ACCESSIBILITY OF SERVICES OF GENERAL INTEREST IN EUROPE

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Abstract

Services of general interest (SGI) are treated as a key factor in the process of economic, social and territorial cohesion by EU policy. The importance of connectivity and accessibility of living and working places and especially of places of production to markets as well as accessibility for citizens’ well-being and management of every day live is object of different studies. But comparative studies on accessibility of SGI across European countries as well as on different types of services are missing. This paper undertakes a first international and comparative study of the accessibility of the population to different services of general interest on a raster cell based distance-to-nearest-provider analysis with GIS software. The accessibility of eight SGI of low, medium and high centrality within five case study areas of different settlement structures in five different EU countries is explored. The paper concludes with some policy recommendations for further SGI supply.

Keywords: Services of General Interest, Accessibility, GIS, regional policy
JEL Classification: R58
1. Introduction

EU policy on territorial cohesion addresses besides strengthening of economic competitiveness also the provision of “services of general interest” as key factor in the process of economic, social and territorial cohesion. For their well-being European citizens deserve services of “universality and equality of access, continuity, security and adaptability; quality, efficiency and affordability, transparency, protection of less well-off social groups, protection of users, consumers and the environment, and citizen participation” (Resolution on the Green Paper A5-0484/2003). It is not definitely defined neither the term “Services of general interest” nor what an “equality of access” means.

The importance of connectivity and accessibility of living and working places and especially of places of production to markets for the economic development is well elaborated (amongst others Lutter and Pütz 1993, Vickermann et al. 1999, Höffler and Platzer 2000). Also the importance of accessibility for citizens’ well-being and management of every day live is object of different studies (amongst others Handy 1993, Witten at al. 2003).

Either these studies are limited to distinct regions (Handy 1993) or distinct services (Guagliardo 2004, Zenk et al. 2005) as showcases for underlying theses or - if interregional or even international comparisons are made - the studies refer to accessibility in general and therefore on a coarse-grained regional (data) level (Vickermann et al 1999, Spiekermann et al. 2011). Comparative studies on accessibility of services of general interest across European countries as well as on different types of services are missing.

This paper undertakes a first international and comparative study of the accessibility of the population to services of general interest on a raster cell based distance-to-nearest-provider analysis with GIS software. Also this analysis underlies limitations due to data and computational restrictions but first time the variation of the accessibility over different types of services and between different types of regions are shown and analysed. Furthermore, this study encompasses a proposal to translate the results obtained into practical information that could be used at the policy level, especially regarding the territorial cohesion policies at EU and regional levels.

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2 The paper bases on an analysis undertaken in the frame of the ESPON project “Indicators and perspectives for services of general interest in territorial cohesion and development (SeGl)”. Beyond the authors of this paper to the analysis have contributed Elisabeth Gruber and Alois Humer (Univie), István Ferencsik (PlanIdea), Tomasz Komornicki and Dariusz Świątek (IGSO PAS). The content of this paper does not necessarily reflect the opinion of the ESPON Monitoring Committee.
1.1. Accessibility – a terminology

The term accessibility firstly describes the capability of reaching a certain location from a different location. Accessibility is therefore associated with the ability of a transportation system providing a certain standard of an affordable and quick possibility to overcome distances (Ingram 1971). Ingram distinguishes between relative and integral accessibility. Relative accessibility describes “the degree to which two places (or points) on the same surface are connected” (Ingram 1971: 101), whereas integral accessibility for a given point describes “the degree of interconnexion with all other points on the same surface” (Ingram 1971: 102).

In the approach of Handy (1993) accessibility consists of two parts: a transportation element which is defined as the ease to travel between different points. It is determined by the quality of a transportation system and by travel distance, time, or costs. The second part is the spatial element reflecting “the distribution of activities, such as residences, employment, stores, offices” (Handy 1993). Additionally the author differs between local and regional accessibility. Local accessibility includes facilities which are nearby or nearest to the community such as supermarkets and drugstores. These facilities are used quite frequently and only short trips are required. Regional accessibility is defined by Handy in respect of regional retail centres like shopping malls. In contrast to the local facilities the regional ones attract clients from a wide geographic area and trips are less frequent with longer distances.

Looking at Hardy’s approach we are already in the midst of discussing accessibility to Services of General Interest (SGI). Therefore, we have to define exactly 1. what “accessibility” means towards SGI and 2. the term ”Services of General Interest”.

The literature of accessibility mainly picks out the physical access by overcoming distances as physical barriers. But “access” can also be refused by high costs, less facilities or unacceptable quality. Penchansky and Thomas (1981) firstly mentioned the so-called five A’s of access to medical care services which are: affordability, availability, accessibility, accommodation and acceptability (Penchansky and Thomas 1981). For the authors “access reflects the fit between characteristics and expectations of the provider and the clients” (McLaughlin and Wyszewianski 2002). The five A’s of access explain on the one hand the provider’s abilities to supply Services of general interest and on the other hand the client’s abilities to use Services of general interest. Their approach does not solely focus on the consumer’s perspective but also include the providers of services and their expectations.
Affordability terms the charge for a service as acceptable or inacceptable for the client or citizen to pay. Too high prices can exclude population groups from services.

For providers availability means extending disposing resources to meet the clients’ needs satisfactorily and – in case of private services - for own profit. Personnel or technology are such resources necessary to offer a certain service. For clients availability means the existence or a certain number of facilities so that they can satisfy their needs.

Accessibility within the five A’s means physical accessibility. The mode of overcoming the distance is dependent on the length and consistency of the stretch – walking distance, biking distance, driving distance etc. The existence of a transportation system is a precondition.

Accommodation is another aspect of access including the organisation of a service, e.g. hours of operation or medical care without appointments are of clients’ major concern.

Acceptability describes how comfortable the client is with the provider and vice versa. Age, sex, social class and ethnicity of provider and of client seem to be important characteristics determine acceptance of a service and being satisfied with it (McLaughlin and Wyszewianski 2002).

All in all, having access to services of general interest is obviously more than reaching a facility. Access depends on several aspects which influence each other. Access would not be guaranteed sufficiently when one of these aspects is not satisfactory. Penchansky and Thomas (1981) defined these aspects for access to medical care services but they can be transferred easily to other services.

The importance of each of these aspects differs between different services. For net-infrastructures like electricity, water or sewage supplies, which don’t effort a client’s or citizen’s transportation to the facility, physical accessibility is a less limiting factor once they are installed. On contrary, providers’ availability for installation and maintenance is of high importance here. For most social services all five A’s are of high importance. And transportation services are both, a service of general interest underlying the five principles of accessibility as well as a precondition for a good accessibility of other services.

1.2. A brief definition of Services of General Interest (SGI)

The term “services of general interest” is very open, seldom defined so that it leads to extensive varying interpretations. Nevertheless, services of general interest are seen as essential for the
citizens’ welfare, quality of life and participation and therefore for the functioning of the society (Bjørnsen et al. 2012). Despite missing a complete and distinct definition EU policy highlights the importance of SGI and relates to the member states’ different terms and definitions according to their historical, economic, cultural and political developments (The Green Paper 2003). The EU underlines several principles that Services of general interest have to fulfil as “universality and equality of access, continuity, security and adaptability; quality, efficiency and affordability, transparency, protection of less well-off social groups, protection of users, consumers and the environment, and citizen participation” (Resolution on the Green Paper A5-0484/2003). To ensure a good and fair provision with Services of general interest an adequate system is required in which services - organised publicly and/or privately - are available, affordable and accessible for every citizen and company linked with a certain quality standard.

With pointing out the prerequisites of affordability, accessibility, availability and quality (acceptability) the elementary definition of services being regarded as “of general interest” addresses the elementary definition of accessibility – the five A’s - mentioned above. Therefore it seems to be crucial that accessibility in its comprehensive definition according to Penchansky and Thomas (1981) is one very important and immanent aspect of SGI.

Under the term “services” infrastructural and technical facilities as well as social facilities are summarised. With the term “general interest” a connection to “public service obligations” is established. Services are of general interest when they fulfil the premise for public service obligation. The term also reflects solidarity in the community with universal benefit and access to services. According to the EU’s definition and interest the services can be grouped into 1. services of general economic interest which include the big net-infrastructure as well services necessary for local /regional economic activities and into 2. social services of general interest for citizens’ benefit and needs as education, medical care etc. Finally a list of services is collected which represents the widest understanding of services of general interest among EU member states³.

As there are comparative data and studies missing across different kinds of services and to learn more about the accessibility of different SGI in different countries (representing different welfare regimes) the following analysis is taken out.

³ See Bjørnsen et al. 2012, p. 19 ff
2. Description of analysis

2.1. Concentration of physical accessibility in five case study regions

The data situation among services of general interest in an European wide view is rather poor. Mainly the availability respectively existence of services can be measured. Availability or existence of a service can be seen as a precondition for accessibility, but as a not sufficient one to understand all aspects of accessibility. Furthermore, data availability restricts accessibility analysis to the physical accessibility. Within the limits of available data the analysis refers 1. to eight particular services and 2. to five distinct case study regions. Despite the choice of particular services and regions the diversification of services and regions allows some general indications of accessibility of services.

A two-dimensional ranking leaned on the concepts of Maslow’s “Hierarchy of needs” and of Christaller’s Central Place Theory finds some empirical evidence (see Figure 1)⁴.

![Figure 1. Two-dimensional ranking of services of general interest](image)

Christaller’s theory is based on market mechanisms that are in its thresholds, which comprises the smallest market area necessary for the goods and services to be economically viable, and the maximum distance consumers will travel to purchase goods and services.⁵

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⁴ See Breuer and Milbert 2012, p. 161

⁵
Maximum distances for services are often set politically and lack a theoretically and empirically underpinning; communities’ financial distress leads to a vivid discussion of expanding distances for certain services. Some theoretical explanation for the maximum distance consumers will travel could be taken by Maslow’s motivation theory. Modern versions of Marslow’s theory arguing against a strict hierarchy but of five interrelated level of needs (see Koltko-Rivera 2006, Reid-Cunningham 2008). Basic needs require a more easy access what means local availability while needs of a higher order are required less frequent if at all. Nonetheless, all five levels of needs are regarded as necessary for well-being in modern societies.

The services for the accessibility analysis are chosen to represent at least three levels of centrality:

- low centrality: pharmacies and primary schools
- medium centrality: railway stations, hospitals and secondary schools
- high centrality: airports, highway entrances and facilities of tertiary education

The five case study regions were selected due to the fact that the required information was easily available; they cover different types of settlement structure and natural barriers/preconditions; and they have different regional policy objectives and EU accession dates:

<table>
<thead>
<tr>
<th>Country</th>
<th>Region</th>
<th>Description</th>
<th>Type</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>East Austrian Periphery</td>
<td>Border-area, Mountainous, Urban/rural</td>
<td>EU15</td>
<td>Regional competitiveness and employment objective</td>
</tr>
<tr>
<td>Germany</td>
<td>Ruhrgebiet</td>
<td>Densely populated, post-industrial, inside Pentagon</td>
<td>EU12</td>
<td>Regional competitiveness and employment objective</td>
</tr>
<tr>
<td>Hungary</td>
<td>Dél-Alföld</td>
<td>Agricultural, peripheral</td>
<td>EU25 (NMS)</td>
<td>Convergence objective</td>
</tr>
<tr>
<td>Poland</td>
<td>Mazowsze</td>
<td>Urban/rural, metropolitan, core area</td>
<td>EU25 (NMS)</td>
<td>Convergence objective</td>
</tr>
</tbody>
</table>

5 Critics argue (i) that with technical (transport and telecommunication) development the central place theory becomes less evident, (ii) that there are problems of empirically proof and (iii) a clear definition of “goods of higher” order in practical planning is missing.

6 Besides these five regions four other regions are case studies in the ESPON project “Indicators and perspectives for services of general interest in territorial cohesion and development (SeGI)”; for more information see http://www.espon.eu/main/Menu_Projects/Menu_AppliedResearch/SeGI.html
2.2. Methodology and data

There exists a large body of literature adapting diverging measures and approaches in the field of accessibility analysis, and numerous methods reviews and evaluations have been published (e.g. (Fortney, Rost, & Warren, 2000; Geurs & van Wee, 2004; Neutens, Schwanen, Witlox, & De Maeyer, 2010; among others). Nevertheless, important questions still remain as a large application spectrum and a huge number of different indicators can lead to methodological chaos. Thus, the selection of an appropriate indicator for analysing the accessibility of services of general interest becomes a crucial question for its research, which strongly influences the quality and usefulness of the obtained results.

The proposed methodology to research the spatial accessibility of services of general interest is based on the comparative analysis between location of service providers and population distribution within the study area (McLaughlin and Wyszewianski 2002). Thus, we disregard any a-spatial measures such as population-to-provider ratio (Guagliardo 2004). Further, we understand ‘distance’ as time-distance, instead of physical (Euclidian) or road-network distance. The former ignore any diversification of road-network, what leads to an underestimation of the factual distances especially in mountainous regions (Lin, Allan, and Penning 2002), while the latter ignore the congestion influence on travel speed e.g. difference between city centre and peripherally located zones (Martin et al. 1998). The time distance measure is advantageous against the other methods, as it allows including factual physical distances as well as all important characteristics of the transport infrastructure like road network density and quality.

In the presented paper, we concentrate exclusively on physical accessibility dimension as the most ‘spatial’ dimension of access. Therefore, we do not include a monetary (cost) distance into our analysis, or other affordability or accommodation dimensions which are other concepts or aspects of distances to services of general interest. Furthermore, we decided to focus our research on distance-to-nearest-provider analysis, based on shortest travel time delivered by calculations conducted in

Spain Navarre Mountainous, peripheral, urban/rural EU12 Regional competitiveness and employment objective

NMS: New Member State
proper GIS software. Although the chosen method has significant limitations (see e.g. Guagliardo 2004), it has also considerable advantages, especially in performing comparative research because of totally different organizational, spatial and economic conditions in the particular case studies. Additionally, the indicator “shortest travel time” is relatively easy to interpret and therefore ideal for policymakers. Finally, the chosen method requires relatively low technical resources, what is crucial in analysing enormous amounts of spatial data.

The designated methodology relies profoundly on data accuracy for all layers used: network, population and location of service providers. For the analysis the GEOSTAT 2006 population grid dataset is used, an integrated, very detailed spatial data base, showing the population distribution within one square kilometre cells. The analysis incorporates only populated cells; unpopulated cells are excluded from the calculations. The number of grid cells in the different case study areas varies according to the size and settlement structure between approximately 1 400 cells in Navarre and 28 000 cells in Mazovia.

The most current population data available and completely comparable for all case study regions dates on the year 2006. While calculating travel time to service providers, the centroid of each populated raster cells is treated as a travel origin. In case the centroid is located outside the existing road network, it is connected to the nearest segment of the network artificially, through shortest path segment. This approach allows obtaining very detailed results, even more detailed than in case of administrative units, which can be very large and therefore neglecting the internal differentiation. The use of spatially very detailed population data allows avoiding - at least partially - the influence of modifiable areal unit problems (MAUP, for details see: Oppenshaw and Taylor, 1981). The spatial data of service providers’ locations and road network data are collected and/or geocoded where needed separately by the project partners responsibly for their case study region. All calculations are made by the responsible project partners using a shared methodology.

The results of the analysis are saved as travel time matrixes, a separate matrix for each case study region, where the rows contain the grid cells (coded by individual IDs) and the columns the eight analysed services. Each cell contains the exact travel time in minutes from the centroid of a certain grid cell to the nearest service of a certain type.

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7 An exception was made in the Spanish case study (Navarra). In this case, even more detailed data were used, delivered by SIOTN 2012 (Navarre Territorial Indicator System).
The results are presented in different ways: Firstly, a set of thematic maps for each service is produced. This allows concluding on regional disparities of Services of general interest accessibility within all five analysed case studies. Secondly, the cumulative graphs are produced, what provides information about diversity of accessibility to particular SGI within the population of the studied area, and permits for comparison between case studies. Foregoing information is supplemented by a set of basic statistics which provide additional information about accessibility level and its diversity within a particular case study.

Additionally, the results will be compared to the population distribution per region and service. This comparison allows identifying for instance those areas which are highly populated but having low accessibility respectively high travel times to a determined service. To realize the vision of territorial cohesion and competitiveness the improvement of provision and/or accessibility of services in those areas have some priority. To get a rough picture where some intervention should have priority a simple categorization is made: Both population and travel times are classified into three categories using quantiles, i.e. equal number of grid cells within each category. The quantiles are built over all grid cells of all five case study regions. Then, the three categories of the two variables are combined to a simple typology with nine classes and presented in maps.

These second figures/maps do not only show the areas with a relatively low level of access to particular service providers, but also confronting policy makers – EU, national and regional - these areas with the population density distribution.

3. Results

3.1 Accessibility to low centrality services

The results confirm that services of lower centrality are more accessible than services of medium and higher centrality for most of the population across the different EU regions. In EU 27 + 4 nearly every municipality is equipped with a primary school. Primary schools are accessible within 10 minutes in most parts of all case study areas (see Figure 2). The population weighted average travel time is between one and half a minute in Navarre (dense network of 217 primary schools in this region) to slightly over 3 minutes in Mazowsze. However, for pupils living in the periphery of these two regions travel time to the nearest primary school is much higher and exceeds 30 minutes in the

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8 See also Stępiak and Rosik 2012
peripheral part of Mazowsze and even 45 minutes in the peripheral part of Navarre (west of Pamplona). The lowest maximum travel time is observed in Ruhrgebiet because of its high population density and in Dél-Alföld where all children have the opportunity to access the nearest primary school below 15 minutes. In Dél-Alföld in most municipalities, children can attend primary school locally until age 14.

Also the accessibility to pharmacies is relatively high in all analyzed regions. The population weighted average travel time is from one minute in Navarre - there are 599 pharmacies in Navarre region - to close to 5 minutes in Eastern Austria. The maximum travel time to the nearest pharmacy is lower than 15 minutes in Ruhrgebiet and exceeds 30 minutes in Mazowsze and Navarre, and is very close to 30 minutes in Eastern Austria and Dél-Alföld. In Eastern Austria the poorest access to pharmacies is in the north-western part of the region. However, most hospitals which are distributed evenly in Eastern Austria run a pharmacy and provide the opportunity of first aid especially at late hours and weekends, when accessibility of pharmacies and doctors is limited.
Figure 2. Travel time by car to primary schools
For both analysed services of low centrality – primary schools and pharmacies – 80% of the population in each case study region have access to the service within eight minutes and less. Regional specific conditions seem to be of higher influence on time needed to reach a service than settlement structure as the comparison of Navarre and Dél-Alföld with rather similar settlement structures denote. But the provision of the services differ in both regions as Figure 3 shows.

Calibrated on the level of travel times over all case study regions in Dél-Alföld the accessibility to primary schools is rather low or medium independent of population density everywhere. In and around Pamplona, in the South and in the North-West of Navarre accessibility is rather high independent of population density and rather low or medium in the midst of the region. The statement that in densely populated areas every spot fulfils the capacity threshold of the service and in lower populated areas services tend to be more concentrated to reach the capacity thresholds can not be confirmed totally. But one has to take into account that for most parts of the regions the accessibility to primary schools and pharmacies is high or at least medium and therefore for most inhabitants (children) acceptable. Furthermore, the categorization is made by few regions and don’t necessarily reflect the EU standard and deviation.
3.2 Accessibility to medium centrality services

The best access to secondary schools is in Ruhrgebiet and Navarre. In both cases the population weighted average travel time is below 3 minutes. In Ruhrgebiet nearly most of the inhabitants have a splendid access to secondary schools. Only for 10% of the population of Ruhrgebiet region the...
travel time to the nearest secondary school is slightly higher and varies between 5 and 13 minutes. The very good accessibility of secondary schools in Navarre of only 2-3 minutes average travel time to 117 secondary schools attracts more than 33 thousands students. The level of accessibility to secondary schools is high despite the sparse population. In Mazowsze, the situation is moderate due to the fact that secondary schools are in each commune (poviat) or sometimes even in municipality (gmina). However, the inhabitants of the municipalities located near the voivodeship borders have a slightly worse access to secondary schools.

In general, in all cases, except of Ruhrgebiet, the maximum travel time to the nearest secondary school for people living in the peripheral areas is 40 to 60 minutes. The longest travel time is in the peripheral fringe of the western and eastern part of Dél-Alföld region where the population weighted average travel time at maximum is close to one hour. However, in Dél-Alföld there has been significant growth in the range of secondary level education in the region over the last ten years and the number of municipalities with secondary schools has increased.

In general, the accessibility to hospitals is in each of the analyzed regions is high. The population average travel time is very low in Ruhrgebiet case (about five and half minute). In Eastern Austria, Navarre and Mazowsze the population weighted average travel time is higher and varies between 10 and 12 minutes which is also a satisfactory result. In Eastern Austria there are 13 hospitals which are distributed evenly in the district capitals. Only in the northern parts of the region, the travel time to the nearest hospital may be close to or longer than 30 minutes. In Poland hospitals are located in general in each commune (poviat). However, in the northern part of Mazowsze people must take more than 60 minutes to get to the nearest hospital.

In terms of accessibility to hospitals the north-eastern part of Dél-Alföld in Hungary is the area with the worst situation. The maximum travel time to the nearest hospital there exceeds 74 minutes, but for emergency cases the travel times are lower. The calculation is focused on the so called weighted hospital centres according to the new health (hospital) infrastructural hierarchy. The emergency air service is well developed and even specified medical centres in Budapest, Kecskemét or Pécs are accessible within 20-30 minutes via air. There is a similar situation in the eastern part of Navarre, where the inhabitants of this peripheral area must take more than one hour to the nearest hospital. In the north and south-western parts of Navarre inhabitants can use hospitals located very close to the border in the neighbouring regions.
The density of railway network in all case studies may be regarded as sufficient (see Figure 4). The population weighted average travel time to the nearest railway station is about 10 minutes. The best accessibility results are achieved in Eastern Austria and Dél-Alföld. Both regions have a very dense railway network mainly due to their sudden development in the time of Habsburg Empire. However after Trianon Treaty major railway lines e.g. Szabadka (Subotica) - Arad - Nagyvárad (Oredera) and Újvidék (Novi Sad) - Kolozsvár (Cluj-Napoca) were lost and the well developed structures fell apart. In Dél-Alföld more than ten railway lines cross the whole area and nearly all bus or railway stops or stations can be reached within 15 to 30 minutes. This high density of railways provided the link of remote farmsteads to the city centres. However in the past five years several stops and even whole lines were terminated and closed. In certain cases in Dél-Alföld the frequency of services is reduced and private vehicles are taking over at the expense of all types of public transport. As concerning Eastern Austria, in the south of the region there is mostly no train connection. This part of Eastern Austria was a part of Hungary and train connections to Vienna or Graz have never existed. In the northern part the main North-South connection in Austria (between Graz and Vienna) is leading through the case study region.

In Navarre the median travel time for population and for raster cells differ a lot. That means that the worst accessibility to the railway system has the sparsely populated areas, the eastern part of the region in particular. The existing railway network is being improved as a new High Capacity Corridor for passengers and goods will connect Navarre to other Spanish and European regions (Basque Country, Barcelona, Madrid and EU-France through Irun). The radial railway net structure of Navarre is similar to the one in Mazowsze region. However, in Navarre and Mazowsze the maximum travel time to the nearest railway line in the regional periphery exceeds 70 minutes.

Surprisingly, in the north-western part of Ruhrgebiet region the maximum travel time to the nearest railway line exceeds 45 minutes. This area is poorly connected to the main and predominantly interregional fast lines connecting the North and South of Germany. Furthermore the rail traffic in Germany lost importance towards the individual motorised traffic in the last centuries.

Beyond settlement structure – e.g. population density, boarder region - some historical factors influence the accessibility. The variety of services tends to be higher in urban areas and cities. But also the historical and political decisions are still influencing the dispersion of services, e.g. secondary schools in Navarre, railway net in Dél-Alföld.
Figure 4. Travel time by car to railway stations
In all case study areas 60% of population reach the next railway station within 15 minutes and less. Reverse, for 40% of the population the accessibility to the rail transport is worse. Apart the railway net infrastructure densely populated spots exist with a low accessibility (Mazowsze, Navarre and Ruhrgebiet, see Figure 5). This fact has to be emphasised against the background that railway transport is an environmental friendly collective transport system which furthermore allows less mobile population groups to take part into social and economic life. As many densely populated spots are stuck by low accessibility this fact can not only be seen as the connectivity problem of fragmented settlement sprawls.
3.3. Accessibility to high centrality services

The access to services of high centrality varies more than of low and medium centrality. The access decreases with the distance to the location of the facility. Accessibility to tertiary schools in the
areas of Eastern Austria located far from Wien and Graz is low because the universities are located mainly in the big, central agglomerations. In Dél-Alföld the location of tertiary education is determined by the dominance of Szeged, where 27 000 students study. In the western and north-eastern parts of the region there are areas with no tertiary school accessible within 45 minutes by car. The variation between municipalities is therefore very large.

However, the population weighted average travel time to the nearest tertiary school in Navarre is only 5 and half minute. The reason is that Navarre has 3 universities in the main urban settlements (Pamplona and Tudela) as well as 25 other tertiary schools in the region. Moreover, there are other Universities in neighbouring regions.

In Mazowsze, there are tertiary schools in each of the former (before 1989) voivodeships and also in few other cities. The access to tertiary schools is very good in close proximity to large or medium-sized towns in all parts of the region. However, at the regional periphery at the western and eastern fringe, students have to take more than ninety minutes to access the nearest tertiary school.

In general in all five case studies at least one motorway is in operation. However, the regions vary in terms of motorway density from the very dense motorway network in Ruhrgebiet, moderate motorway density in Navarre and Eastern Austria to relatively low density in Mazowsze and Dél-Alföld. Therefore the population weighted average travel time differs between about 4 minutes for Navarre up to 47 minutes in Dél-Alföld. In particular in Mazowsze and Dél-Alföld the grid-based assessment shows that travel times to the nearest motorway entry of over 60 minutes are quite common.

In Navarre as well as in Mazowsze the motorway network has a radial structure with the core in Pamplona and in Warszawa. In case of Navarre the motorways lead to neighbouring autonomous communities and France. In Mazowsze the few sections of existing motorways and express roads still do not lead to neighbouring regions. In the Mazovian voivodeship symptoms of polarisation can be observed in transport investment needs.

The worst situation is in Dél-Alföld region where the travel time to the nearest motorway partly exceeds 90 minutes. The situation is most unfavourable in Békés County where no motorway or semi-motorway exists.

The travel time to airports varies remarkably between case studies (see Figure 6). The airport Noain near Pamplona in Navarre is well located and was renewed in 2011. Navarre has two other national
airports located very close to the regional border. Therefore Navarre’s accessibility to airports is very good, nearly as good as the accessibility to airports in the Ruhrgebiet region where three airports in and close to the region are operation internationally. The population weighted average travel time to the nearest airport in both regions is below 30 minutes and below 50 minutes at its maximum.

For Mazowsze and Eastern Austria the population weighted average travel time is between 50 and 60 minutes. In Eastern Austria there are motorway links to the airports located outside of the region (Wien and Graz). However, in the north-western parts of Eastern Austria accessibility to airports remains low. The accessibility to the airports in Mazowsze region has significantly improved after the Modlin airport opened in June 2012 and located north-of-Warsaw. However, people living in the southern and eastern part of the region still suffer from very poor access to the nearest airport.

The poorest accessibility to airports has Dél-Alföld in Hungary. The population weighted average travel time exceeds there 130 minutes and 3 hours at its maximum. The only international airport is Liszt Ferenc International located in Budapest. The median for population is also higher than the median for raster cells. The reason for this is that the best accessibility to the nearest international airport, due to its closeness to the Liszt Ferenc Airport, is in the north-western part of Dél-Alföld which is sparsely populated. The situation is bad in the area on the east of Szeged because the Szeged airport’s status is “a non-public airport with right to temporary border opening” whiles the Kecskemét airport is a military one.
Antonia Milbert, Ina Marie Breuer, Piotr Rosik, Marcin Stepniak and Xabier Velasco - Accessibility of services of general interest in Europe

Figure 6. Travel time by car to airports
Great parts of Mazowsze and Dél-Alföld are badly connected to airports. Affected are also densely populated areas (see Figure 7). Only 10% of the total population in Dél-Alföld reaches an airport within 60 minutes. In these disconnected densely populated areas also enterprises and economic active facilities are stuck by this disservice. On the contrary one has to take into account that in both countries respectively regions railway transport has a high importance and motorways are not developed equally to other regions standards.

**Figure 7. Categorization of accessibility of population to airports**
4. Conclusion and further research

Services of lower centrality are better accessible in terms of less travelling time for most of the population. The disperse location of these services guarantees that people can reach these services within reasonable time and fulfil their (daily) needs. In the case of primary schools the disperse location permits a quick travel to and from school for small children. There is a slight worse situation of accessibility in sparsely populated areas if these services underlie market mechanisms or staying under public financial pressure. Nonetheless there seems to be a common understanding of the need of a broad supply and well accessibility of these services across European states.

Services of low centrality and of daily or frequent need are important factors of the citizens’ well-being and satisfaction of living conditions. Besides pharmacies and primary schools also shopping facilities, physicians and jobs should be available in low distance to access. Not considered here are all services which are distributed by net infrastructures like fresh water, electricity, telecommunications etc. Low accessibility of services of frequent or daily needs complicate the organisation of job- and family life; migration can be the consequence of unsatisfactory accessibility. Where the population density is high the provision of these services should meet the capacity thresholds. The well accessibility of the services of low centrality in the five case study regions analysed here bears some buffer for stronger centralisation if necessary even in many sparsely populated areas. It is a political and societal decision how to keep or improve the accessibility of these services in sparsely populated areas with low accessibility. Alternative ways of provision (e.g. boarding schools or internet shops/pharmacies) are established in other sparsely populated regions but only function if accepted by the population. These alternative ways need some societal habituation.

The variation of accessibility across case study regions increases on services of medium and high centrality. The location of cities as location of these services in the region in general and in relation to important centres or the capital plays an important role for their accessibility. On the other side the share of population and areas with less accessibility increases. Additionally the accessibility is dependent on the connectivity of all areas to these hot spots of services by the rail- or road-network.

But the differences among the case study regions can’t be explained only by settlement structure. The settlement structure of Navarre e.g. is rather similar to the East Austrian periphery. But actually
Navarre’s performance regarding accessibility to services is more similar to the one of Ruhrgebiet which is in contrast to Navarre a densely populated region in the core of Europe’s pentagon. The implementation and distribution of services of medium and high centrality in Ruhrgebiet is not only an effect of high demand because of population density but also a political decision of supporting a region in its transformation process from a mining industry to a high technology and tertiary industry region. These are regional specific pre-conditions which increase also the living conditions for the citizens.

Of high importance for the results presented here is the national political privileging of public (railways) or individual (motorways) transport. This might be the main cause for the relative worse accessibility of medium and high central services in the EU new member states by car. Poland and Hungary have still a good developed and dense net of railway transport while the net of motorways is still below average, partly in bad or uncompleted status. But after accession to the EU there are deep changes going on what will have impact on the accessibility in NMS.

The somewhat worse accessibility situation in Austria as a neighbour of NMS might be an effect by the boarder situation lingering on. Especially the areas of Eastern Austria periphery close to the boarder show less accessibility.

The implementation of services in former centuries and their drawback in recent history has an effect of the deviation and location and therefore on the present accessibility of services. Implementation and drawback don’t affect only sparsely populated areas but also densely populated settlement areas. The impact of liberalisation and financial stress of most governments to the accessibility of services probably leads to a decline of accessibility, especially – but not only - in more sparsely populated areas.

The following decision structure (see Figure 8) can be used for policy makers in EU and on national respectively regional level to prioritise the areas of intervention. Especially in times of financial pressure the temptation to close facilities and concentrate them in central spots is high with the effect of reducing the accessibility for population. In case these adjustments are unavoidable to meet the financial objectives, the relative accessibility of population to services maps could be used to apply adequate policies strategies.
Further research is necessary:

- To prove the results further regions should be included in the analysis, either from other countries and/or other regions from the five countries presented here with different settlement structures and different historical development/economic structure.
- For distinct services the accessibility analysis should be stronger related to the target users of that service. E.g. the accessibility of primary schools should be related on kids of the relevant age; the demographic changes going on in most areas have great impact on the decision of closing or concentration of services.
- The quantile classification method applied is meant to be a tool for policy makers to prioritize and evaluate their decisions. The calibration here on the five case study regions is only considered as a sample and simplifies the threshold discussion. Other classification methods and thresholds should be elaborated.
- As many other analysis this analysis is limited to the motorised transport by car. Especially to evaluate the regions and countries with a high level of rail transport properly an analysis with combined transport should be repeated. Problem here is the data availability of rail transport including frequency of departure and connections.

**Figure 8. Decision structure for policy makers**

<table>
<thead>
<tr>
<th>Accessibility level</th>
<th>Population</th>
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</thead>
<tbody>
<tr>
<td>YELLOW: maintain service provision</td>
<td></td>
</tr>
<tr>
<td>RED: priority area in order to develop/improve service provision</td>
<td></td>
</tr>
<tr>
<td>GREEN: well accessible area, preferable for population development or candidates for service provision adjustment.</td>
<td></td>
</tr>
<tr>
<td>PURPLE: maintain service provision</td>
<td></td>
</tr>
<tr>
<td>GREY FRAME: depending on type of service different strategies and further</td>
<td></td>
</tr>
</tbody>
</table>

- YELLOW: maintain service provision
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- GREEN: well accessible area, preferable for population development or candidates for service provision adjustment.
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References


