



Federal Institute for
Research on Building,
Urban Affairs and
Spatial Development

within the Federal Office for
Building and Regional Planning

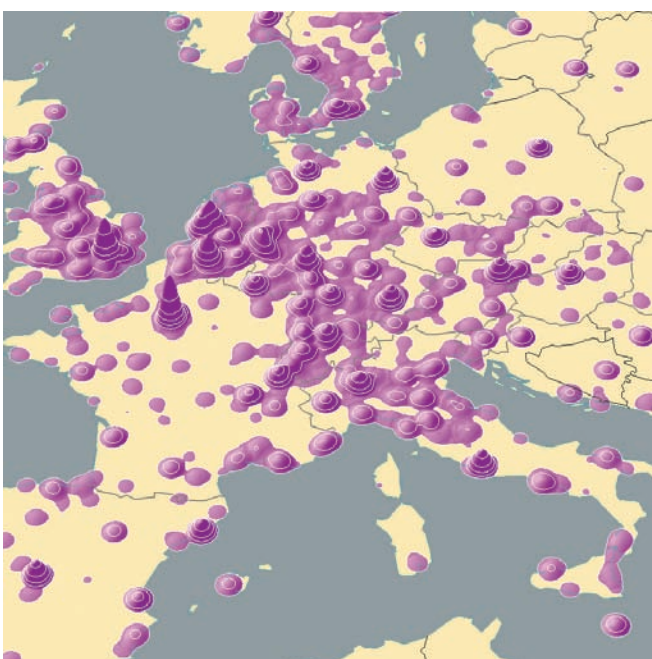


BBSR-Berichte KOMPAKT

Metropolitan areas in Europe

Abstract of a new BBSR study

7 / 2010



Density categories of metropolitan functions
(see page 10)

Metropolitan regions are characterised by a dense concentration of functions which they play in social and economic networks at a supraregional, European and global level. Describing these metropolitan functions and analysing their spatial distribution has long been an element of spatial research in Germany and Europe and also in the BBSR and its precursor institutes. This „Berichte KOMPAKT“ issue presents the results of a new BBSR study for the first time dealing with the whole European territory. According to a new, theoretically substantiated principle, the spatial distribution of metropolitan functions in Europe will be measured according to standardised criteria and coherent metropolitan areas will be defined and characterised.

The related data are entirely based on unofficial statistics, originally collected from the Internet or calculated. In the context of its political consulting activities, the BBSR will use this new information and the data as an input for the European discussion (e.g. the review of the Territorial Agenda of the EU) and to advance the principles for spatial development in Germany.

Introduction

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. This has meant that metropolitan regions have increasingly established as an important strategic element of European and global competitiveness. They were considered in the current policy documents of the Territorial Agenda of the European Union (2007) and the Concepts and Strategies for Spatial Development in Germany (2006). Research on metropolises and metropolitan regions also has a long tradition in Europe and Germany. The BBSR and its precursor institutes as well as the European research network ESPON have supported the development of related political-strategic, national and EU documents by providing scientific analyses of the urban system. However, methodologically based regional investigations on metropolitan areas referring to the whole European territory have so far been lacking. Methodological limits are also reached in terms of data and measurement concepts for metropolitan functions comparable across Europe. This is where the new study presented by the BBSR starts:

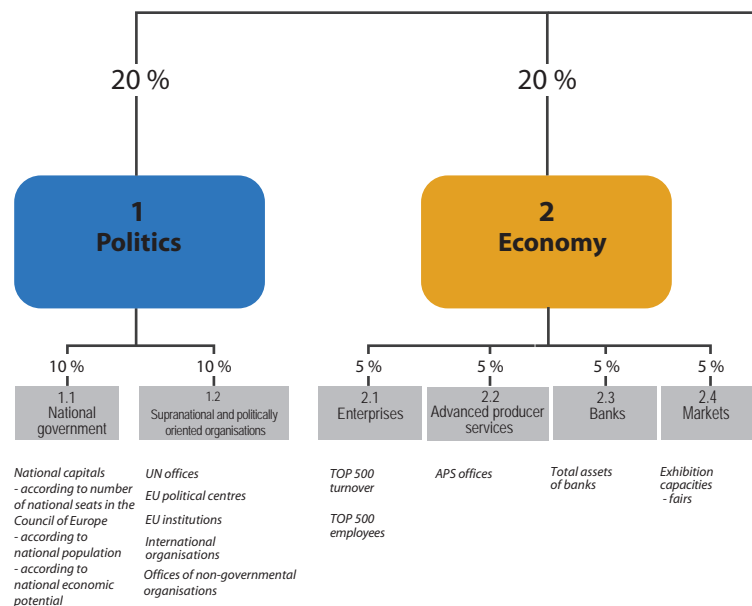
- The classification of metropolitan functions will be restructured based on theoretical principles.
- A new database comparable across Europe with 38 indicators will be created.
- The whole European continent will be covered by describing locations based on exact local coordinates (municipalities) and not limited by preselecting cities and regions.
- A new standard method of regionalisation to define comparable metropolitan areas in Europe will be developed and
- based on this metropolitan areas in Europe will be compared and characterised according to the significance and variety of their functions.

Because of the BBSR's close relations with German and European spatial planning policy, it will make proposals how to use the results in updating the Territorial Agenda of the EU and the German principles for spatial development.

Selecting functional areas

In order to find appropriate indicators to give a quantitative description of metropolitan functions, a theory-based classification of clearly defined subfunctions is required which collectively provide a comprehensive picture of how a metropolis or metropolitan region is characterised. Previous approaches were not sufficiently detailed and differentiated. Based on the principle of the functional differentiation of social systems and on the findings of regional-economic theories, five areas of metropolitan functions were defined:

- "politics" including international relations of national governments and supranational organisations,
- "economy" including global production, trade and financial relations,
- "science" including globally significant universities, research networks and innovations,
- "transport" and its role in the worldwide networking of persons, goods and information and
- "culture" including arts and sports events being of worldwide importance.



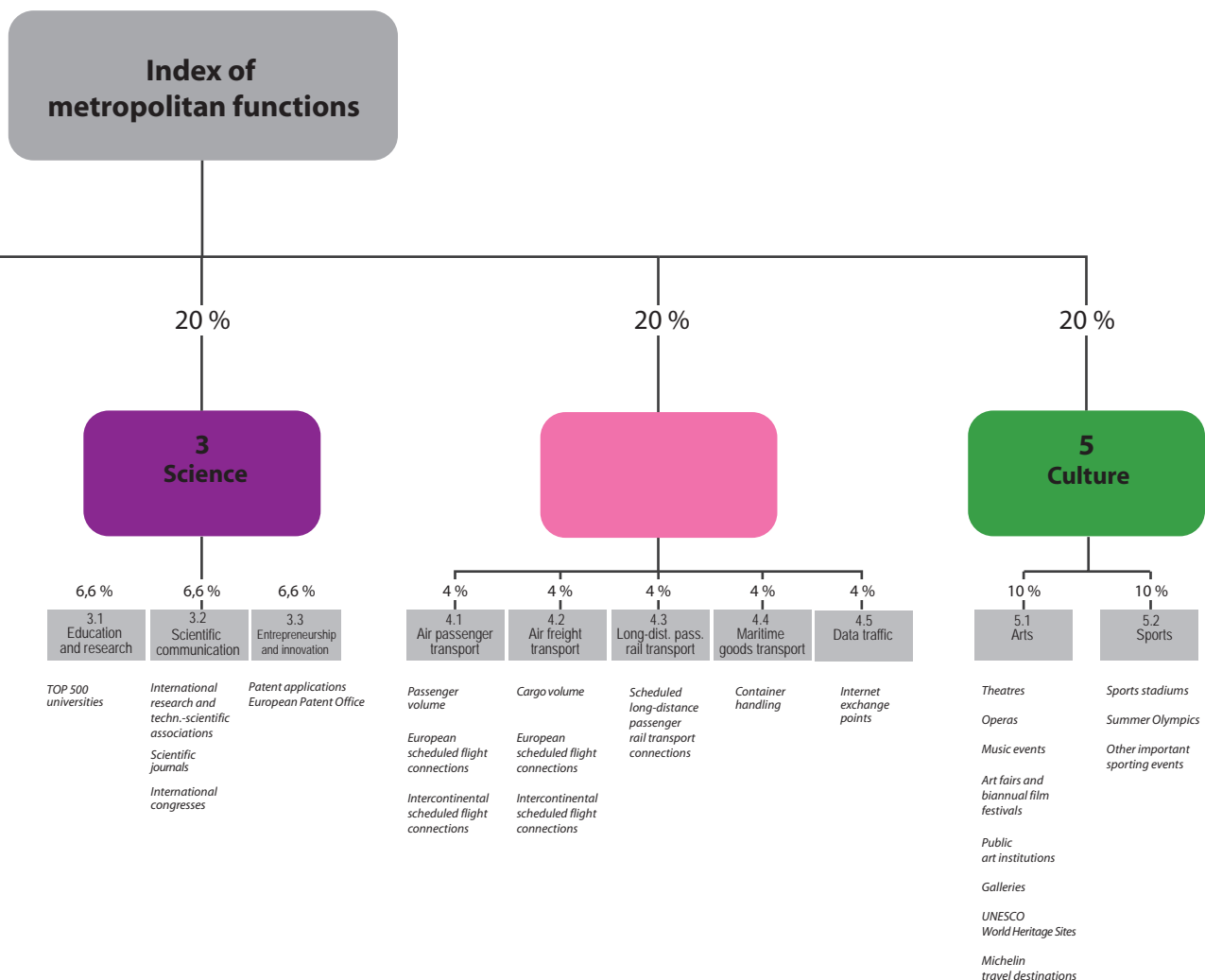
Selecting indicators

Selecting indicators to operationalise the theoretical concept of metropolitan functions requires a degree of pragmatism. Compromises have to be made in selecting indicators since not all statistical information is available and useful for the whole European territory and in a standardised form. The 38 indicators selected in the context of this study, however, meet the following requirements:

- cover the whole investigated territory of Europe;
- defined for all countries according to standard criteria;
- high qualitative standard and reliable unofficial statistical data;
- exact geocoding of data on the level of local administrative units or based on exact local coordinates;
- highly specified indicator value to depict the European and global context.

Indexing and weighting

The 38 indicators were combined by an additive composition. All indicators with their maximum value are standardised to 100 so that the range of all indicators is between 0 and 100. This prevents indicators with large ranges from dominating those with small ranges. In principle, all indicators within a group of indicators have 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. Similarly, weighting a group of indicators in forming an index for a functional area depends on how many groups mark out a functional area. Weighting each function differently is specifically avoided as it is assumed that all functions are equally significant.

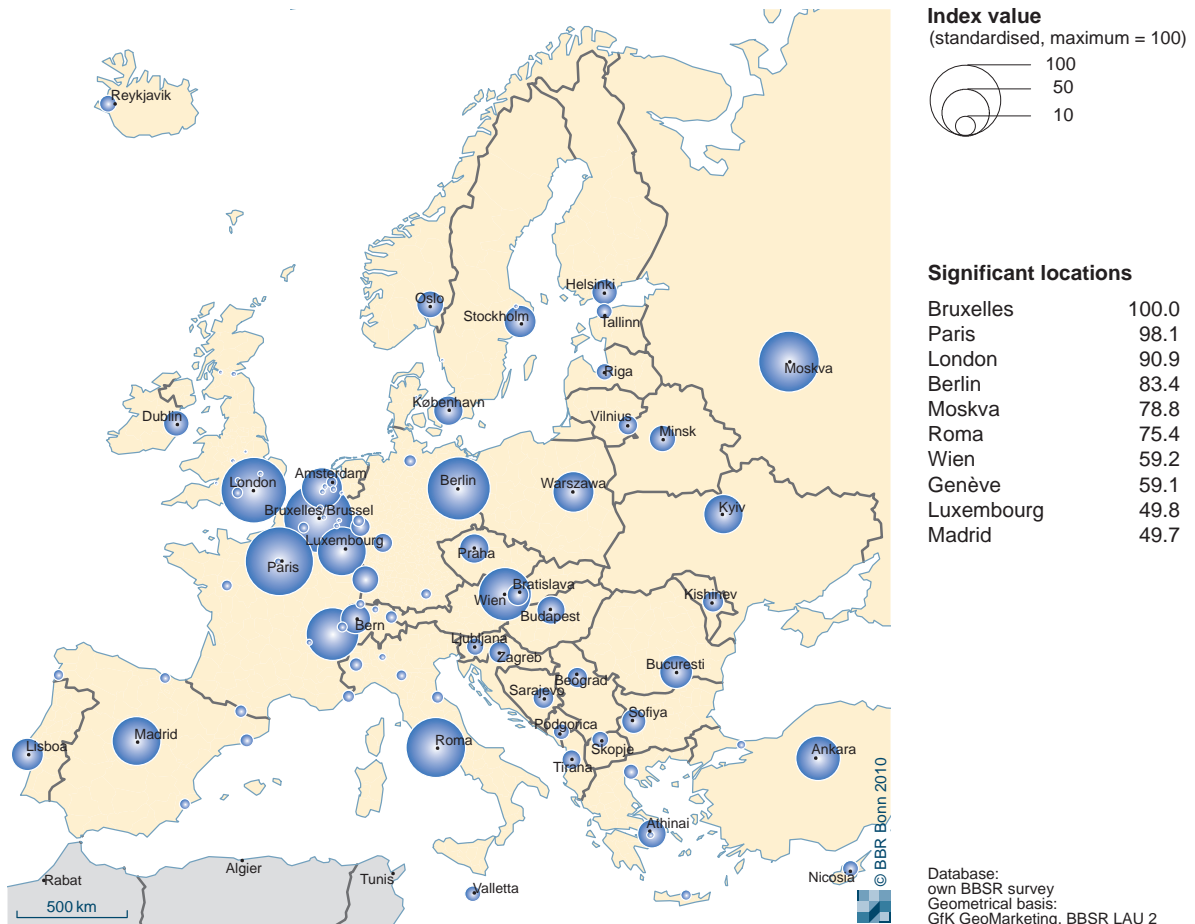


Functional area “politics”

National government policy levels are entwined with European and worldwide policy levels. As this function is geographically localised – normally in capitals –, certain cities have a key national and international significance and represent hubs within the global political decision-making network. Political parties, social movements, lobby groups and various non-governmental organisations also have an impact on state and society as well as on related decisions. In addition, there are international organisations under international law fulfilling supranational tasks, for instance the United Nations or the European Union and their institutions. Metropolitan functions in the “politics” area are thus only found in those places where such national and international institutions of the political system are located. This is why only 92 locations in Europe can be assigned to this functional area.

As a result, the spatial distribution of the “politics” function is highly concentrated. Because of the national importance of capitals in terms of population, economic power and seats in the Council of Europe and different figures of local UN and EU institutions and non-governmental organisations, some cities have different significances within the system of locations. National capitals are outstanding, however. 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, as laid down in the Lisbon Treaty, also stand out. Especially in the European central area, there are many centres adding to the network of capitals within this functional area, demonstrated by the examples of Frankfurt, Den Haag and Bonn and the Northern Italian cities. There is a clear lack of regional capitals such as the seats of the German federal state governments. They were not taken into account as a selection criterion comparable across Europe could not be found.

Index of metropolitan functions – functional area “politics“

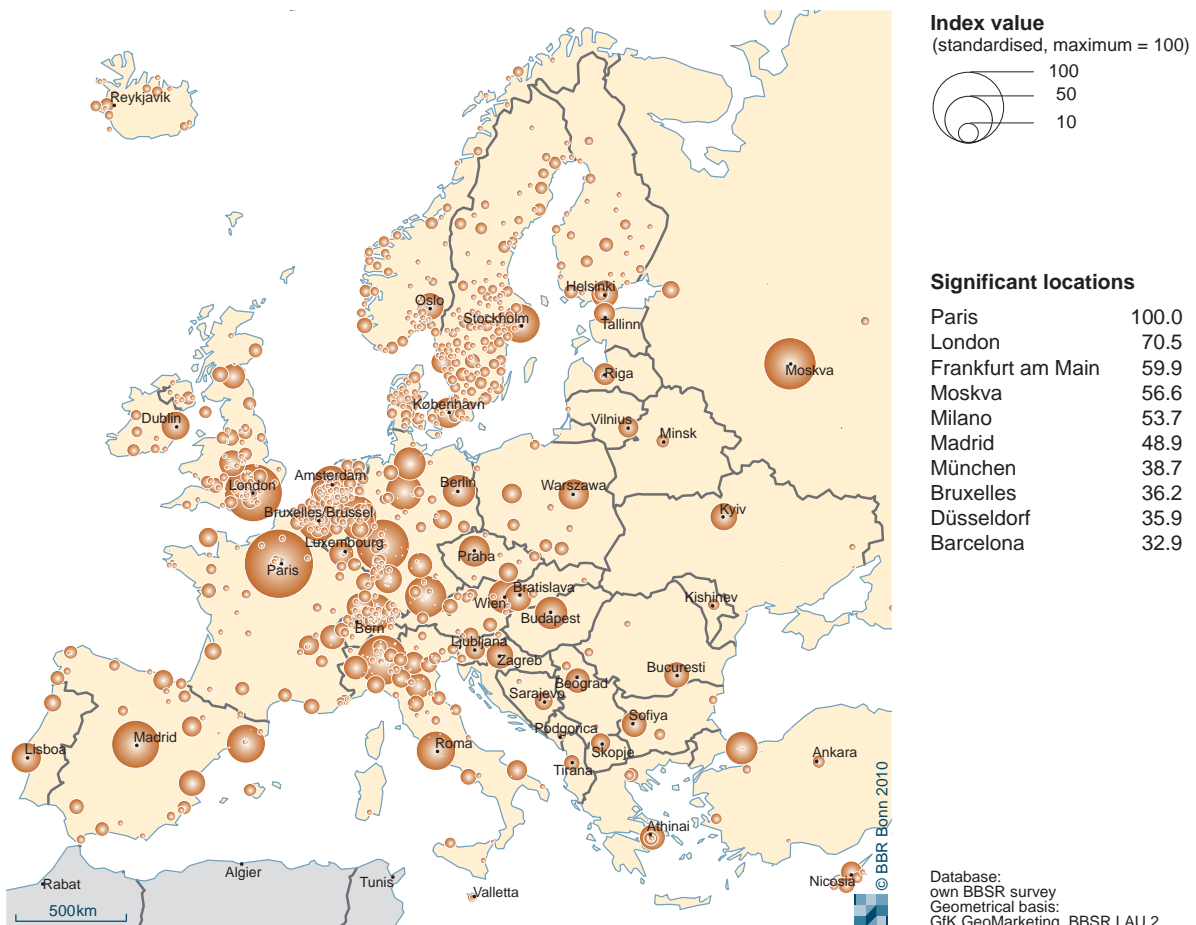


Functional area “economy”

Metropolises are locations of corporate headquarters, financial institutes, stock exchanges, main offices of insurance companies and business service companies. With their often impressive headquarter buildings, they symbolise economic power and strength and shape the skyline of a large city. Against the background of growing economic engagements, metropolises are particularly regarded as the spatial hubs of the increasing global networking. The concentration of economic activities in metropolises, the large number of institutions within this area and the resulting density of interaction illustrate the special quality of these locations. In order to illustrate the economic system, four correlating indicator groups are defined: enterprises, business services, banks and markets (fairs). The data situation in this area is very difficult, which is why three of the four indicator groups include only one indicator.

A review of all the four indicator groups reveals a comparably high spatial spreading to around 1,000 locations. Significant economic centres can be found in all European countries, those with the highest density in Central Europe with Paris and London being the most significant. These economic centres are often the capitals of their relevant countries and therefore their political centres. In Italy and Turkey, for example, the political centres are not the economic centres at the same time. Particularly in Eastern Europe, important economic centres are rarer. Furthermore, special features appear – for example in the case of business service companies. In Scandinavian and BeNeLux countries, the number of their locations is comparably high and they are dispersed, indicating a different spatial pattern in some countries.

Index of metropolitan functions – functional area “economy”

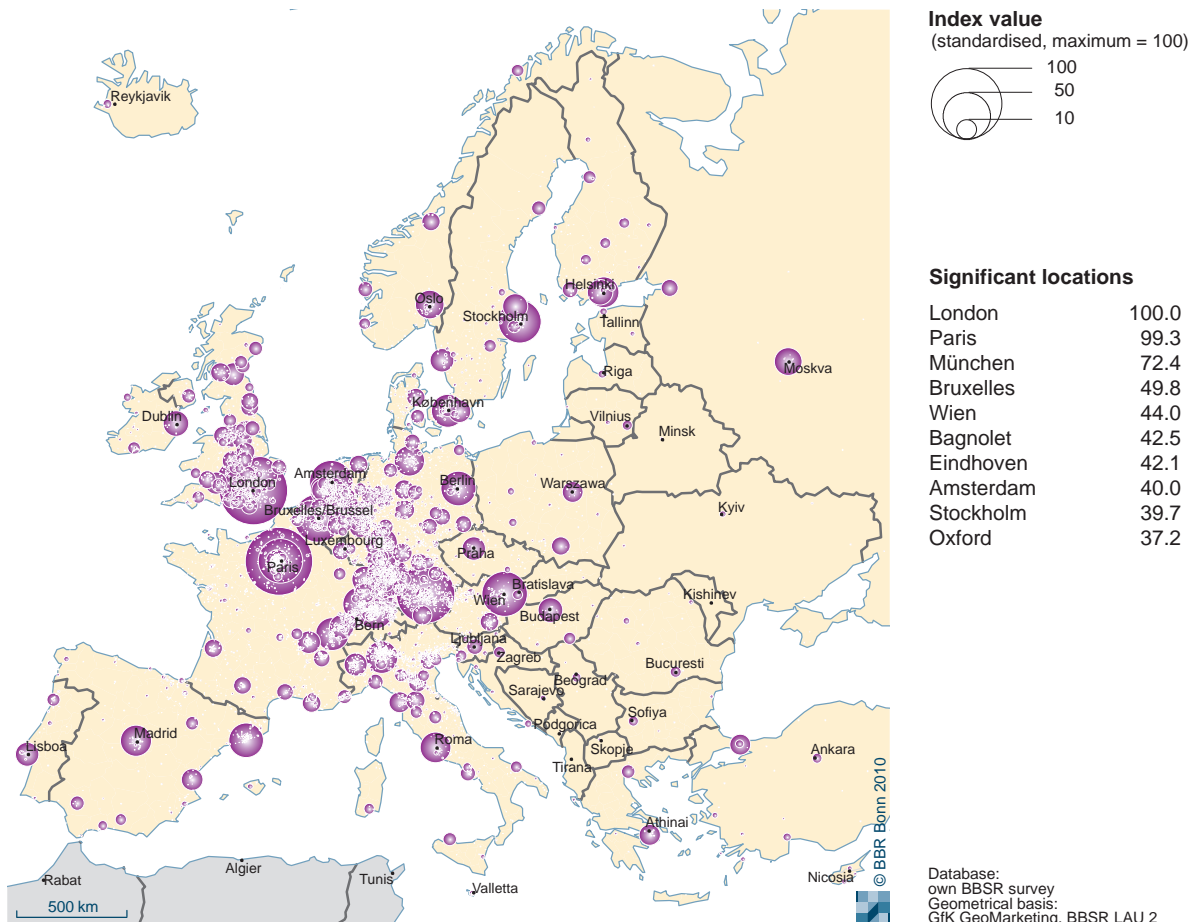


Functional area “science”

In many current regional-scientific discussions and regional-economic theories, knowledge as a resource is highly valued based on the argument that the development opportunities of cities and regions greatly depend on their potential and capacity in the field of science. Besides innovation-oriented framework conditions, research institutes, universities and enterprises – and thus the chance of their networking – are therefore of high importance within the functional area “science”. These factors account for successful innovation and provide the basis for positive regional-economic development. This functional area is divided up into the three indicator groups “education and research”, “scientific communication” and “entrepreneurship and innovation”. The spatial distribution of the locations in this functional area is described by five indicators.

Among the most important scientific centres, London and Paris reign supreme. They are followed by a wide margin by Munich, which again is way ahead of Brussels and Vienna. Among the most important 15 positions, some specialised locations can also be found in the science area: Eindhoven, Cambridge and Oxford. Numerically, Germany with 20 cities is generally very well represented among the most important 100 positions. Eastern and South-Eastern European cities, however, are hardly found among the 100 most significant locations. The wide spread of small locations is due to the very large number of patent applications. The reason is that most of the more than 6,600 locations showing a value in this functional area are based on only this indicator. Values for all three indicator groups can be identified in only 147 locations and in around 390 locations for at least two of the three indicator groups.

Index of metropolitan functions – functional area “science”

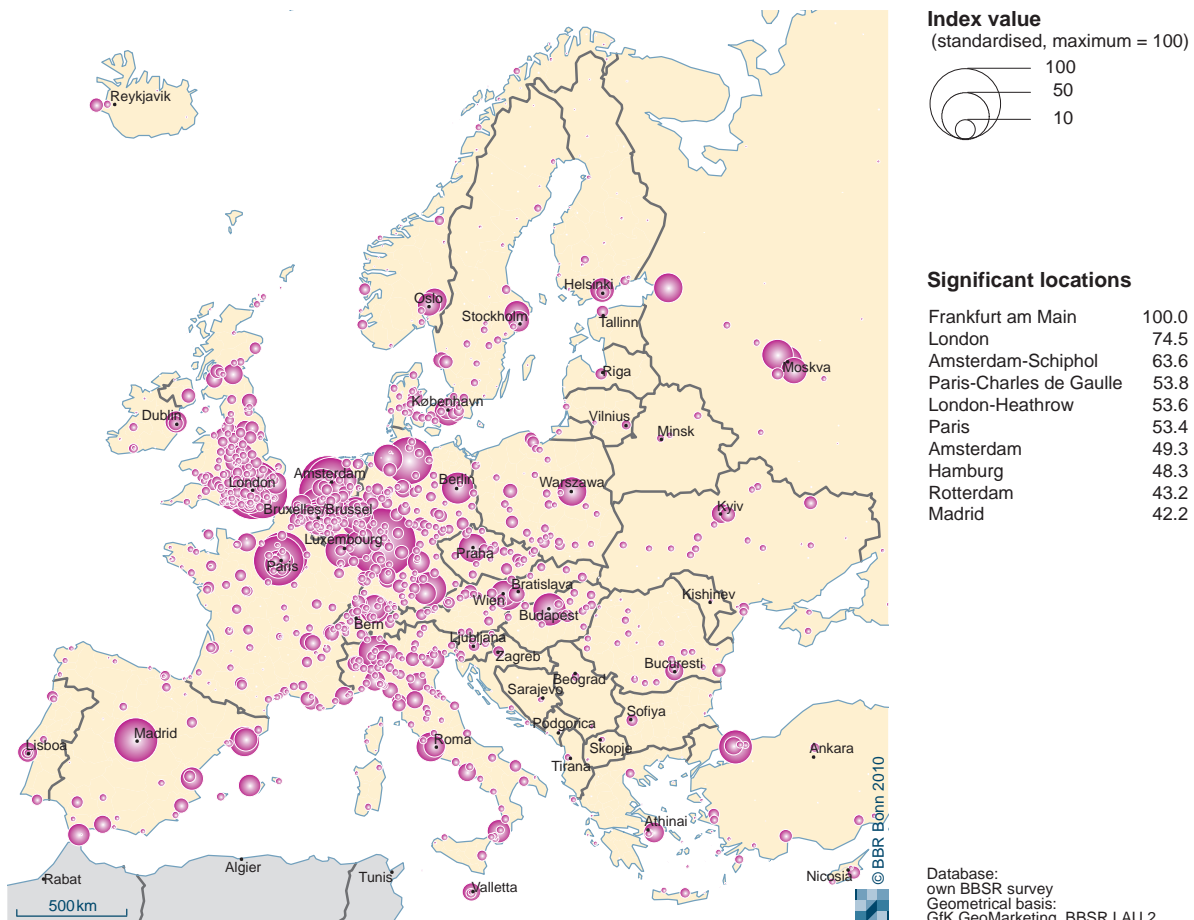


Functional area “transport”

The increasing international division of labour and networking require cities and regions to be involved in a high-quality transport and telecommunication infrastructure to participate in global exchanges. In the functional area “transport”, the passenger, cargo and data volumes are therefore used as indicators to show the significance of a location as a hub within European and international networks. The following transport modes exist: air, railway, sea and telecommunication. In total the functional area “transport” is described through nine indicators in five indicator groups. As in the case of other functional areas, the “transport” indicator groups are involved in the index with the same weighting. As the air transport sector is subdivided into a passenger and a freight sector though, it has been double weighted. This is justified because of its special importance for international accessibility.

The approximately 1,100 locations in this functional area are spread all over Europe. It is also clear that the values in this functional area are highest in the European core area. They rapidly decrease towards the periphery, especially towards the north and the east. The high-quality transport offered is primarily oriented towards the high demand potentials of agglomerations, where population and jobs are concentrated, as well as towards important hubs of the European air transport network, e.g. Frankfurt, London, Paris, Madrid. Some of the significant airports, however, are located outside large centres in their surrounding areas. In Europe’s periphery, large tourist airports such as Palma de Mallorca, Antalya and Malaga and large container seaports on the coasts score as well.

Index of metropolitan functions – functional area “transport”

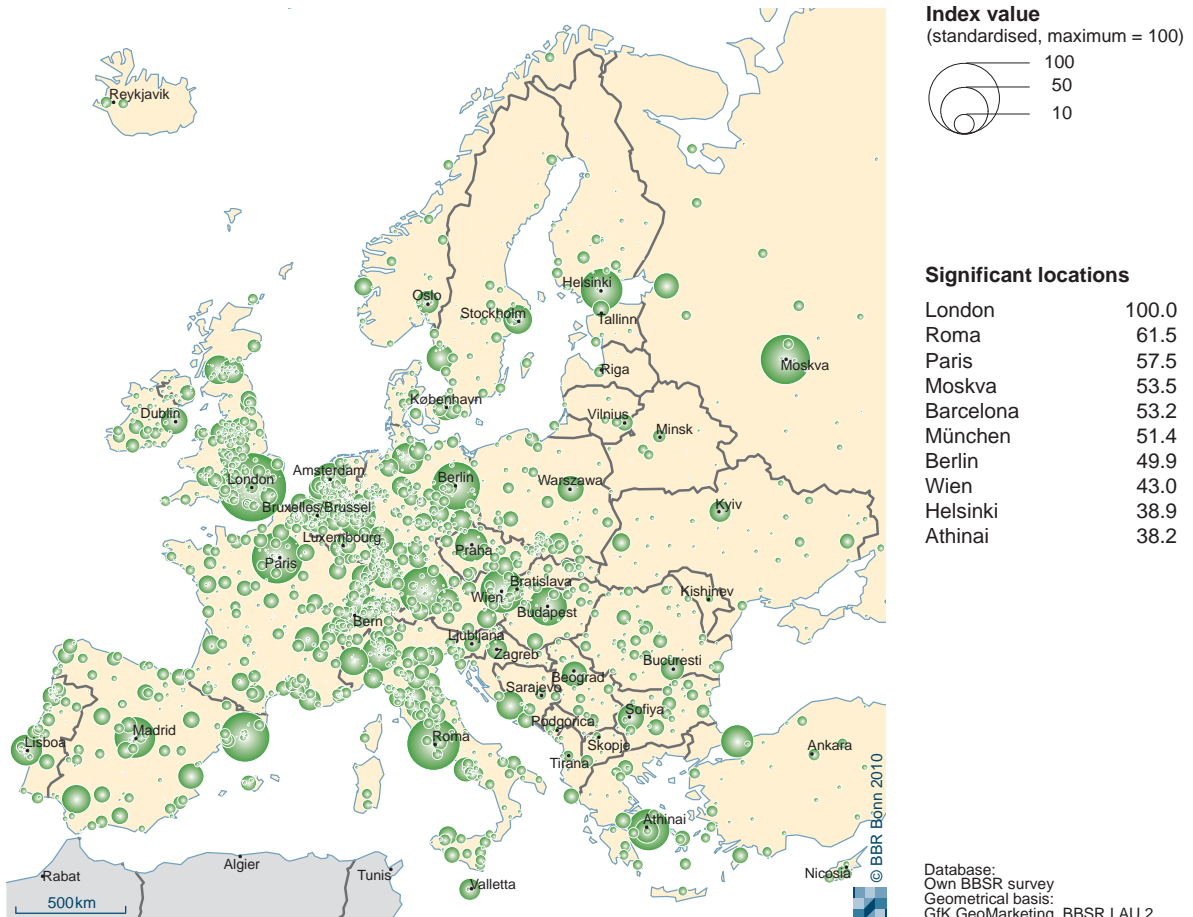


Functional area “culture”

Culture is of special importance to metropolises. Cultural offers for instance are important goals for international tourism since unique collections in museums or top-class events attract worldwide attention and get large response. Cultural offers are also an expression of the cultural life in these cities and shape their worldwide image. As a soft location factor, they can increase the attractiveness of these cities and increase their quality of life. The term “culture” covers very different aspects. We only use arts and sports to represent the supralocal, European and worldwide importance of the cultural scene of a city. As a result, top-class institutions, sports events and performing and visual arts events, concerts of world-famous stars and orchestras as well as important places of cultural interest of the recent and ancient past fall in this category. The functional area “culture” is represented via eleven indicators.

Combining arts and sports in the functional area “culture” leads to a wide spatial spreading to around 3,000 locations across Europe. The Central European Pentagon is not so prominently displayed as in other functional areas. Many locations outside the European core area also have high values. On the one hand, this has to do with the occurrence of large sports events in metropolises such as Barcelona, Rome, Athens, Moscow and Helsinki. On the other hand, significant UNESCO World Heritage Sites and tourist destinations are also found outside modern metropolises, as demonstrated by the examples of Split, Carcassonne, Delphi, Assisi and Lucca. But it is also clear that large cities, which regard themselves as metropolises, have the highest ranks.

Index of metropolitan functions – functional area “culture”

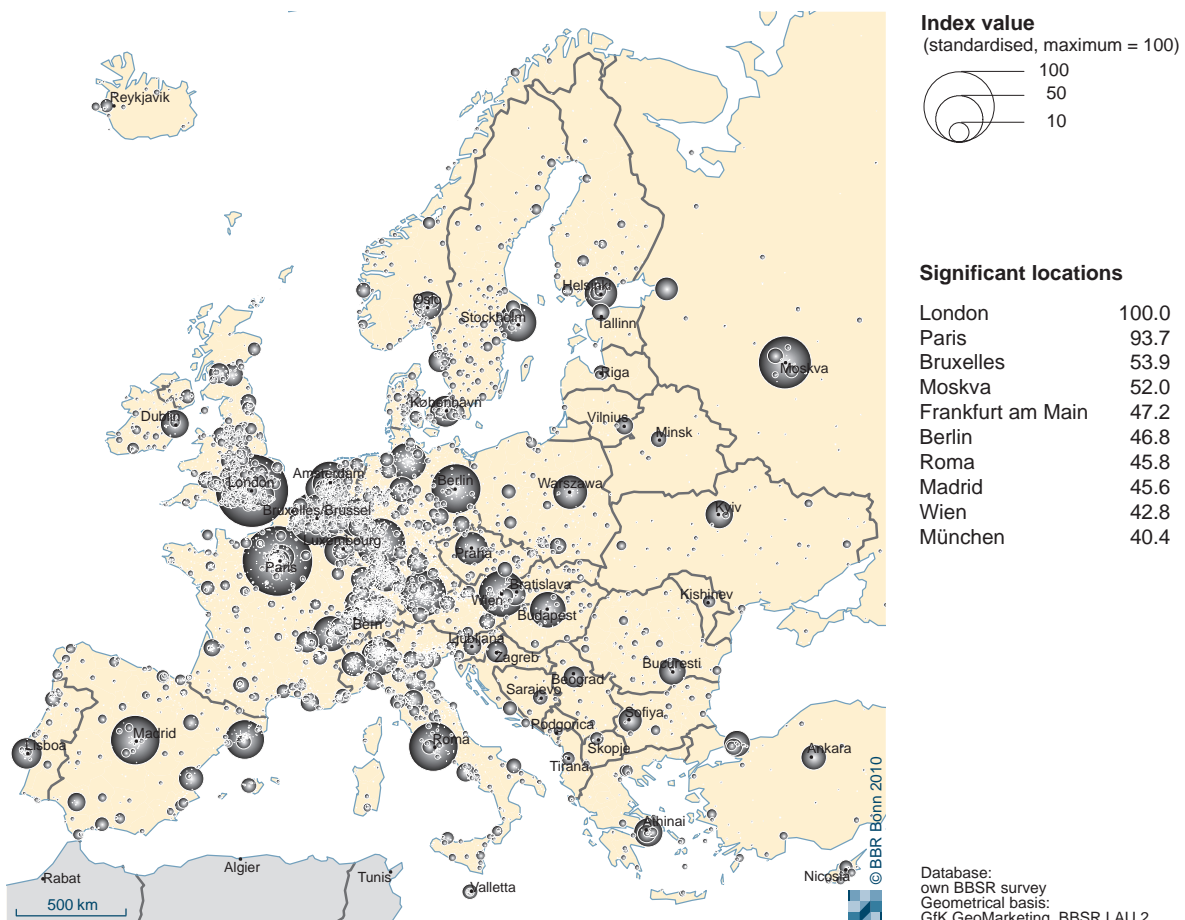


Locations of metropolitan functions in Europe

The 38 indicators recorded from all five functional areas can be found in 8,480 locations (local authorities) on the overall European territory. This means that 7 % of the potential locations reveal metropolitan functions. In the aggregate index, however, the majority of these locations reveals very low values. Only 184 locations have an index value of three points and more out of the maximum 100 points that can be achieved. This corresponds to a marginal value of a standard deviation above the average. Altogether, these 184 locations cover already 63 % of all metropolitan functions. An increasing value of the aggregate index goes along with an increasing variety of functional areas in each location. This means that values for all five functional areas can be identified for only 67 locations, while there are values for only one identified in 6700 locations.

Metropolitan functions are intensively concentrated in Central Europe. The “Pentagon” formed by London, Hamburg, Munich, Milan and Paris covers around 50 % of all locations with metropolitan functions which also hold nearly 50 % of all metropolitan functions. Outside the Pentagon, the density of locations with metropolitan functions is much lower and significant locations can sporadically be found. Within the Pentagon and close to it, the locations are decentralised, especially in Germany, Switzerland, the Netherlands and Italy. In these four countries, the most significant location only covers up to 20 % of the country’s metropolitan functions, showing that there are many more significant locations. In most small and medium-sized Eastern European countries the majority of metropolitan functions are largely concentrated on capital cities. They often occupy more than two-thirds of the metropolitan functions of their relevant country.

Index of metropolitan functions – aggregate index

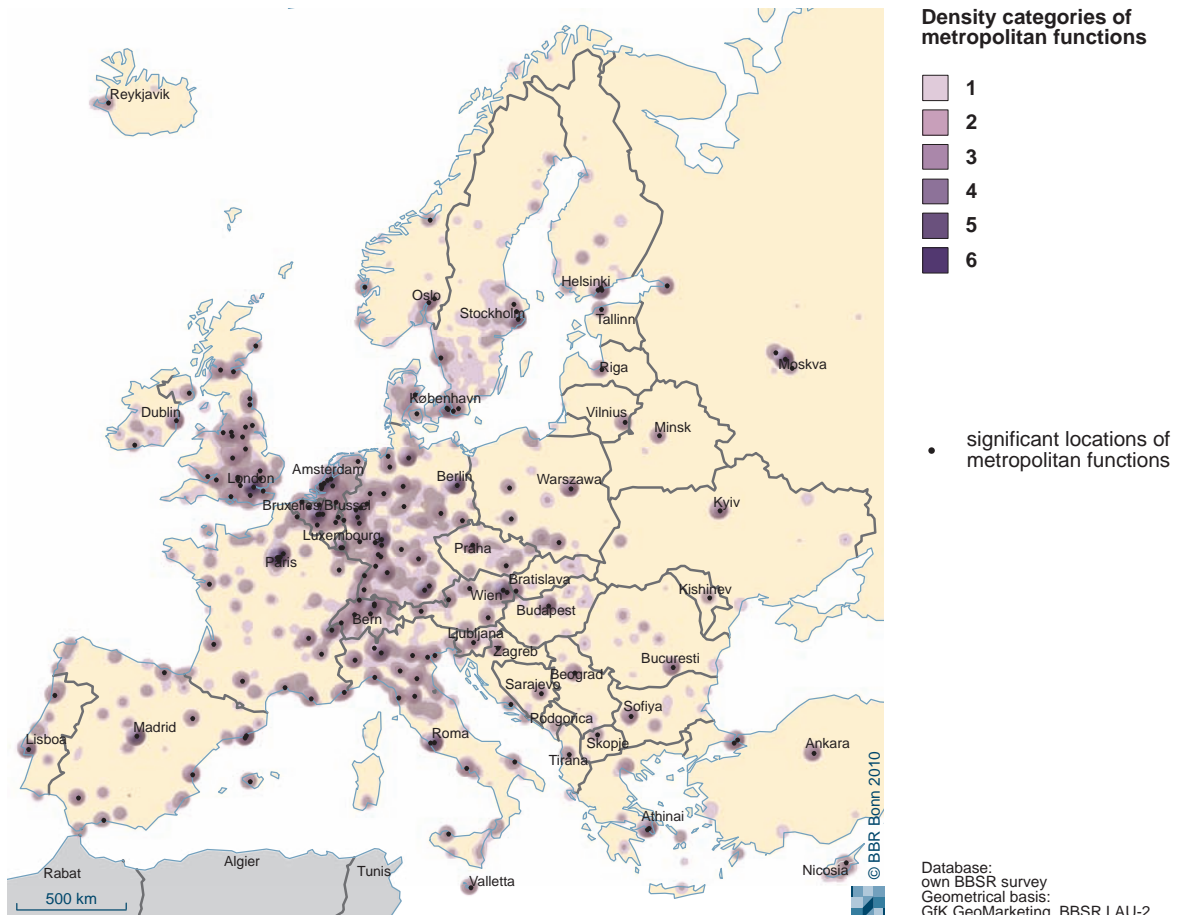


Regional density of metropolitan functions

A first step towards a regionalised analysis is to produce spatial clusters of locations of metropolitan functions which belong together. This is to bring together small territorial units sharing central functions e.g. core city and surrounding area. Based on a gravitation approach, distance-weighted density values, which take locations within a radius of 50 km into account, are calculated with GIS from the location-based data used for the index of metropolitan functions. Classifying them into six density levels, similar to heights in topographical maps, produces a “range of densities” demonstrating the spatial concentration of metropolitan functions – regardless of administrative borders. The figure on the cover shows an angular view of a detail of this range of densities.

Central Europe is prominently portrayed within the European Pentagon as a nearly coherent “mountainous region” with generally high densities of metropolitan functions since many locations with high index values situated close to each other are found there. The highest density level, however, is only reached by the areas around London and Paris. 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 medium density levels 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 bipole within a country, 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 also exist, e.g. in Northern Italy. In addition, there are many dispersed areas with low density levels partly extending to the European periphery.

Density categories of metropolitan functions



Defining metropolitan areas

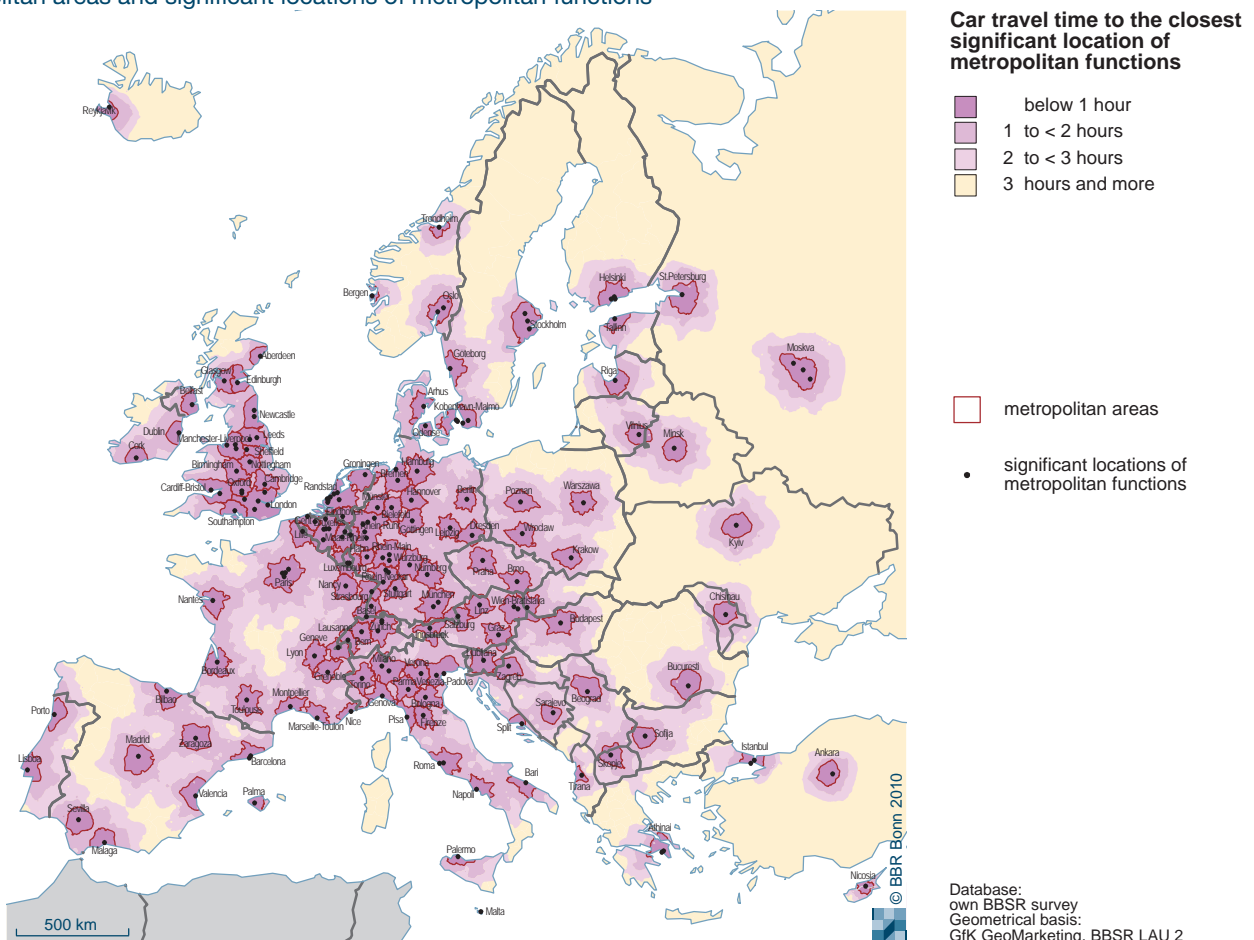
The 184 most important metropolises with at least three index points (see above) provide the basis for analytically defining metropolitan areas with the BBSR Accessibility Model. To define them, a car travel-time isochrone of 60 minutes is drawn around the cores of important locations. Cores close together are merged into a polycentric territorial unit so that 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 their surface area, are then comparable. Exceptions occur 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 the catchment areas are limited in this way.

Besides the one-hour isochrone to define metropolitan areas, two- and three-hour isochrones are drawn in the map. Those areas which are able to reach a significant location of metropolitan functions within two hours, are still considered as “close to a metropolitan area”. Some functions of metropolitan cores can even have an effect beyond what is demonstrated by the three-hour catchment area.

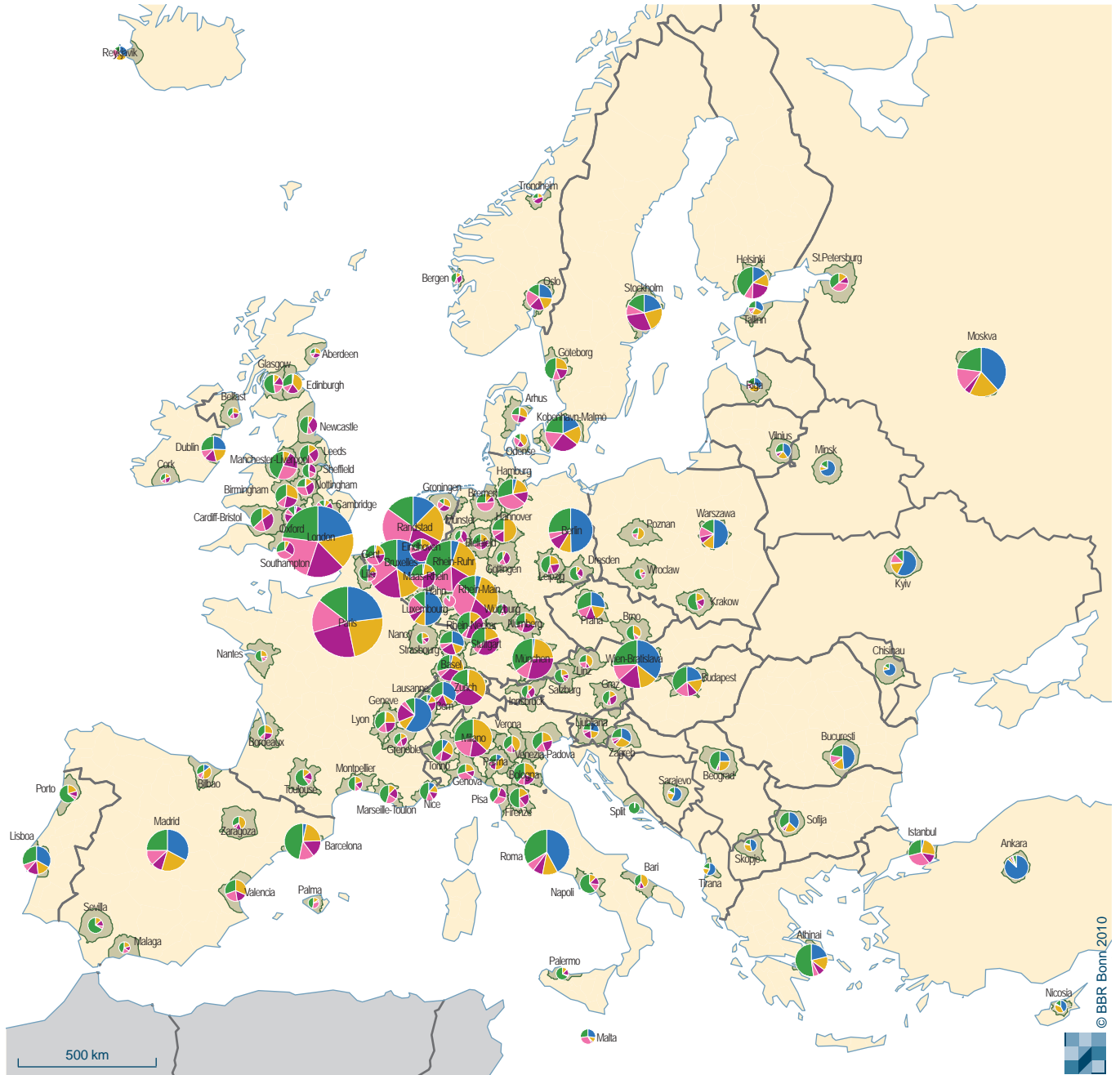
Central Europe – i.e. Germany, Denmark, Belgium, Netherlands, Luxembourg, Switzerland, Austria, Slovenia and the Czech Republic – but also western France, Northern Italy and England are nearly completely characterised by metropolitan areas or by their closeness to metropolitan area cores. Areas “far from metropolitan areas” beyond the three-hour isochrone hardly exist in Western and South-Western Europe. However, they are still typical of Northern Europe and large parts of Eastern and South-Eastern Europe.

The 125 metropolitan areas, which were analytically defined according to standardised criteria, should not be confused with metropolitan regions in Germany or other European countries, which, in the political context, have emerged and are understood as cooperation areas. The metropolitan areas defined serve to combine locations of metropolitan functions and the following statistical comparison.

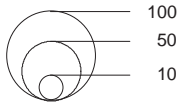
Metropolitan areas and significant locations of metropolitan functions



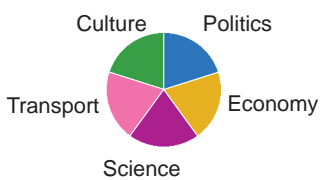
Metropolitan functions in metropolitan areas



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



Shares according to functional areas



Significant metropolitan areas

London	100.0
Paris	97.9
Randstad	74.5
Bruxelles	66.8
Rhein-Ruhr	51.1
Moskva	47.2
Wien-Bratislava	45.1
Rhein-Main	41.2
Roma	40.8
Berlin	38.7

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

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Demographical and economic importance of metropolitan areas

350 million inhabitants live and work in the 125 metropolitan areas identified, which is about 50 % of the population of the total area studied. The average number of inhabitants in all 125 metropolitan areas is about 2.8 million while the numbers of inhabitants in each metropolitan area 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. Reykjavik and Trondheim with only 230,000 inhabitants are the metropolitan areas with the smallest population. The average population density of metropolitan areas is 350 inhabitants per km². Here again, there are great differences. With more than 4,900 inhabitants per km², Istanbul has by far the highest population density followed by Malta with just under 1,500 inhabitants per km² as well as Barcelona and Moscow each with about 1,000 inhabitants per km². In 24 metropolitan areas the densities are even under 150 inhabitants per km², the upper limit set by the OECD to define rural areas. Reykjavik with about 64 inhabitants per km² has the lowest density.

The economic potential of the whole European area studied is also concentrated in the 125 metropolitan areas identified. Based on the sum of the absolute gross domestic product (GDP) in 2005, 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 represent already 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. 14 metropolitan areas for instance – which are Reykjavik, Hahn, Sofia, Vilnius, Tallin, Nicosia, Minsk, Malta, Skopje, Tirana, Split, Sarajevo and Chisinau – just reach a GDP each of up to 10 billion euros.

Functional importance of metropolitan areas

Combining the index values of the metropolitan function locations of each metropolitan area into an aggregate index (standardised to 100 and unweighted) reveals large differences of significance among metropolitan areas. Similar to the case of the locations, the metropolitan areas of London and Paris maintain a leading position in terms of metropolitan functions. In terms of the aggregate index, these two metropolitan areas have much higher values than the other metropolitan areas. On the following ranks, the significance of the polycentric metropolitan areas Randstad, Rhine-Ruhr, Rhine-Main and Vienna-Bratislava is only revealed by regionalisation and again shows the necessity of a regional analysis. All in all, the most significant metropolitan areas are concentrated in the European core area, the Pentagon. Within the Pentagon, metropolitan areas often border on each other, some even go beyond national borders. As a result, they bear a large number of metropolitan functions. The Eastern European countries including Greece and Turkey, however, just have a few other metropolitan areas in addition to their capital city regions. They have far fewer metropolitan functions.

Not only the level of the aggregate index but also the variety of metropolitan functions and a balanced supply are important criteria to determine the significance of metropolitan areas. Although there is a basic relation between the level of the aggregate index and the variety of metropolitan functions, it is clear that significant metropolitan areas – according to the aggregate index – do not always have the greatest variety of metropolitan functions. Typical examples are smaller and medium-sized capital cities in Europe with a strong significance because of their political function. Last but not least, very specialised metropolitan areas with only one dominant metropolitan function, such as Ankara with its political and Split with its cultural-historical function as well as Oxford as a British university and scientific centre, have to be mentioned.

Classifying metropolitan areas

When looking at the aggregate index and the functional diversity of metropolitan areas in relation to each other, four types can be distinguished (see map):

Metropolitan areas with a great variety of functions

This group of the 21 largest and most significant metropolitan areas in Europe consist of large European capitals as well as some very densely populated agglomerations. Metropolitan areas in this group not only have a very high functional significance but also have a great variety of functions illustrated by the fact that at least four of the five functional areas have above-average index values.

Metropolitan areas with a considerable variety of functions

This group of 19 members also consists of larger metropolitan areas characterised by a high functional significance. However, the variety of metropolitan functions is not as high as in the first group since only two or three functional areas have above-average index values. Some capitals of medium-sized European countries, for example, have an above-average

functional significance. But only two to three functions – one of them “politics”, the second one mostly “culture” – are strongly represented.

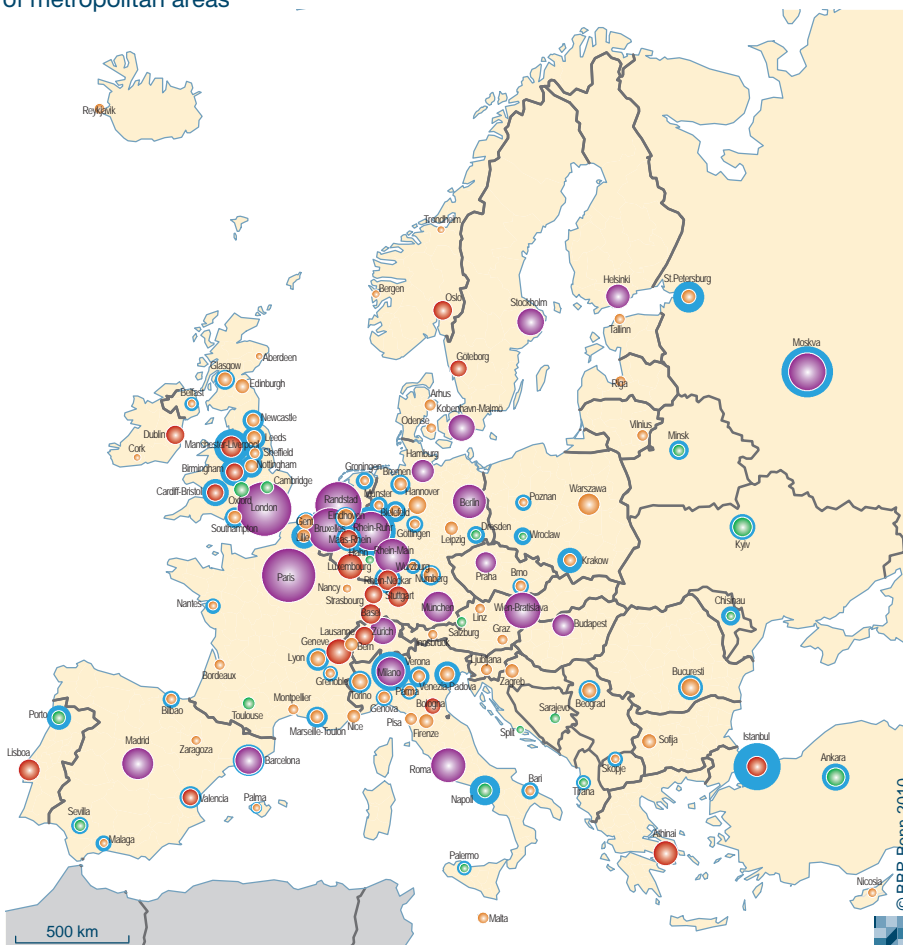
Metropolitan areas with a limited variety of functions

Compared with the last type, this group of 67 members includes medium-sized and smaller metropolitan areas whose significance is based on the level of the aggregate index of metropolitan functions rather than on their variety. National capitals are hardly represented. The variety of metropolitan functions in this group is restricted and is dominated by one functional area – mostly “culture”.

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

Metropolitan areas in this group of 18 members have a relatively low functional significance and are highly specialised in one functional area dominating the aggregate index by at least 50 %. These metropolitan areas therefore are not fully functional European metropolitan areas but rather national exceptions.

Types of metropolitan areas



Types of metropolitan areas

- metropolitan areas with a great variety of functions
- metropolitan areas with a considerable variety of functions
- metropolitan areas with a limited variety of functions
- metropolitan areas with a limited variety of functions and large degree of specialisation

- metropolitan areas with a surplus of importance of the population

Index value of metropolitan areas

(standardised, maximum = 100)



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

Metropolitan areas in Germany

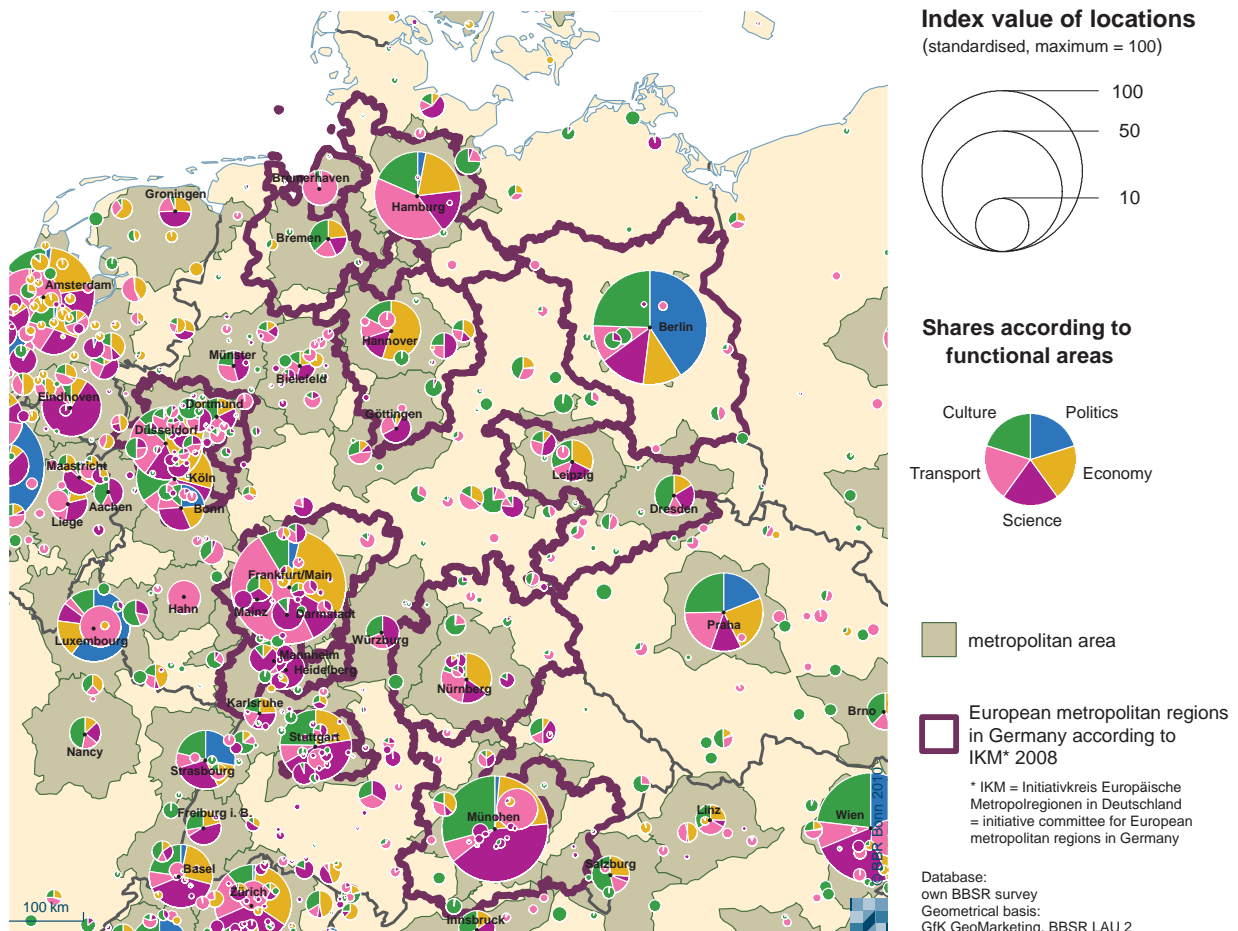
Germany has the most metropolitan areas in Europe. Among 125 metropolitan areas studied in the total European area, 17 are located in Germany. Germany is moreover involved in several cross-border metropolitan areas. Aachen and Freiburg have an especially important share in the role of the metropolitan areas Maas-Rhine and Basel. This is an illustration of the polycentric structure of the German urban system and the absence of a core which dominates all other centres as in almost all other European countries. Even the capital of Berlin does not have this outstanding significance although the functional area „politics“ has quite high values.

All established German, politically defined metropolitan regions are either covered by one or several of the analytically defined European metropolitan areas even if their shapes are not completely identical. In addition, Bielefeld and Muenster – perhaps both together and by including the Dutch border area – have the potential to form another European metropolitan region.

Conclusions

The analytical results and the new coordinate-based database on metropolitan functions in Europe can be used as a foundation stone in the field of the German and European spatial development policy to update the Territorial Agenda of the EU (TAEU) and the principles for spatial development in Germany. In the context of the recently started discussion on the European metropolitan system and a possible policy for metropolitan regions, an agreed basis for evidence including a standardised set of indicators comparable across Europe and a comparable spatial reference basis have not previously existed. The BBSR therefore would like to submit a proposal with this study. The metropolitan region concept, which has already established in the German spatial planning policy, is now capable of showing the significance of regions within the European competition between metropolitan regions, to contribute to realigning the boundaries of existing metropolitan regions or to subdividing metropolitan regions into subareas, to support initiatives for new metropolitan regions and to gain information about useful networking opportunities of locations of specific functions inside and outside metropolitan regions.

Metropolitan functions in Germany



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