VASAB
VISION & STRATEGIES
AROUND THE BALTIC SEA

Accessibility of the Baltic Sea Region Past and Future Dynamics

Accessibility is a key concept for territorial development and an essential location factor. It holds significance on various spatial scales. Even in the areas geographically distant from the European core, where accessibility is generally poor, its local differentiation may decide about development.

The VASAB Ministerial Conference in 2014 in Tallinn underlined that connectivity and accessibility in the Baltic Sea Region (BSR), as well as the links between the Region and Europe's core areas, and between the Region and other neighbouring regions are amongst the key development issues in the BSR. The key challenge for the countries and regions is to interconnect Trans-European, national and regional intermodal transport networks in the best way possible.

The concept of accessibility potential is based on the assumption that the attraction of a destination increases with its size, and declines with distance, travel time or cost. For the analysis presented in this publication, destination size is represented by regional population and the impedance by travel time. Accessibility potential to the population can be seen as an indicator for the size of market areas for suppliers of goods and services and thus as an indicator showing the competitive position of regions. The accessibility potential indicators are presented as index values, i.e. the BSR average accessibility is always set to 100 and all regional indicator values are standardised using this average.

There are two basic possibilities to look at changes of accessibility over time. One is to analyse the relative changes, the other is to use absolute changes. Both approaches might yield different results as one region might perform in different ways depending on the way the change is looked at. Therefore, this publication considers relative and absolute changes to analyse accessibility dynamics both in the past and future. The two most influential factors affecting past accessibility are demographic changes and the development of the transport market. This trend will continue in the same direction.

The future accessibility trends of the BSR are determined by the future demographic changes and the planned trans-European transport networks of the European Union (EU) - TEN-T policy[1] defining infrastructure developments as well as development in East- and Southeast Asia.

TEN-T corridors in the BSR are:

- The Scandinavian - Mediterranean corridor;
- The North Sea - Baltic corridor;
- The Baltic - Adriatic corridor.

The accessibility scenarios of this VASAB publication are meant to describe realistic situations according to planned transport infrastructure development changes.

The Context of Past Accessibility Changes

Demographic Changes

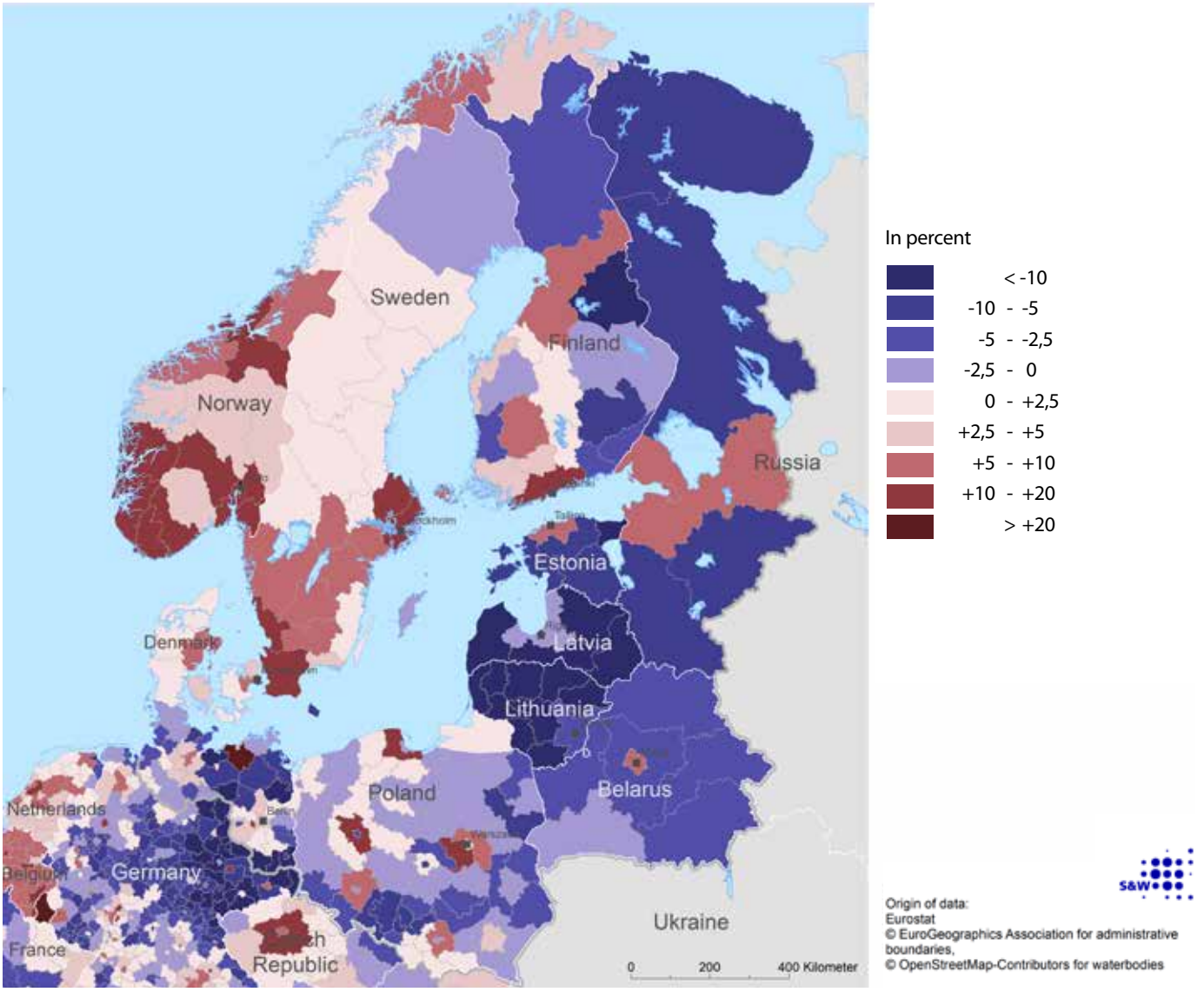
Population change has a significant impact on accessibility potential of the BSR regions. Changes in the population distribution in the BSR macro region in the period 2006-2016 were significant (Figure 1). A substantial population increase took place in southern Sweden, Finland, Norway and Denmark, as well as in the St. Petersburg region. In Poland, there was a clear concentration of the population in the vicinity of the five largest centres (the so-called "Big Five"): Warsaw, Gdansk, Poznan, Krakow and Wroclaw. It results from the intense migration to these cities from the peripheries and from massive suburbanisation. The same process can be observed in the surroundings of Tallinn, Helsinki and Minsk. In Lithuania and Latvia, the better situation of suburban zones of Vilnius and Riga is expressed only in the less negative population balance. In general, most of the south-eastern part of the Baltic Sea macro region (Lithuania, Latvia, Estonia, Belarus, eastern Poland, part of Russia and eastern Finland and north-eastern Germany) are characterised by rapid population loss during the last ten years. In the new EU member states, it is caused by parallel migration to the largest cities and abroad. In Russia and Belarus, internal directions were important for the largest centres (Moscow, St. Petersburg, Minsk). The concentration of people in major metropolises also occurs in the Nordic countries.

The processes indicate the growing differentiation of the macro region with respect to the demographic situation. It takes place in two dimensions: a) East-West; and b) peripheries - the largest centres. The scale and speed of changes affect the indicators of spatial accessibility. Over a period of 10 years, the population of some areas increased by over 20 % (Skåne, southern Norway, the Stockholm region, the suburbs of Gdansk, Poznan, Warsaw and Helsinki). At the same time, the population of most units in Lithuania, Latvia and Mecklenburg - Vorpommern fell by more than 10 %. If new transport investments were not implemented in 2006-2016, demographic changes would probably have caused a noticeable decrease in the level of accessibility potential in the eastern part of the macro region. This should also be considered in the context of changes in the demographic structure (aging process).

[1] The Trans-European Transport Network (TEN-T) is a European Commission policy directed towards the implementation and development of a Europe-wide network of roads, railway lines, inland waterways, maritime shipping routes, ports, airports and rail-road terminals. It consists of two levels:

- The Core Network, containing the most strategic parts/connections linking the most important nodes to be completed by 2030. For the implementation of the core network, a multimodal corridor approach has been adopted.
- The Comprehensive Network, covering all European regions shall ensure good accessibility of all regions to be implemented by 2050.

Figure 1 **Population development, 2006-2016**



Past Transport Infrastructure Development

In some countries of the BSR, the motorway network was already widely developed by 2006 (Table 1) and all countries have experienced an increase of the motorway network before 2016. Poland has invested heavily in motorways.

In the Nordic countries national roads have an important role for the connectivity of regions and cities: lower densities and lower traffic volumes do not require motorway standards here, something which is also true for several parts of the Baltic States. In all three Baltic States as well as in Russia and Belarus quality and capacity of national roads was significantly improved.

The development of the rail infrastructure in the BSR, on the other hand, was very different in the different countries (Table 2). In some countries, such as Finland, Lithuania and the BSR parts of Germany there was an increase in the length of the railway network in actual use. However, all other countries saw a decrease of the railway network in operation. The overwhelming part of the rail infrastructure in the BSR does not allow operating speeds for high speed railways. Quite the opposite, non-modernised tracks, outdated signalling techniques and rolling stock lead to slow and often unreliable train services.

Table 1 **Length of the motorway network in the EU member states of the BSR**

Year	DK	DE*	EE	FI	LV	LT	NO	PL	SE
2005 (km)	1,032	2,051	99	693	-	** 309	264	552	1,700
2016 (km)	1,255	2,155	145	890	-	314	392	1,640	2,118
Change (km)	223	104	46	197	-	5	128	1,088	418

Source: Eurostat (2018), BMVI (2017) *BSR part only ** data for 2010

Table 2 **Length of the railway lines in use in the EU member states of the BSR**

Year	DK	DE*	EE	FI	LV	LT	NO	PL	SE
2005 (km)	2,646	* 6,657	968	5.732	2.270	1.771	4.114	19.507	11.017
2016 (km)	2.539	* 6,760	918	5.926	1.860	1.911	3.895	18.429	10.882
Change (km)	-107	* +103	-50	+194	-410	+140	-219	-1078	-135
% electrified in 2016	24.5	** 52.8	14.4	55.2	13.5	6.4	63.1	64.0	75.2

Source: Eurostat (2018), Destatis (2018) *BSR part only ** Germany

Changes in the Transport Market

Changes in transport accessibility related to new investments are a response to the situation on the transport market. During the period 2005-2016 changes in road accessibility were connected with the enlargement of the European Union, and then the collapse in 2008-2009 related to the economic crisis. After 2012, the volume of transport stabilised in most of the BSR countries.

The dynamics of road transport cannot be treated as an effect of improving transport accessibility. It is rather one of its indirect causes. The large scale of growth in Poland and the Baltic States (including the scale of transit from Eastern Europe) caused significant increases in the number of HGV (heavy goods vehicles), and thus the demand for new infrastructure. The development of the TEN-T North Sea - Baltic Corridor (including in particular the construction of Via Baltica) is seen as the answer to this demand.

In the case of rail transport, the scale of changes in the period considered was generally lower. Also in this case, the effect of the 2008 crisis is visible. However, the enlargement of the European Union itself is much less marked. The overall increase in transport in the new member states was mostly taken over by road transport. Also in subsequent years, the increase in the volume of transported cargo occurred mainly in the Scandinavian countries (especially in Norway and Denmark), and in the beginning also in Germany. This confirms the hypothesis about favourable modal changes, which might have been the effect of railway investments. Rail transport continued to decrease in Poland and the Baltic States.

There are various stages of development of the transport market in the BSR countries. In Germany and the Nordic countries, the development of infrastructure and the improvement of railway accessibility can be seen as one of the factors of favourable changes of the modal structure towards a more environmentally friendly railway transport. In Poland and the Baltic countries, the negative dynamics of transport probably has an indirect impact on the delay of railway investments relative to roads.

For accessibility by rail in Europe, the development of high-speed rail services is an important element. For the BSR, Eurostat (2018) lists only three countries (Sweden, Poland and Germany) that have high-speed rail transport.

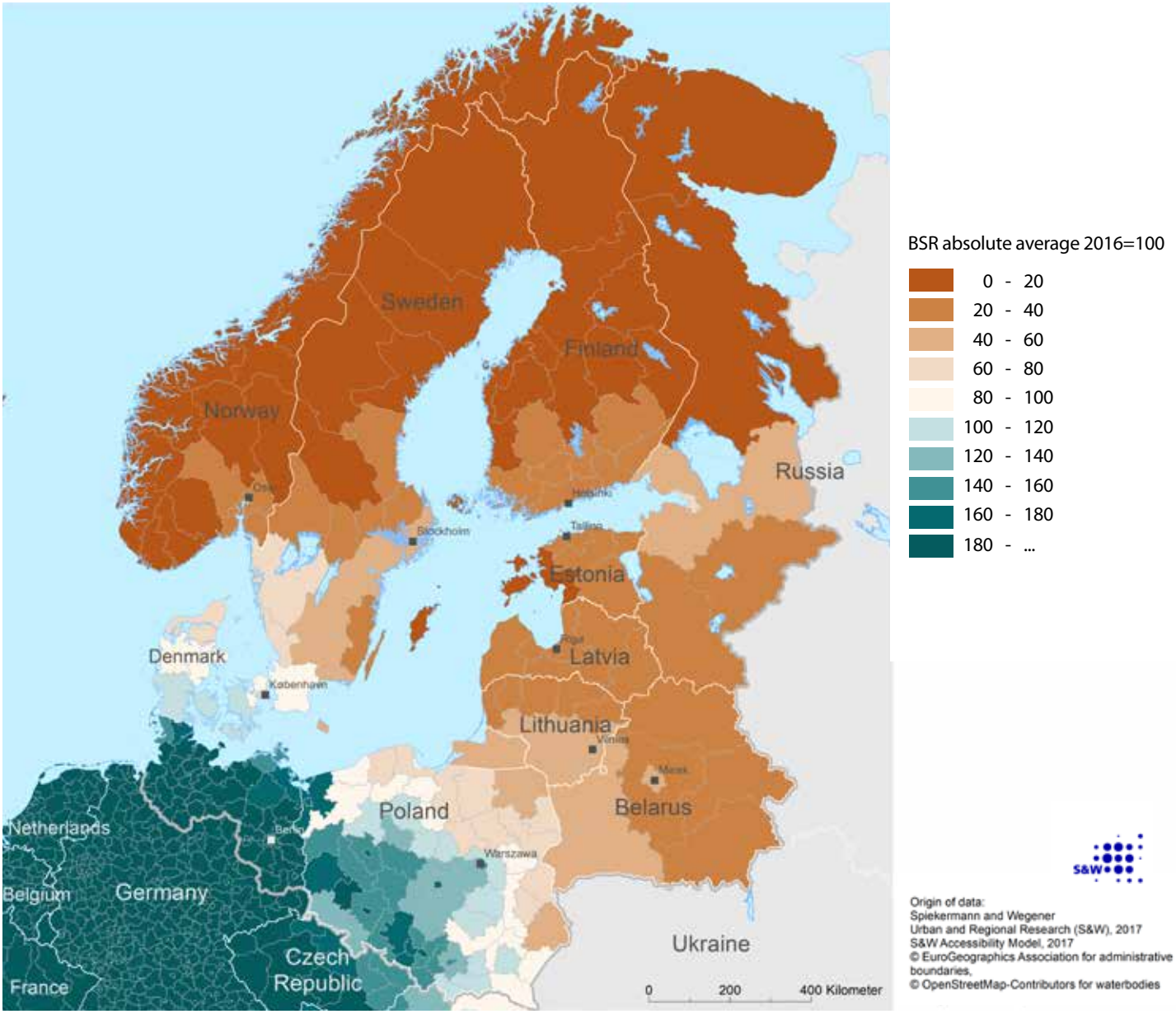
In the Baltic countries and Poland the number of private passenger cars is constantly growing. In Poland, this increase is still linear, and the level has almost doubled since 2005. This is related to liberal regulations regarding the import of used cars from Western Europe. The quality of public transport in peripheral areas and mass suburbanisation in the vicinity of the largest urban centres are also important. In both cases, the use of cars becomes a precondition for economic activity. In this context, accessibility in road transport can be seen as a determinant of the position on the labour market and an indicator of overall quality of life. Mass motorisation also creates pressure on the development of road infrastructure and is an indirect cause of some actions improving the level of accessibility.

In all BSR countries during the last fifteen years, there was a dynamic growth of air traffic, and thus the demand for infrastructure for this mode of transport. It has to be associated with the expansion of low cost airlines that has spread all over Europe. However, the growth rate was higher in the new member states, especially in Poland, Lithuania and Latvia. The investments in airport capacities have been done in several capitals and other larger cities in the BSR, like Warsaw, Riga, Tallinn, Helsinki, Stockholm, Hamburg. In the BSR area of Russia, the residents and visitors of the St. Petersburg, Leningrad and Kaliningrad regions benefitted from the large-scale reconstructions of the airport complexes in St. Petersburg and Kaliningrad.

Accessibility Potential by Road

The level of accessibility potential by road in the BSR (Figure 2) is the highest in the German regions and decreases in the northeastern direction, as one moves away from the demographic-economic core of the EU (the so-called Pentagon). The demographic potentials of the largest urban regions of the BSR apart from Germany (Stockholm, Copenhagen, Warsaw) only to a little extent balance or compensate this decrease. The exception is St. Petersburg, which distinguishes itself by a very large demographic mass. However, its impact on a general level of accessibility of the region is restricted by a low permeability of borders between EU countries and Russia. The area of relatively better accessibility extends from Germany further East, towards central Poland, primarily due to recent investments in road infrastructure along the Warsaw-Berlin corridor.

Figure 2 **Accessibility potential, road, 2016**



All other regions of the BSR have a rather low accessibility potential by road that is less than half of the BSR average accessibility, in the far northern regions even less than a fifth of the BSR average. Also, all Baltic Sea islands are characterised by relatively low accessibility.

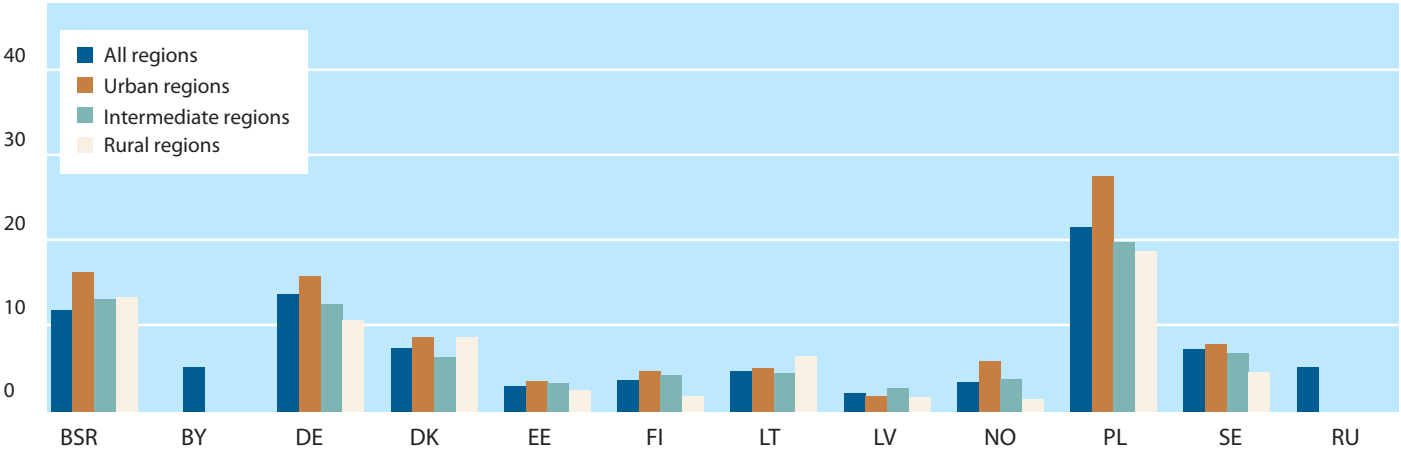
The general differences in the level of road accessibility between the countries of the BSR are significant. Germany's (BSR part only) and Poland's average road accessibilities are above the BSR average, Denmark's is about average, all other countries are below average, of these the Russian BSR regions have the highest accessibility by road. For the countries with higher accessibility, this is mainly due to the location of these countries, and in the case of Germany due to the well-developed motorway network. In the BSR as a whole, urban regions have higher accessibility potential by road than other regional types, especially the BSR area of Germany, Poland and Finland.

In the years 2006-2014, higher relative improvements of up to 50 percent of the initial value of road accessibility took place in particular in Poland, Sweden and Norway, and somewhat less also in Finland, Belarus, Lithuania and Kaliningrad region, due to road investments made by those countries. The relative changes were of moderate character in the regions that already enjoyed high road accessibility (BSR part of Germany, Denmark), however, the most insignificant changes were noted in the regions that had a very poor accessibility (Russia, East Belarus, Latvia, northern regions of Finland, Sweden and Norway). In some parts of the latter mentioned regions, even a drop in the value of accessibility index occurred, which can be explained by depopulation processes.

At the same time, looking at absolute changes of accessibility potential by road, the pattern of regions benefitting most is somewhat different. The higher relative gains in northern and eastern regions of the BSR are not visible anymore; the stronger relative gain is an outcome of the low initial values. Nevertheless, the relative gains in those regions show effects of transport infrastructure investments. The highest absolute gains are to be found in Polish regions followed by multiple regions in the BSR area of Germany and partly in Denmark. Here, massive road infrastructure investments linking areas with high population figures led to a clear absolute increase in road accessibility.

This spatial pattern of higher and lower absolute gains in accessibility is confirmed when aggregating the changes to countries and regional types (Figure 3). The BSR as a whole has increased its average accessibility in 2016 by about 12 index points of its 2006 average level. The highest gains occurred in Poland with an increase of slightly more than 20 index points,

Figure 3 **Accessibility potential by country and urban-rural typology, road, absolute change 2006-2016**



DE, RU: only BSR regions included; BY, RU no differentiation by typology

followed by the German parts of the BSR with an increase of 13 index points. The road accessibility gain of all other countries was below BSR average.

In general, the effect of relative and absolute improvements in road accessibility was of lower significance towards eastern and northern directions. The above described changes may indicate that there was an increase in disparities between the most and the least accessible regions within the BSR.

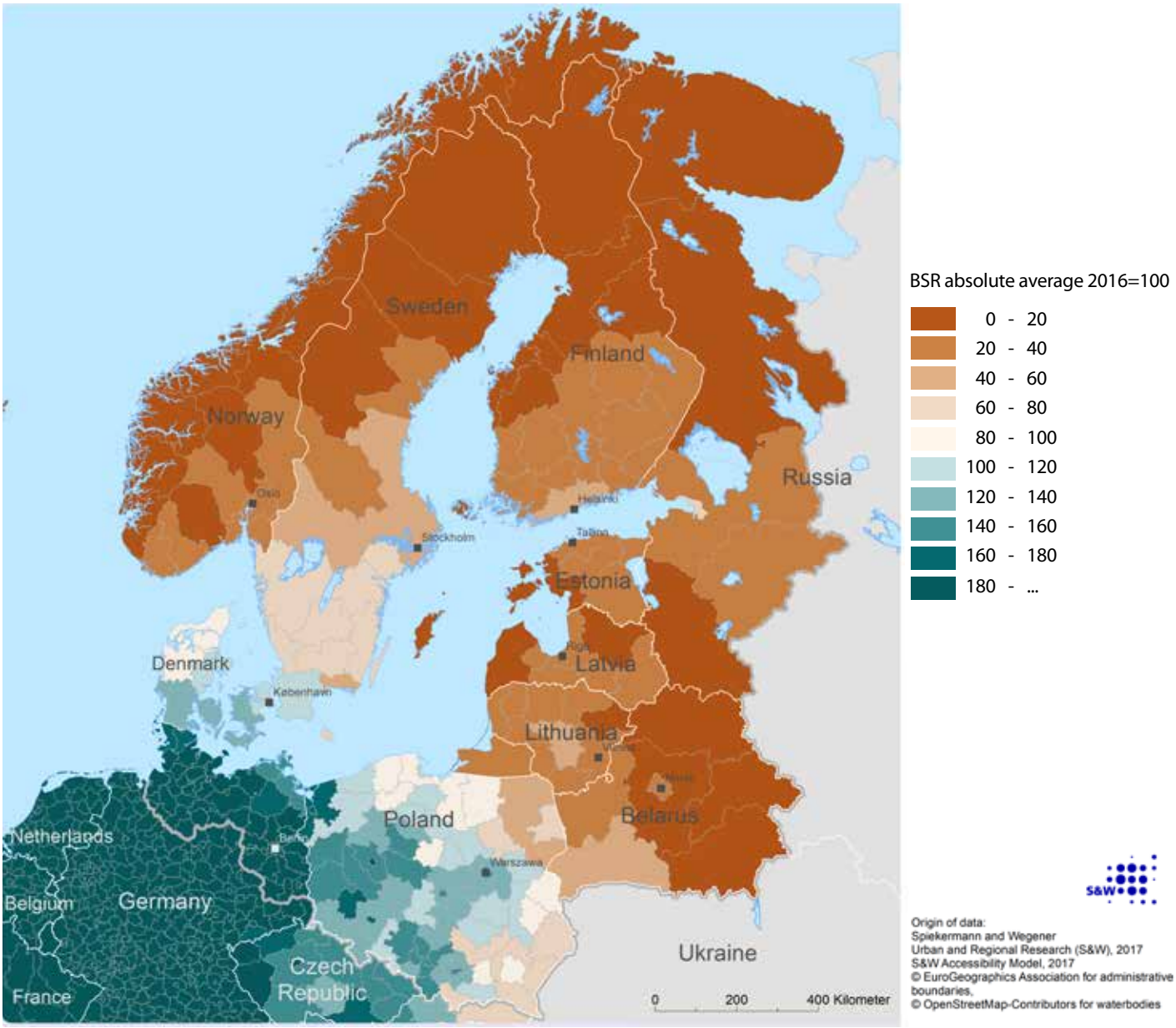
The classical concentric structure of accessibility potential by road in Europe with highest values in the Benelux countries and western parts of Germany was somewhat modified in the BSR primarily by investments within the transport corridors Hamburg - Copenhagen - Oresund bridge - Stockholm and Berlin - Warsaw. The distribution of zones in which accessibility has improved indicates that the investments were very important in very specific sections. These include, for example, the central fragment of the Polish A2 motorway between Lodz and Warsaw.

Accessibility Potential by Rail

The highest accessibility by rail in the BSR is in the German BSR regions (Figure 4). Most regions of Poland (up to the Vistula line) and Denmark and due to the Oresund bridge even the region of Scania in Sweden have rail accessibility values above the BSR average, i.e. the area of above BSR average accessibility is somewhat larger than for road. Rail accessibility decreases steadily towards the northern and eastern regions of the BSR. However, in the case of railway accessibility potential, the small- and large-scale disparities within the BSR might be even bigger than for road accessibility.

There are also significant differences in accessibility by rail between the BSR countries. The highest recorded rates are again in Germany's BSR regions, followed by Poland and Denmark, all above BSR average. The average values of Sweden and the Russian BSR regions are clearly higher than those of the other countries. In the BSR as a whole and in most countries, the urban regions have higher rail accessibility than rural regions; the differences are the highest for the BSR regions of Germany and for Poland, i.e. countries with the highest rail accessibility. However, in Denmark as a country with above BSR average rail accessibility, the situation is much more balanced between the different region types. This is also the case in Lithuania, Latvia and Estonia, but on a rather low overall level of rail accessibility. Larger internal polarisation is also visible in the Nordic countries, especially in Norway and Finland, where the far north rural regions have the lowest rail accessibility.

Figure 4 **Accessibility potential, rail, 2016**

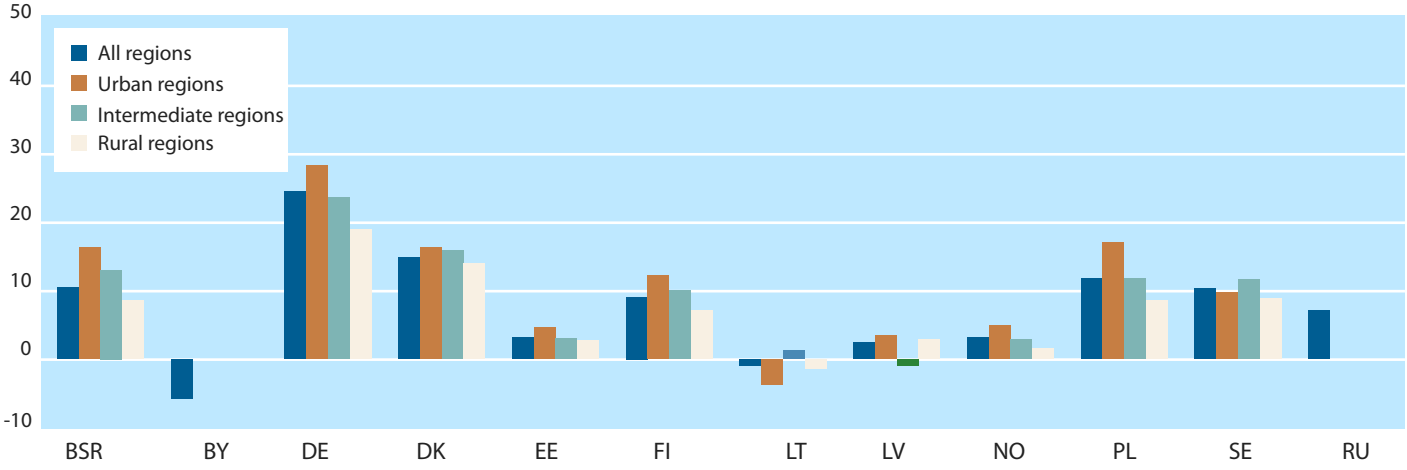


During the past ten years, relative improvements in rail accessibility took place mainly in the Nordic countries due to the modernisation and upgrading of railways lines in Sweden, Norway and Finland and in Russian BSR regions in particular through the high-speed connections of St. Petersburg. Relative rail accessibility gains occurred also in regions of the three Baltic States and of Poland and Germany. However, it has to be remembered that, to some degree, the relative growth was an effect of a "low base" (low rail accessibility in the previous years).

Belarus and some regions of eastern Poland, Lithuania, Latvia and Russia noted even a decrease in the level of rail accessibility during the period considered. This is the cumulative effect of depopulation and decapitalisation of the railway network. The important barrier is the difference between the European and Eastern European gauge of railway tracks, meaning that railway investments in Poland did not translate into improved accessibility in the former USSR countries (including the Baltic States), as it was the case in road transport.

In comparison to road accessibility, the spatial pattern of absolute changes of accessibility potential by rail is somewhat different. In the Nordic countries, increases are visible in southern Finland and in the corridor from Stockholm to Copenhagen as well as in other parts of Denmark.

Figure 5 **Accessibility potential by country and urban-rural typology, rail, absolute change 2006-2016**



DE, RU: only BSR regions included; BY, RU no differentiation by typology

On average, rail accessibility in the BSR grew by 10 index points of the 2006 average (Figure 5). However, the changes during the ten years since then were rather heterogeneous across the BSR. On the one hand, the regions of Germany belonging to the BSR experienced a growth of about 25 index points in accessibility potential by rail, Denmark's regions 15 and Poland's 12. Sweden and Finland saw a growth of almost ten index points, i.e. at about BSR average, Russian BSR regions grew about seven index points. The growth of rail accessibility in Estonia, Latvia and Norway was rather modest; Belarus and Lithuania experienced even a slight reduction. This is partly due to the fact that positive accessibility effects of investments in rail infrastructure, if happened at all in some of those countries, were outbalanced by population decline. The result of those two factors are only modest growth or even decline of accessibility when measured as accessibility potential as it is done in this publication. In the BSR as a whole, urban regions benefitted most of the growth in accessibility potential by rail while rural regions experienced lower gains. The more favourable development of the urban regions is because the urban regions in the more strongly growing countries, in particular in the BSR regions of Germany, Poland and Finland, gained much more than the other regional types in those countries. However, in Denmark and Sweden, which had also a clear increase in rail accessibility, the growth was more evenly distributed across urban, intermediate and rural regions.

Accessibility Potential by Air

Accessibility in air transport is conditioned by the location of airports, by their accessibility through land transport modes and by the flight services offered. The resulting spatial pattern of accessibility potential by air is very distinct from the patterns for road and rail (Figure 6). The clear centre-periphery continuum of the land modes is replaced by a mosaic of highly accessible regions surrounded by regions with much lower air accessibility. All countries have at least one region which has an accessibility potential by air which is clearly above the BSR average. All the countries of the BSR, the region surrounding each country's capital with its international airport makes up the highest accessible group of regions in the BSR.

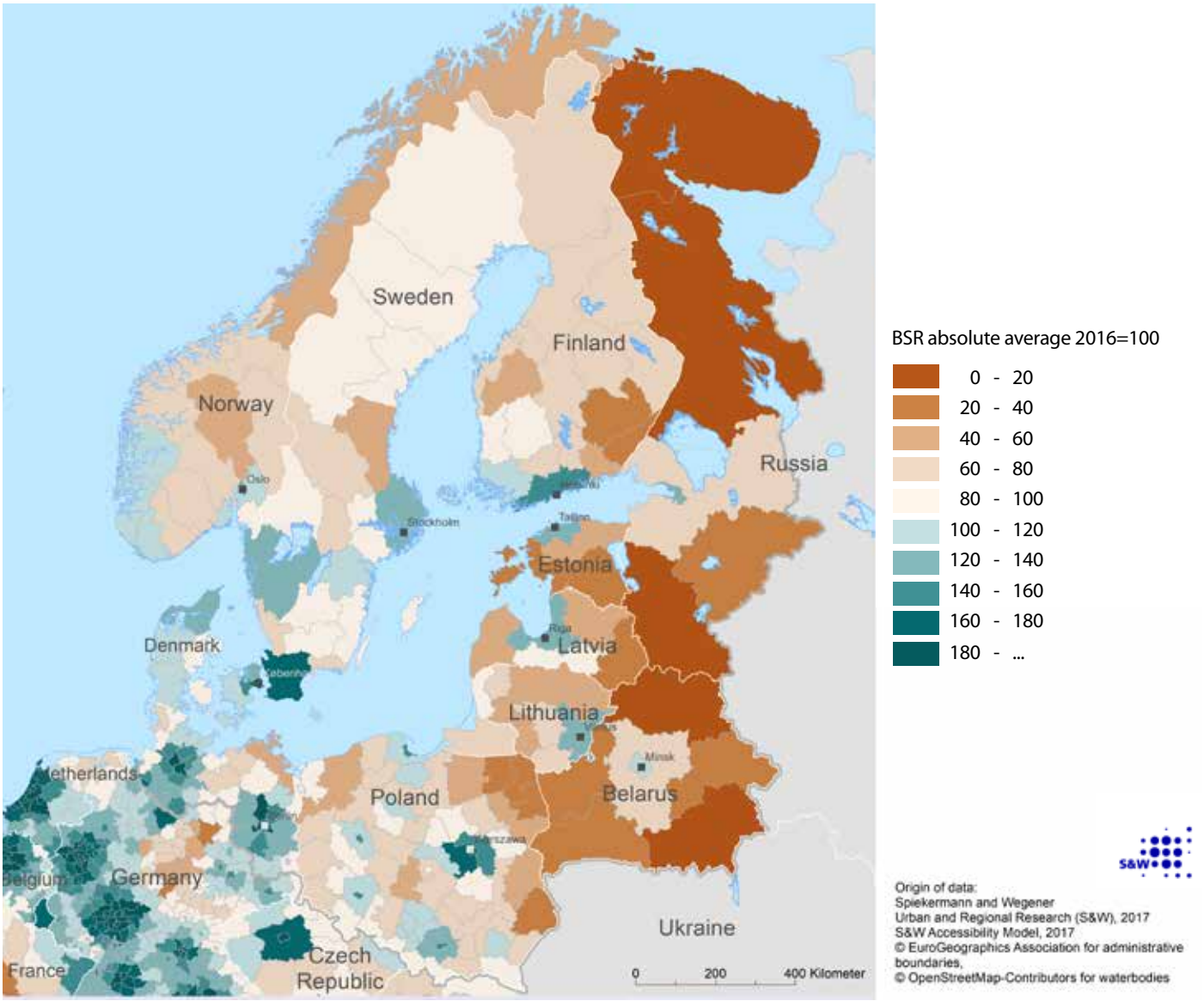
However, it can also be seen that the area benefitting in terms of air accessibility from good air connectivity is rather confined to the surrounding of the individual airports. That means that regions with comparatively low air accessibility can be found in all countries of the BSR. Patterns of high and low air accessibility are visible in all countries. However, differences are more clearly pronounced in the three Baltic States, Belarus and Russia than in Poland and in the Nordic countries. The northern regions' air accessibility is not as markedly below the BSR average as the comparative road and rail accessibility. This is mainly due to the substantial number of regional airports mainly served by flight connections to the capitals of the countries.

In contrast to the accessibility in road and rail transport, indicators of air accessibility reach similar values in all countries. Only Denmark and the BSR regions of Germany are clearly higher due to their international airport hubs. The main differences in the BSR are not between countries but between urban regions and rural regions. This is true for the BSR as a whole but also for each individual country. Urbanised regions are better accessible in all countries of the BSR. This proves that air transport is an important factor balancing the level of multimodal accessibility in the BSR on the national scale. At the same time, it polarises regional spatial systems by favouring metropolises served by international airports.

The years 2006-2016 were the period of a spectacular growth in the level of air accessibility throughout all "new" EU member states through the construction of new airports, modernisation of existing facilities and expansion of low-cost carriers, this was also true for Russia and Belarus. Relatively, the most significant growth in accessibility was noted in the three Baltic States, in the western and southern parts of Poland, in Belarus and Russia and in a few regions in Norway and Finland. However, the combined working of reduced flight services in some regional airports and sometimes shrinking of population led also to negative changes in air accessibility in regions of Germany, Sweden, Finland and Russia. The absolute growth in air accessibility follows more or less that of the relative changes.

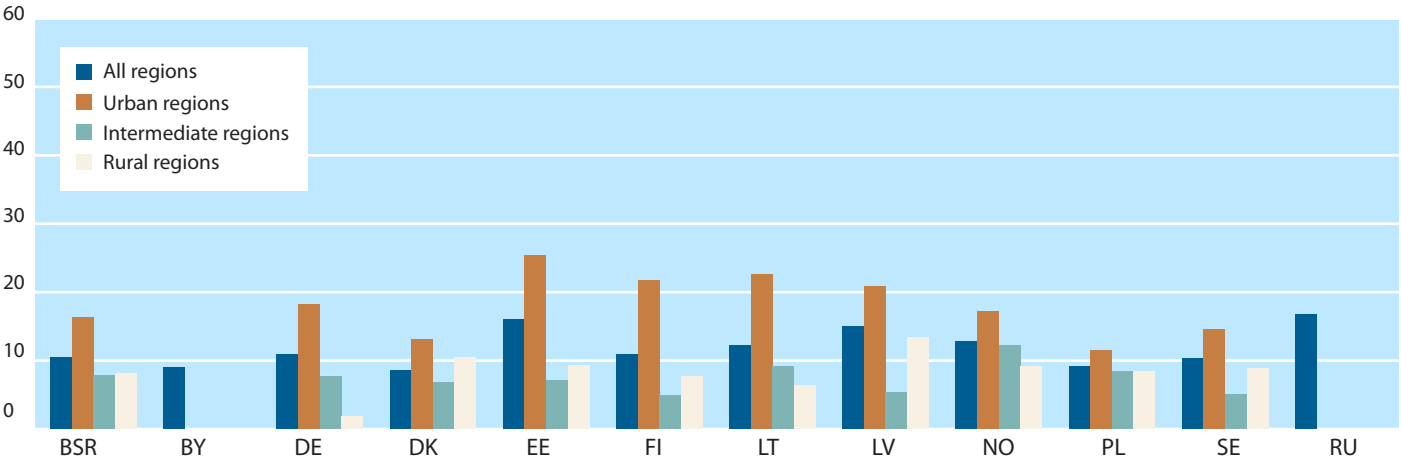
In the country by country comparison of absolute growth of air accessibility, the Russian BSR regions, the three Baltic States of Estonia, Latvia and Lithuania and Norway experienced the strongest push (Figure 7). This was possible because mainly

Figure 6 **Accessibility potential, air, 2016**



the urban region, i.e. the capital regions of those countries and St. Petersburg gained through the improved facilities and connections of their airports. The growth of Danish and German BSR regions was at a lesser degree as those regions have the highest absolute values, there is a tendency of a more balanced pattern of air accessibility in the BSR. Some areas have improved air accessibility due to their location near modernised airports in neighbouring countries. This applies, for example, to northern Lithuania (the airport of Riga) and north-eastern Poland (Lithuanian airports in Vilnius and Kaunas).

Figure 7 **Accessibility potential by country and urban-rural typology, air, absolute change 2006-2016**

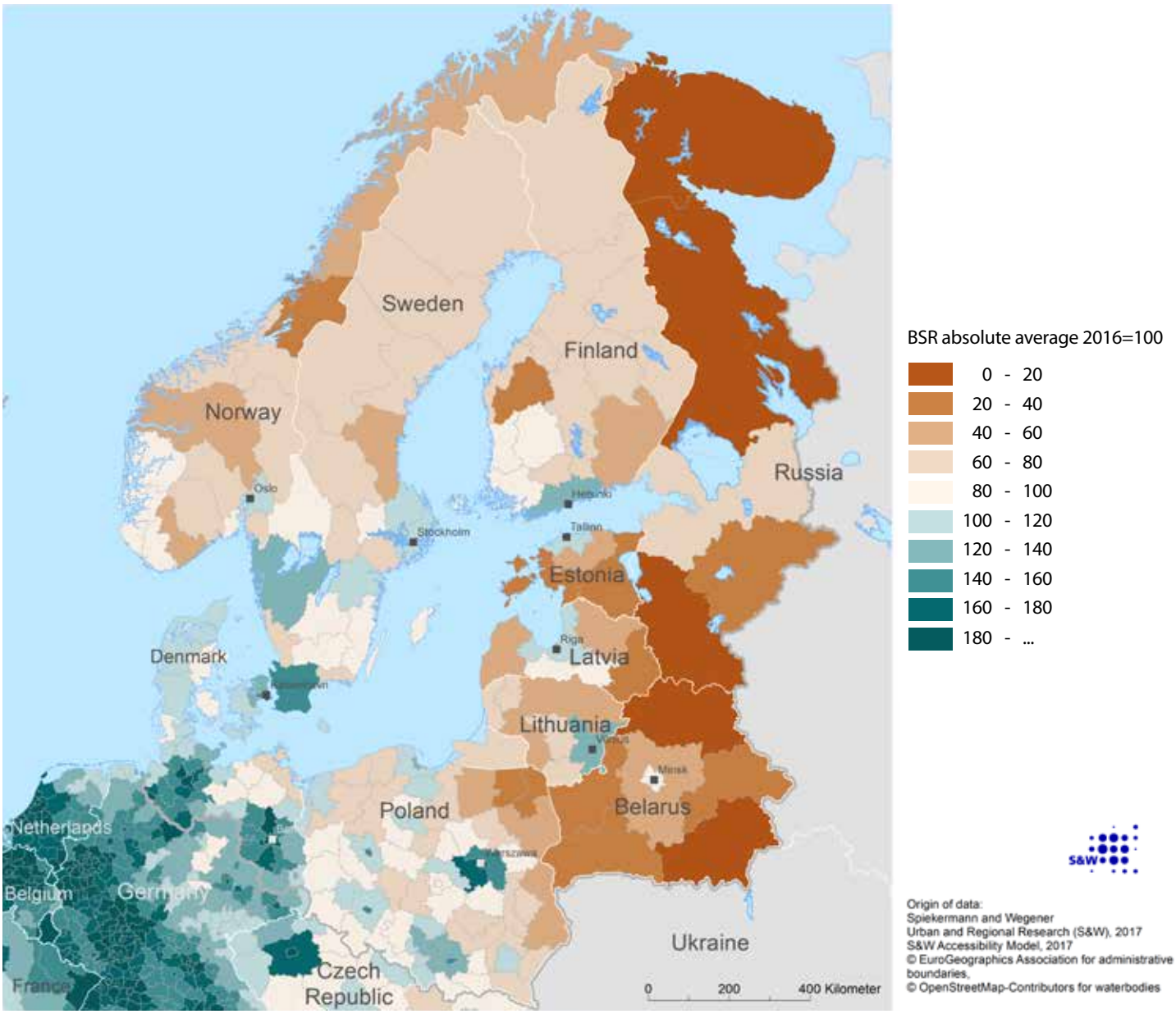


DE, RU: only BSR regions included; BY, RU no differentiation by typology

Accessibility Potential, Multimodal

Accessibility potential multimodal is an aggregate indicator composed of road, rail and air accessibility. The accessibility potential indicators specified here reflect Europe-wide accessibility to a higher degree than local or regional, multimodal accessibility is mainly, but not solely determined by air accessibility. Consequently, the overall spatial pattern of multimodal accessibility (Figure 8) is somehow comparable to that of air accessibility. But there are some important differences. Overall, the regions that have high air accessibility do also have high multimodal accessibility. These are mainly the capital regions of almost all countries. However, due to lower road and rail accessibility, the Minsk and St. Petersburg regions are now below the BSR average. On the other hand, favourable conditions for road and rail accessibility might compensate for low air accessibility. This is the case for many BSR regions in Germany which have clearly below average air accessibility, but clearly above multimodal accessibility. In other regions, in particular the northern regions in the Nordic countries, relatively good air accessibility compensates for the rather low degrees of road and rail accessibility.

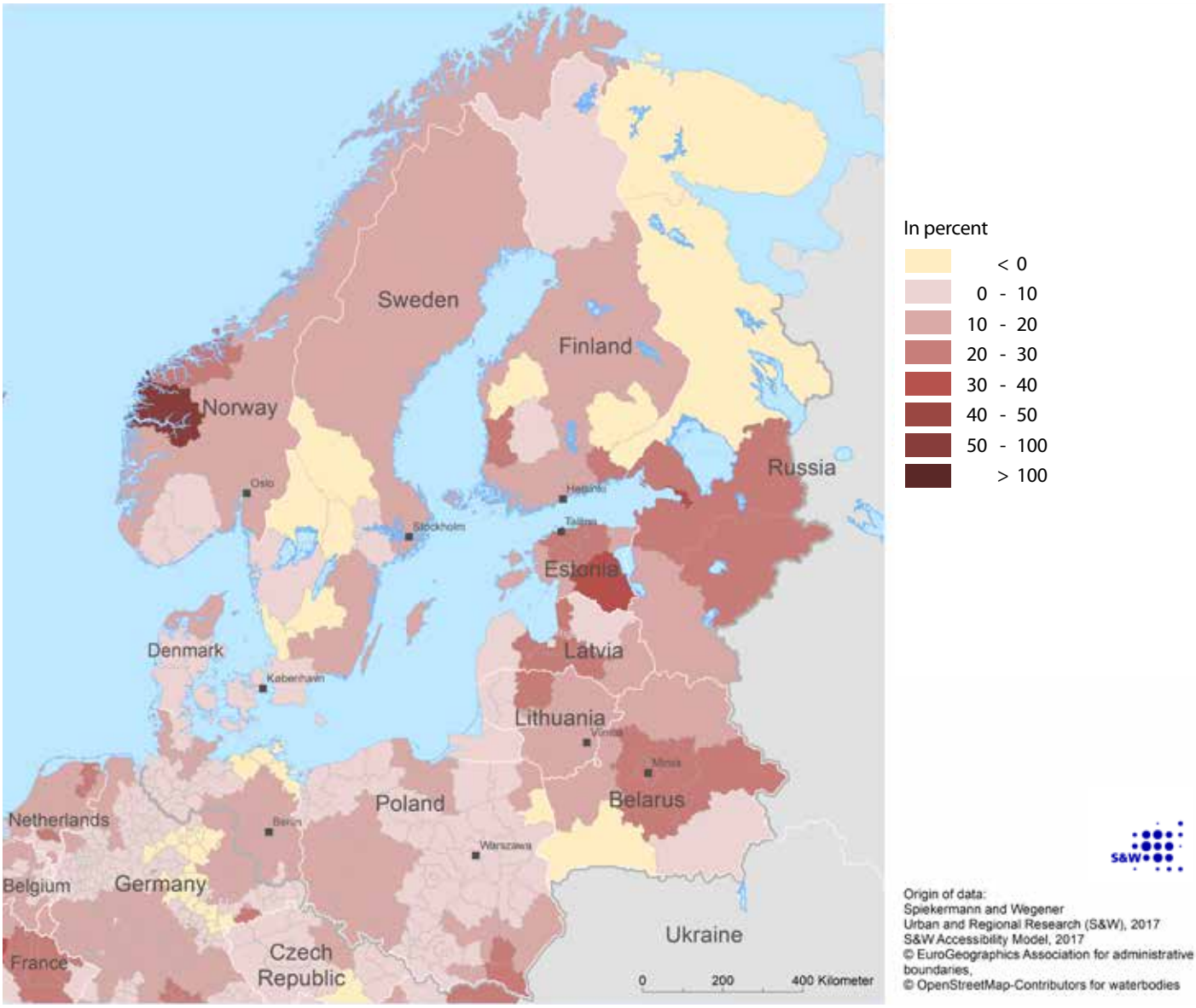
Figure 8 **Accessibility potential, multimodal, 2016**



The aggregation of multimodal accessibility by country shows the highest values for the BSR regions of Germany followed by Denmark; then Sweden and Poland which have average multimodal accessibility corresponding to the BSR average. All other countries, except Belarus with a rather low performance, have an index value around 80. In all countries, there is a clear accessibility divide between urban regions and rural regions. This is particularly true for Germany, Lithuania, Latvia, Estonia and little less pronounced in Finland and Norway. A much lower degree of polarisation between urban and rural regions is to be observed in Poland and Sweden.

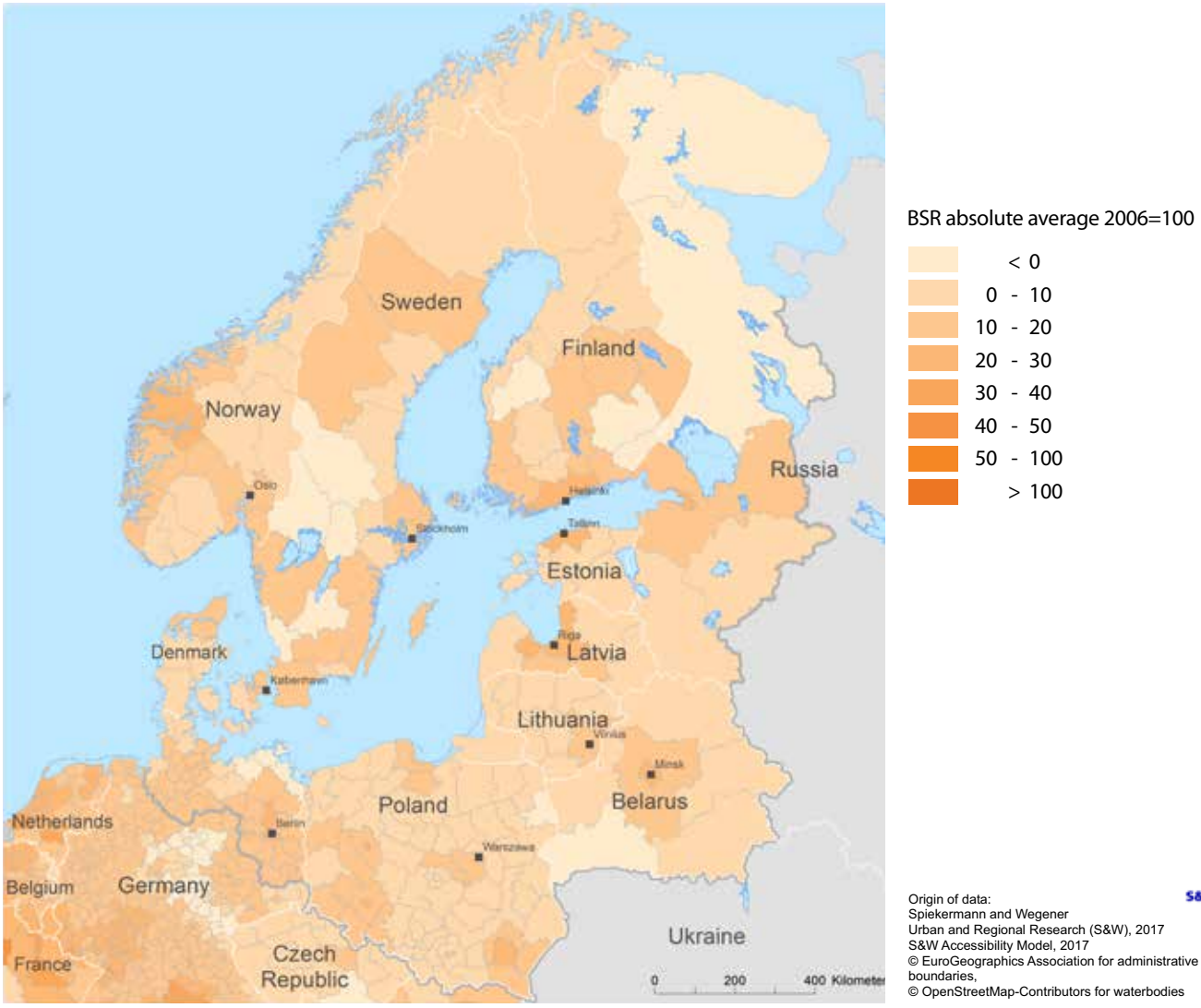
Also, changes in air accessibility influence, in a significant way, the increase of multimodal index values (Figure 9 and Figure 10). But due to the negative development of air accessibility in some regions, multimodal

Figure 9 **Accessibility potential, multimodal, relative change 2006-2016**



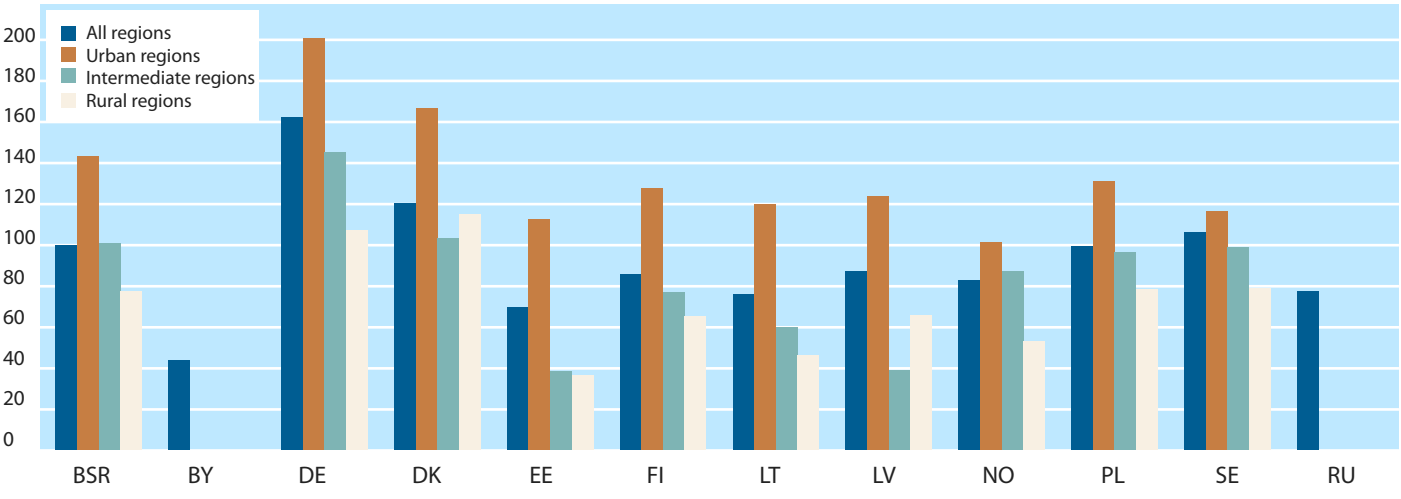
accessibility has also decreased. In absolute terms general transport accessibility within the BSR has improved mostly in the vicinity of capitals and a few other large agglomerations, among them Helsinki, Stockholm, Oslo, Copenhagen, Tallinn, Riga, Vilnius, Minsk, St. Petersburg, Warsaw, Gdansk, Poznan, Wroclaw and Berlin. The improvement of accessibility in the vicinity of some cities results from the cumulative effect of the modernisation of airports and the development of road infrastructure in the region. This applies, for example, to Wroclaw and Gdansk in Poland, but also to Riga and Minsk.

Figure 10 **Accessibility potential, multimodal, absolute change 2006-2016**



The fact that urban regions are benefitting most from accessibility increases is confirmed by the aggregation of multimodal accessibility changes to the urban-rural typology (Figure 11). In all countries of the BSR growth in multimodal accessibility is highest in urban regions. There are partly significant growth gaps between urban regions; this is most pronounced in Germany, Finland, Estonia, Latvia and Lithuania. On the other hand, differences in growth between countries are minor, all the countries saw average multimodal accessibility gains of around ten index points, the range is between eight and fifteen index points with the Russian BSR regions having on average the highest growth followed by the German BSR regions and the Estonian and Latvian regions. To conclude, disparities in accessibility did not rise between countries but between urban and rural regions within countries.

Figure 11 **Accessibility potential by country and urban-rural typology, multimodal, 2016**



DE, RU: only BSR regions included; BY, RU no differentiation by typology

Accessibility to Opportunities

Accessibility potential to population by different transport modes is only one of many ways accessibility indicators can be specified. There are other options of interest to be reached via the transport network that might give different insights in the overall performance of the BSR in terms of accessibility. Two other destination activities of interest, labelled here as opportunities are accessibility to local and regional services and access to jobs. Due to restrictions of data available, these types of accessibility can only be presented for parts of the BSR. For access to services, data is only available for regions of the EU, for access to jobs, data is only available for some countries of the BSR.

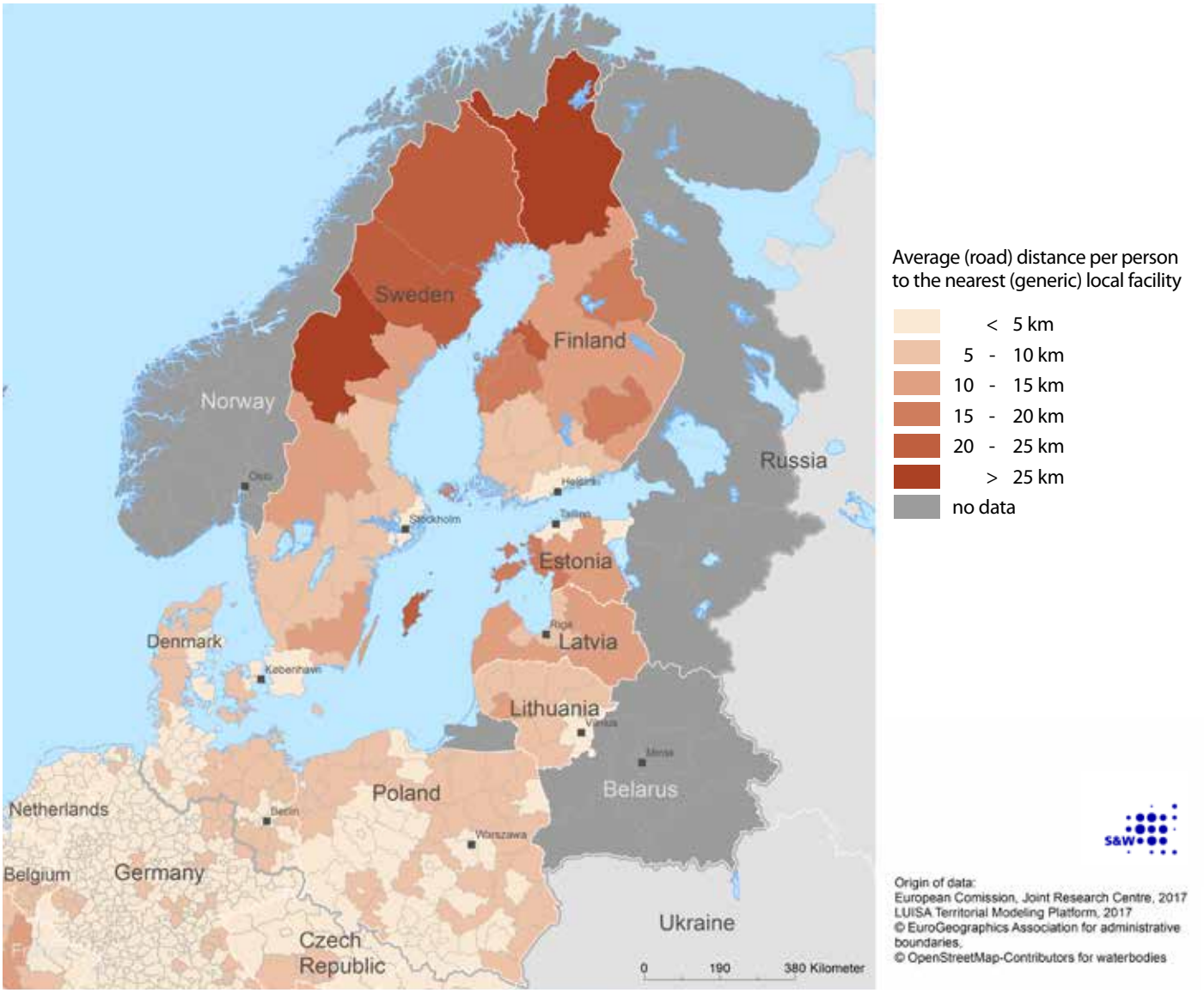
Accessibility to Local and Regional Services

Local and regional centres usually combine a range of different functions for the population living in the surroundings. Good access to those centres is an essential component of the quality of life. The Joint Research Centre of the European Commission has assessed to what degree the population of the EU regions can access what type of centre[2]. The indicator is expressed as average road distance per person to the nearest centre. The calculation is based on a large-scale population grid and the results are then aggregated to NUTS-3 regions.

Figure 12 shows the accessibility to local centres. Ideally, they serve about 5 to 10 thousand people and have opportunities such as schools, small health facilities, childcare services, sport facilities, small markets etc. The spatial pattern of accessibility to local centres is closely linked to the various types of settlement structures in the BSR. In general, access to local centres and their services is better in the south-west and decreases gradually going north-east in the BSR. The polycentric settlement structures in Germany as well as western and southern Poland, with a huge number of smaller towns and cities provide good access for the population to local centres. Average road distances are in many regions less than 5 km or in the range of 5 to 10 km. People living in regions of Denmark or Lithuania or in the southern parts of Sweden or Finland have similar short distances. This is also the case for most of the capital regions in the BSR. In many areas in Latvia and Estonia the distance to the next centre is already more

[2] Kompil, M.; Lavalle, C. (2017a): Access to local services. European Commission - Joint Research Centre.-
Kompil, M.; Lavalle, C. (2017b): Access to regional services. European Commission - Joint Research Centre.-

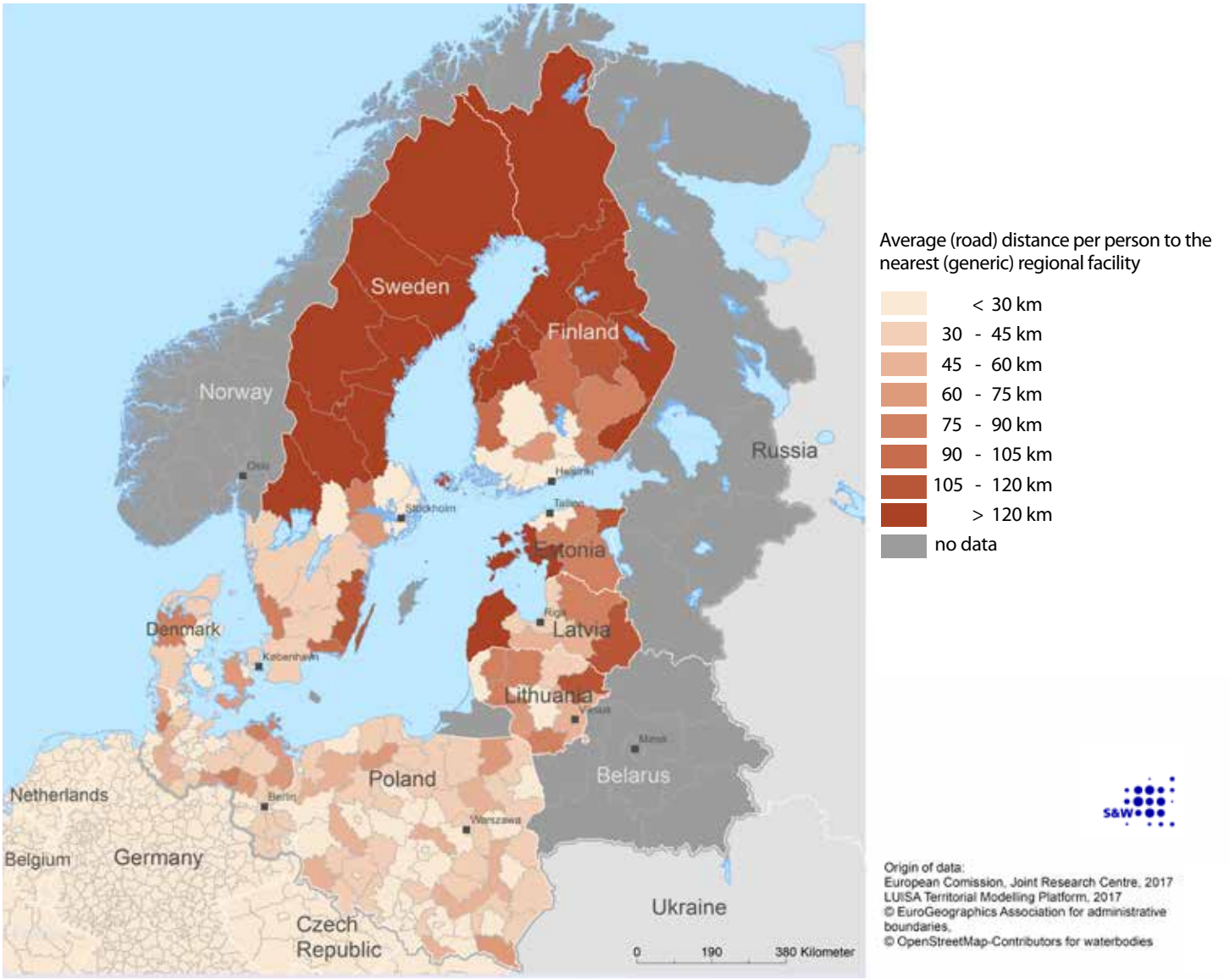
Figure 12 **Accessibility to local services**



than 10 km. This is also the case in the middle parts of Sweden and Finland. Living further north in these two countries means to travel on average more than 20 or even more than 25 km to the next local centre.

Figure 13 depicts the accessibility to regional centres. Ideally, they serve between 500 thousand and 1 million persons and have specialised centres for education and health, large facilities for sports and culture, governmental services, high-tech services etc. The overall spatial pattern of access to regional centres is comparable to that of access to local centres; i.e. living more north- and eastwards in the BSR means to

Figure 13 **Accessibility to regional services**



face longer distances to the next regional centres. From most BSR regions in Germany, Poland and Denmark average road distances to regional centres are in a range up to 50 km. However, there are a few regions in those countries that face longer distances of up to almost 100 km. Distances in southern Sweden and southern Finland are also in the range of up to 60 km, further north in the two countries these distances exceed 100 km. The three Baltic States present a very distinct situation. As Estonia, Latvia and Lithuania only have a few of such regional centres, disparities in their accessibility are very high. Besides short distances in regions forming those centres, people living in other regions might face road distances of between 50 and 100 km or more.

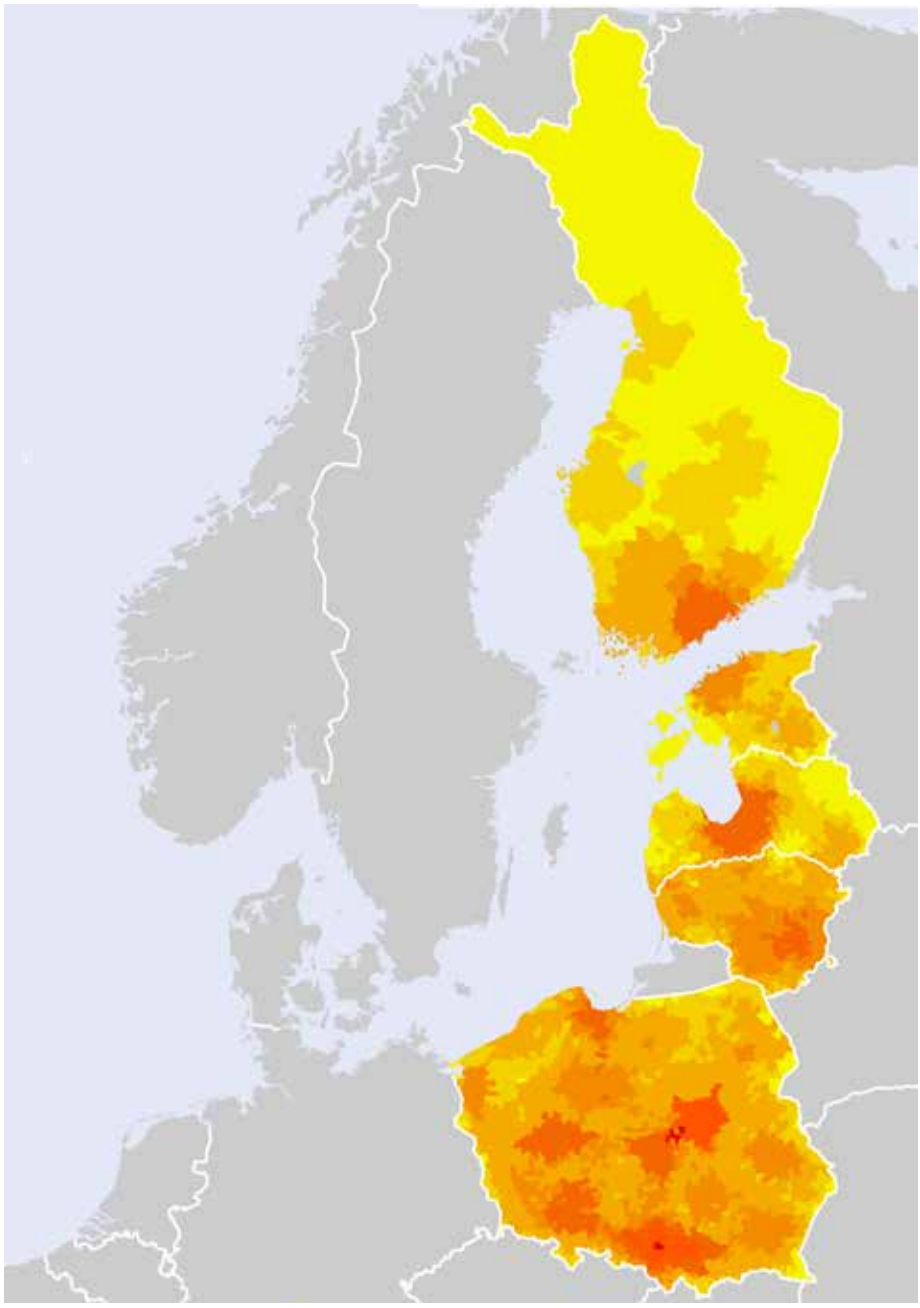
Accessibility to Jobs

The amount of jobs that are accessible in reasonable commuting time is an important factor considered by households when making location decisions. It reflects the opportunities of the regional labour market from the point of view of the population. However, accessibility data for this is usually not available at all. In the frame of ESPON TRACC project an accessibility to jobs indicator in the BSR has been calculated only for some regional case studies - covering Finland, Estonia, Latvia, Lithuania and Poland[3] (Figure 14). The indicator was defined as the amount of jobs reachable from each LAU-2 region in less than 60 minutes travel time. It was concluded that the threshold of 60 minutes can be considered to represent the usual maximum daily commuting time for a single direction.

Low accessibility areas are often interrupted by distinct axes of higher accessibilities along rail corridors. Accessibility to jobs is highest in star-shaped axes connecting the

[3] Kotavaara, O., Antikainen, H., Rusanen, J. (2013): TRACC - Transport Accessibility at Regional/Local Scale and Patterns in Europe. Volume 3 TRACC Regional Case Study Book. Part G Finland case study. Luxembourg: ESPON and Department of Geography, University of Oulu
Schürmann, C. (2013): TRACC - Transport Accessibility at Regional/Local Scale and Patterns in Europe. Volume 3 TRACC Regional Case Study Book. Part F Baltic States case study. Luxembourg: ESPON and RRG.
Stepniak, M., Rosik, P., Komornicki, T. (2013): TRACC - Transport Accessibility at Regional/Local Scale and Patterns in Europe. Volume 3 TRACC Regional Case Study Book. Part E Poland case study. Luxembourg: ESPON and IGSO PAS.

Figure 14 **Accessibility to jobs at municipal level in Finland, Estonia, Latvia, Lithuania and Poland, road (Source: Spiekermann et al., 2015)**



The spatially more detailed accessibility to job indicator proves that in the territory of the BSR, regardless of the development of infrastructure, zones of internal periphery located between large metropolises are formed and consolidated. In some extreme cases, poor accessibility of public transport can lead to transport exclusion. The condition to overcome these processes is to pay more attention to networks of regional significance. Identification of these problems is possible only if local level accessibility analyses are also performed. This allows for a resolution that identifies the local transport exclusion. In order to detect these weaknesses and propose appropriate solutions to overcome the deficiencies, BSR studies should be undertaken on the accessibility at a local level.

agglomeration centres into their hinterland. Accessibility to jobs shows obvious differences with specific spatial patterns for the countries, and also stark disparities between the two transport modes and the types of regions, with a strong concentration on the agglomerations.

Accessibility to jobs and in the same way also to many services of general interest is determined not only by the existence of extensive transport infrastructure, but also by appropriate connections to secondary networks. Also large distances between junctions on motorway exits brings problems to municipal level. Local solutions have thus crucial influence on the ultimate effectiveness of investments pursued in the TEN-T corridors.

To be observed particularly in Poland, accessibility to jobs indicates a formation of inner peripheries not only in eastern Poland, but also on the borderlands of central provinces. They are particularly visible in the case of job accessibility by public transport. The construction of new infrastructure does not always improve the situation if it is not accompanied by the development of secondary networks. This may lead to a situation described as transport exclusion by which inner peripheries can be formed. This is particularly true for accessibility to jobs by public transport, e.g. there is almost no possibility in many Polish regions of getting to work in medium-sized cities by public transport.

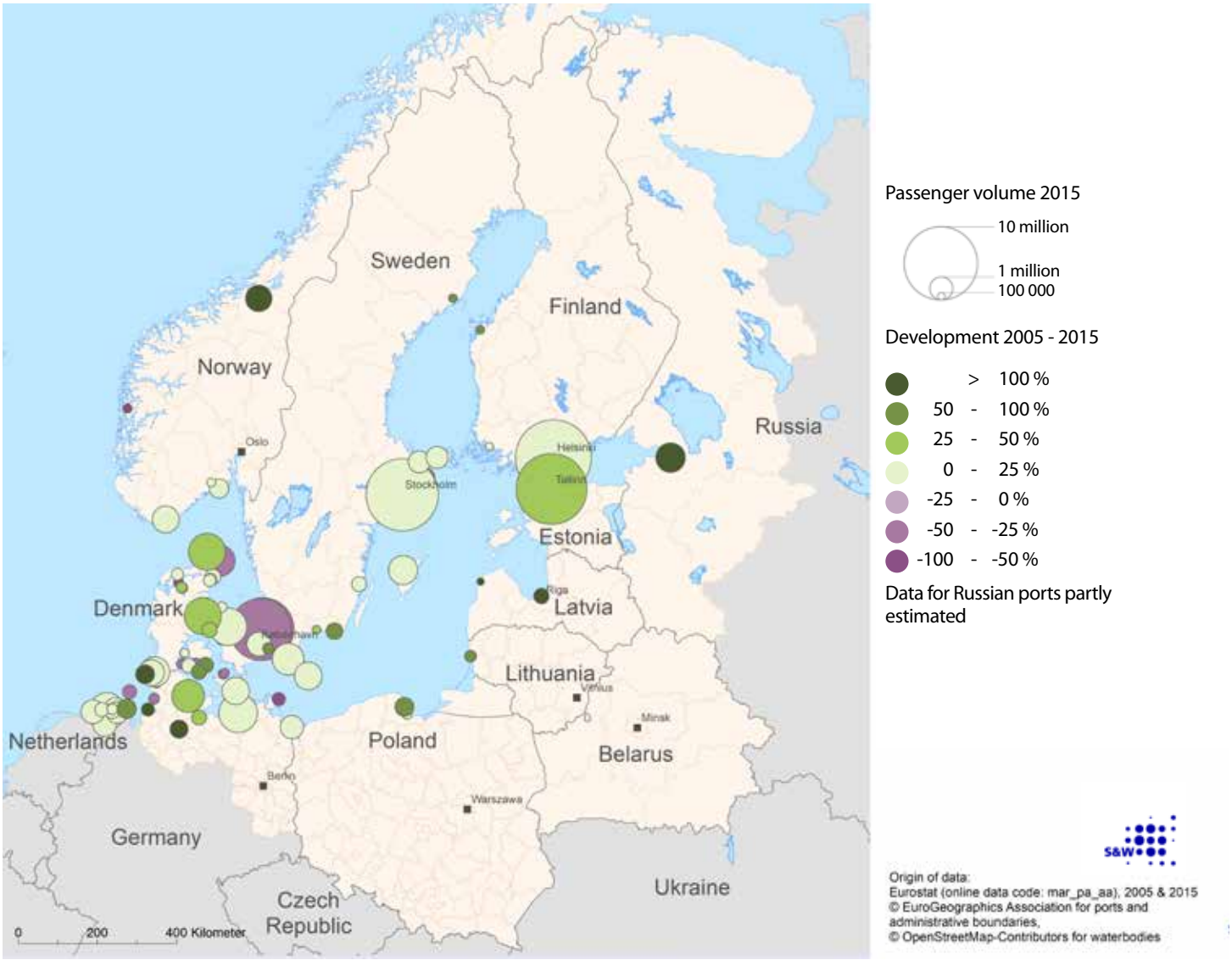
Maritime Accessibility

Ferry routes are an essential element of mutual accessibility between Baltic coastal regions. The BSR ferry network is made up from relatively short distance ferry lines linking mainly islands to the mainland and long-distance ferries linking different parts of the macro region. However, for certain longer distance connections their functioning is influenced by competition with regard to other means of transport. This concerns primarily air transport. Frequency of services for ferry lines is not noticeably greater than 20 years ago, despite the fact that considerable development of both social and economic links took place. Construction of Oresund bridge was one of the major causes of the withdrawal of ferry services between Swinoujscie and Copenhagen that had been functioning on a daily basis for decades. The alternative, that was meant to satisfy the demands, proved to be a slightly shorter ferry line to Ystad in Sweden.

The structure of the ferry network and its specific functions determine the passenger volume in BSR ports (Figure 15). Whereas the western area is characterised by many smaller, medium-sized and some larger ports handling often shorter distance ferry transport, but also long-distance ferry transport and cruise passenger lines, the north-eastern parts of the Baltic Sea are made up of rather few ports, yet, handling large numbers of ferry and cruise passengers. Here, the largest passenger volumes occur in Stockholm, Helsinki, Tallinn and St. Petersburg which saw a substantial growth of particularly cruise passengers. Cruise ships call only at selected ports. And, those ports of the Baltic Sea have apparently developed a specific division of tasks. Whereas the German ports provide access to cruise ships, i.e. most of the cruise passengers of those ports start or end a cruise there, the other ports serve mainly as destination for excursions from the cruise ships. Copenhagen is the only major port that has developed both functions.

In maritime transport of goods, the southern and eastern Baltic coast (Germany, Poland, Baltic States) is characterised by a lower number of decidedly large seaport establishments recording, in general, growth in cargo handling. However, goods volumes in those ports are markedly fewer than in the North Sea ports of Germany, the Netherlands and Belgium. In the coastal areas of Denmark, Sweden and Finland there is a dense network of small seaports, part of which is gradually decreasing the tonnage of transhipment cargo. Remarkably a significant increase in capacity and freight volume was observed in the Russian port of the Baltic Sea basin. For example, the freight volume of Ust-Luga port (Leningrad region) increased from 3.8 million tons to 93.4 million tons in 2016. The increase in the capacities of the Russian BSR ports is connected with a significant decrease in the volume of servicing of Russia export-import cargo in some ports of the Baltic States and Finland.

Figure 15 **Passenger volume of maritime ports, 2005-2015**



Concentration of shipping traffic in large ports of the Baltic Sea coast, especially ports of Gdansk, Klaipeda and Riga poses a threat to the road and rail networks that serve them. They are often used simultaneously in the transport of goods and passengers. These problems require special attention and solutions, also in terms of modal changes, i.e., increasing the role of the railway.

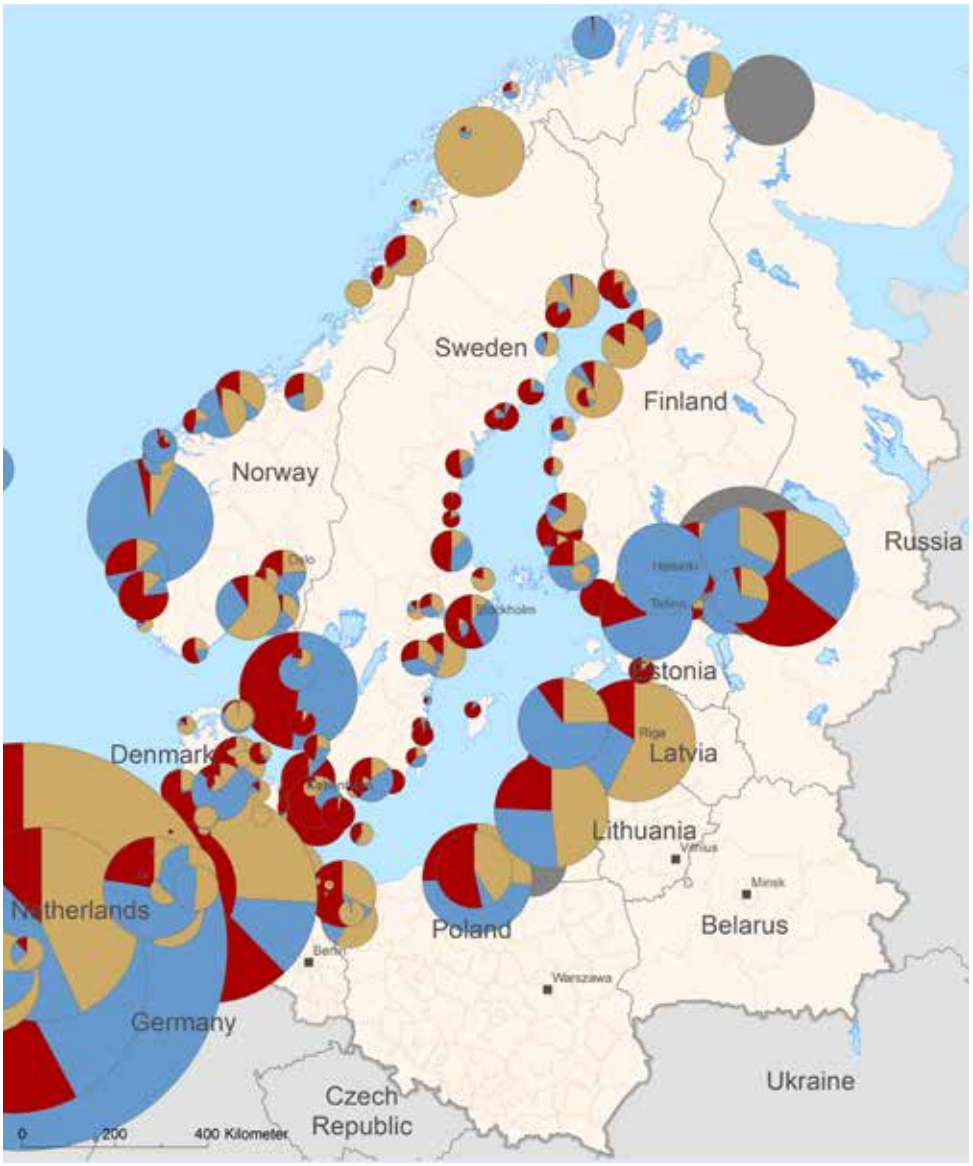
The ports have very different functions as the differentiation by main cargo type indicates (Figure 16). Some of the ports with larger volumes in Finland, Estonia and Norway have concentrated on liquid bulk. Most of the smaller ports along the Swedish and Finnish Baltic coast concentrate either on dry bulk goods or on unitised goods. The larger ports on the southern coast of the Baltic Sea are more diversified, i.e. have significant tonnage of all three main cargo types. Again, the huge diversity of ports and their functions becomes apparent.

From the huge number of ports along the Baltic Sea only a selection handles container traffic. The share of the container transport in the Baltic Sea is not significantly larger as compared with the North Sea ports in Germany, Belgium and the Netherlands where the substantial large container ships port. However, container traffic in the ports of the Baltic Sea is growing steadily; rapid growth has been noted especially in Gdansk and Riga. Since 2012, the deepwater container terminal in Gdansk has provided a direct connection with the port of Shanghai. Gdansk is becoming the main hub in the Baltic Sea where reloading of containers takes place onto smaller forms of transport (mainly in transit to Russia).

Most of the container traffic to or from the BSR with the rest of the world takes place via the European main ports along the North Sea coast.

The connectivity in terms of container volumes is somewhat higher between the Baltic Sea ports and the Dutch ports (primarily Rotterdam), than with the Belgian ports. At the same time, the container trade volume is more balanced for most of the Baltic ports, i.e. the number of imported and exported containers from/to Rotterdam is in the same dimension.

Figure 16 **Freight volume of maritime ports by type of cargo, 2015**



Freight volume (tons)

10 million

10 million

1 million

Type of cargo

- Dry bulk goods
- Liquid bulk goods
- Unitised goods
- No Data

Data for Russian ports partly estimated

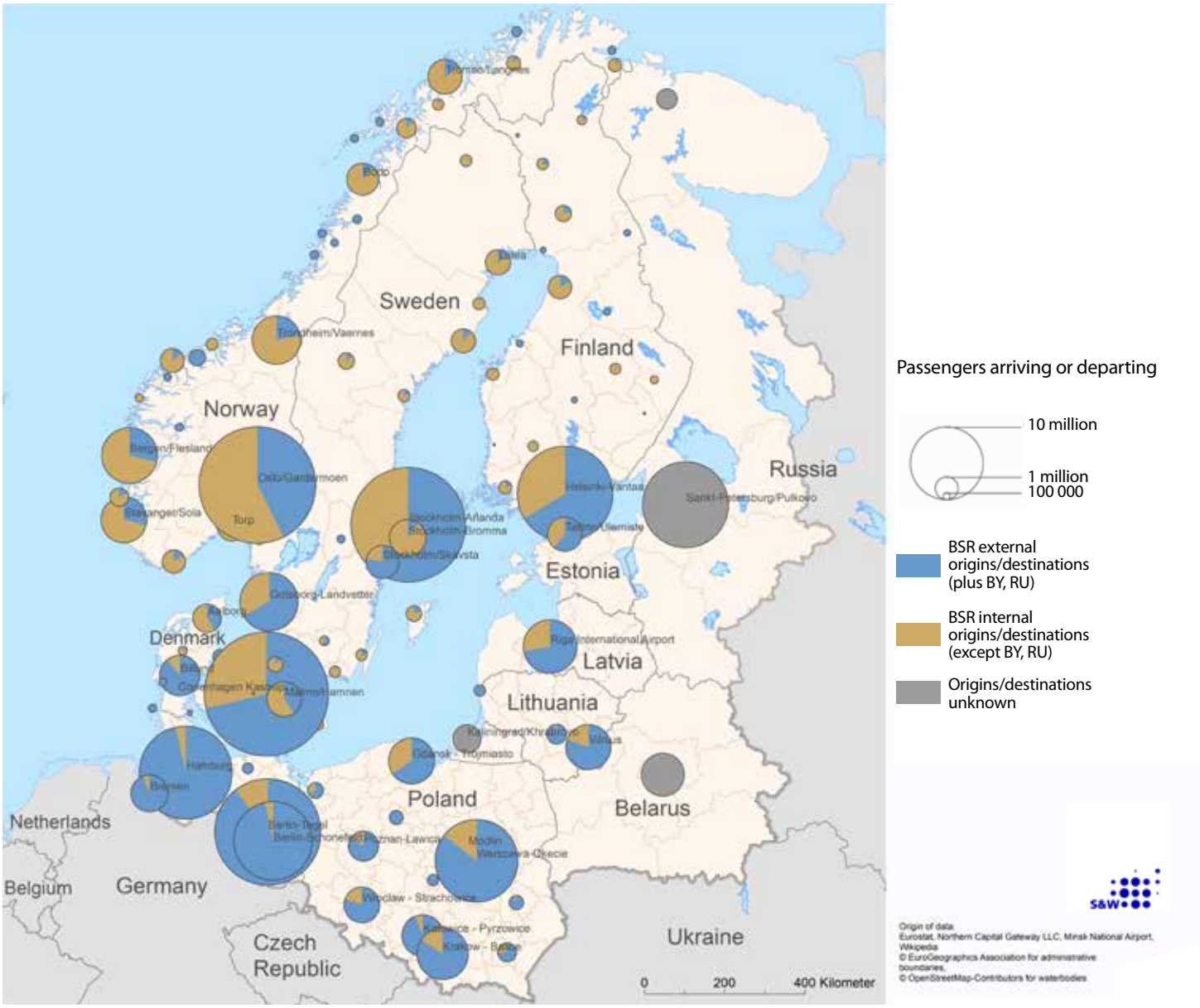
The German ports of Hamburg and Bremen at the North Sea coast are the most important maritime hubs for containers traveling to or from the Baltic Sea. Not only the total volume of container flow between the Baltic Sea and the German North Sea ports is much higher than for the two other world port regions, but also the number of ports in the Baltic Sea that have container traffic with the German North Sea ports is substantially larger.

Air Connectivity

Because of its remote location in comparison to the core areas of the EU and its partly sparsely populated areas, air connectivity of the BSR is a decisive factor for competitive accessibility. Fairly good air accessibility partly compensates for lower road and rail accessibility of the macro region.

The BSR is characterised by a rather dense network of international and regional airports (Figure 17) serving the BSR and destinations outside the BSR. Airports with the largest passenger volumes are the airports of the Nordic capitals Copenhagen, Oslo, Stockholm and Helsinki as well as the airports of St. Petersburg, Warsaw, Hamburg and the two Berlin airports. The airports of the capital cities of Estonia, Latvia, Lithuania and Belarus have clearly lower numbers of passengers, and the volumes are comparable with some of the second-tier airports in Poland (Krakow, Katowice, Wroclaw, Gdansk),

Figure 17 **Passenger volume of airports, 2016**



Billund in Denmark, Gothenburg in Sweden and Stavanger, Bergen and Trondheim in Norway. An important characteristic for air connectivity in the BSR is the considerable number of smaller regional airports in Norway, Sweden and Finland.

Many airports of the BSR, in particular also those of Poland, the three Baltic States, Belarus and Russia have seen a rapid growth in the last decade. For example, the passenger volume of St. Petersburg airport increased from 5,1 million in 2006 to 13,3 million people in 2016, and for the same period at the Kaliningrad airport from 0,7 million to 1,6 million people. In Poland, a deconcentration of air traffic took place at the same time towards that of the second-tier airports of the country. Northern Poland is more strongly associated with the BSR than the central and southern parts of the country. Relatively weak connections with the BSR are also shown by the airports of northern Germany. Other countries, in particular the Nordic countries with many domestic flights and to a lesser degree the Baltic States have a stronger orientation of flights within the BSR.

For flight connections within the BSR, the airports of Copenhagen, Oslo, Stockholm and Helsinki are the major hubs. Besides links to all capital cities in the BSR and some smaller cities, they have a substantial number of flight connections within their own countries to link all the smaller cities to the capitals. The airports of the capital cities plus a few additional airports such as Hamburg, St. Petersburg and the second-tier Polish airports provide also the most demanded flight connections to destinations outside the BSR.

Figure 18 **Intermodal travel time to New York City**

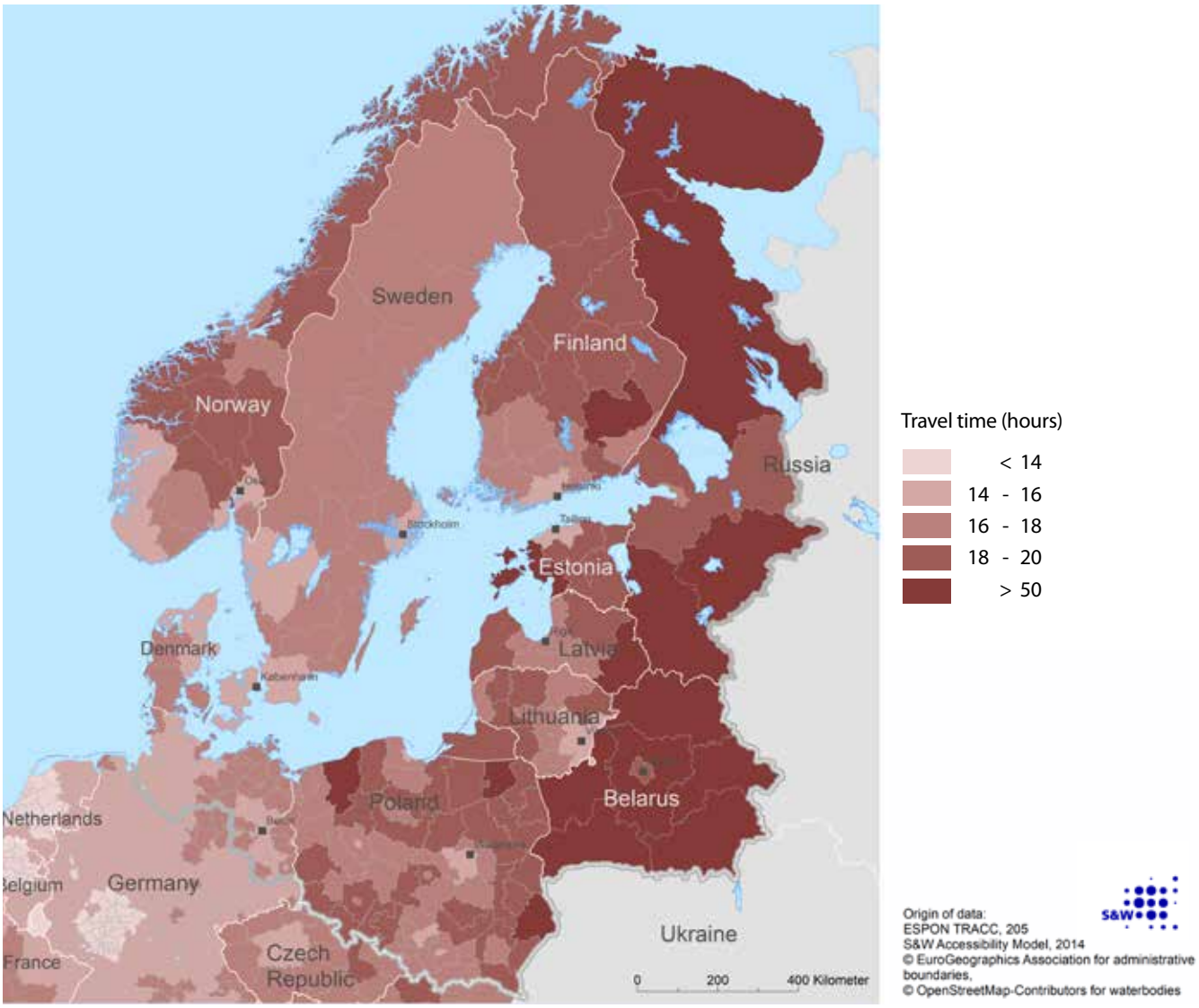


Figure 18 displays what the air connectivity means in terms of travel times to global destinations. The map shows intermodal travel times from the centres of the regions to a global destination, New York City as the selected example. As expected, travel times from BSR origins are longer than from western European regions. However, the capital cities of the BSR have travel time ranging to around 15 hours to this global city, i.e. only little more than from Western Europe. However, apart from capital cities people from other regions need substantially more time travelling to or from New York, possibly an indication why economic activities, in particular that of global players concentrates in the capital regions of the BSR.

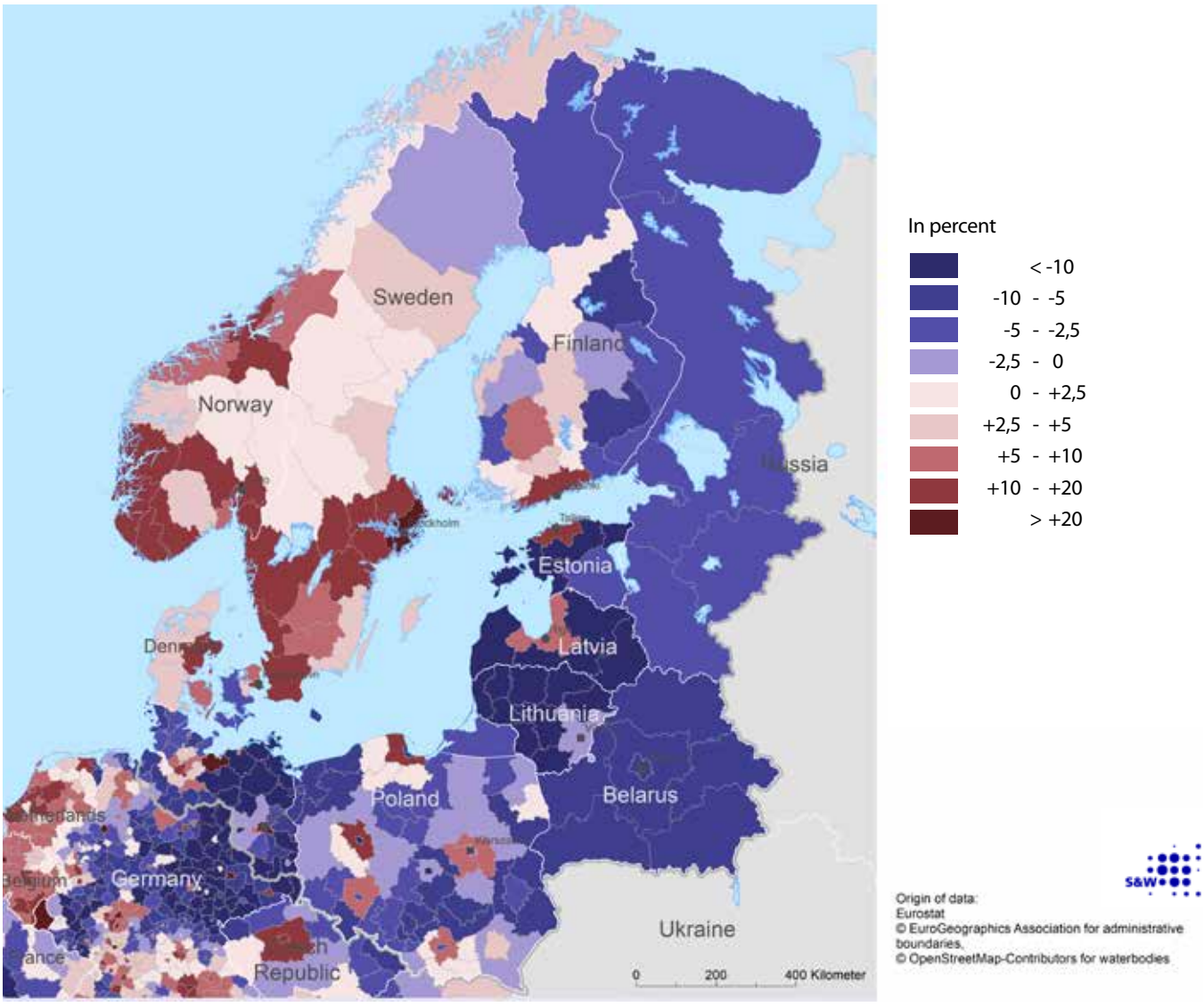
The air market for freight is much more concentrated on a few airports in the BSR than passenger traffic. The airports of the four capitals of the Nordic countries - Copenhagen, Oslo, Stockholm and Helsinki have a multiple freight volume compared to the airports of other capitals in the BSR. Other airports only play a minor role for air freight traffic with the exception of Hamburg, Billund, Goteborg, Malmo and Katowice.

Effects of TEN-T Investments on the Accessibility Potential of the BSR

Future Demographic Changes

The prognosis of future demographic changes indicates a probable continuation of the processes that have occurred in the past. It should be assumed that in several regions (rural parts of the BSR area in Germany, many rural parts of Poland, non-capital regions of the Baltic States, Belarus, the BSR area of Russia and several regions in Finland) depopulation will deepen further. Positive population development in the BSR will be in more than a dozen metropolises and in Sweden and Norway (Figure 19). Thus, also the transport accessibility calculated in the macro scale will be determined by the relations and at the same time the infrastructure connecting these centres. The transport challenge will be to service less and less populated peripheral zones and to ensure the efficiency of the transport system in and around the metropolises.

Figure 19 **Population development, 2016-2030**



Future Transport Infrastructure Development

The future, long-term transport infrastructure development in and outside the BSR is subject to political decisions at different territorial levels, in particular at the national and the European level. Some of which have already been taken, or are planned to take place or be revised. The TEN-T gives a good orientation on the development of the main corridors and strategic transport links in the BSR.

There are four strategic corridors of the TEN-T running through the BSR: the Scandinavian-Mediterranean corridor, the North Sea-Baltic corridor and the Baltic-Adriatic corridor. The Orient / East Med corridor overlaps in the BSR parts of Germany with sections of the above corridors.

The **Scandinavian-Mediterranean corridor** runs from the Finnish-Russian border via Helsinki to Stockholm and Malmo and Copenhagen. There are two legs to the European mainland. One runs through Denmark to Hamburg and further south to Nuremberg. The other continues via the German seaport of Rostock towards Berlin and then further south via Leipzig and Nuremberg where it joins the first leg heading further south to Italy. The infrastructure development projects in this corridor within the BSR are mainly related to rail.

This corridor development includes:

- One of the most important transport infrastructure projects in the western part of the BSR, the Fehmarn Belt Fixed Link to remove one of the main remaining bottlenecks in the European transport network by directly connecting Denmark's capital and Sweden with Hamburg and Schleswig Holstein and thus the European mainland. The tunnel and corresponding rail infrastructure will reduce travel time between Copenhagen and Hamburg by about two hours.
- Plans are in place in Denmark, Sweden and Finland to further accelerate rail transport. In Denmark, a high-speed strategy "Hour model" for inter-city connections shall reduce travel time between the neighbouring pairs of the four largest cities of the country to one hour.
- Sweden is in the process of further upgrading and increasing the operational speeds in the Nordic triangle.
- In Finland, the corridor development might include new fast or high-speed rail lines between Turku and Helsinki and between Helsinki and the Russian border towards St. Petersburg.

The **North Sea-Baltic corridor** stretches from the large seaports in Belgium, the Netherlands and Germany to the BSR seaports in the Baltic States and Finland. Within the BSR, there is a leg of the corridor starting in Hamburg and running towards Berlin. The corridor continues to Warsaw and from there northwards via the Baltic States and continues to Helsinki.

- The Rail Baltica (currently in development) is the most prestigious and aspiring project that will form the backbone of the corridor in the BSR. It will connect Estonia (Tallinn), Latvia (Riga), Lithuania (Kaunas and a branch to

The Connecting Europe Facility (CEF) mechanism should be evaluated positively as an instrument allowing for the construction of infrastructure sections, especially rail that links the states of the Baltic Sea macro region. This mechanism should to a larger degree support multimodal solutions, in particular in goods transport in the West-East direction, as well as in relation to crossing over the Baltic Sea. An element enhancing the multimodal solutions are the change of track gauge on the eastern border of Poland and transhipments facilities/points. Cross-Baltic ferry connections should be more frequent (for better use of the new North-South road and rail infrastructure in Central Europe, by Scandinavian flows). Development of the sea transport (mainly containers) in Gdansk, Klaipeda and Riga should be followed by rail and intermodal solution inside Poland, Lithuania and Latvia, otherwise road freight traffic will increase significantly.

The existing, and also the planned development of infrastructure (both rail and road) insufficiently improves the accessibility of regions directly adjacent to the Baltic coast (Poland, Lithuania, and also Sweden and Mecklenburg – West Pomerania in Germany). It is expedient to create and support the corridor TEN-T running directly along the southern coast of the Baltic Sea (Via Hanseatica).

There are sections of the road and rail network in the transport system, where influence on the level of accessibility in the whole BSR is definitely higher than others. Future investments should focus on such sections (e.g. Via Baltica and Rail Baltica on the Polish-Lithuanian section).

Vilnius) and Poland (Warsaw) through a new high-speed rail link (up to 250 km/h) in European standard gauge. Rail travel between the Baltic capitals will become highly competitive with other modes in terms of time and cost.
- Rail Baltica might be extended with a rail tunnel between Tallinn and Helsinki to Finland.
- Polish plans in the North Sea-Baltic corridor consider high-speed rail up to 360 km/h development connecting Warsaw, Lodz and Kalisz, with branches to Wroclaw and Poznan (Y line) .

The **Baltic-Adriatic corridor** runs from the Baltic ports in Poland via the Czech Republic, Slovakia and Austria to Italy and Slovenia and their ports at the Adriatic Sea. Two sub-corridors start at the ports of Gdansk and Gdynia and connect directly via Warsaw to Katowice and beyond, a third one runs from Szczecin/Swinoujscie via Poznan and Wroclaw to Ostrava.

The main foreseen activities are:
- Upgrade of rail lines;
- Improvements in accessibility of the Baltic Sea ports.

The future development of the BSR will besides the development of the European-Transport network and the additional national infrastructure developments also be influenced by possible transport route developments north and east of the macroregion for cargo transport between the countries of East and South-East Asia (China, South Korea, Japan, etc.) and Western European countries. In addition to the traditional route for cargo transport by sea vessels through the Suez Canal, the increase in freight volume using the Northern Sea Route, the Trans-Siberian Railway or the New Silk Route might be possible. One advantage would be significantly shorter route lengths and times of cargo delivery between Asia and Europe compared to the traditional and not always safe sea route through the Suez Canal.

A further important element that may affect the future accessibility of the BSR is potential investments in the European-Asian infrastructure of the so-called New Silk Road. The Baltic Sea countries and the Balkans are currently competing for the route of these connections. The distribution of trade relations with China in the EU seems to favour the Baltic direction. The eastern border of Poland is a favourable place for intermodal solutions within the potential corridor (tracks gauges changes). However, a strong competition of logistic centres and terminals in Russia, Belarus, Poland and Germany may emerge. The formal course of the New Silk Road is defined by a document issued under the auspices of the United Nations: Intergovernmental Agreement on the Trans-Asian Railway Network from 2006 (Asian part). The real chance of developing these connections is strongly conditioned by geopolitical and macroeconomic factors. The development of industrial and logistics infrastructure may lead to the formation of intermodal hubs outside the EU with a possible consequence that future transport of goods to Poland, Scandinavia and Western Europe would be mainly based on road.

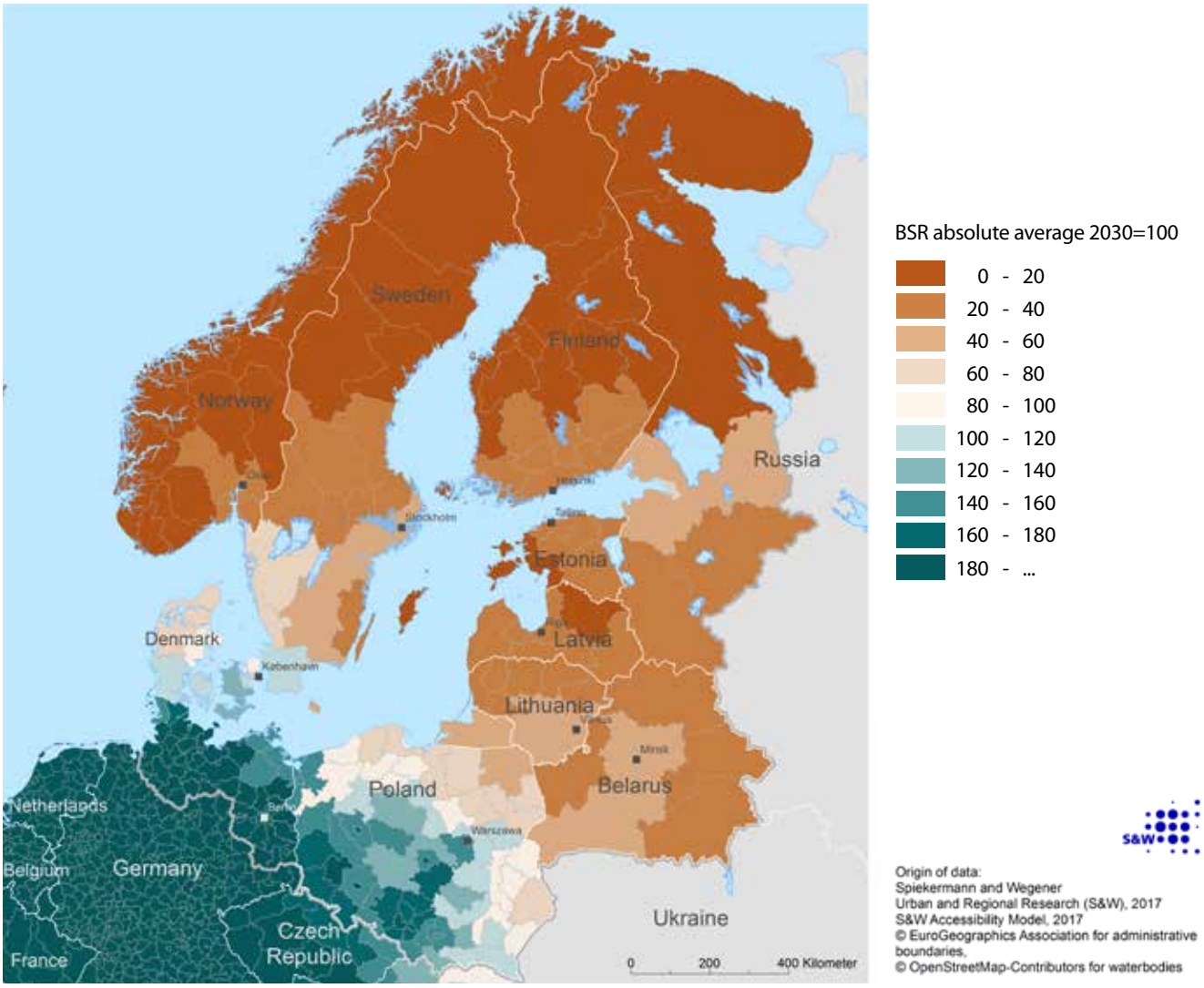
The most striking example for the development of such a sizeable new infrastructure taking advantage of possible future accessibility advantages is the development of the Industrial Park Great Stone near the Minsk airport. This joint venture of China and Belarus is clearly based on the expectation that such interface regions between the Eurasian and the European economic blocks will have strong locational assets through the improved connectivity to Asia and to Europe.

Future Accessibility Potential by Road

Figure 20 shows the accessibility potential by road for the year 2030 and standardised to the BSR average of that year. The assumptions made for road network changes have mainly been based on the TEN-T core network development. The standardisation of the indicator does not point to the changes as the overall pattern of high and low accessibility by road is similar to the current one, however, the level of accessibility will grow almost everywhere in the BSR.

These possible relative future changes due to the TEN-T development are highlighted in Figure 21 which displays the development of accessibility by comparing the future situation of 2030 with the current one. On the one hand, improvements in accessibility are to be recorded towards the eastern direction, especially in Poland and beyond through the completion of the construction of the Via Baltica route in Poland. However, because of low population density, the areas closely adjoining the Baltic Sea will still be in a relatively low situation in terms of the standardised accessibility indicator in Poland, Lithuania and also in Estonia (Figure 20). In Poland, the main changes will take place in the eastern part. This will result in better accessibility of West Belarus and Lithuania. However, the beneficial impact of Polish investments on the regions located towards the East and North-East from Poland's border will be

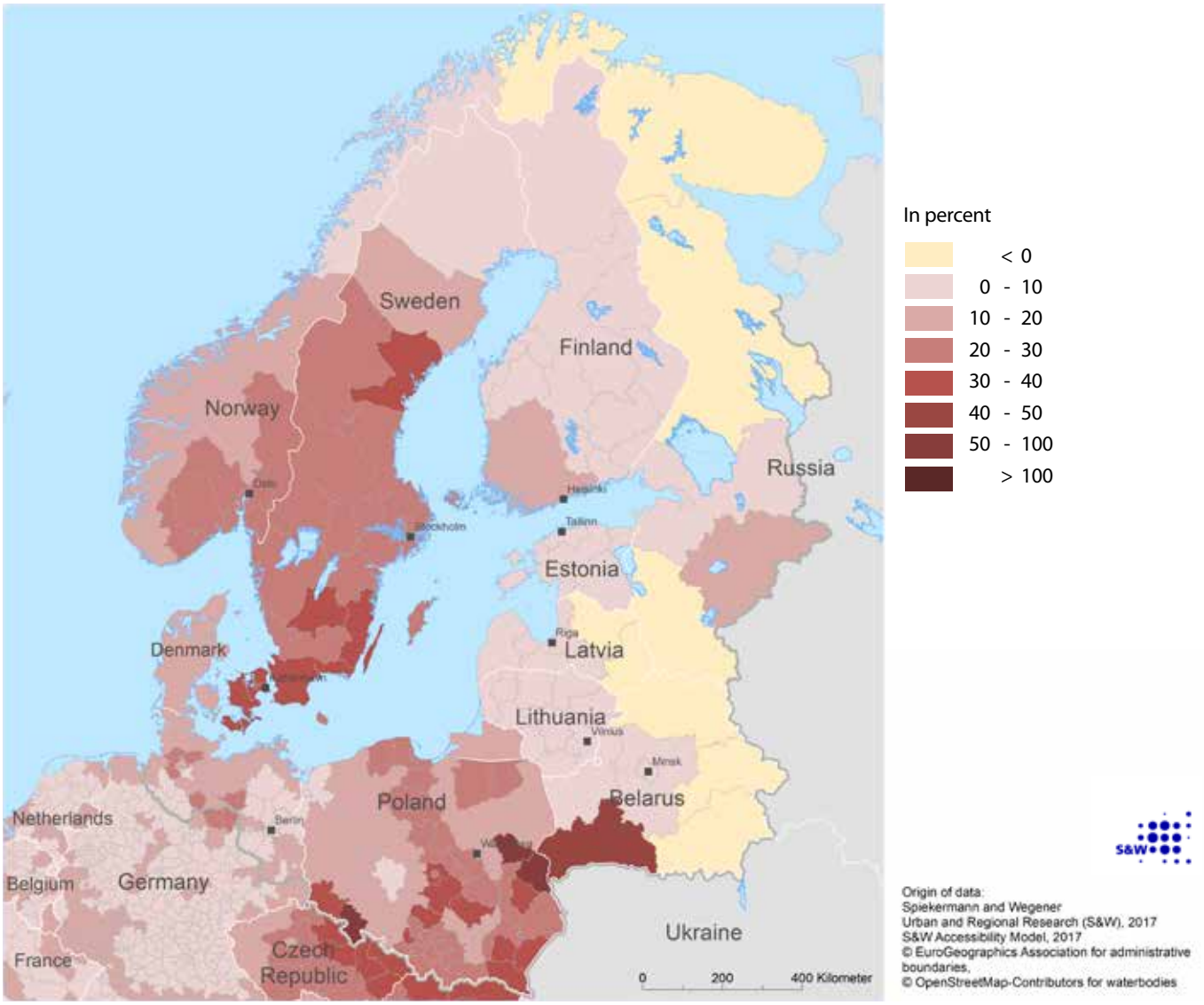
Figure 20 **Accessibility potential, road, 2030**



significantly reduced by demographic crisis with some depopulation trends in these areas. In the northern parts of the BSR, the key investment will be the Fehmarn Bridge, which should radically improve the accessibility of East Denmark (Zeeland), as well as Sweden and Norway together with further road investments there. Schleswig-Holstein will also benefit from the link to Scandinavia as well as from completing motorway links (A20) north of Hamburg.

In terms of accessibility potential by road, Poland, Germany (BSR regions) and Denmark and to a slightly lesser degree also Sweden are the countries that benefit most from the envisaged development of the road networks in Europe (Figure 22). Growth of accessibility in Poland and Denmark is mainly in favour of the urban regions whereas in the BSR part of Germany all regional types gain with a similar level. In most other countries, the increases in the potential type assessment are only modest. The regions of those countries of the BSR do not benefit in terms of accessibility although there will be new high-quality road infrastructure in place. The modest growth or even decline in accessibility by road is due to the fact that the underlying population projection expects strong population losses for parts of that area. That means that the demographic development offsets the benefits of the improved road network,

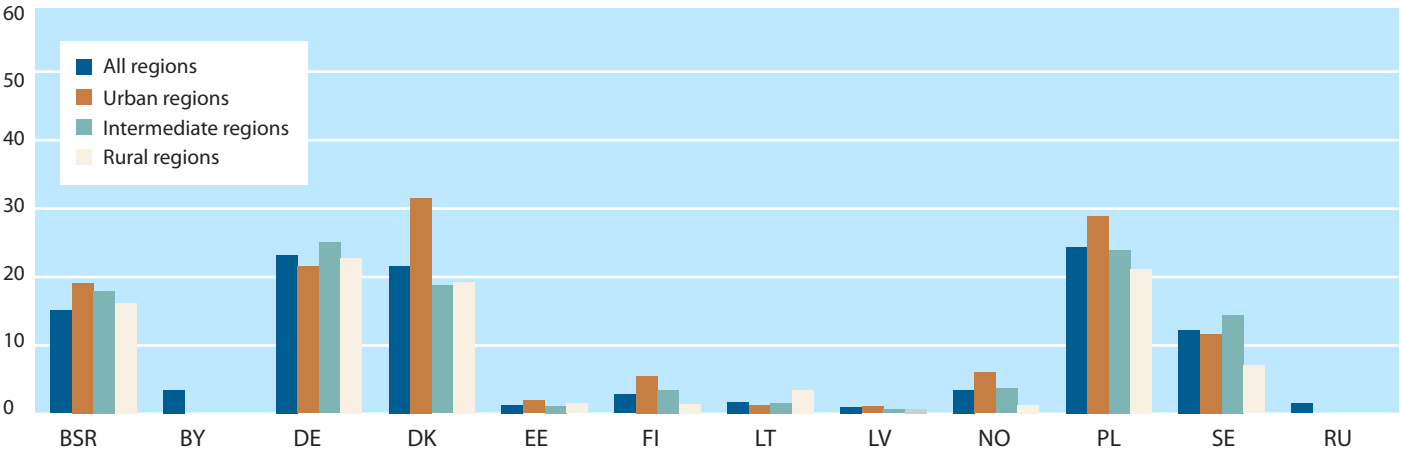
Figure 21 **Accessibility potential, road, relative change 2016-2030**



i.e. population market potential type accessibility indicator will grow only by a little if at all.

When assessing the effects of future investments in the TEN-T North Sea-Baltic corridor (especially Via Baltica, but also Rail Baltica), the structure of the huge traffic currently taking place on this route must be taken into account beyond what can be grasped by accessibility indicators. This is largely transit traffic between Russia and Western Europe. HGVs cross the EU border in Latvia and then use the route through Lithuania and Poland to Warsaw and further west to Berlin. Internal traffic under the BSR is much smaller and would probably require smaller scale investments.

Figure 22 **Accessibility potential by country and urban-rural typology, road, absolute change 2016-2030**



DE, RU: only BSR regions included; BY, RU no differentiation by typology

Future Accessibility Potential by Rail

The assumptions made for rail network changes have mainly been based on the TEN-T core network development. The possible future accessibility potential by rail pattern has a lot in common with the current one. However, disparities between high and low accessibility areas seem to be less pronounced, and, the area of above BSR average accessibility will extend further away from the south-western areas of the BSR towards eastern and northern directions. High-speed rail will also bring higher accessibility to regions outside the area with high accessibility potential by road. Of prominent visibility are those corridors in Germany that head towards Berlin and beyond, in Poland towards Warsaw, and in Denmark towards Copenhagen and even further to the Scania region in Sweden. Obviously below BSR average accessibility by rail will also in future be found in the Nordic countries and the Baltic States. The lowest accessibility by rail will remain in the far north regions and the Baltic States. Many regions of western parts of Poland will have accessibility by rail above the BSR average with a few exceptions that will be slightly below average.

By displaying the accessibility changes only (Figures 23), the highly spectacular improvements in rail accessibility that will take place in the BSR in the next fifteen years will become apparent. This is mainly due to the completion of the Rail Baltica project running across the south-eastern area of the BSR where today rail transport plays a marginal role in socio-economic development. Several regions of the Baltic States, but also in Belarus which benefits as well, will double its accessibility potential by rail. The Rail Baltica even outsets the negative effect of population decline in the regions of the Baltic States.

The current distribution of passenger flows and demographic potential backs up the usefulness and advisability of development of high-speed rail transportation in the corridors: a) Hamburg-Copenhagen-Stockholm; b) Berlin-Warsaw.

Decisions concerning the Rail Baltica implementation have to be taken cautiously, with taking into account geopolitical (linking St. Petersburg) and demographic factors (depopulation of Latvia, Lithuania and East Poland). This particularly concerns passenger traffic (potential high-speed rail option).

Figure 23 Accessibility potential, rail, relative change 2016-2030

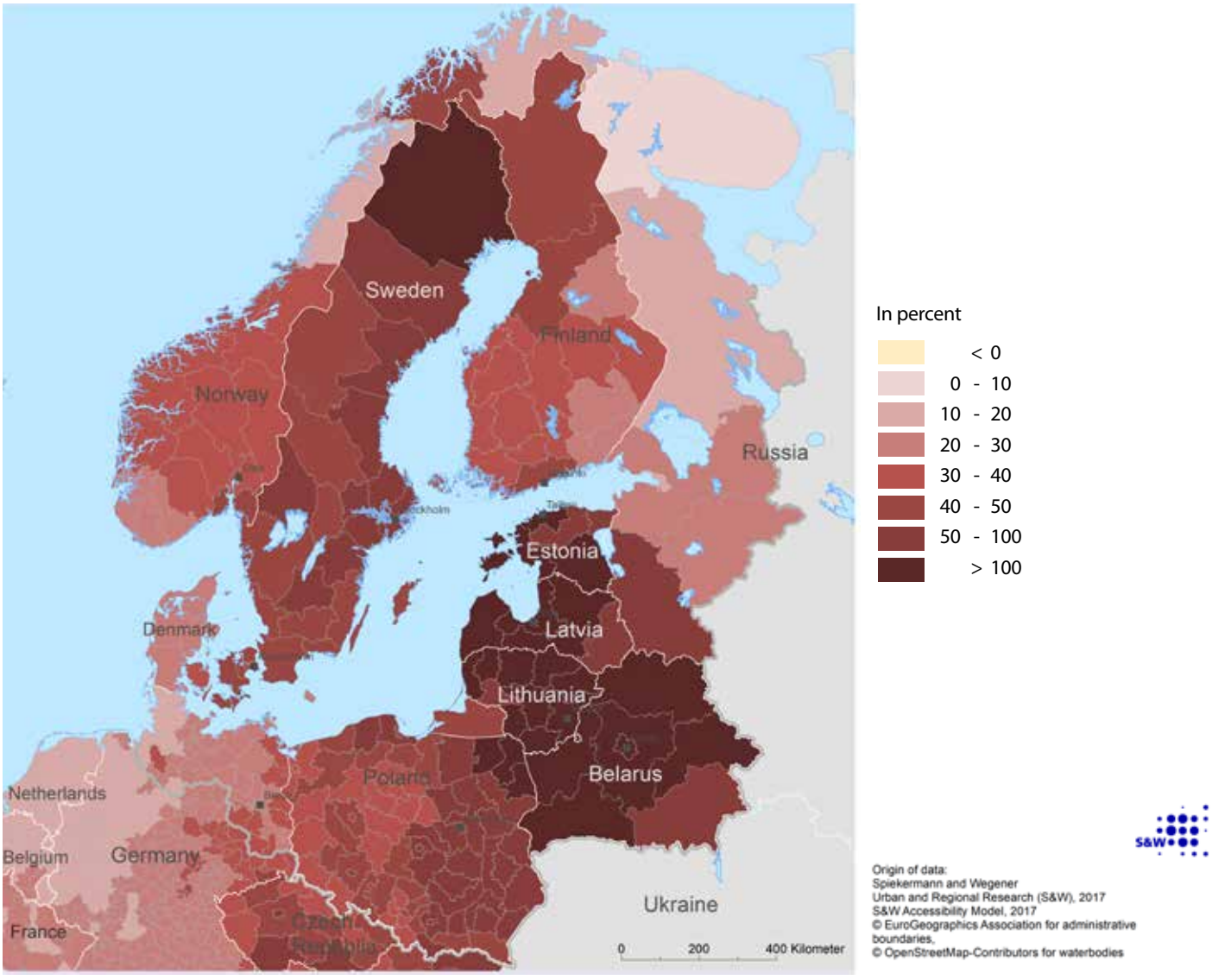
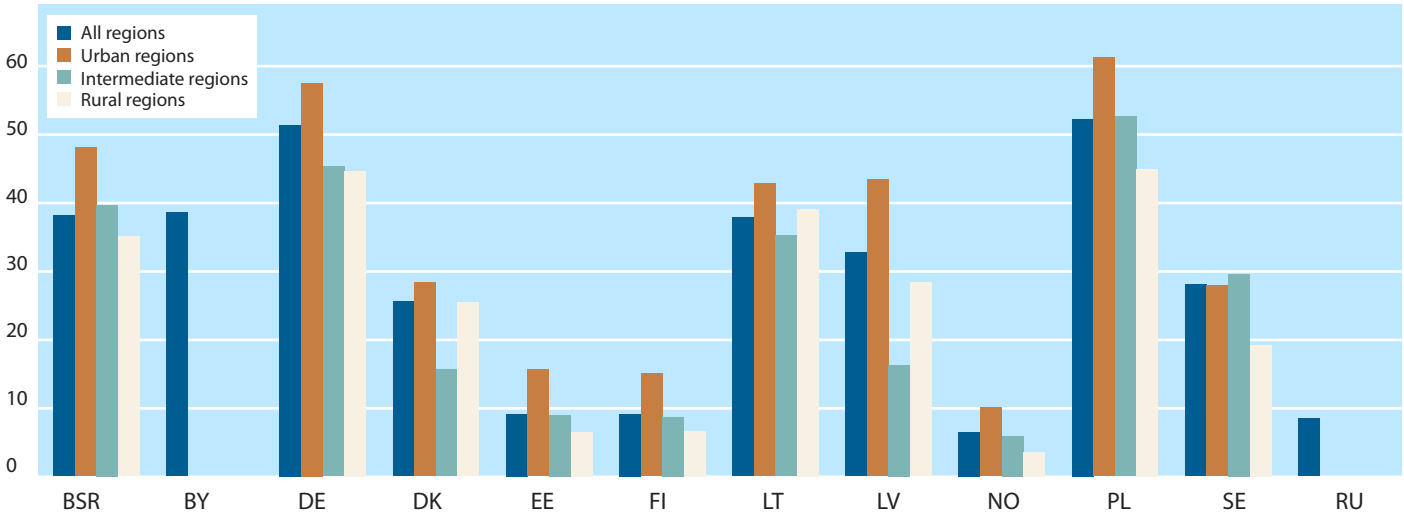


Figure 24 **Accessibility potential by country and urban-rural typology, rail, absolute change 2016-2030**



DE, RU: only BSR regions included; BY, RU no differentiation by typology

Under the framework of the BSR cooperation liberalisation of rules of travelling between EU and Belarus and Russia should be, as far as possible, pursued. This should allow for strengthening the market basis of investments (especially rail) and for making a more optimal use of the existing infrastructure (e.g. rail infrastructure in Belarus).

It has been shown that the past and future introduction of high-speed rail has much larger effects on the accessibility potential than development of the road network. From a spatial development point of view, road accessibility is a precondition for regional development. However, the role of the game changer is with high-speed rail. The introduction of a new level of service in terms of speed and related travel time between the agglomerations of the BSR would be of enormous benefit for the connected cities, and, with appropriate secondary networks also of benefit for the surrounding regions.

In the case of Sweden and Denmark, of similar importance will be the Fehmarn bridge. The future high-speed rail connections linking uninterruptedly Hamburg with Copenhagen and beyond to Sweden will benefit the Scandinavian regions by increasing accessibility potential by rail by more than 50 percent for most regions.

In terms of absolute increases of rail accessibility (Figure 24), the greatest improvements will be in Polish and German regions, followed by Lithuania, Belarus, Denmark, Latvia, Sweden and Estonia. The expected improvements for Russia, Finland and Norway are only modest. The future development of the high-level rail infrastructure of the BSR will benefit urban regions in all countries (except in Sweden) much more than rural regions. This is specific to high-quality and high-speed rail infrastructure which serves primarily larger urban regions and thus might increase development opportunities between cities and the countryside in the BSR countries.

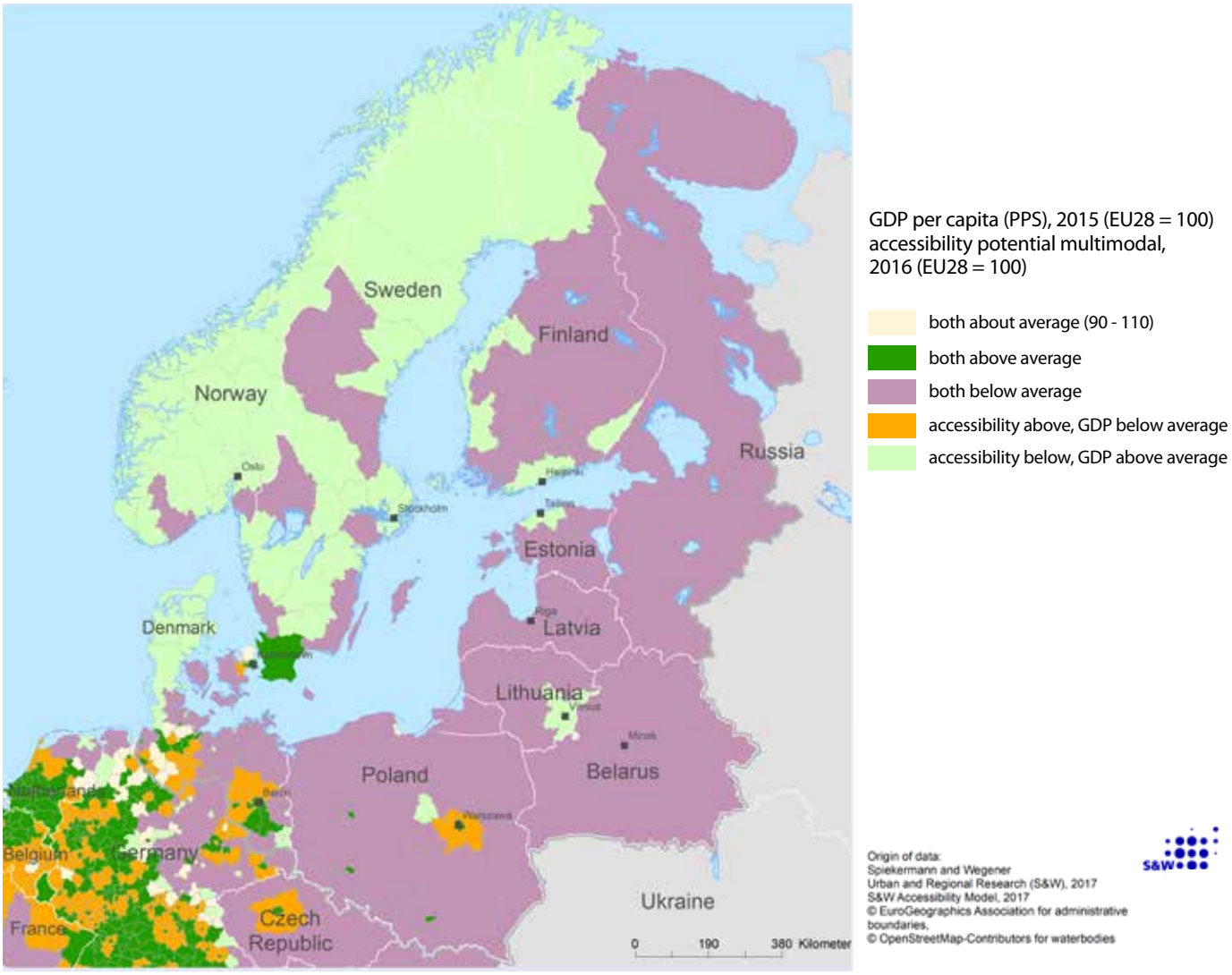
The increases of accessibility potential by rail are significantly higher than those for road. There will be key improvements of the overall conventional rail network mainly because the introduction of (almost) high-speed rail services into the BSR will introduce a new level of service to the region which is so distinct from current levels of operation in many parts of the BSR. Whereas the improvements in the road network are substantial, but will not yield such big jumps in possible travel speeds as it is the case for rail.

Regional Effects of the TEN-T and Potentials for Regional Development

In general, accessibility corresponds to a certain degree to the economic performance of regions. There seems to be a clear relationship between accessibility and GDP. Studies have shown that this relationship is much stronger for multimodal accessibility than looking at individual transport modes.

There is a general tendency that regions with lower levels of accessibility have a lower economic performance and that regions with higher accessibility do better in economic terms. In general, the regions of the BSR behave similarly to all European regions. However, there are two major groups of outliers which distort the basic relationship. On the one hand, there are regions that have low or very low accessibility and high GDP which are mainly regions from the Nordic countries. On the other hand, there are regions with high accessibility but only moderate or even below-average GDP

Figure 25 **Accessibility potential and GDP, 2016**



which are mainly regions in the European centre that do not belong to the group of best performing regions in economic terms.

The maps (Figures 25 and 26) show the relationship between multimodal accessibility and GDP per capita in its spatial dimension. Figure 25 shows which regions have both indicators above and below averages or where one indicator is above and the other below the averages. Two categories dominate in the BSR. Firstly, most regions in the southern and eastern parts of the BSR, in Germany, Poland, the Baltic States, Belarus, Russia and Finland, with the exception of capital regions (as well as southern European regions) are performing below avarage in both categories. Secondly, most regions in Norway and Sweden and some in Denmark and the BSR part of Germany as well as the capital regions of Finland, Estonia and Lithuania have a below average accessibility, however, their economic performance is above EU28 average despite the low accessibility. Only some metropolitan regions in the BSR, Copenhagen/Malmo, Hamburg, Berlin, Poznan, Wroclaw and Warsaw have accessibility and GDP performing better than the European average. The hinterlands of these regions partly have above average accessibility, but the GDP is below.

Figure 26 **Accessibility potential vs. GDP, 2016**

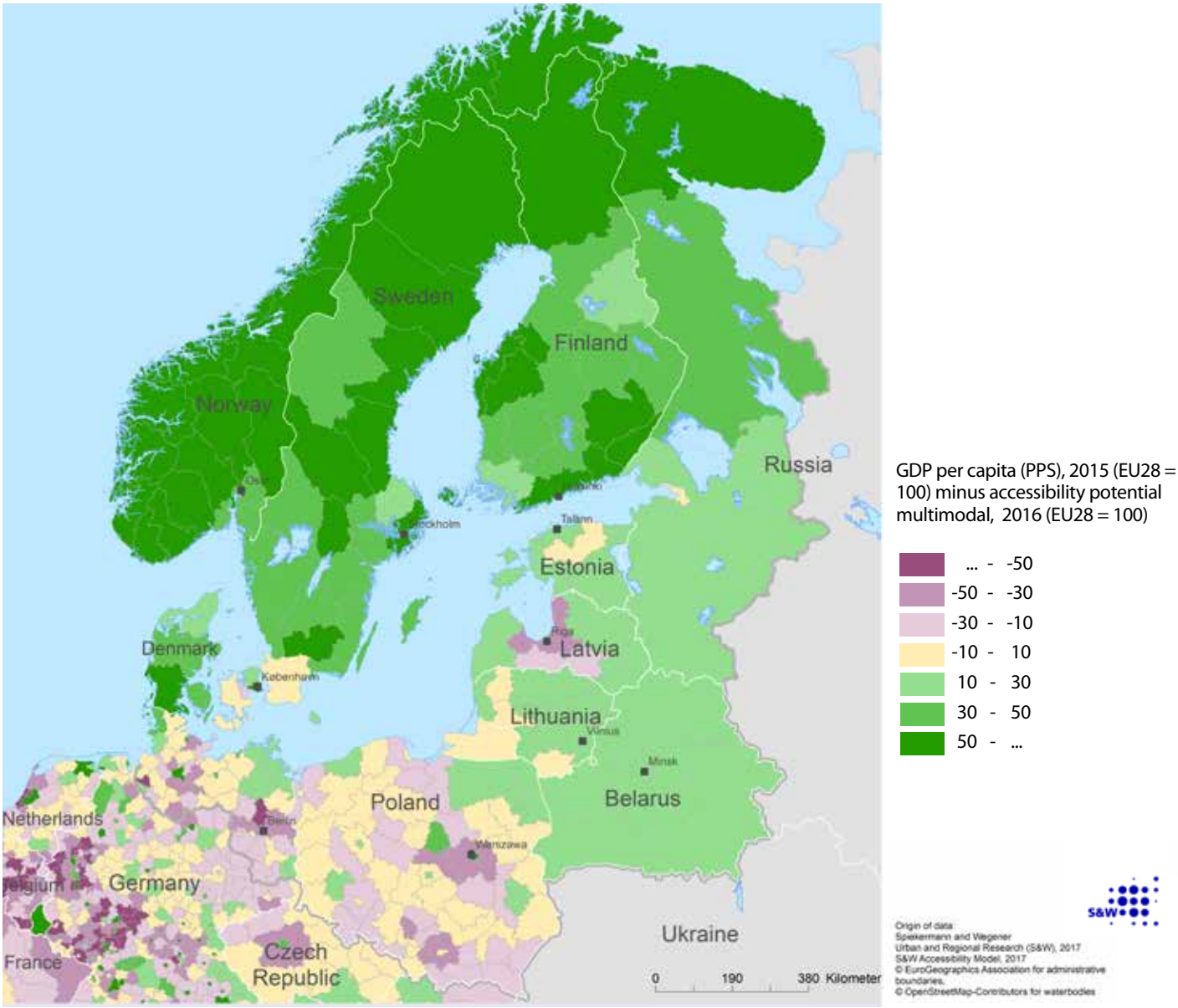


Figure 26 presents more precisely to what degree the economic performance corresponds to the expectation from the location, i.e. the map shows how much the regions perform better or worse than their accessibility would suggest. This is done by building the difference between the standardised index values for accessibility and GDP. Positive values indicate higher economic performance than accessibility, negative values indicate the opposite, i.e. higher accessibility than GDP. Looking at the relationship between regional accessibility and economic performance in this way, new insights emerge. Nearly all regions in the Nordic countries, of the Baltic States, of Russia and Belarus, and a few in the other countries are overperforming, i.e. they have a much better economic performance than location would suggest and thus other important regional assets. Many core cities of agglomerations in Western Europe are also overperforming. Many regions in Poland and Germany (BSR part) as well as Riga and its surrounding area are underperforming, i.e. the degree of accessibility cannot be utilised in economic performance. In most cases, these regions are rural regions or old-industrialised regions in the process of economic transition or suburban regions of

metropolitan regions. In the two countries (Germany and Poland), there are also several regions in which the degree of economic performance corresponds to the level of accessibility.

Investments in the TEN-T will have positive effects on the accessibility of the BSR regions primarily rail investments will make a difference. A study on the effects of the Rail Baltica with a tunnel extension to Helsinki[4] provides insight in the way new transport infrastructure might influence regional development in the BSR and thus can be used to speculate about those effects.

The highest benefit to the accessibility of the BSR would be ensured if the Core Network will be complemented by the Comprehensive network and the tunnel between Helsinki and Tallinn will be constructed.

[4] Spiekermann, K., Wegener, M. (2013): Regional impacts of a railway tunnel between Helsinki and Tallinn. Final Report of a Quantitative Impact Assessment in the course of the Central Baltic Interreg IVA project Helsinki-Tallinn Transport and Planning Scenarios (H-TTransPlan). Dortmund: S&W.

The initiated investments (railway and road) in countries with less developed infrastructure (Poland, the Baltic States) should not be interrupted, as it would threaten to maintain a significant accessibility polarisation (larger than at the threshold of their accession to the EU).

Second tier cities play a significant role for economic growth and jobs as well as polycentric and cohesive territorial development of countries. Third tier cities contribute to these processes as well. Hence connections of second and third tier cities shall be supported and relevant strategic investments and tools for their better accessibility and connectivity developed.

Transport infrastructure development is not the only and probably not the most important issue that impacts area development. With respect to territorial cohesion in Europe and in the BSR, multi challenged regions (economy, demography, social challenges) need comprehensive strategies to enhance their assets and to develop them as attractive locations to live and to implement competitive economic activities. The development of high-quality transport infrastructure and connections is only one element in such strategies aiming at territorial cohesion and a balanced development of the BSR. And, with respect to the environment and combating climate change, the environmental consequences of new transport infrastructure and ever rising transport volumes have to be taken seriously into account and to be assessed against the possible benefits.

Main Conclusions

The area of the BSR is characterised by a very strong internal differentiation of accessibility levels, irrespective of the mode of transport and the applied method of analysis. At the same time, the BSR plays an important role in Europe's transport system. This role is gradually increasing, including thanks to increased participation in intercontinental exchange and as a result of improved accessibility to land ports. An important factor was the EU enlargement to the countries of the southern and eastern Baltic coast.

Transport infrastructure projects can have substantial impacts on accessibility potential of individual regions and cities. In particular, high-speed rail has been able and will be able to reshape the BSR in terms of accessibility by bringing higher accessibility to regions outside the European core. The same is true with accessibility by air which can benefit also more remote cities and regions. However, air transport is much more dependent on market behaviour of carriers with a larger fluctuation of air services at individual airports and thus with the possibility of fast growing but also fast decreasing accessibility by air in the adjacent regions.

In the period 2006-2016, the BSR road and rail accessibility improved, but the improvement was territorially uneven. Though, it is evident that changes in one country can improve accessibility in another, such as the development of the Polish North-South corridors improved the accessibility of Sweden or even Norway. Western Belarus and Lithuania also improved accessibility because of Polish road and rail investments. Transport investments in one part of the BSR do - in terms of accessibility - benefit not only that region in which the investment takes place, but has through a wider network effect also positive effects on other parts of the macro region.

Accessibility and the needs of BSR infrastructure development strongly depends on geopolitical and demographic factors. These two determinants may undermine the effect of transport infrastructure development. In the former case, the restriction may have an abrupt character, relating to the changes in permeability of borders as well as in the demand for transport of goods. In the latter case, these changes are long-term processes related with population movements and with changes of demographic structure.

The processes indicate the growing differentiation of the macro region with respect to the demographic situation. It takes place in two dimensions: a) East - West; and b) peripheries - the largest centres. Most of the south-eastern part of the Baltic Sea macro region (Lithuania, Latvia, Estonia, Belarus, eastern Poland, part of Russia and eastern Finland and north-eastern Germany) are characterised by rapid population loss during the last ten years.

If new transport investments were not implemented in 2006-2016, demographic changes would probably have caused a noticeable decrease in the level of accessibility potential in the eastern part of the macro region.

Changes in the Transport Market

The overall increase in transport in the new EU member states was mostly taken over by road transport. Also the increase in the volume of transported cargo occurred mainly in the Scandinavian countries (especially in Norway and Denmark), and in the beginning also in Germany. This confirms the hypothesis about favourable modal changes, which might have been the effect of railway investments.

In all BSR countries in the years 2005-2016 there was a dynamic growth of air traffic, and thus the demand for infrastructure for this mode of transport.

Accessibility Potential by Road

In the BSR as a whole, urban regions have higher accessibility potential by road than other regional types, especially the BSR area of Germany, Poland and Finland.

The most insignificant changes were noted in the regions that had a very poor accessibility (Russia, East Belarus, Latvia, northern regions of Finland, Sweden and Norway). In some parts of the latter mentioned regions, even a drop in the value of accessibility index occurred, which can be explained by depopulation processes.

The effect of relative and absolute improvements in road accessibility was of lower significance towards eastern and northern directions. This may indicate that there was an increase in disparities between the most and the least accessible regions within the BSR.

Accessibility Potential by Rail

The area of BSR average accessibility by rail is somewhat larger than for road. Rail accessibility decreases steadily towards the northern and eastern regions of the BSR. However, in the case of railway accessibility potential the small- and large-scale disparities within the BSR might be even more significant than for road accessibility.

In the BSR as a whole and in most countries, the urban regions have higher rail accessibility than rural regions; the differences are highest for the BSR regions of Germany and for Poland, i.e. countries with highest rail accessibility.

Since 2006, Belarus and some regions of eastern Poland, Lithuania, Latvia, and Russia noted even a decrease in the level of rail accessibility. This is the cumulative effect of depopulation and decapitalisation of the railway network. The important barrier is the difference between the European and eastern European gauge of railway tracks, meaning that railway investments in Poland did not translate into improved accessibility in the eastern BSR countries, as it was the case in road transport.

Accessibility Potential by Air

Air transport is an important factor balancing the level of multimodal accessibility in the BSR on the national scale. At the same time, it polarises regional spatial systems by favouring metropolises served by international airports.

In all countries the regions surrounding the capitals with their international airports make up the most accessible group of regions in the BSR.

Accessibility Potential, Multimodal

As the accessibility potential indicators are specified in a way that they reflect Europe-wide accessibility more than local or regional accessibility, multimodal accessibility in the BSR is mainly, but not solely determined by air accessibility.

The aggregation of multimodal accessibility by country shows the highest values for the BSR regions of Germany followed by Denmark; then Sweden and Poland which have average multimodal accessibility corresponding to the BSR average. In all BSR countries, there is a clear accessibility divide between urban regions and rural regions.

In absolute terms general transport accessibility within the BSR has improved mostly in the vicinity of capitals and some other large agglomerations such as Helsinki, Stockholm, Oslo, Copenhagen, Tallinn, Riga, Vilnius, Minsk, St. Petersburg, Warsaw, Gdansk, Poznan, Wroclaw and Berlin.

Disparities in accessibility did not rise between countries but between urban and rural regions within countries.

Accessibility to Local and Regional Services

The spatial pattern of accessibility to local and regional centres is closely linked to the various types of settlement structures in the BSR. In general, access to local and regional centres and their services is better in the south-west and decreases gradually going north-east in the BSR. The polycentric settlement structures in Germany as well as western and southern Poland, with a huge number of smaller towns and cities provide good access of the population to services.

Acessibility to Jobs

The 60 minute threshold can be considered representative of the maximum daily commuting time per direction to one's job. This accessibility is highest in star-shaped axes connecting the agglomeration centres into their hinterland.

Accessibility to jobs and in the same way also to many services of general interest is determined not only by the existence of extensive transport infrastructure, but also by appropriate connections to secondary networks. Also a large distance between junctions on motorway exits brings problems to the municipal level. Local solutions have thus crucial influence on the ultimate effectiveness of investments pursued in the TEN-T corridors.

The construction of new TEN-T Core Network infrastructure does not always improve the situation if it is not accompanied by the development of secondary networks.

Maritime Accessibility

The development of maritime passenger and freight traffic during the last decade has been very heterogeneous. On the Baltic Sea container transport developed rapidly, mainly due to the direct line from Shanghai to Gdansk, and container traffic has a high degree of concentration in Ust- Luga (Leningrad region) and Gdansk/Gdynia. The role of ports on the southern and eastern Baltic coast is growing but only in particular places. The accessibility of the Baltic ports in relation to global freight hubs has definitely improved. Due to new developments of transport, the importance of ferry lines is decreasing. Nevertheless, they are an essential element of mutual accessibility between Baltic coastal regions.

The share of the Baltic Sea with container transport is not as markedly large as compared with the North Sea ports in Germany, Belgium and the Netherlands where a significant amount of large container ships call. However, container traffic in the ports of the Baltic Sea is growing steadily.

Air Connectivity

Because of its remote location regarding the European core areas and its partly sparsely populated areas, air connectivity of the BSR is a decisive factor for competitive accessibility. Fairly good air accessibility compensates partly for lower road and rail accessibility of the macro region.

The BSR is characterised by a rather dense network of international and regional airports serving the BSR and destinations outside the BSR. Many airports of the BSR, in particular also those of Poland, the three Baltic States, Belarus and Russia have seen a rapid growth in the last decade.

The future development of the BSR will besides the development of the European-Transport network, including 2nd level nodes and the additional national infrastructure developments, also be influenced by possible transport route developments north and east of the macroregion for cargo transport between the countries of East and South-East Asia and Western European countries.

The planned trans-European transport networks of the EU are forming the base of the future scenarios for road and rail up to the year 2030.

The development of population and transport infrastructure are the crucial elements of future accessibility potential changes. The transport challenge will be to

service less and less populated peripheral zones and to ensure the efficiency of the transport system in and around the metropolises. However, disparities between high and low accessibility areas seem to be less pronounced in the future, and, the area of above BSR average accessibility will extend further away from the south-western areas of the BSR towards eastern and northern directions.

Displaying the accessibility changes only, the highly spectacular improvements in rail accessibility that will take place in the BSR in the next fifteen years will become apparent. This is mainly due to the completion of the Rail Baltica project running across the south-eastern area of the BSR.

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Nearly all regions in the Nordic countries, of the Baltic States, of Russia and Belarus, and a few in the other countries are overperforming, i.e. they have a much better economic performance than location would suggest and thus also other important regional assets. Many core cities of agglomerations in Western Europe are also overperforming. Many regions in Poland and Germany (BSR part) as well as Riga and its surrounding area are underperforming, i.e. the degree of accessibility cannot be utilised in economic performance. In most cases, these regions are rural regions or old-industrialised regions in the process of economic transition or suburban regions of metropolitan regions. In Germany and Poland there are also several regions in which the degree of economic performance corresponds to the level of accessibility.

The full background Report is available at:

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