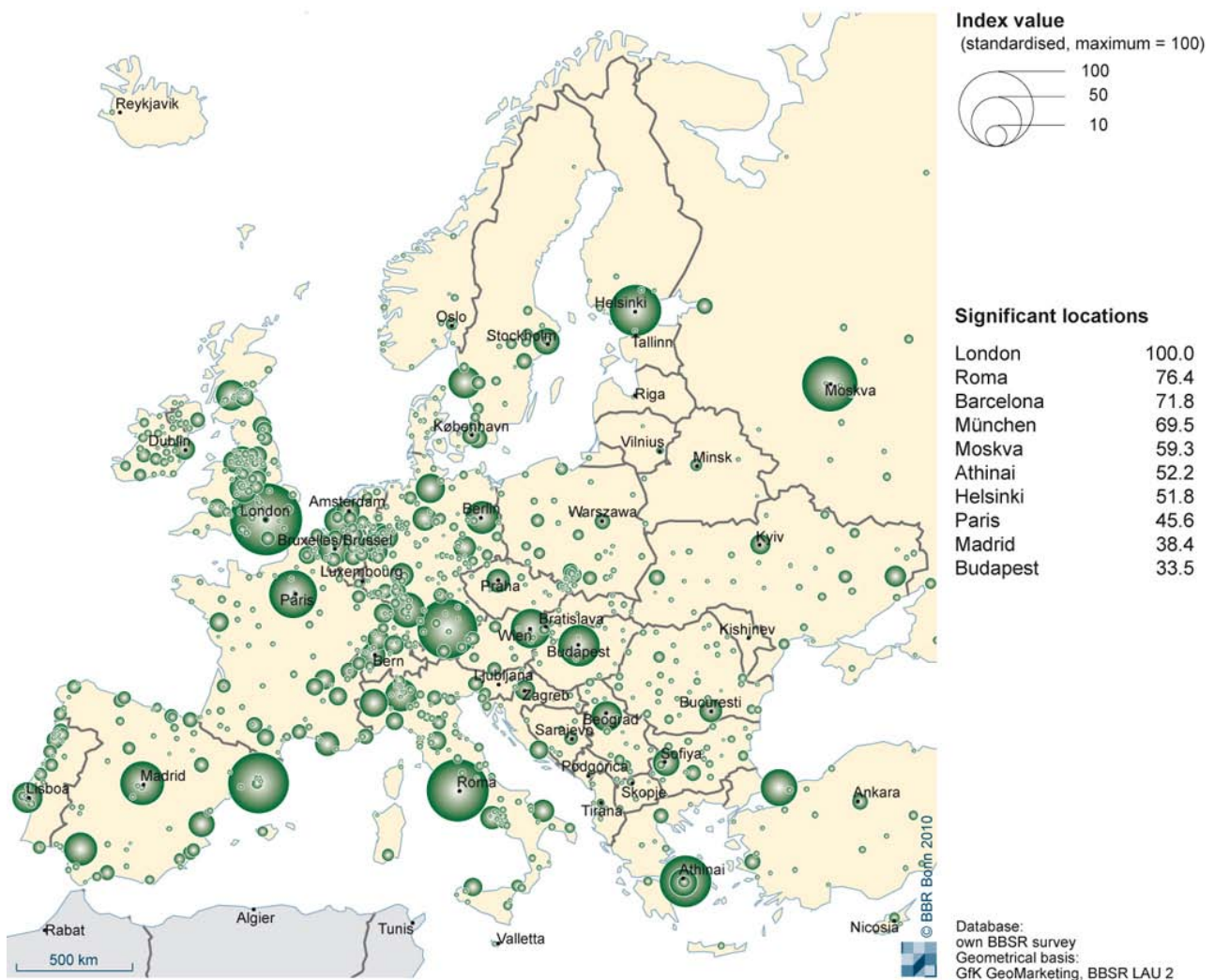
All in all, there is a high concentration of sports stadiums in Europe although being very decentrally distributed. In this case as well, large cities are locations of more and larger stadiums. With 615,000 seats in its stadiums, London for example has an outstanding position but Istanbul also has considerable capacities with 303,000 seats.

Paris has 17 large sporting events, Rome 14 and London, Madrid and Vienna 12 each. Some sports reveal strongholds, a peculiarity being found in the field of tennis: Some few tennis tournaments take place outside metropolitan regions (e.g. Gstaad), which is a consequence of the locational preferences of the primary target group. All in all, Eastern European locations are rather well represented among large sporting events.

Overall analysis of the indicator group “sports”

Similar as in the indicator group “arts”, metropolitan functions in the group “sports” are largely spread all over Europe (Fig. 38). This has to do with the fact that large importance is attached to sports and that many stadiums do consequently exist in Europe. But here as well, large centres prevail – especially the venues of the Summer Olympics, e.g. Munich.

Figure 38:
Spatial distribution of the indicator group “sports”



4.5.3 Overall analysis of the functional area “culture”

Some functions of the metropolitan function “culture” can often be found outside large cities, however, they are concentrated in classical metropolitan locations.

Figure 39:
Spatial distribution of the metropolitan function “culture”



Index value
(standardised, maximum = 100)



Significant locations

London	100.0
Roma	61.5
Paris	57.5
Moskva	53.5
Barcelona	53.2
München	51.4
Berlin	49.9
Wien	43.0
Helsinki	38.9
Athinai	38.2

Database: own BBSR survey
Geometrical basis: GfK GeoMarketing,
BBSR LAU 2

As expected, the metropolitan function “culture” reveals a large spatial spreading across Europe (Fig. 39), many locations outside the European core area also have high values. Consequently, the European Pentagon is not so prominently depicted than in the case of other metropolitan functions. Nevertheless, those large cities, which consider themselves as metropolises, have the highest ranks.

4.6 Locations with metropolitan functions in Europe – overall analysis of all functional areas

480 of 8.480 locations in Europe cover just under four-fifths, 163 locations about two-thirds and the most important 15 locations already one quarter of metropolitan functions.

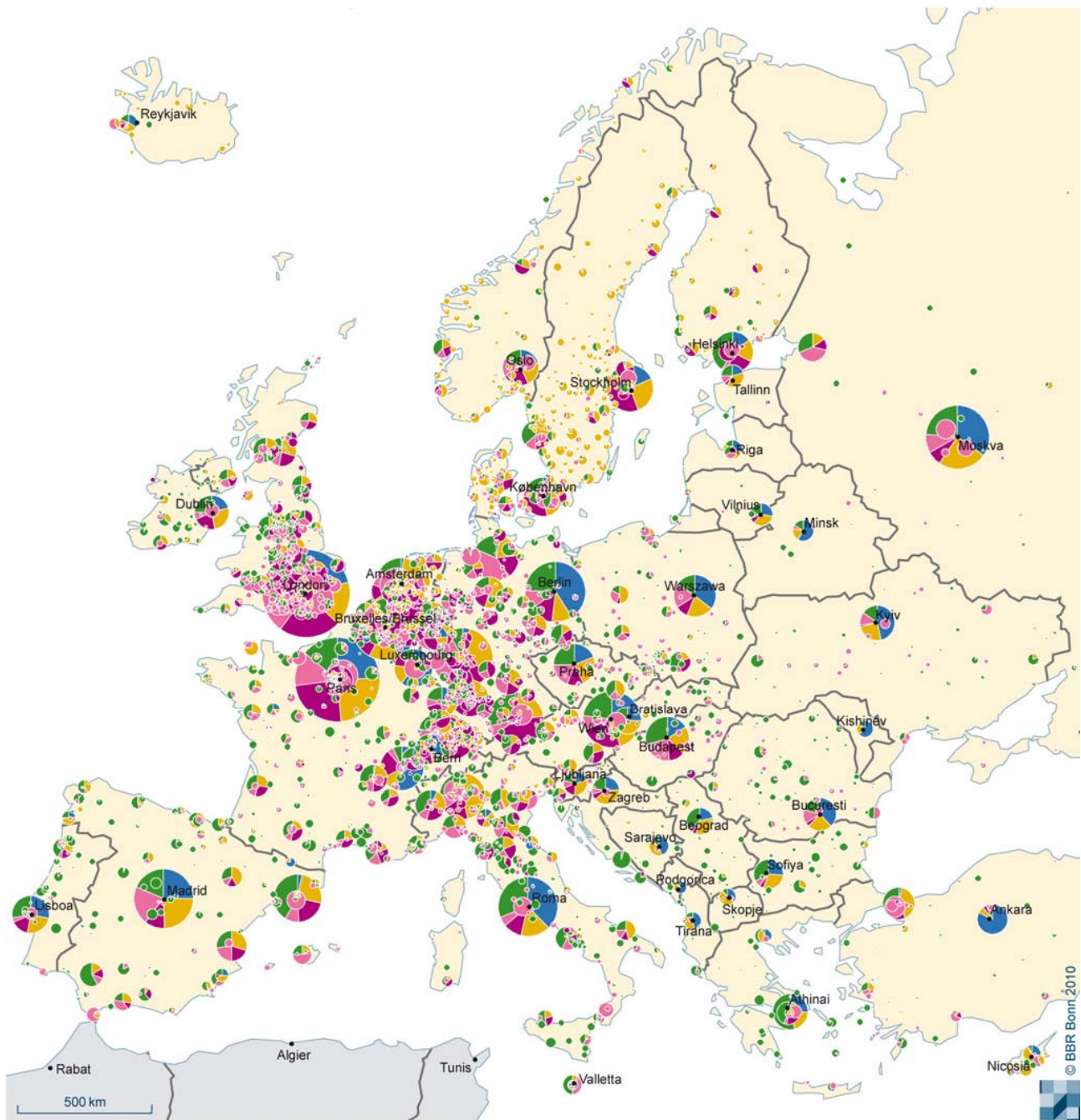
Number and role of metropolitan locations

The 38 indicators covered by the metropolitan functions politics, economy, science, transport and culture can be found in 8,480 locations in Europe. They were measured on the level of municipalities and LAU 2 units (Local Administrative Units forming the basis of the European NUTS regions). Among the altogether 120,000 LAU 2 units in Europe, 7% show metropolitan functions. A look at the aggregate index, combining all single indicators into an index of metropolitan functions, reveals that the majority of these 8,480 locations have very low values. Only 480 achieved an index of metropolitan functions of at least one point while altogether representing already 78% of all metropolitan functions in Europe. Measured by the standardised maximum of 100 points, held by London, this one point already represents a very low marginal value.

If the maximum limit is increased to three aggregate index points and more, which corresponds to a marginal value of a standard deviation above the average, only 184 locations are left over, which, however, together already cover 63% of all metropolitan functions. When setting the minimum limit at 25 points, the number decreases to only 15 locations covering just under a quarter of all European metropolitan functions. These 15 locations comprise all large European capitals – lead by London in front of Paris and followed by Brussels, Moscow, Berlin, Rome, Madrid, Vienna, Amsterdam and finally Stockholm. In between, this ranking is completed by Frankfurt/Main, Munich, Barcelona, Milan and Hamburg as important financial and business locations without any national government function (Fig. 40).

As expected, the 15 most important metropolitan locations in Europe mainly include capitals. The following basic patterns can be observed: The higher the index of metropolitan functions, that means the metropolitan significance of a location, the more functional areas are represented in a location and the more equally they are distributed there. In other words: Locations with a low index value of metropolitan functions tend to have only a few but at least one dominating metropolitan function while locations with higher values cover several or all functions, that means they are multi- or even omni-functional.

Figure 40:
Spatial distribution of metropolitan functions in Europe



Index value

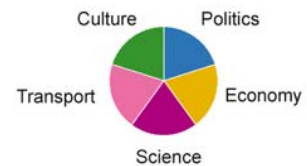
(standardised, maximum = 100)



Significant locations

London	100.0
Paris	93.7
Bruxelles	53.9
Moskva	52.0
Frankfurt am Main	47.2
Berlin	46.8
Roma	45.8
Madrid	45.6
Wien	42.8
München	40.4

Shares according to functional areas



Database: own BBSR survey
Geometrical basis: GfK GeoMarketing, BBSR LAU 2

The fact that especially capitals count among the most important metropolitan locations is mainly a result from the functional area "politics" whose indicators strongly focus on them. Owing to important functions in the field of supranational or international policies, Geneva, Strasbourg and Bonn as seats of UN or EU institutions also have high values in this functional area. There are altogether only 92 locations in Europe for which a political metropolitan function can be identified.

In terms of metropolitan functions, major airport locations close to large agglomeration centres constitute a peculiarity. If they are not part of the urban area and thus of the same LAU 2 unit but are situated in adjacent administrative units, the related metropolitan function is spatially separated. As a result, only low values in the functional area "transport" are achieved, on the one hand. Examples are Moscow, Luxembourg, Stockholm, Munich, Barcelona, Helsinki, Istanbul, Athens und Rome. On the other hand, airport locations in the surrounding area of these large cities have a high, often monofunctional significance within the functional area "transport". Only a regionalised analysis on the level of metropolitan areas takes these divided metropolitan functions within small territorial units into account and produces a useful picture of all metropolitan functions available. This important step will be described in Chapter 5.

Another regional peculiarity of the economic indicator "advanced producer services" also results in mostly monofunctional and decentralised locations. In some Scandinavian countries for example, especially Sweden, such high-value service providers have their locations or subsidiaries outside the largest cities as well thus shaping the picture within the functional area "economy".

Spatial distribution of metropolitan functions

The metropolitan function "science" has the largest distribution with over 6,600 locations. The functional area "culture" as well is very widely spread with around 3,000 locations. The majority of the smaller locations only scores through these two functional areas. The two functional areas "economy" and "transport", which can be found in around 1,000 to 1,100 locations, take a medium position.

Important locations, however, are characterised by multi- or even omnifunctionality. All in all, values for all five metropolitan functions can be found in only 67 locations. Another 277 locations cover at least four functional areas and another 386 locations cover three functional areas. The majority of metropolitan locations, altogether more than 6,700, is monofunctional though.

In most small and medium-sized Eastern European countries the majority of metropolitan functions is concentrated in capital cities. Significant examples are Moldova with its capital Chişinău , Estonia with Tallinn, Albania with Tirana, Lithuania with Vilnius, Belarus with Minsk, Latvia with Riga and Slovenia with Ljubljana. In these countries more than two-thirds of their metropolitan functions are often concentrated in their capitals. Some larger

countries as well, mostly also situated in Eastern Europe, show concentration tendencies: Hungary with Budapest, Russia with Moscow, Slovakia with Bratislava, Serbia with Belgrade, Croatia with Zagreb, Bulgaria with Sofia, Ukraine with Kiev. In Austria, more than half of the national metropolitan functions are concentrated in the capital Vienna.

Country ranking of metropolitan functions and locations

Turning the eyes away from single locations to countries produces the following picture: With about 16% Germany has the largest share in all metropolitan functions in Europe followed by the United Kingdom with just under 12%, France with 10%, Italy with about 8% and Spain with nearly 6%. These five countries thus cover more than half of the metropolitan functions in Europe. When putting the metropolitan functions into relation to the population of each country, some medium-sized countries show the highest densities. In Europe, 1 million inhabitants on average receive 4 index points. In Luxembourg, this density value increases to about 55 points per 1 million inhabitants so that this country takes a leading position. Switzerland (17 index points/1 million inh.), Sweden (14), Belgium (12), Norway (12), Denmark (10), Austria (10) and the Netherlands (10) also reveal above-average densities. With around 6 points, Germany and the United Kingdom are only slightly above the average though. Compared to that, most Eastern European countries only have average or even below-average functional density values. Only Estonia (5.6), Slovenia (5.5), the Czech Republic (4.5) and Croatia (4.3) reach values being slightly above the European average.

Metropolitan functions and locations concentrating on the European core area?

As shown in the spatial distribution of metropolitan functions in Figure 40 and as already mentioned in connection with the various metropolitan functions, they are strongly concentrated in the Central European core area. Around half of all locations with metropolitan functions, which also cover about 50% of all metropolitan functions, are situated within the European Pentagon formed by London, Hamburg, Munich, Milan and Paris. Outside the Pentagon, there is not only a much lower density of such locations but can significant locations also be found very occasionally .

Within the Pentagon and a little beyond though, there is a very decentralised spread of metropolitan functions. This especially applies to Germany, Switzerland, the Netherlands and Italy where the most significant location in each country only covers up to 20% of the metropolitan functions of the related country.

5 Metropolitan areas – spatial concentration of significant metropolitan functions

Where and how do locations with metropolitan functions form metropolitan clusters within the European area? A new GIS-based approach of regionalisation merges various locations of metropolitan functions and produces comparable metropolitan areas in Europe.

The results so far have provided details about the locations of metropolitan functions in Europe but not yet about metropolitan areas in which metropolitan functions are concentrated. However, attention must be paid to them as a purely location-specific analysis is not informative enough.

Classical monocentric and solitary metropolises such as Warsaw, Budapest, Prague, Ankara and Sofia are very rare and often owe these features to the administrative structures in their countries or to special spatial and settlement structure-related trends. Even in the surrounding areas of Paris, Madrid and Rome a variety of other locations of metropolitan functions can be found apart from the polycentric structures of other larger agglomerations in Europe. Airports close to large cities with their metropolitan character and population concentration, which functionally belong to these cities, have to be taken into account as well. Accordingly, metropolitan functions have to be analysed within a regional context.

The question therefore arises where and how locations with metropolitan functions are concentrated in Europe and form metropolitan clusters – metropolitan areas. It is answered in two steps: Based on the spatial density of *metropolitan functions*, significant concentrations of metropolitan functions were first of all identified which virtually form the cores of metropolitan areas. The *metropolitan areas were then exactly defined* by means of an accessibility model developed in the BBSR.

This procedure requires a strictly analytical method of regionalisation which is independent of the administrative form and size of areas in the various European countries and of their spatial and settlement structure-related features as well. This is how cities and regions all over Europe can be adequately compared in terms of their metropolitanisation.

Regionalisation method

Geographical/analytical basis

The regionalised definition of the density of metropolitan functions and the definition of metropolitan areas is based on the small LAU 2 units, which have already served as a basis to collect the metropolitan functions of the whole study area. The regionalisation started from the 8,480 locations of metropolitan functions identified, each location being part of a LAU (Local Administrative Unit) 2 urban unit. Similar as all approx. 120,000 LAU

2 units in Europe, representing the municipal level forming the basis of the NUTS hierarchy, they are geocoded via their geometric centres through a geographical information system (GIS). This approach of regionalising via the LAU 2 level is largely independent of any administrative borders, they do at least not have any impact owing to the very low territorial reference basis. Comparisons on a Europe-wide level are also possible. Compared to that, the advantage of aggregations based on administrative units – in Europe for example based on the NUTS 3 level – would be that they consider and distinguish political responsibilities and could be directly linked to other regional statistical data – for example of Eurostat. A disadvantage would be that the forms and sizes of these NUTS areas, which are nationwide very different, would have a strong effect on the results⁵⁸ and would also limit their Europe-wide comparability considerably. Cross-border structures and interrelations would also be neglected.

Regionalising in three steps:

Step 1: defining spatial densities of metropolitan functions

Step 2: merging significant locations of metropolitan functions

Step 3: defining metropolitan areas by means of the BBSR Accessibility Model

5.1 Density of metropolitan functions

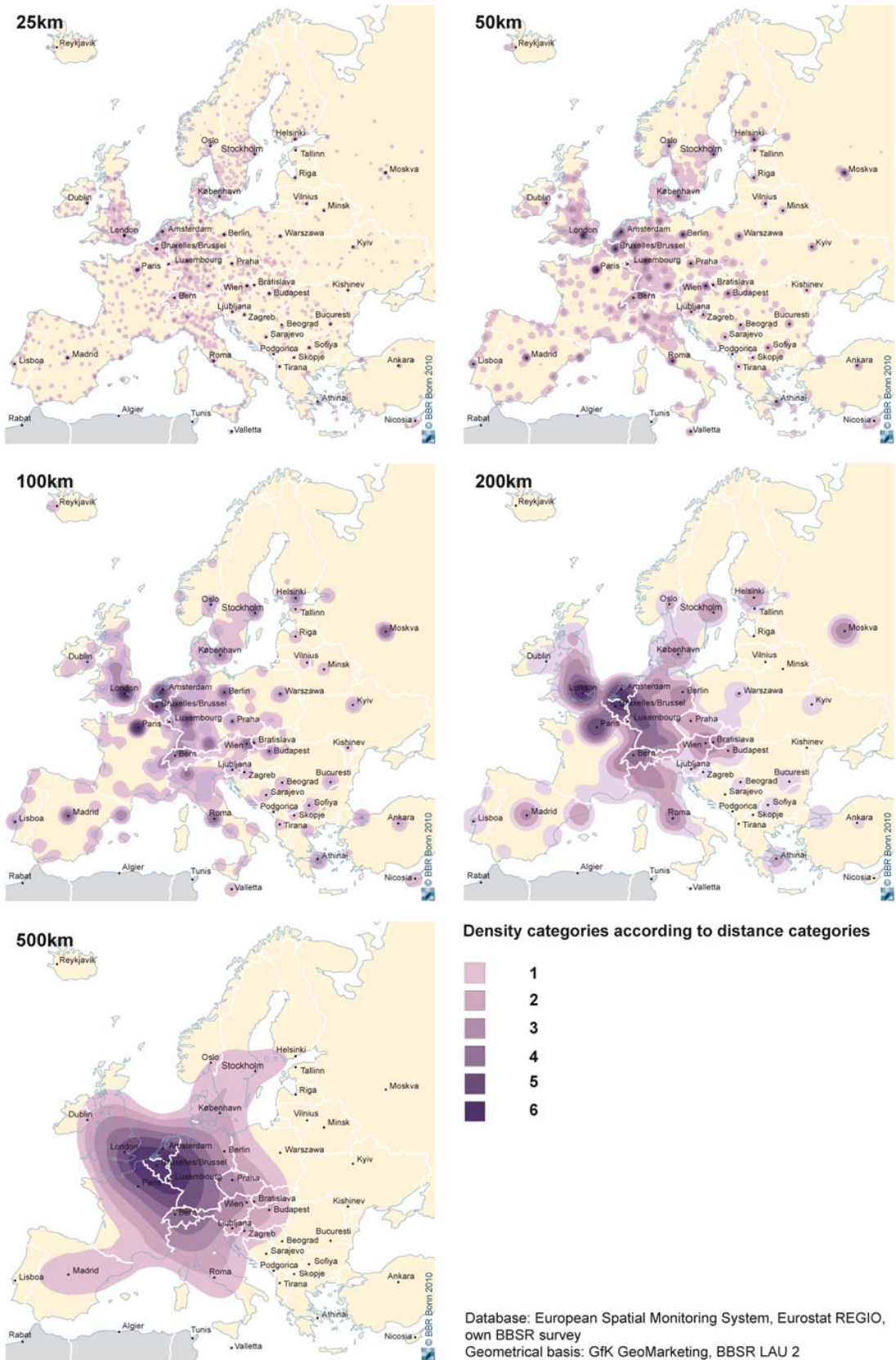
Defining metropolitan areas in Europe must be preceded by defining spatial densities of metropolitan functions. This is why in a first step of regionalisation, the location-related values of the index of metropolitan functions, gained from the overall analysis of metropolitan functions (see Chapter 4.6), were classified in density categories of metropolitan functions.

Regionalisation by means of GIS involves raster data produced from point data that are independent of any administrative borders and that are based on a gravitation approach including distance-weighted density values. A result of the gravitation approach, which is based on a quadratic kernel function, is that the density value calculated for each point within the study area is influenced by the index values of all locations in its surrounding area. In this context, distance-weighting means that index values of nearby locations influence the density value of a point more intensively. The further away they are from a point, the less are they included in the calculated density value of this point.

What is important is the search radius. It indicates the size of the area within which a location with metropolitan functions influences the density calculated. There are no special related provisions, what is important is the subject of research. In this study, a search radius of 50km was used to find a compromise between good regional generalisation and adequate differentiation on a large area. This marginal value is for example used in the law on regionalising public passenger transport to distinguish between local and large-distance passenger transport. Using the 50km margin implies that mutual relations and dependencies of locations with metropolitan functions range within this radius of about one

hour of car travel time. Measuring on a large area produces a sufficiently differentiated picture.

Figure 41:
Densities of metropolitan functions with various search radii



Several search radiuses were, of course, tested, concretely radiuses of 25, 50, 100, 200 and even 500km (Fig. 41). By nature, the differences between centre and periphery become blurred with increasing radius. This becomes especially apparent when comparing the 25km search radius, representing an intraregional dimension, and the 500km radius, taking continental dimensions. The 100 and 200km search radiuses underline the concentration of metropolitan functions being important on a larger area.

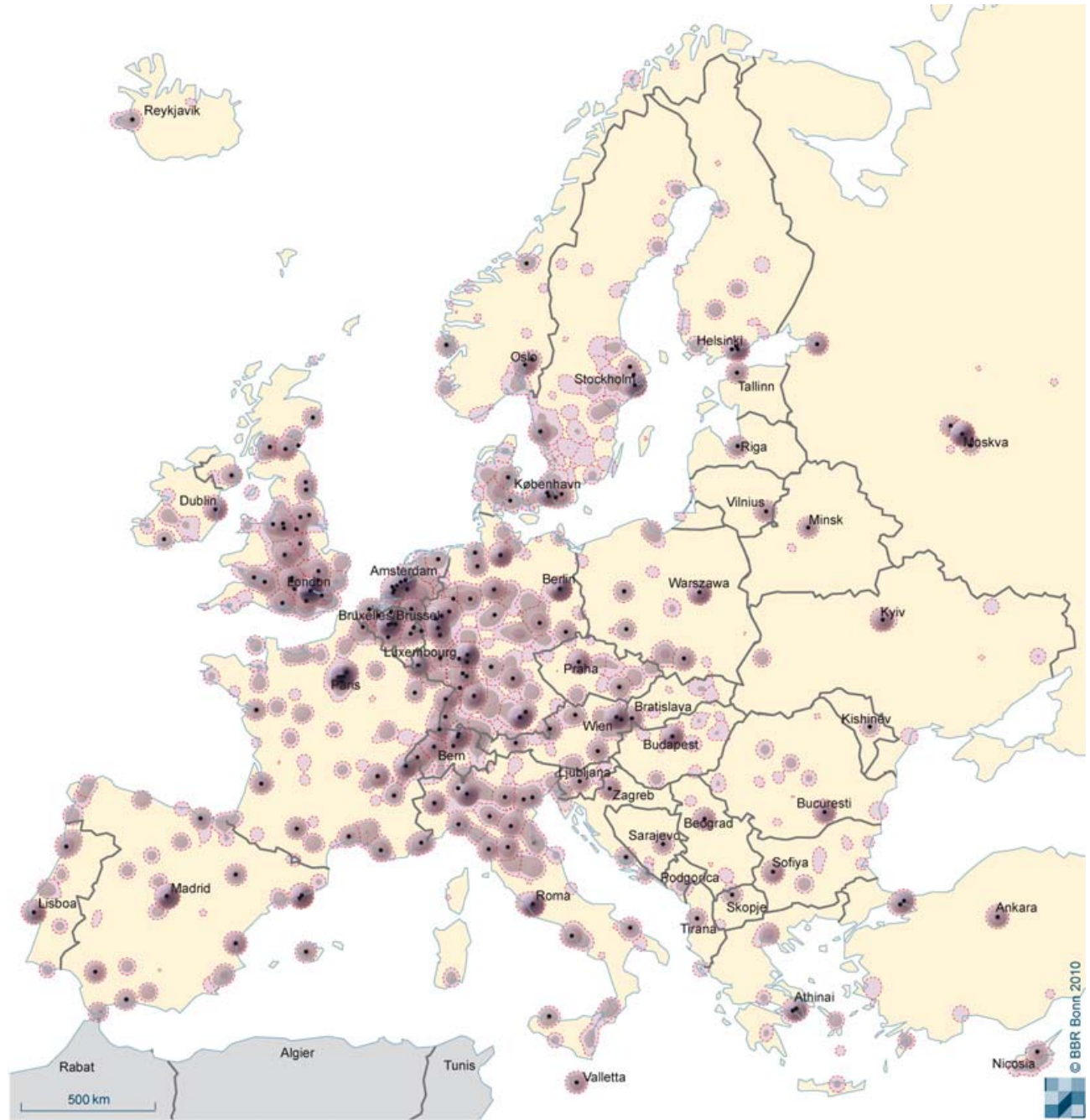
Regionalisation Step 1: areas with a high density of metropolitan functions

Figure 42 gives an overview of the spatial concentration of metropolitan functions and serves as a basis for regionalisation later on. It shows altogether 248 spatial segments representing regional concentrations of metropolitan functions but not metropolitan areas. Central Europe, i.e. the European Pentagon, is prominently depicted as nearly coherent “mountainous region” with generally high densities because many locations with high index values are situated close to each other.

The highest density level, however, is only reached by the areas around London and Paris while the second highest level can be found more frequently: in and around Brussels, Amsterdam (Randstad), Frankfurt (Rhine-Main), Berlin, Munich, Moscow, Rome, Madrid and Rhine-Ruhr. Areas with a medium density level do not only occur as solitary peaks within the “range of densities”, they often appear as large coherent areas with a polycentric structure. They might for example occur as a national bipole, as in the case of the cities of Glasgow and Edinburgh, i.e. Central Scotland, or as a cross-border bipole, as in the case of Vienna-Bratislava. Large polycentric megalopolises with a variety of centres do also exist, e.g. in Northern Italy. In addition, there are many dispersed areas with low density categories partly spreading to the European periphery.

In some countries, concentrations of metropolitan functions can completely or nearly be spread all over the national territory. Having a look at the areal share of such concentrations, it is 99% of the area of small and island countries but also of the Netherlands. In Luxembourg, Switzerland and Belgium it is about 90% and in Germany and Denmark approx. 70%. In France, the metropolitan functions are mainly concentrated to Paris, concentrations can only be found in one third of the national area. The situation is more balanced in the United Kingdom: While London reaches the highest density of metropolitan functions just like Paris, half of the British territory also achieves such high values.

Figure 42
Density categories of metropolitan functions



Density categories of metropolitan functions
 1 2 3 4 5 6

• significant locations of metropolitan functions

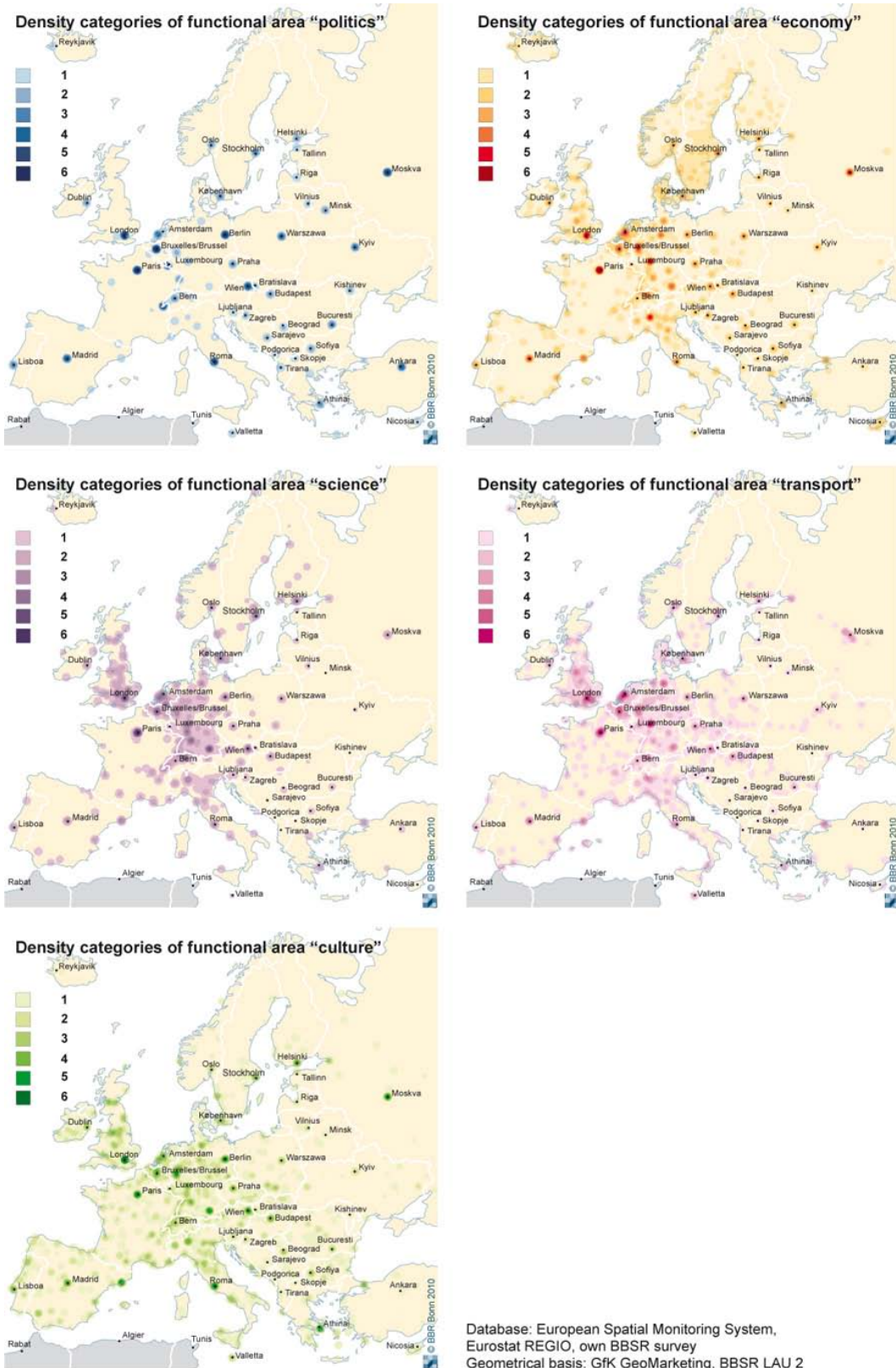
○ spatial segments

Database: own BBSR survey
 Geometrical basis: GfK GeoMarketing,
 BBSR LAU 2

Density values of functional areas

The distribution of densities in each functional area is very different (Fig. 43).

Figure 43:
Density of metropolitan functions according to functional areas



Owing to the small number of locations, the functional area "politics" by nature is the most concentrated. Although compared to that, economic functions are concentrated in a larger number of subareas, they are more concentrated to the Central European core area. Due to the high spreading of locations within the urban system, the other functional areas appear as large density zones.

Calculating the density of metropolitan functions

The result maps only include those areas showing a minimum density of metropolitan functions. This is to highlight the spatial concentration of metropolitan functions. The areas are defined based on a standard minimum value of 0.00025 aggregate index points per km² and cover 15% of the study area. This serves to produce a "range of densities" classified into six density categories which correspond to heights. Classifying the density categories is done according to the Natural Breaks Classification method minimising the differences within a category and maximising those between categories.

5.2 Defining metropolitan areas in Europe

125 metropolitan areas are created around the 184 important locations of metropolitan functions in Europe.

The 248 spatial segments of the "range of densities" are not yet metropolitan areas, they bring adjacent locations of metropolitan functions together. This means that locations sharing metropolitan functions within small territorial units, e.g. airports in the surrounding area of cities, are merged. These segments provide the basis for merging significant locations of metropolitan functions (Regionalisation Step 2), from which metropolitan areas will then be created (Regionalisation Step 3).

Regionalisation Step 2: significant locations of metropolitan functions

In order to define metropolitan areas with the Accessibility Model, their cores, i.e. significant locations of metropolitan functions, have to be defined. In this study, it is all locations with an aggregate index of at least three points. This value was used because it is a standard deviation above the average.

All in all, there are 184 important locations of metropolitan functions spread across all European countries except for Andorra, Liechtenstein, Monaco, San Marino and Montenegro. They together represent around 63% of all metropolitan functions measured.

Figure 42 shows that all 184 cores belong to one spatial segment. The number of cores per spatial segment indicates monocentric or polycentric structures of metropolitan areas even if they do not depict the whole urban system and involve specialised centres such as airports beyond the urban system. Spatial segments without any core were not considered when defining metropolitan areas.

In 90 cases, several important locations of metropolitan functions within a spatial segment indicate a polycentric metropolitan area: In the case of Randstad, it is seven important locations, in the case of Brussels, London, Paris and Rhine-Ruhr it is five each and within the Copenhagen/Malmö segment it is four locations. In the case of Helsinki, Maas-Rhine, Manchester-Liverpool, Moscow, Rhine-Main, Rhine-Neckar, Stockholm, Vienna-Bratislava and Zurich it is three of such locations. The spatial segments Athens, Barcelona, Basel, Bremen, Cardiff-Bristol, Gent, Istanbul, Leeds, Luxembourg, Milan, Munich, Newcastle, Oslo, Oxford, Rome and Venice-Padua cover pairs of significant locations of metropolitan functions. All other 94 spatial segments only cover one dominating location of metropolitan functions and indicate a monocentric metropolitan area.

Regionalisation Step 3: metropolitan areas in Europe

The metropolitan areas in Europe were defined with the BBSR Accessibility Model. To define them, a car travel time isochrone of 60 minutes was drawn around the cores involved. In case that the catchment areas of two cores from different spatial segments overlap, a surrounding area is assigned to the nearest core. In merging significant locations in polycentric spatial segments, the number of metropolitan areas is reduced from 184 to 125.

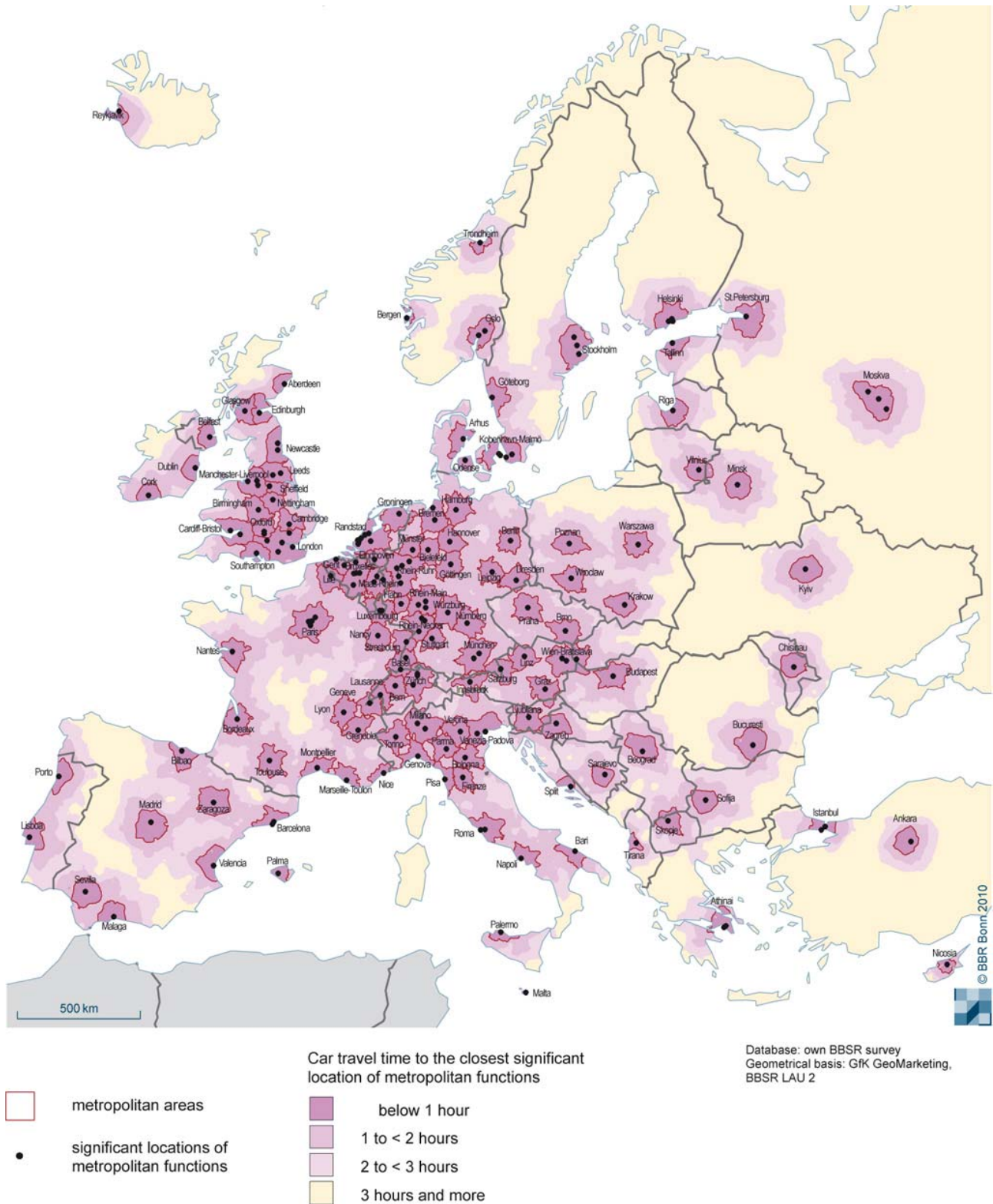
The method produces metropolitan areas of about the same size which, in terms of area and accessibility of their cores, are comparable (Fig. 44). Exceptions arise if cores – as in the case of Malta or Palma de Mallorca – are situated on an island or border on other metropolitan areas and if their catchment areas are limited in this way.

Metropolitan areas have an average area of about 8,350 km². With around 250 km², the island country Malta is the smallest European metropolitan area, London the largest with 19,000 km². The 125 metropolitan areas altogether cover an area of around 1 million km², which is about 10% of the total European area.

Areas close to metropolitan area cores

Apart from metropolitan areas, the 2-hour isochrone served to define so-called areas close to metropolitan area cores which includes that some functions of metropolitan area cores may also have an impact beyond these areas. It comes to light that Central Europe – i.e. Germany, Denmark, Belgium, Netherlands, Luxembourg, Switzerland, Austria, Slovenia and the Czech Republic – but also western France, Northern Italy and England are nearly completely covered by metropolitan areas or by their closeness to metropolitan area cores (also cf. Fig. 44).

Figure 44:
Metropolitan areas and significant locations of metropolitan functions (cores)



Areas far away from metropolitan area cores

The 3-hour isochrone – also standing for the car travel time – finally served to depict so-called off-peak connections by which a journey to and departure from the nearest metropolitan area core is possible on the same day (also see Fig. 44). This travel time margin was used to depict areas far away from metropolitan area cores. Such areas can hardly be found in Western and South-Western Europe but they dominate in Northern Europe and large parts of Eastern and South-Eastern Europe. In Northern Europe they go largely along with very low population densities. In parts of Eastern Europe, however, there is a large discrepancy between the population potential, on the one hand, and developing areas with metropolitan functions, on the other hand.

5.3 Functions and characters of metropolitan areas

The metropolitan areas defined can be compared in terms of their significance.

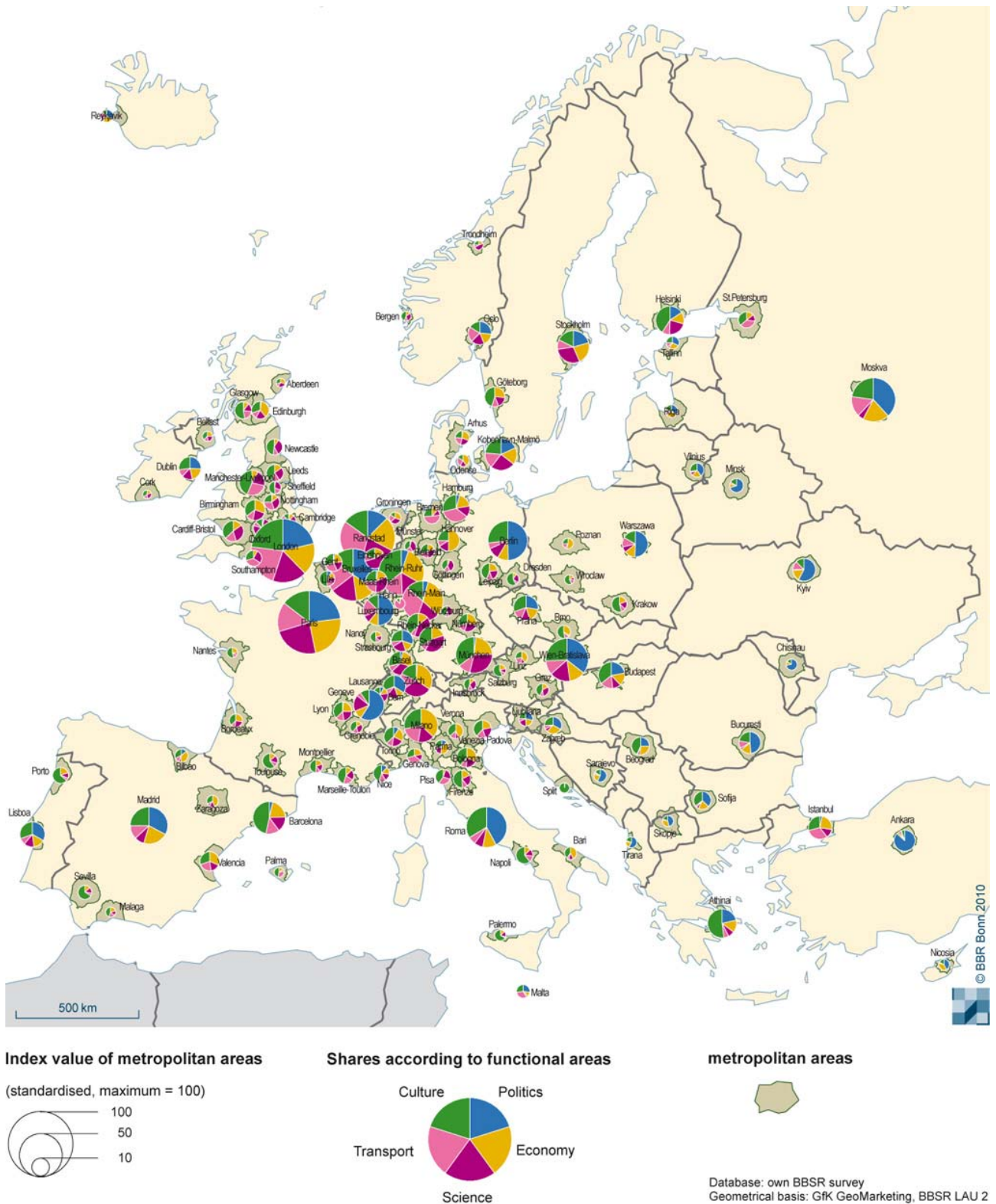
Although the 125 European metropolitan areas only cover about 10% of the European territory, 50% of the related population, 65% of the related GDP and 80% of metropolitan functions are concentrated there. But there are considerable disparities between these areas in terms of their metropolitan significance, functional diversity and orientation as well as their population and economic performance.⁵⁹

Metropolitan functions of metropolitan areas

Metropolitan areas in Europe are of very different significance although these differences are not as large as among the locations of metropolitan functions, which are revealed by the aggregate index of metropolitan functions structured according to the shares of the five metropolitan functions (Fig. 45, also see Annex 2). Similar to the case of the locations, the metropolitan areas of London and Paris maintain a leading position in terms of metropolitan functions. They also have much higher values than the other metropolitan areas in terms of economic performance (cf. below). They are followed by Randstad, Brussels, Rhine-Ruhr, Moscow, Vienna-Bratislava, Rhine-Main, Rome und Berlin – just to mention the ten leading metropolitan areas. The significance of the polycentric metropolitan areas of Randstad, Rhine-Ruhr, Rhine-Main and Vienna-Bratislava in this group is only revealed by regionalisation and again shows the necessity of a regional analysis.

The metropolitan areas are clearly concentrated in the Central European core area, the European Pentagon. Within the Pentagon, they often border on each other, some even extend across national borders so that they bear a large number of metropolitan functions. Compared to that, the Eastern European countries as well as Greece and Turkey just have a few other metropolitan areas in addition to their capital city regions.

Figure 45:
Metropolitan functions in metropolitan areas



Aggregating metropolitan functions in metropolitan areas

The metropolitan functions in metropolitan areas were compared in the same way as when aggregating the functions on the locational level. In all three aggregating steps, based on indicators, indicator groups and functional areas, the range of values were first of all standardised to their maximum value, added up and divided by the number of indicators or indicator groups. After having merged the five functional areas, London reaches the maximum value with an aggregate index of 86.9 points, Cork the minimum value with 1.6 points. Finally, all aggregate index values of the 125 metropolitan areas were standardised, London reaching a maximum aggregate index value of 100.

They also have a less comprehensive variety of metropolitan functions. In the capital metropolitan areas of these countries, except for Moscow, the functional area "politics" is dominant while the other functional areas have low values. This becomes especially apparent in the case of Turkey and Ankara where politics dominates while the second centre Istanbul mainly covers the remaining functional areas.

What is also important is the composition of the aggregate index regarding the metropolitan functions – politics, economy, science, transport and culture. Although this composition differs between the metropolitan areas, the following basic tendency can be observed: Most of the important metropolitan areas with a high aggregate index value have a rather balanced variety of metropolitan functions. An exception is Berlin where the governmental function dominates. Metropolitan areas with low aggregate index values, however, often show a stronger specialisation but some of these areas also have a balanced variety of functions.

In terms of their metropolitan role and functional diversity, these differences between metropolitan areas become even more apparent when classifying them. In doing so, the relation between metropolitanisation and population potential will also play a role.

Population potential of metropolitan areas

350 million inhabitants live and work in the above-mentioned 125 metropolitan areas, which is about 50% of the population of the total study area. The average population of all 125 metropolitan areas is about 2.8 million inhabitants. This mean value, however, is not very informative as the populations in all metropolitan areas are very different. With approx. 15 million inhabitants each, London and Moscow have the largest population followed by Rhine-Ruhr with more than 13 millions and Istanbul and Paris with approx. 12 million inhabitants each. Reykjavík and Trondheim with only 230,000 inhabitants are those metropolitan areas with the smallest population.

The average population density of metropolitan areas is 350 inhabitants per km² although there are strong differences: With more than 4,900 inhabitants per km², Istanbul by far has the highest population density followed by Malta (just under 1,500 inhabitants/km²),

Barcelona and Moscow (about 1,000 inh./km²). Compared to that, the densities in 24 metropolitan areas are even under 150 inhabitants per km², the upper limit set by the OECD to define rural areas. Reykjavík with about 64 inhabitants per km² has the lowest density. The extreme differences in the population density are based on the consistent surface area of the metropolitan areas which does not take the regional settlement structure into account.

Economic potential of metropolitan areas

The economic potential of the whole European study area is also concentrated in the 125 metropolitan areas. Measured by the sum of the absolute gross domestic product (GDP) in 2005 – based on LAU 2 units – these areas with around 8,500 billion euros hold approx. 65% of the GDP of the study area. The economically most important metropolitan areas are London (609 billion euros), Paris (500 billion euros), Rhine-Ruhr (369 billion euros), Randstad (317 billion euros) and Milan (265 billion euros). Together they already represent 25% of the GDP of all 125 metropolitan areas. Compared to this, especially Eastern European metropolitan areas or areas with a smaller population just reach a fraction of it in absolute figures. 13 metropolitan areas for instance – which are Reykjavík, Hahn, Sofia, Vilnius, Tallinn, Nicosia, Minsk, Malta, Skopje, Tirana, Split, Sarajevo and Chişinău – just reach a GDP each of up to 10 billion euros.

5.4 Classifying European metropolitan areas

Metropolitan areas in Europe are not only very different in terms of their metropolitan functions, their population and economic performance. A main difference is the combination of metropolitan functions or their specialisation according to which various types of metropolitan areas in Europe can be defined.

Functional diversity of metropolitan areas

Not only the value of the aggregate index but also the variety of metropolitan functions and their ratio are important criteria to assess the significance of metropolitan areas. The question is therefore how diverse or balanced or specialised metropolitan areas are with regard to the five functional areas.

In this context, four types can be distinguished (see below):

(1) A metropolitan area has a great variety of functions if at least four of five functional areas have above-average index values. The classification is based on the average values of all 125 metropolitan areas in each functional area. (2) Metropolitan areas having above-average index values two or three functional areas, still have a considerable variety of functions but also reveal functional focuses. (3) Metropolitan areas with a limited variety of functions are those which have above-average index values in only one or no functional area. (4) There are also metropolitan areas with one specific functional area having a

share of more than 50% in the aggregate index. If this is the case, these are metropolitan areas with a limited variety of functions and a large degree of specialisation.

Although there is a basic relation between the level of the aggregate index and the variety of metropolitan functions, it becomes clear that significant metropolitan areas – according to the aggregate index – must not always offer the greatest variety of metropolitan functions. There are for example metropolitan areas whose significance changes if the metropolitan diversity is additionally taken into account:

- Type 1, for instance, includes those capital regions which, owing to their political function, have above-average index values but also have high index values in all other functional areas.
- Metropolitan areas, which have a rather high aggregate index, which is, however, only dominated by one or two functional areas, go downhill to Type 3. Typical examples are smaller and medium-sized capital cities in Europe with a strong significance because of their political function.
- Metropolitan areas with a considerable aggregate index but highly specialised on one dominant function slide down to Type 4. In the case of Ankara it might be the political function, in the case of Oxford the scientific one. It might also be the “transport” function, as in the case of Hahn, or “culture”, as in the case of Split. Ankara, for example, is important as national capital of Turkey while a variety of the other metropolitan functions are concentrated in Istanbul. Split is important as national cultural centre of Croatia although neither covering the capital function nor any other metropolitan function. Oxford is the British if not European university and scientific centre – but little significant in terms of other functional areas. The extreme specialisation of the German metropolitan area of Hahn in the Hunsrück Mountains on the “transport” function is based on Frankfurt-Hahn Airport. Hahn is, however, too far away from the Rhine-Main metropolitan area to be assigned to this area with the mentioned regionalisation method.

Types of metropolitan areas

Type 1: Metropolitan areas with a great variety of functions

Barcelona, Berlin, Brussels, Budapest, Hamburg, Helsinki, Copenhagen-Malmö, London, Madrid, Milan, Moscow, Munich, Paris, Prague, Randstad, Rhine-Main, Rhine-Ruhr, Rome, Stockholm, Vienna-Bratislava, Zurich

This group of the 21 largest and most significant metropolitan areas in Europe comprises large European capitals as well as some very densely populated agglomerations. The metropolitan areas within this group do not only have a very high functional significance and diversity, they have a high population potential and economic power (cf. Annex 2).

Type 2: Metropolitan areas with a considerable variety of functions

Athens, Basel, Bern, Birmingham, Bologna, Cardiff-Bristol, Dublin, Geneva, Gothenburg, Istanbul, Lisbon, Luxembourg, Maas-Rhine, Manchester-Liverpool, Oslo, Rhine-Neckar, Strasbourg, Stuttgart, Valencia

This group of 19 members also comprises larger metropolitan areas characterised by a high functional significance and having a high economic performance. The diversity of metropolitan functions, however, is not as high as in the first group. Some capitals of medium-sized European countries, for example, have an above-average functional significance but only cover two or three functional areas – one of them “politics”, the second one mostly “culture” – both being very strongly represented.

Type 3: Metropolitan areas with a limited variety of functions

Aberdeen, Aarhus, Bari, Belfast, Belgrade, Bergen, Bielefeld, Bilbao, Bordeaux, Bremen, Brno, Bucharest, Cork, Edinburgh, Eindhoven, Florence, Genoa, Gent, Glasgow, Göttingen, Graz, Grenoble, Groningen, Hanover, Innsbruck, Cracow, Lausanne, Ljubljana, Leeds, Leipzig, Lille, Linz, Lyon, Malaga, Malta, Marseille-Toulon, Montpellier, Münster, Nancy, Nantes, Newcastle, Nice, Nicosia, Nottingham, Nuremberg, Odense, Palma, Parma, Pisa, Poznań, Reykjavik, Riga, Sheffield, Skopje, Sofia, Southampton, Saint Petersburg, Tallinn, Turin, Trondheim, Venice-Padua, Verona, Vilnius, Warsaw, Würzburg, Zagreb, Zaragoza

Compared with Type 2, this group of 67 members includes medium-sized and smaller metropolitan areas whose significance is rather based on the value of the aggregate index of metropolitan functions than on their variety. National capitals are more rarely represented. If yes, they are of small and medium size and are mainly situated in Eastern Europe and island countries. The variety of metropolitan functions in this group is restricted and dominated by one functional area – mostly “culture”. This also applies to the capitals within this Type as this functional area is hardly represented there. Although the metropolitan areas in this Type have a basic metropolitan potential, the question is whether they are always of European importance. This would have to be checked in particular cases.

Type 4: Metropolitan areas with a limited variety of functions and large degree of specialisation

Ankara, Cambridge, Chişinău, Dresden, Hahn, Kiev, Minsk, Naples, Oxford, Palermo, Porto, Salzburg, Sarajevo, Seville, Split, Tirana, Toulouse, Wrocław

The 18 metropolitan areas in this group have a relatively low functional significance but are very highly specialised in one functional area, which is why they are no fully functioning European metropolitan areas but rather national exceptions.

Metropolitan areas with a surplus of importance of the population

Metropolitan areas can also be represented as agglomerations in which people, institutions and industries are concentrated. Many studies have highlighted this aspect of agglomeration. However, the BBSR index of metropolitan functions especially highlights the functional aspect, which also applies to the classification of metropolitan areas. In Chapter 5.3, the population potential and the economic power only served as additional features to characterise metropolitan areas.

Within the spatial structure, the population potential is then particularly expressed. Combining this criterion with the classification into types, that means comparing metropolitan areas and their functional importance with their population potential, leads to partly large discrepancies (also cf. map element “Metropolitan areas with a surplus of importance of the population” in Fig. 46):

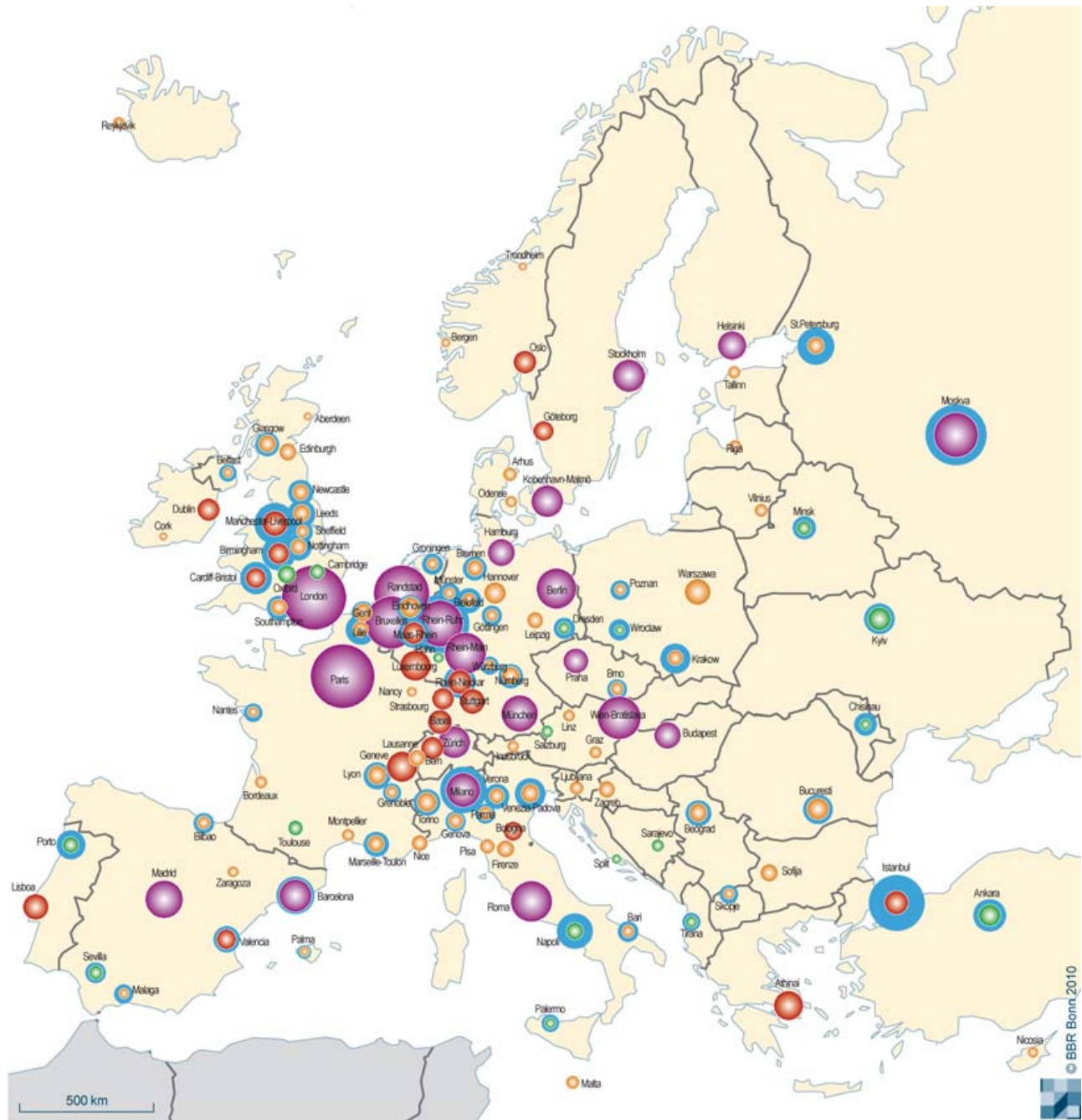
There are metropolitan areas with a – sometimes much – larger population potential than expected from the metropolitan functions measured. In other words: Compared with their population potential, the metropolitan importance is rather low. This applies to many peripheral, small and medium-sized metropolitan areas, but also to some old industrialised areas. A reason may be that these areas either have further development potentials or that their metropolitan importance is historically determined. A population with a large surplus of importance can be found in the metropolitan areas of Istanbul, Naples and Saint Petersburg as well as in many smaller metropolitan areas in Eastern Europe and in the United Kingdom.

Cross-border metropolitan areas





The metropolitan areas were identified and defined largely independently of administrative borders, i.e. of national borders as well. The 125 metropolitan areas, defined based on the Accessibility Model, therefore often go beyond national borders to a different extent or touch metropolitan areas in neighbouring countries. Here again it has to be stressed that these areas are defined based on analytical distances and not cross-border cooperation. Nevertheless, there is a very high probability for cross-border cooperation – also if metropolitan areas are located close together in a cross-border area.

Luxembourg together with four neighbouring countries is the metropolitan area with the most cross-border relations. Vienna-Bratislava, Maas-Rhine and Basel are trinational metropolitan areas. Other important cross-border metropolitan areas are Salzburg, Lille, Strasbourg, Geneva and Copenhagen-Malmö. The metropolitan areas of Graz, Brussels, Milan, Dresden, Gent, Zagreb, Vilnius, Skopje, Innsbruck and Nice to a partly larger or smaller degree also extend to neighbouring countries. Figure 47 shows this aspect for Central Europe. Owing to the many metropolitan areas, there can be found many cross-border relations.

Figure 46:
Types of metropolitan areas in Europe



Types of metropolitan areas

-  Type 1: metropolitan areas with a great variety of functions
-  Type 2: metropolitan areas with a considerable variety of functions
-  Type 3: metropolitan areas with a limited variety of functions
-  Type 4: metropolitan areas with a limited variety of functions and large degree of specialisation

Index value of metropolitan areas
(standardised, maximum = 100)

-  100
50
10
-  metropolitan areas with a surplus of importance of the population

Database: own BBSR survey
Geometrical basis: GfK GeoMarketing,
BBSR LAU 2

German metropolitan areas in Europe

Among the 125 metropolitan areas studied in the total European area, 17 are located in Germany. The German side is furthermore to a different extent involved in some cross-border metropolitan areas – in Maas-Rhine, Basel, Luxembourg, Strasbourg, Zurich, Salzburg and Groningen. Aachen and Freiburg especially play a significant role as they have a large share in the importance of the metropolitan areas of Maas-Rhine and Basel. In the case of the other five cross-border metropolitan areas, the German regions strongly benefit from functions abroad. All in all, Germany has the most metropolitan areas in Europe and is also represented in all four types of metropolitan areas: with five areas in Type 1, with two in Type 2, with eight in Type 3 and with two areas in Type 4. Four of the cross-border metropolitan areas belong to Type 2 and one each to the other three Types.

This is an expression of the polycentric structure of the German urban system and of a missing core dominating all other centres in Germany. Even the capital of Berlin does not have this outstanding significance although in the functional area "politics" only the national government function and, for methodical reasons, i.e. especially owing to the lack of comparability beyond Europe, not the regional governmental function as well was measured (cf. Chapter 4.1.1). The federal country structure in Germany thus has not yet been adequately considered in the index of metropolitan functions but is compensated by strengths in other functional areas in German metropolitan areas. Berlin metropolitan area, for example, is represented in Type 1, i.e. the most important metropolitan areas with a great variety of functions, on the same level as the metropolitan areas of Rhine-Ruhr, Rhine-Main, Munich and Hamburg although Berlin shows high values in the functional area "politics" while the other cities have low values.

Two other German metropolitan areas belong to Type 2, the group of metropolitan areas with a considerable but not great variety of functions: Rhine-Neckar and Stuttgart. These areas do not have any values for the function (national) "politics" and there is only a low value for "transport". They focus on the functions "science", "economy" and "culture". Nevertheless, they are considered as strong metropolitan areas. With Luxembourg, Basel, Maas-Rhine and Strasbourg, Type 2 furthermore includes four cross-border metropolitan areas involving Germany. Important metropolitan locations are, however, mostly situated abroad. As already mentioned, Aachen nonetheless has a quite considerable share in the Maas-Rhine metropolitan area and Freiburg in the Basel metropolitan area. In these cross-border metropolitan areas, intensive cross-border cooperations have traditionally existed.

The group of smaller and medium-sized metropolitan areas with a limited variety of functions, i.e. Type 3, includes the metropolitan areas of Bremen, Hanover, Göttingen, Leipzig, Nuremberg, Würzburg, Münster and Bielefeld. These metropolitan areas do not have the potential to bear comparison with the more important metropolitan areas of the first two Types. All functional areas are represented – except for the "politics" function – but generally do not reach the European average anymore. The European average is reached or even outperformed in only one functional area. Examples are the metropolitan

areas of Nuremberg, Hanover and Leipzig with the functional area “economy”, Würzburg, Göttingen and Münster with the functional area “science” and Bremen with the functional area “culture”. Due to the large surface area of the politically defined metropolitan regions established in Germany, these metropolitan areas are only subregions like Leipzig within the Halle/Leipzig Saxon Triangle metropolitan region, Hanover and Göttingen within the Hanover-Braunschweig-Göttingen-Wolfsburg metropolitan region and Nuremberg and Würzburg within the Nuremberg metropolitan region. Combining each potential of these areas into an overall region, of course, would increase their significance and also functional diversity. Metropolitan areas within this group, which have so far not been established in Germany as metropolitan regions, are Münster and Bielefeld.

Type 4, metropolitan areas with a limited variety of functions and large degree of specialisation, includes the two metropolitan areas of Dresden and Hahn. Dresden with its high specialisation on the “culture” function and Hahn with its specialisation on the “transport” function owing to their large distances to adjacent areas represent separate metropolitan areas and are only of low metropolitan importance in the European context. Dresden is fully integrated in the German Halle/Leipzig Saxon Triangle metropolitan region so that the question of independence does not arise and therefore the potentials of the metropolitan areas of Leipzig and Dresden can be together analysed. If this metropolitan region was extended to Thuringia, other significant potentials, especially in the areas of science, culture and transport, could be added. Compared to that, Hahn metropolitan area, which only appears as a metropolitan area owing to the rather large importance of Frankfurt-Hahn Airport, is by no means an independent metropolitan area but rather a geographical exclave of Frankfurt metropolitan region.

All established German, politically defined metropolitan regions are thus covered by either one or several of the analytically defined European metropolitan areas even if their shapes are not completely identical (see Fig. 47). In addition, Bielefeld and Münster – perhaps both together or by including Dutch border area potentials – definitely have the potential to play an important role among the 125 significant metropolitan areas in Europe.

6 Conclusions for the German and European spatial development policy

The results of this study provide information on the links between metropolitan locations and within metropolitan regions but especially a new database on metropolitan functions in Europe and on the monitoring of metropolitan regions on which concepts and strategies of spatial development in Germany and Europe may be based.

Adjusting the German concept of metropolitan regions

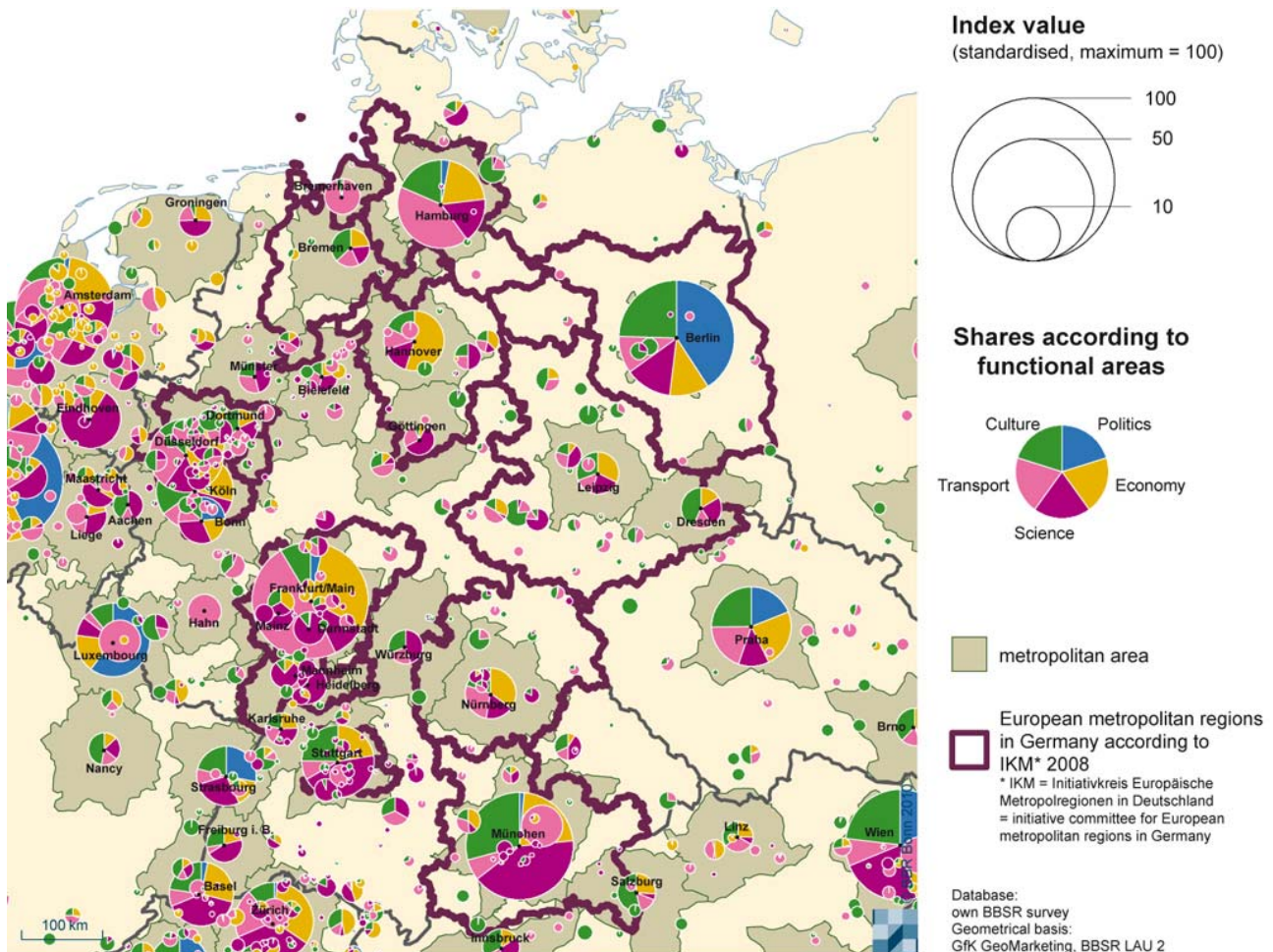
Comparing German metropolitan regions with other European regions has so far not been possible because both a consistent territorial reference basis and a standardised set of indicators were missing. The method developed in the study and the Europe-wide indicators defined now enable to directly compare the consistently defined metropolitan areas without the result being distorted by national peculiarities. When comparing the analytical metropolitan areas with the politically defined metropolitan regions, however, their different geographical shapes must be taken into account.

Comparing metropolitan areas in Europe on an analytical basis enables to classify politically defined metropolitan regions in Germany based on their significance and oriented towards European criteria. The eleven metropolitan regions, so far acknowledged by the German Standing Conference of Ministers responsible for Spatial Planning without drawing any distinctions between them, may thus gain various statuses within the German spatial development policy. Similar as for the central places system in Germany, a hierarchical concept of metropolitan regions can be developed by assigning various functions to metropolitan regions within a European and national context. In addition, indications for new potential cooperations to create metropolitan regions (example: Münster-Bielefeld) and for useful spatial mergers (examples: Frankfurt-Hahn or Nuremberg-Würzburg) as well as evidence of existing cooperations (examples: Dresden-Central Germany or Hanover-Göttingen) can be found. Cross-border relations of German regions in the west (Maas-Rhine including Aachen, Saar-Lor-Lux) and south-west (Upper Rhine, Lake Constance), to which Innsbruck and Salzburg in the south-east might, if necessary, be added, also prove true. Although the metropolitan cores of these regions are mainly situated abroad, incorporating these cross-border metropolitan areas into an advanced concept of metropolitan regions for Germany should be taken into consideration. The related municipal database would finally also enable to analyse those cities not counting among the 125 metropolitan areas regarding metropolitan functions (cf. Fig. 47).

In the "Initiativkreis Europäische Metropolregionen in Deutschland (IKM)" (initiative committee for European metropolitan regions in Germany) the eleven German metropolitan regions work together and among other things coordinate their policy with the Federal Government and the federal states as well as the EU. The BBSR supports the initiative especially with supraregional information and data by providing spatial and urban

development data from its spatial monitoring system for the jointly developed monitoring system of metropolitan regions. It was initiated in 2006 and has since then been updated every two years. The coordinate-based information on the spatial distribution of metropolitan functions on hand may also be aggregated for the areas of the German metropolitan regions so that the metropolitan regions within Germany can be compared. This is to be considered when updating the monitoring in 2010.

Figure 47:
Metropolitan functions in Germany



Based on our detailed data, it will also be possible to gain information about useful networking opportunities of locations of specific functions within metropolitan regions. In view of the rather large size of German metropolitan regions, it is especially important to involve functions outside cores. Networking metropolitan potentials of equal or different functional areas is an important element of strategies to support the role and competitiveness of German metropolitan regions in Europe. The demonstration project “Supraregional partnerships”, funded under the “Demonstration Projects of Spatial Planning” programme of the German Government, deals with exactly this approach. In the project it is analysed in six German metropolitan regions and four catchment areas of cross-border regions how potentials of various subregions may be interconnected within the large study areas and used for the joint regional development.

Updating the concepts for spatial development

The “Concepts and Strategies for Spatial Development in Germany”, adopted by the German Standing Conference of Ministers responsible for Spatial Planning in 2006, include an idealized general metropolitan area concept within the “Growth and Innovation” concept which is based on the eleven acknowledged metropolitan regions. This concept is to be updated and advanced which was the subject of a request from the 36th Standing Conference of Ministers Responsible for Spatial Planning to the BBSR.

The “Growth and Innovation” concept is based on an analytical definition of metropolitan cores and of their suburban metropolitan regions as well as their catchment areas, which are not identical to the politically defined metropolitan regions. This analytical definition could be updated with the data and differentiations described in this report taking the political reality into account.

In accordance with the classification of European metropolitan areas, the updated “Growth and Innovation” concept should distinguish several categories of metropolitan regions thus including other smaller areas in order to suggest new initiatives. It could also make suggestions for classifying very large metropolitan regions, e.g. Rhine-Ruhr or Central Germany, into subregions. Networking important locations of metropolitan functions within metropolitan regions and across borders could be depicted from which spatial planning measures, transport expansion measures and proposals for a regional development strategy could be derived.

Updating the Territorial Agenda of the EU

The European level was and is an important initiator of the current scientific and political discussion about metropolitan areas or metropolitan regions. The Lisbon Strategy of 2000 has put the topics growth, jobs and innovation on the agenda of European political cooperation and has thus moved metropolitan regions as “growth engines” into the limelight. The European Spatial Development Perspective (ESDP) of 1999 and the Territorial Agenda of the EU (TAEU) of 2007 have formulated the polycentric spatial development of the European territory as a political objective of the European spatial development policy and thus also supported centres and their balanced distribution. This European discussion had a large impact on various national discussions in EU member countries, last but not least on the spatial development policy and the discussion about the concepts for spatial development in Germany. As a consequence of the Lisbon Treaty, which came into effect in December 2009, and the extension of the EU objectives “economic and social cohesion” by the new objective “territorial cohesion”, cities and regions and related spatial (“place-based”) policies are even more present in the European discussion.⁶⁰ With its Green Paper, the European Commission has started the European discussion about implementing the territorial cohesion objective in the EU.⁶¹ The Lisbon Treaty and the Green Paper, however, highlight those regions with economic problems and geographical peculiarities (islands, mountain regions etc.) but mostly exclude

dynamical urban areas. Compared to that, urban as well as rural and peripheral areas are incorporated in the studies and policy documents on the Europe 2020 strategy updating the Lisbon Strategy. In this respect, the European discussion about metropolitan regions, especially about a EU policy for metropolitan regions, is still open and ambivalent.

The comments concerning the discussion about the metropolitan system in Germany also and especially apply to the European discussion: an agreed basis for evidence concerning the European metropolitan system has so far not existed, neither a standardised comparable set of indicators nor a comparable spatial reference basis. A generally accepted basis for evidence would, however, be an important prerequisite for advancing the European spatial development policy, which means developing policies and concepts to handle European metropolitan areas in a political way. The current study aims to promote this European process of consensus building by developing a transparent and easy traceable method to describe European metropolitan areas avoiding artefacts for instance caused by incomparable statistical NUTS units.

Further research needed

In this study, new methods were tested and have created important bases by which to analyse urban and metropolitan areas in Europe at the same time. They should be advanced in different ways and directions. Although the current study is partly based on network data, the analyses and presentations are concentrated on the hubs of these networks, the metropolises and their surrounding areas. The network edges, the links between these hubs, still have to be analysed in more detail. For further regional statistical analyses, metropolitan areas not defined on an administrative basis furthermore have to be brought together with data of statistical territorial units, which requires data reassessments. Finally, the regional influence and importance of metropolitan areas, but also of non-metropolitan areas should be investigated in more detail. This is where the discrepancies in Europe, including various political requirements and opportunities for action, are particularly large.

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Annex

1 List of indicators used

2 Quantitative presentation of metropolitan areas

Annex 1: List of indicators used

Indicator	Description	Source	Survey year
Note: If not otherwise indicated, the indicators represent the sum of the values of each indicator			
1. Politics			
1.1 National government			
National capitals	Weighted by the number of seats in the Council of Europe	Europarat, http://www.coe.int/t/d/Parlamentarische_Versammlung/Intro.asp#Mitgliedsstaaten	2008
National capitals	Weighted by the national population	Statistical Yearbook 2008 for the Federal Republic of Germany	2008
National capitals	Weighted by the national gross domestic product	Statistical Yearbook 2008 for the Federal Republic of Germany	2008
1.2 Supranational government function			
UN offices		The Europa world year book: Volume 1, London, Europa Publications	2008
EU political centres		Official Journal of the European Union C 115/265 Protocol (No 6) on the Location of the Seats of the Institutions and of Certain Bodies, Offices, Agencies and Departments of the European Union	2009
EU institutions		http://europa.eu/agencies/inyourcountry/index_de.htm	2008
International organisations based on international law		The Europa world year book: Volume 1, London, Europa Publications	2008
NGO institutions		Union of International Associations, Yearbook of International Organisations 2008/09, München; http://www.uia.be/yearbook	2008
2. Economy and finances			
2.1 Enterprises			
TOP 500 turnover of European enterprises		Ranking des Handelsblatts 2008, Worldscope, Bloomberg, Unternehmensangaben, HB Research - http://www.handelsblatt.com/grid/europas-top-500,5,2335651	2007
TOP 500 employees of European enterprises		Ranking des Handelsblatts 2008, Worldscope, Bloomberg, Unternehmensangaben, HB Research - http://www.handelsblatt.com/grid/europas-top-500,5,2335652	2007

Indicator	Description	Source	Survey year
2.2 Advanced producer services (APS)			
Subsidiaries of offices in the field of advanced producer services	Subsidiaries of 26 companies leading the world in terms of knowledge-intensive services	Websites of the following companies: Law firms: Allen & Overy, Baker & McKenzie, Freshfields Bruckhaus Deringer, Latham & Watkins, Linklaters Opinion and marketing research: ACNielsen, GfK Group, TNS Group Rating agencies: Fitch Ratings, Moody's Investors Service, Standard & Poor's Consultancies: Arthur D. Little, Bain & Company, Booz Allen Hamilton, The Boston Consulting Group, McKinsey & Company. Advertising companies: BBDO, Impirc, J Water Thompson, Saatchi & Saatchi, TMP Worldwide, Young & Rubicam Audit firms: Deloitte Touche Tohmatsu, Ernst & Young, KPMG, PricewaterhouseCoopers	04/2007
2.3 Financial service providers			
Banks	Balance sheet total	Reed International Services Ltd: The Bankers' Almanach. London.	2003
2.4 Fairs			
Exhibition capacities of fairs	Availability of exhibition halls in exhibition centres in sqm	AUMA - Ausstellungs- und Messe-Ausschuss der Deutschen Wirtschaft e.V., Geschäftsbereich Globale Märkte	2009
3. Science and innovation			
3.1 Education and research			
TOP 500 universities (Shanghai Index)		Academic Ranking of World Universities der Shanghai Jiao Tong University	2008
3.2 Scientific communication			
International research and technical-scientific associations		Verbände, Behörden, Organisationen der Wirtschaft; Deutschland und Europa; 2008 Hoppenstedt Firmeninformation GmbH, Darmstadt - www.hoppenstedt-verbaende.de	2008
Scientific journals		Thomson Reuters Master Journal List	2009
International congresses		Yearbook of International Organizations 2008/2009 der Union of International Associations	2007

Indicator	Description	Source	Survey year
3.3 Entrepreneurship and innovation			
Patent applications to the European Patent Office		European Patent Office	2005
4. Transport and telecommunication			
4.1 Air passenger transport			
Passenger volume of international airports		Airport Council International	2004
European scheduled flight connections		OAG Flugdatenbank (OAG MAX Standard Single User Apr 08")	21/4/2008-25/4/2008
Intercontinental scheduled flight connections		OAG Flugdatenbank (OAG MAX Standard Single User Apr 08")	21/4/2008-25/4/2008
4.2 Air freight transport			
Cargo volume		Airport Council International	2004
European scheduled flight connections		OAG Flugdatenbank (OAG MAX Standard Single User Apr 08")	21/4/2008-25/4/2008
Intercontinental scheduled flight connections		OAG Flugdatenbank (OAG MAX Standard Single User Apr 08")	21/4/2008-25/4/2008
4.3 Long-distance passenger rail transport			
Scheduled long-distance passenger rail transport connections	Direct long-distance connections with a journey time of more than 60 minutes to the terminus of railway stations with fifty and more departures per day.	"DB Reise-Service" travel information of DB AG (HAFAS) DB Vertrieb GmbH, Reiseauskunftsmedien (P.DVD 51), Frankfurt/Main	10/11/2008-14/11/2008
4.4 Maritime goods transport			
Container handling	Container handling in TEU (Twenty Foot Equivalent Units)	http://www.hafen-hamburg.de/content/view/34/33/lang,de/ (as at 10 August 2009)	2004-2008
4.5 Data traffic			
Internet exchange points	Number of local ports of providers	Euro-IX (European Internet Exchange Association)	30/08/2006

Indicator	Description	Source	Survey year
5. Culture and sports			
5.1 Culture			
Theatres		Performing Arts Yearbook for Europe (PAYE), 16th edition 2006	2006
Operas		Performing Arts Yearbook for Europe (PAYE), 16th edition 2006	2006
Music events		Websites of Rolling Stones, Madonna, Sting, Bon Jovi, Anna Netrebko, Anne-Sophie Mutter, Vienna Philharmonic, New York Philharmonic Orchestra, venues of the musical "Cats" and of periodical annual jazz festivals, tour dates of 2005, 2006 and 2007	
Art fairs and biannual film festivals		www.artfacts.net and www.artnet.de	August 2007
Public art institutions		www.artfacts.net and www.artnet.de	August 2007
Galleries		www.artfacts.net and www.artnet.de	August 2007
UNESCO World Heritage Sites		whc.unesco.org	2009
Michelin travel destinations	Number of stars by which travel destinations were rated	Michelin Travel Publications (2001): The Green Guide Europe	2001
5.2 Sports			
Summer Olympics	Venues of the Summer Olympics since 1948 by today including Summer Olympics 2012 hosted by London.	www.olympic.org/uk/games/index_uk.asp	2009
Important sporting events	Venues of World Cups or European Football Championships, World Championships in Athletics and European Athletics Championships (indoors and outdoors) as well as of World Aquatics Championships and European Aquatics Championships since 1945, of ATP and WTA tournaments in 2009	http://de.wikipedia.org/wiki/Fu%C3%9Fball-Weltmeisterschaft, http://de.wikipedia.org/wiki/Fu%C3%9Fball-Europameisterschaft, http://www.iaaf.org/history, http://www.atpworldtour.com/Tournaments/Tournament-Landing.aspx, http://www.sonyericssonwtatour.com/page/Calendar/0,,12781,00.html, http://de.wikipedia.org/wiki/Schwimm-Europameisterschaft, http://de.wikipedia.org/wiki/Schwimmweltmeisterschaften	2009
Sports stadiums	Number of stadium seats	www.worldstadiums.com	2009

Annex 2: Quantitative presentation of metropolitan areas

Rank	Metropolitan area	Index of metropolitan functions	Functional area					Inhabitants in million	GDP in billion €	Area in thousand sqm.
			Politics	Economy	Science	Transport	Culture			
1	London	100.0	92.6	71.1	75.7	95.0	100.0	15.1	608.9	18.9
2	Paris	97.9	98.4	100.0	100.0	65.4	61.7	12.3	500.6	16.9
3	Randstad	74.5	40.4	65.5	68.9	100.0	49.2	9.7	317.0	13.7
4	Bruxelles	66.8	100.0	39.1	48.7	56.4	46.3	6.7	211.7	15.0
5	Rhein-Ruhr	51.1	11.2	62.9	35.6	33.1	79.3	13.3	369.0	18.0
6	Moskva	47.2	78.6	39.8	9.3	30.8	46.5	14.6	113.1	15.2
7	Wien-Bratislava	45.1	69.6	24.5	30.2	21.4	50.4	4.1	112.6	16.8
8	Rhein-Main	41.2	7.7	58.0	33.1	56.0	24.2	5.3	180.3	12.3
9	Roma	40.8	75.0	19.1	12.3	11.6	59.5	4.6	136.8	8.8
10	Berlin	38.7	83.2	15.1	16.2	8.5	44.9	4.5	100.1	7.7
11	Madrid	34.6	49.5	32.9	12.4	17.5	38.0	6.5	167.2	12.8
12	München	32.9	2.3	32.3	41.9	16.1	50.5	4.3	170.8	14.1
13	Milano	28.1	1.2	44.9	19.2	22.8	34.0	8.4	264.9	14.6
14	Barcelona	25.8	3.8	23.5	17.1	15.2	52.6	5.6	132.2	5.5
15	Stockholm	25.3	22.9	24.8	32.2	10.6	19.6	2.3	95.2	16.4
16	Zürich	25.2	1.1	36.4	34.2	18.1	19.9	3.4	140.1	12.0
17	Kobenhavn-Malmö	24.7	19.1	19.2	26.8	17.3	25.1	2.9	115.9	10.1
18	Luxembourg	22.8	49.7	11.0	7.3	18.4	12.7	1.8	60.6	10.8
19	Geneve	22.7	58.5	9.3	16.7	4.8	9.6	1.3	45.2	6.2
20	Athinai	20.8	19.3	12.6	6.1	5.4	46.9	4.0	101.3	6.0
21	Helsinki	20.1	13.8	11.6	18.6	7.8	35.6	1.5	58.3	8.9
22	Hamburg	18.2	3.4	13.8	10.8	28.4	22.8	3.8	130.6	10.2
23	Budapest	17.3	17.0	11.6	7.9	11.8	27.1	3.4	45.0	10.4
24	Warszawa	16.4	35.9	9.5	5.4	8.6	11.9	3.0	40.4	8.5
25	Lisboa	15.7	22.6	10.4	8.7	5.6	20.9	3.2	60.4	7.5
26	Manchester-Liverpool	15.5	0.0	5.4	13.8	19.0	29.3	6.7	182.7	9.9
27	Stuttgart	15.4	0.0	13.7	25.5	5.1	22.7	3.6	116.9	6.6
28	Praha	15.2	18.2	11.2	7.5	9.0	20.2	2.3	34.3	9.9
29	Rhein-Neckar	14.0	0.0	8.6	25.3	3.6	23.3	4.0	121.0	9.5
30	Basel	13.8	1.9	15.9	19.9	4.7	17.6	2.4	77.2	9.2
31	Istanbul	13.5	1.7	14.7	7.1	18.2	16.9	12.3	65.7	2.5
32	Oslo	13.1	15.1	9.9	10.7	12.1	9.2	1.3	94.2	8.3
33	Kiyev	12.9	32.5	9.0	0.6	6.9	7.0	3.6	13.3	11.7
34	Dublin	12.4	13.9	11.1	8.3	5.8	14.6	1.6	72.9	5.3
35	Bern	12.3	18.2	5.5	8.8	4.1	16.7	1.4	47.8	6.8
36	Hannover	12.0	0.0	26.4	8.0	4.5	13.3	2.5	68.3	8.3
37	Maas-Rhein	11.5	1.0	8.0	16.5	11.9	12.5	3.5	81.6	9.9
38	Strasbourg	11.5	15.0	7.1	10.8	3.9	13.1	1.6	43.7	6.8
39	Bucuresti	11.3	23.8	7.6	1.4	5.5	10.9	3.4	20.7	11.7
40	Ankara	11.1	41.9	1.9	1.0	0.8	2.7	4.1	24.2	6.2
41	Birmingham	10.5	0.4	13.8	10.3	5.5	15.8	4.5	126.6	8.3
42	Cardiff-Bristol	10.5	0.4	6.8	13.8	8.0	16.7	3.9	116.3	11.5
43	Eindhoven	10.1	0.0	7.1	23.9	4.4	8.5	2.6	75.8	6.0
44	Göteborg	9.9	0.4	11.2	7.3	4.9	19.1	1.2	36.3	8.8
45	Bologna	9.5	0.0	13.0	7.7	4.4	16.1	2.3	69.9	8.8
46	Valencia	9.2	0.0	12.5	6.6	8.9	12.2	2.7	52.0	8.4
47	Torino	9.2	3.8	9.1	7.8	4.3	15.0	2.8	74.8	10.4
48	Lyon	8.5	0.8	8.4	8.3	5.4	14.0	2.8	84.0	8.8
49	Oxford	8.1	0.7	0.5	26.4	2.8	4.6	1.2	44.0	5.5
50	Venezia-Padova	7.9	0.0	7.4	7.9	5.9	13.1	3.7	105.1	11.0
51	Beograd	7.8	8.5	9.2	1.2	0.7	14.5	2.6	10.7	10.9
52	Nürnberg	7.8	0.0	10.1	8.6	4.9	10.2	2.3	70.4	10.3
53	Sofija	7.7	12.6	6.5	1.2	1.1	12.0	1.6	7.8	9.0
54	Gent	7.7	0.7	7.2	6.3	8.6	10.5	2.1	55.7	5.6
55	Edinburgh	7.5	0.6	12.1	6.2	3.7	9.8	1.3	42.5	6.6
56	Firenze	7.4	0.0	5.7	6.9	3.1	16.5	1.8	51.2	6.6
57	Glasgow	7.2	0.4	3.1	4.8	6.3	16.7	2.2	60.3	6.9
58	Zagreb	7.1	10.2	9.1	1.6	2.2	7.9	1.5	14.7	6.4
59	Leeds	7.0	0.0	4.4	7.8	4.7	13.3	3.1	84.5	7.8
60	Napoli	6.9	0.0	3.8	4.3	3.6	18.2	5.0	77.3	5.7
61	St. Petersburg	6.6	0.0	4.2	3.6	10.4	10.5	5.3	25.6	17.8
62	Leipzig	6.6	0.0	6.5	5.9	3.3	12.9	1.9	38.0	7.6

Rank	Metropolitan area	Index of metropolitan functions	Functional area				Inhabitants in million	GDP in billion €	Area in thousand sqm.	
63	Nice	6.5	3.5	4.2	4.0	3.5	12.9	1.4	39.8	3.6
64	Newcastle	6.4	0.0	2.3	9.4	2.6	13.4	2.5	63.5	8.9
65	Marseille-Toulon	6.4	0.0	3.4	6.1	5.5	12.6	2.4	64.7	5.8
66	Porto	6.2	0.0	5.3	2.9	1.6	17.3	3.3	38.9	6.5
67	Bremen	6.2	0.0	3.4	3.0	13.5	7.2	2.2	57.5	10.9
68	Southampton	6.2	0.0	2.0	7.1	10.0	7.9	2.3	69.2	6.7
69	Lausanne	6.2	2.1	3.9	9.0	2.3	9.6	0.8	30.0	4.7
70	Lille	6.0	2.5	3.5	3.4	3.6	13.1	3.6	80.1	8.4
71	Nottingham	5.8	0.3	3.5	7.5	7.8	6.3	2.7	77.3	6.3
72	Krakow	5.8	0.0	4.6	4.4	2.4	13.7	3.6	24.4	8.2
73	Cambridge	5.6	0.6	2.3	15.0	3.4	2.8	1.3	42.7	7.0
74	Verona	5.5	0.0	10.4	1.7	3.1	8.9	2.4	69.6	8.9
75	Pisa	5.5	0.0	1.5	5.5	7.2	9.7	1.4	33.4	4.4
76	Toulouse	5.4	0.0	3.0	4.0	2.4	14.2	1.6	42.7	9.9
77	Genova	5.3	0.0	5.1	2.9	8.4	6.8	1.5	38.4	6.4
78	Ljubljana	5.0	6.4	4.5	4.1	1.7	5.3	1.0	16.5	10.1
79	Arhus	4.8	0.3	6.0	4.7	4.7	5.1	1.0	33.7	7.0
80	Bielefeld	4.8	0.0	4.2	5.8	4.7	6.0	2.3	59.5	6.9
81	Minsk	4.7	14.3	2.0	0.1	0.8	3.5	2.1	5.1	7.2
82	Vilnius	4.7	8.1	4.5	1.4	0.7	5.6	0.9	7.1	10.5
83	Sevilla	4.6	0.0	2.7	2.7	1.1	13.6	1.7	28.0	10.2
84	Parma	4.5	2.5	7.9	2.9	1.6	4.8	1.5	41.3	8.0
85	Malta	4.5	5.4	2.1	0.6	6.2	5.2	0.4	4.5	0.2
86	Bilbao	4.4	2.5	7.4	0.8	2.4	6.0	1.7	46.4	7.4
87	Brno	4.3	0.0	6.4	0.5	1.9	10.0	1.6	13.5	10.4
88	Bordeaux	4.2	0.0	5.0	4.3	2.0	6.8	1.4	37.9	10.0
89	Reykjavik	4.1	5.9	4.8	1.2	3.3	2.6	0.2	9.8	3.7
90	Tallinn	4.0	5.7	4.6	0.8	1.9	4.5	0.5	6.7	5.6
91	Montpellier	4.0	0.0	3.4	3.5	2.1	8.5	1.3	29.3	6.3
92	Riga	4.0	6.0	5.3	1.0	1.5	3.7	1.1	9.0	7.3
93	Graz	3.9	0.0	3.2	4.9	1.4	7.6	1.2	29.2	9.9
94	Sarajevo	3.9	9.8	3.4	0.5	0.5	2.8	0.7	1.7	6.2
95	Sheffield	3.7	0.0	0.4	4.6	2.9	8.2	1.7	41.3	3.9
96	Bari	3.7	0.0	6.9	1.7	1.0	6.5	1.6	28.0	5.2
97	Linz	3.7	0.0	6.6	1.6	3.5	4.4	1.2	34.8	8.3
98	Innsbruck	3.7	0.0	2.0	4.7	2.1	7.1	0.6	19.9	7.5
99	Grenoble	3.6	0.0	2.6	4.5	2.4	6.3	1.3	34.5	7.7
100	Odense	3.6	0.0	6.5	2.6	4.0	2.6	0.7	21.6	4.3
101	Salzburg	3.6	0.0	3.2	2.0	1.3	9.2	1.0	28.1	8.5
102	Dresden	3.6	0.0	1.7	3.6	1.2	9.2	1.7	35.0	7.6
103	Göttingen	3.6	0.0	1.0	5.9	2.6	6.0	1.6	36.6	9.0
104	Groningen	3.4	0.0	4.6	4.8	3.2	2.3	1.7	50.1	8.6
105	Zaragoza	3.4	0.0	6.5	2.1	1.2	4.9	0.9	20.9	12.1
106	Münster	3.2	0.0	0.5	5.5	2.9	5.2	1.7	43.5	6.0
107	Tirana	3.1	7.8	2.5	0.0	0.5	2.6	1.2	2.8	2.3
108	Chisinau	3.0	9.6	1.4	0.0	0.2	2.0	2.0	1.1	11.1
109	Palermo	3.0	0.0	1.7	2.1	0.4	9.0	1.2	19.2	3.0
110	Nicosia	3.0	5.6	4.9	0.3	0.1	2.1	0.4	6.6	2.8
111	Skopje	2.9	5.8	4.0	0.1	0.5	2.4	1.4	3.3	7.7
112	Nancy	2.9	0.0	2.8	2.0	1.4	6.6	1.0	23.9	9.2
113	Poznan	2.9	0.0	6.6	0.7	2.0	3.2	1.5	12.8	9.0
114	Hahn	2.8	0.0	0.0	0.3	10.6	1.2	0.4	8.3	3.7
115	Nantes	2.8	0.0	3.0	0.8	1.7	6.5	1.3	35.0	8.9
116	Würzburg	2.7	0.0	0.1	5.1	1.2	5.3	1.3	33.3	10.2
117	Belfast	2.5	0.0	2.8	2.4	1.6	4.2	1.1	30.4	5.7
118	Malaga	2.5	0.0	2.2	1.5	2.2	4.8	1.4	22.3	7.0
119	Palma	2.4	0.0	1.7	0.5	3.4	5.0	0.7	16.1	3.1
120	Split	2.4	0.0	0.0	0.1	0.3	10.1	0.4	2.2	4.6
121	Bergen	2.4	0.0	1.7	3.0	1.1	4.6	0.3	15.5	2.0
122	Wroclaw	2.2	0.0	1.7	0.9	1.5	5.7	1.7	12.2	10.2
123	Trondheim	2.1	0.0	1.7	4.3	0.7	2.2	0.2	10.2	3.2
124	Aberdeen	2.0	0.0	2.6	2.7	1.0	2.5	0.4	17.1	4.3
125	Cork	1.8	0.0	1.6	2.3	1.2	2.9	0.4	20.3	5.4