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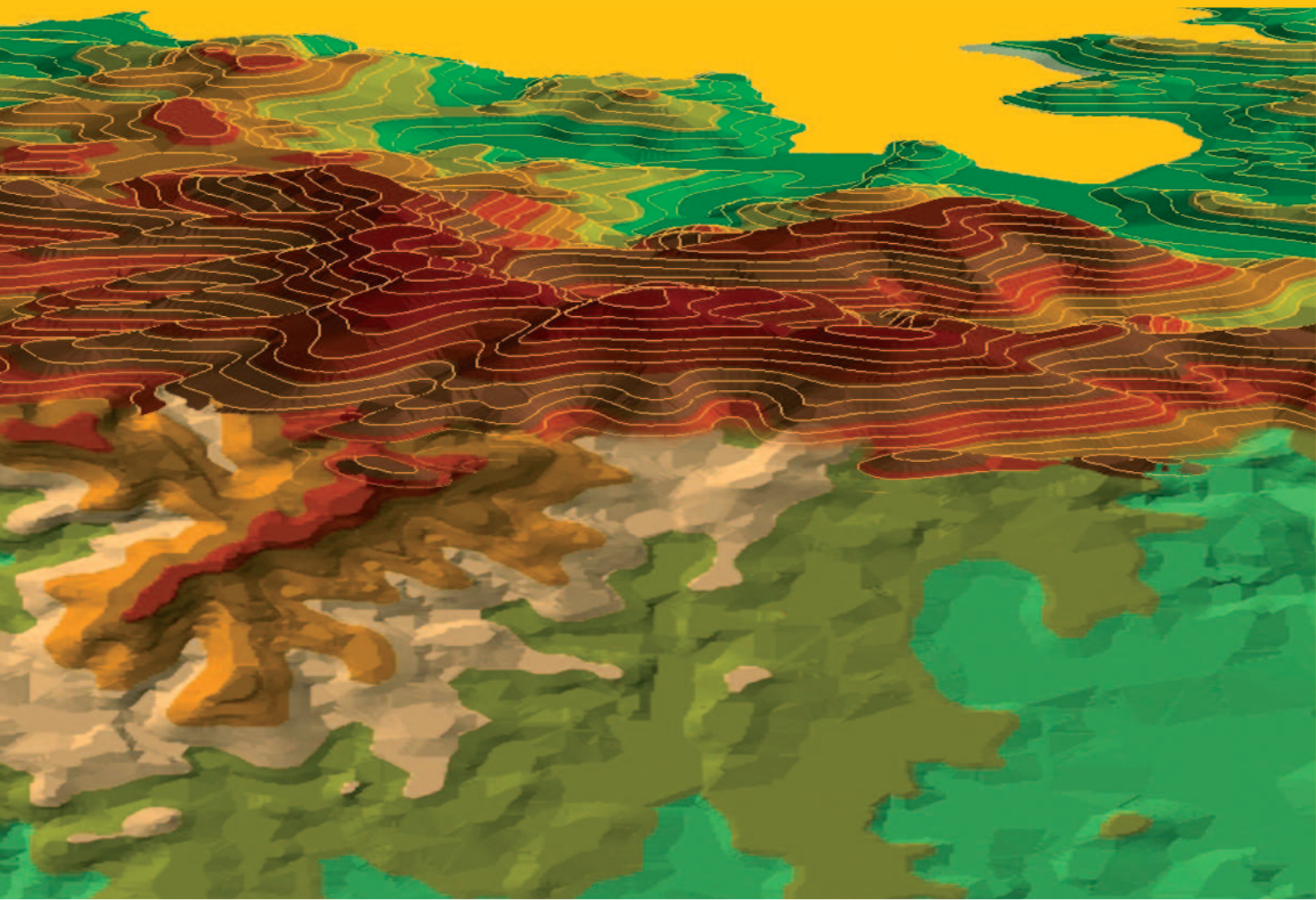

Fig. 1: Border crossing in Cieszyn/Český Těšín (Photo J. Kolejka)

Fig. 2: Border crossing in Gugin/Guben (Photo P. Zawierta)

Illustrations related to the paper by Sylwia Dołzbłasz

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Articles:

Symmetry or asymmetry? Cross-border openness of service providers in Polish-Czech and Polish-German border towns

Sylwia DOŁZBŁASZ [a]

Abstract

The symmetry and/or asymmetry in terms of cross-border openness of service providers is examined in this article, for the cases of two border twin towns: Cieszyn/Český Těšín at the Polish-Czech border, and Gubin/Guben at the Polish-German border. To assess the level of openness of firms towards clients from the other side of the border, four trans-border categories were examined: neighbour's language visible at store location; business offers in the language of the neighbour; the possibilities of payment in the neighbour's currency; and the staff's knowledge of the language. This enabled a comparison of both parts of the particular twin towns in relation to the character of cross-border openness, as well as an assessment of their symmetry/asymmetry. Comparisons of Gubin/Guben and Cieszyn/Český Těšín with respect to the analysed features were also carried out. The analysis shows significant variation in the level of cross-border openness towards clients from neighbouring countries. Whereas in the Polish-Czech town a relative symmetry was observed, in the Polish-German case, significant asymmetry was noted.

Keywords: *trans-border shopping trips, border twin towns, divided cities, cross-border relations, Polish-Czech border, Polish-German border*

1. Introduction

Location at a national border creates very specific conditions for the development of border twin towns. The existence of the border, due to formal or legal, psychological and economic barriers, could hamper their development. Their location at a border, however, could become one of the elements of the towns' territorial capital. Integration processes in the European Union create opportunities for the disappearance of internal borders and their separating impact. It seems, however, that the effects of vanishing political barriers will occur with varying degrees of intensity for different national borders.

Border cities can be considered as laboratories of integration. Due to the tangible presence of the border in the daily life of citizens and the closeness of the neighbouring countries, cross-border practices of different kinds seem to be more significant than in other parts of the borderlands. Moreover, the practical dimension of integration actions and/or the effects of the lack of such actions are much more noticeable in these cities. This is important, in both tangible fields, such as cross-border transport, spatial planning, rescue services and police actions, as well as in the intangible realm, such as the issue of national stereotypes, local identities and the promotion of cities.

This article discusses the issue of the cross-border openness of service companies operating in border twin towns. While overall cross-border relations consist of a great number of determinants – from political, historical, cultural or economic fields, and the different cross-border practices resulting from them – the question of a company's openness towards clients from the other side of the border is one of the dimensions regarding the integration of cities that are divided by a border. It is also an expression of the determinants and relations that are present in the cities.

The main objective of this study is to analyse the shaping of the cross-border openness of service providers in the border twin towns of Cieszyn/Český Těšín on the Polish-Czech border, and Gubin/Guben on the Polish-German border. The research focused mainly on an evaluation of the level of openness of firms towards clients from the neighbouring country, as well as an analysis of the spatial distribution of companies and their structural type. The more specific aim of the study was to determine whether cross-border openness is symmetrical or asymmetrical for the cases of Cieszyn/Český Těšín and Gubin/Guben, as well as to carry out a comparative analysis of the Polish-Czech and Polish-German border twin towns.

2. Theoretical background

When analysing the functioning of the companies in border cities, several issues seem to be particularly important: the issue of the border and its role; the specificity of border twin cities; and cross-border shopping mobility. The border is a complex phenomenon, a political construct, but also a social one (Newman, 2006; Newman, 2010; Paasi, 2011). It can not only be a political barrier, but also a spatial, communication, economic, cultural, historical, or, what is equally important, a mental border (Brunet-Jailly, 2011; Rippl et al., 2010; Van Houtum, 1999). When analysing determinants of the role of a state border, however, one must remember that although its obvious material implications are important, a borderland is shaped by a complex set of cultural, historical and political interactions and processes occurring within its space (Knippschild, 2011; Van Houtum, 1999).

The border of a country is always some kind of a barrier, even in strongly integrated areas such as the European Union (O'Dowd, 2010; Bygvrĺ and Westlund, 2004). With processes of globalisation and integration, the role of the

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border as a barrier (e.g. a control barrier) is diminishing, and in the "right" conditions its negative effects are noticeable only in a small way, although they do not disappear completely (Ackleson, 2005). The characteristic feature of a border is that it can be a barrier, but that it can also provide certain opportunities: it can bring benefits, but also problems (Agnew, 2008; Sohn and Lara-Valencia, 2013; Van der Velde and Spierings, 2010). What is important, then, is that both positive and negative effects of a border can be felt at the same time. Seeing the border as a barrier is a common practice, but a border location may potentially be a development factor, as well as a resource for economic, cultural, and political development (Gerber, Lara, de la Parra, 2010; Reitel, 2006; Sohn, 2013).

There are a number of terms used to denote towns/cities situated at a state border, which results in terminological ambiguity. There is no single, generally accepted and used definition of towns directly neighbouring across a state border. Neither is there a uniform classification for this type of settlement unit. Terms in use point either to the origin of forming such settlement networks, or the way they function in present times, their size, cultural, or environmental context, etc. The names in use are inter alia: divided city, split town, twin towns, sister towns, city-pairs, double city, border town, trans-border cities, bi-national cities, cross-border urban spaces, and cross-border metropolises. Among the most frequently used, usually in a narrower sense, is the term "divided city", referring to cities which used to form one settlement unit but were separated by a border, leading eventually to the formation of two separate cities (this term, however, has recently been used in the context of conflicts as well as divisions, e.g. language division, ethnic division within one city, etc.).

"Twin towns/cities" is a broader term, which implies the direct proximity of urban units, but does not have to result from the division of one former unit. It may be caused, for example, by the development of cities near a border on both sides, gradually getting nearer each other to finally become spatial neighbours across the border. This term, however, is also used to describe a pair of cities co-operating with each other, which are not necessarily neighbours or even in the same country. Border town (city) seems the most frequently used. Usually, it applies to cities located very close to a border, near another urban unit on the other side. But it is also used to describe cities (towns) at the border, not always neighbouring a city on the other side, but a one which is strongly affected by the border in its daily functioning[1] (Arreola, 1996; Jańczak, 2009; Jańczak, 2013; Joenniemi and Sergunin, 2011; Kulczyńska, 2010; Lundén, 2004; Lara-Valencia and Giner, 2013; Sohn and Lara-Valencia, 2013). Jańczak argues that the most suitable name seems to be border twin towns (cities), which emphasizes the direct neighbourhood of cities (towns) across a state border, regardless of the original formation of such a pair of cities (Jańczak, 2013).

The unique location at a national border affects nearly all of the aspects of border cities' functioning (Buursink, 2001). These effects can, with regard to the role of the border and local determinants, be perceptible to a greater or lesser degree. But it seems that integration processes in Europe may contribute to a change in perceiving the border location as a problematic place – to seeing it as providing certain advantages. Border twin cities have a chance of becoming places of intense cross-border cooperation, which may help change their unfavourable situation into a more favourable one. They can be a connector of some sort between neighbouring countries (especially between their border regions), and can encourage finding common solutions to problems, as well as achieving common development aims (Dołzbłasz and Raczyk, 2012).

The processes of trans-border urban integration may be different (Reitel, 2013). The peripheral location of border cities generally has a negative effect on their development. In fact, it applies to entire border regions and contributes to their underdevelopment (Roper, 2007; Sohn and Lara-Valencia, 2013; Vaishar et al., 2013). In the situation of the reduction of formal barriers connected with the border and the occurrence of beneficial socio-economic determinants, however, the border location may be an impulse for the development of divided cities. It seems that the intensification of cross-border cooperation (both formal and informal) has a positive influence on counteracting peripherality (Knippschild, 2011; Krätke, 1999; Cappellin, 1993), and has a positive impact on border regions, including border cities. It has to be noted, however, that the dynamic development of cross-border cooperation does not usually translate directly into economic development, which is generated by a number of internal and external factors (Krätke and Borst, 2007). But it surely helps the integration of two parts of the city divided by the border, in terms of spatial, social, and economic dimensions. Economic activity is often the driving force for the dynamic development of border cities. In this context, it has to be pointed out that when talking about integration progress in borderland regions, the intensity of exchange between areas on both sides of the border does not have to be related to the increasing convergence of their structures; to the contrary, it may be closely related to larger socio-economic differences (Arreola, 1996; Topaloglou et al., 2005).

Trans-border shopping trips are an important element of cross-border relations that have a very practical dimension. Their direction, intensity, the range of services and products provided, etc. depend on current determinants present in the neighbouring countries. The roles of a border – as a barrier (the more difficult it is to cross, the less shopping trips will take place), its role with respect to political conditions (generally important for the development of cross-border cooperation), and for those elements closely related to shopping trips (such as, inter alia, prices on both sides of the border, the purchasing power of citizens, or their transport capabilities) – are, of course, all important. It should be noted that shopping trips can provide an economic basis for the functioning of border cities/regions by generating the majority of a company's income and, through this, the income of citizens. On the one hand, shopping trips may be one of the elements generating co-operative behaviours in both local governments (by facilitating trans-border practices), and companies and citizens (cooperation of companies, citizens getting acquainted with each other, and conducting other cooperative activities, etc.). On the other hand, however, they can provoke negative attitudes of entrepreneurs: for example, in a situation when citizens go shopping and acquire services on the other side of the

[1] Some authors, however, define this term very narrowly, e. g "border town as towns that are separated by a state boundary somewhere within an earlier centre, or at least somewhere between city centre and suburbs" (Lundén 2004, p. 126). Almost all of them were formed as a result of dividing a country, and consequently dividing cities.

border, thus lowering the income of local companies. The complementary structure of economic entities, not generating an increase in competition, seems to be more desirable in this context.

Two opposing tendencies can be observed in the phenomenon of consumer mobility, with the first increasing mobility and the second decreasing it. The first group of factors includes pull factors (pulling people to the neighbouring country, consumers consider shopping at home less appealing than in foreign places, etc.), and push factors (pushing people from their motherland, shopping abroad is perceived as more attractive, etc.). The factors which reduce cross-border mobility include "keep" factors (discouraging citizens from leaving their country) and "repel" factors (discouraging citizens from visiting the neighbouring country), and as a consequence the differences between the home and foreign country are too large to accept (Spierings, Van der Velde, 2008). Different elements are relevant in shaping consumer mobility, such as, inter alia, prices, quality, the diversity of goods and services, curiosity and the sense of strangeness, an understanding of regulations, the shopping environment, and the quality of public space. Rational and emotional differences are very important, as they influence the level of unfamiliarity. As concluded by Van der Velde and Spierings (2010), both differences that are too great and the lack of them, cause a reduction in consumer mobility. The most beneficial viewpoint from the point of its development is the position of "familiar unfamiliarity", when the other side of the border is different than ours and this is what draws us there, but when these differences are not too big and do not repel us (Spierings and Van der Velde, 2008). It has to be pointed out that, due to different conditions on both sides of the border, cross-border shopping is generally asymmetrical, although this is not static and may change (Leimgruber, 2005).

These often contradictory results from previous literature have been incorporated into this research project, as much as possible.

3. Research design

An assessment of the cross-border openness of firms was conducted in the central areas of the studied towns in September 2011. The study included 752 companies from the service sector (432 located in Cieszyn/Český Těsín, and 320 in Gubin/Guben, that were marked and freely accessible[2]). This assessment engendered gathering data about any company's specific location, character (down to the sub-class level: NACE Rev.2 (OJ L393/1 30.12.2006)), and trans-border characteristics: a banner in the neighbour's language visible at the store's location; marketing materials (fliers, a price list, handouts, business cards, etc.) in the neighbour's language; payment methods that included the neighbour's currency; and basic language skills among the staff (verified by personal interview). The above-mentioned four attributes of cross-border openness were chosen because they could be used to present the attitude of the service companies in border towns to clients from the other side of the border. The analysis of these factors enabled an assessment of whether the companies from the service sector not only take into consideration satisfying local demands, but also the demands for products and services from the neighbouring city.

The results of this study demonstrate the analysis of the structure of service providers in terms of the four qualities indicating the cross-border openness, as well as the subject of their activity. Furthermore, information on the location of individual providers enabled the creation of a picture of the spatial distribution of companies with regard to the studied categories[3]. This created an opportunity to include not only statistical analysis in this research project, but also the spatial dimension of the phenomenon of cross-border openness of companies in towns divided by a border. In this study, the methodology that proved to be effective for the analysis of the twin city Zgorzelec/Görlitz (Dołzbłasz and Raczyk, 2012), was applied to two border twin towns, one on the Polish-German border and the second on the Polish-Czech border. This design then also encompassed a comparative analysis, not only for two parts of a particular town but also between the Polish-Czech and the Polish-German cases. Furthermore, the analysed towns are relatively similar with respect to size and urban structure, which allowed for a more profound assessment of the role of other factors influencing cross-border openness of service providers. Finally, this study focused on symmetry/asymmetry in terms of conditions for the cross-border openness of firms, as well as the level of cross-border openness itself. It should be noted, however, that the phenomena examined were the same, but the approach was different and led to a broader analysis (especially in terms of the conditions for cross-border openness of firms).

4. Determinants of cross-border openness of service providers in the border twin towns of Cieszyn/Český Těšín and Gubin/Guben

When analysing the determinants of the functioning of border twin towns, a whole spectrum of factors has to be taken into consideration: some part of them results from the characteristics of the neighbouring countries; and others relate to the specificity of the cities themselves. The role of the border itself is surely a very important factor: the more formal it is, the greater the limitations for the development of the border cities generally are. Both Gubin/Guben and Cieszyn/Český Těšín, in the context of belonging to the European Union as well as to the Schengen Zone, have potentially favourable conditions for integration between the cities. It has to be said that international relations are friendly on the national level between Poland, Czech, and Germany, as well as at the regional level. In this context, one also has to consider the relatively intense formal cross-border cooperation conducted within the framework of EU programmes by local self-governments and other institutions (NGOs, cultural institutions, schools, etc.), from both towns. Border twin towns stand out with their great number of projects and are important, although not dominant, centres of cross-border cooperation (Dołzbłasz, 2013).

[2] The study did not include an unknown number of units operating either in private flats or in difficult to access locations, because its main focus remained on the actual, visible signs of businesses' openness to the citizens of the neighbouring country, deemed to be most evident in the town centres.

[3] The analysis did not include supermarkets as they were located outside the city centres, which were the areas chosen by design for the study.

Disparities in the level of socio-economic development on both sides of the border are among the most important factors shaping trans-border relations. It seems that the high level of disparity is an important factor which hinders cooperation. In this respect, the Polish-Czech border areas are regions with relatively low level of disparities, while the Polish-German border is characterised by a decreasing but still high level of economic disparities (see: First ESPON Synthesis Report, 2013; Knippschild, 2011). These differences, however, as well as the connected level of income and prices on the two sides of the border, may intensify the connections and mobility of citizens with regard to trans-border mobility (getting to work, buying goods and services on the other side of the border, etc.).

The similarity of problems and objectives regarding socio-economic development is another crucial determinant shaping cross-border relations. In this respect, some symmetry in the Polish-Czech border region can be observed in relation to encountered problems, such as joint mountainous regions, similar economic structures, processes of integration with the EU and tourism development (Pokluda, 2005; Vaishar et al., 2013). In the case of the Polish-German border region, historical, political and economic determinants result in dissimilarities to a much greater extent (Dołzbłasz, 2012).

In urban geographical research, historical conditions play a very important role. Cieszyn, since its formation in the 10th century, has changed its national affiliation a number of times, and the region of Teschen Silesia, with Cieszyn as its capital, has been a separate entity since 1920, in both cultural and administrative terms. Cieszyn was a typical national and cultural melting pot of Central Europe, first governed by Polish, then Czech and Austrian state organizations. The issue of national affiliation appeared in 1918, when Poland and Czechoslovakia regained independence and borders had to be drawn between them. Both countries claimed the right to this territory. The issue was settled in 1920 by international arbitration, which divided the urban complex of Cieszyn by a state border running along the Olza River. On its right bank, the main parts of the city became Polish, while the left-bank part of the city was allocated to Czechoslovakia (Zenderowski, 2002a; Zenderowski, 2002b; Fig. 1 – see cover p. 2).

The origin of Guben (Fig. 2 – see cover p. 2) dates back to the 13th century, and throughout most of its history it belonged to German state organisms (e.g. Lower Lusatia, Saxony, Prussia). Guben was divided in 1945, pursuant to the arrangements made at the Potsdam Conference, drawing the Polish-German border along the Lusatian Neisse and the Oder rivers. As a result, the left side of the city became German, and the right-bank part formed a Polish town called Gubin. One of the important consequences of this decision was the complete exchange of populations in the part that became Polish.

Taking into consideration these historical and cultural issues, the cultural barriers were greater at the western border of Poland with Germany than at the southern border with the Czech Republic, e.g. the persistence of stereotypes, attitudes towards neighbouring nations and historical experiences, etc. (Rippl et al., 2010). A specific situation can be observed in Teschen Silesia. On the one hand, the barriers are weaker due to similarities in language and culture. Furthermore, the existence of national minorities and mixed families further favours the disappearance of barriers (about 16 per cent of the population of Český Těšín declared Polish nationality, although the Czech minority on the Polish side is smaller (Siwek, 2008)). On the other hand, however, the history of these lands, such as the battle for Teschen Silesia (Buttin, 2006), may still cause attitudes of antipathy for the citizens on the other side of the border.

Similar attitudes can be found in Polish-German relations. One should note, however, that with the passing of time these attitudes are diminishing. Moreover, it has to be stated that among local self-government authorities, cooperative attitudes prevail (Dołzbłasz, 2012).

Natural determinants may be an important factor in shaping trans-border relations (Więckowski, 2013). In both cities in this study, the border was established on the basis of environmental features (in Gubin/Guben – the Nysa Łużycka River, in Cieszyn/Český Těšín – the Olza River). This influenced the development of both cities after the division of the border. In addition, despite functioning within the Schengen region, the fact of dividing both parts of the city with a river hinders their spatial integration, as the connections are limited to bridges. From the point of view of potential integration of the cities, the fact that the bridges are located in the central points of the cities (connecting the central areas for services, history, etc.) is important. Both cities are characterised by a relevant symmetry in size. The area of Gubin is about 21.0 km^2 with a population of 17,000, while the area of Guben is much larger – 44.0 km^2, although the population is only slightly greater (about 20,000). The area of Cieszyn is 28.5 km^2 with a population of about 36,000, while Český Těšín is 34.0 km^2 with a population of about 25,000. Considering these determinants, it may be stated that there is a relative symmetry of structures for both Gubin/Guben and Cieszyn/Český Těšín. The direct closeness of the centres of both parts of a divided city and, what is very important, the existence of a bridge between them, has a positive influence on the relatively good availability of service providers (concentrated in the city centre) for citizens from the other side of the border river. Spatial proximity, in spite of minor infrastructural disproportions, are other elements shaping the symmetry of a divided city.

5. Specific determinants for trans-border shopping trips

In the context of analysing the cross-border openness of companies located in border twin towns, it is important to include factors connected to the cross-border mobility of the citizens (inter alia, purpose and frequency of crossing the border, prices of goods and services, etc.) and the structure of service providers. In both analysed cases, the majority of the citizens of the Polish town have visited the town on the other side of the border river[4]. In the case of Gubin/Guben about 80% of the citizens of Polish Gubin took part in cross-border practices of different kinds (Dolińska et al., 2013). The purpose for travelling to German Guben was diverse, but the dominating one was shopping (about 93% of the respondents). Citizens of Gubin go to Guben for walks (about 76%), to meet acquaintances (almost 40%), and for cultural reasons (about 33%). Other motives were less common, including acquiring services, partaking in religious celebrations, making joint

[4] Unfortunately, there are no data regarding the cross-border mobility of the citizens of Guben and Český Těšín.

projects, and joining in family holidays. Citizens of Polish Gubin perceive the neighbouring Germans mainly as tourists and customers (about 80 per cent of the responses), although it has to be pointed out that they also see them as friends and neighbours (about 60%). Taking into consideration the role of the joint cross-border activities given by the citizens of Gubin, it is clearly visible that economic cooperation is the most important (Dolińska et al., 2013).

In the case of the border twin towns of Cieszyn/Český Těšín, similarly to Gubin/Guben, the majority of citizens from the Polish part visit the Czech part of the city (Mosakowska, 2012). Considering the aims and frequency of crossing the border by the citizens of Polish Cieszyn, it may be concluded that they cross the bridge at least once a month, mainly in order to go shopping (75%), visit relatives (35%), or spend their free time in Český Těšín (80%). The shopping motive was the main factor in generating cross-border mobility in the citizens of Cieszyn (about 15 per cent went shopping everyday or several times a week on the other side). Almost 10% of the respondents crossed the border to reach their work, and about one per cent went to the Czech side several times a month for educational reasons.

Almost 50 per cent of the surveyed citizens of Cieszyn have family, friends, or acquaintances on the Czech side, which undoubtedly has an influence on the relatively large percentage of visiting family/friends among the motives for crossing the border (Mosakowska, 2012). The mutual attitude of the citizens of Cieszyn and Český Těšín towards their neighbours was generally friendly, as well as the opinions about each other. Prejudices and stereotypes played a relatively small role here (Zenderowski, 2002a).

While the citizens of Cieszyn are characterised by a moderate or weak ability to speak the Czech language, the citizens of Český Těšín can communicate in Polish easily – mainly due to the relatively large Polish minority living there. It has to be noticed here that the local dialect plays an important role in mutual communication – a peculiar mix of the Cieszyn dialect, Polish, Czech, and German words (Zenderowski, 2002a). In Gubin/Guben, however, the ability to speak the language is very asymmetrical, with a relatively good knowledge of the German language among Polish Gubin citizens, compared to a very weak knowledge of the Polish language in German Guben.

A very important factor from the point of view of cross-border openness of service providers is the level of prices in the neighbouring countries (note that the currency in Germany is the Euro, in Poland it is Złoty, and in the Czech Republic it is the Czech koruna). The prices of food in 2012 in Poland were about 60 per cent of the EU27 average, while in the Czech Republic the figure was 82 per cent (Kurkowiak, 2013). Non-alcoholic beverages in Poland cost about 79% of the EU27 average, while in the Czech Republic they cost 98 per cent. In comparison and as expected, prices in Germany were much higher: the average price of food was 106% of the EU average, while the price of non-alcoholic beverages was 104 per cent. When considering alcoholic beverages, the situation was slightly different. The prices in Poland were 93% of the average, in Czech Republic they were 96 per cent, while in Germany the prices of alcohol were lower and were about 82% of the EU average. The prices of tobacco were the highest in Germany (102 per cent of the EU average) and much cheaper in Poland and the Czech Republic (respectively, 58% and 69% of the EU average).

It is worth mentioning that mutual contacts on a larger scale, shopping tourism among others, were made possible because of the political and socio-economic transformations of 1989. Former relationships of this type were practically non-existent, mainly due to the low permeability of the border and the centrally-planned economic system in the three countries under analysis. The permeability of the Polish-Czechoslovakia border was greater only for several years (in the 1960s and 1970s), and for the Polish-German border in the 1970s. For the inhabitants of the border cities (towns) under consideration, they did not get the chance to become used to shopping tourism (i.e. by legal means, although illegal practices of border trade were obviously commonplace).

Since the 1990s, as a result of the opening of the Polish-Czech border, the role of retail trade in the spatial-functional structure of Cieszyn/Český Těšín has started to increase, generating specific forms of trade focused on servicing customers from the other side of the border, as well as creating new large-format store forms. The difference in product prices favoured mutual shopping tourism (at the beginning of the 1990s, approximately 60,000 people on market days). As the difference in prices began to fall, the intensity of shopping tourism diminished. There is still an observable border movement, however, for shopping purposes (Kulczyńska and Matykowski, 2008). Currently, Poles mainly buy alcohol, tobacco, confectionary, and healthy food in the Czech Republic.

In Gubin/Guben, the political-economic transformation that started in 1989 also contributed to, among other things, changes in cross-border trade. In Polish Gubin there was an increase in trade units, marketplaces focused on German customers started to develop in great numbers, and at the turn of the century, supermarkets started to rise. In German Guben, supermarkets had already appeared in late 1980s and are still often visited by Poles. Currently, the lowering of the price difference has caused a great fall in the importance of marketplace trade compared to the 1990s (50–60% of consumers were German). Additionally, the development of supermarkets also hindered marketplace trade and negatively influenced retail trade. In the 1990s the traffic was one-sided – German customers went to Poland to buy goods. Currently, due to the equalisation of prices, this asymmetry is not as big as it was then, and the percentage of Polish customers on the German side of the border is constantly increasing (Polish customers mainly buy household chemicals and cosmetics, but also clothes, electronics, and household equipment) (Kulczyńska, 2010). German customers still benefit from the lower prices of food and services (mainly hairdressing and cosmetics) on the Polish side of the border.

6. Cross-border openness of service sector companies

The analysis of both border twin towns was conducted in their central areas[5]. The research areas are characterised by a large concentration of economic entities and good

[5] In Cieszyn/Český Těšín the assessment of economic entities took place in the area circumscribed by Zamkowa, Michejdy, Kochanowskiego, Limanowskiego, Schodowa and Łyska streets on the Polish side, and by Hlavní Třída, Nádražní, Střelniční, nábřeží Míru, Štefánikova and Božkova streets on the Czech side. In Gubin/Guben, the study area on the Polish side was located between Kołłątaja, Kunickiego, Żymierskiego, and Piastowska streets, and in German Guben between Alte Poststrasse, Lohmuhlenweg, Gasstrasse, Grünstrasse, and Uferstrasse.

accessibility for customers from the other side of the border, due to the closeness of the bridges. In Cieszyn/Český Těšín, the largest concentration of service providers on the Polish side is observed on the Main Square and streets connected with it, as well as between the Main Square and the border crossing. On the Czech side, the largest amount of economic entities was located on Hlavní Třída Street, the street leading from the border crossing to the city centre. A comparison of the Polish and Czech sides shows the difference in the number and location of service providers. In Cieszyn there are more of them and they are dispersed, while in Český Těšín there is a visible concentration of them on the main street.

In Gubin/Guben the study also included areas with the greatest concentration of service provider activity in the city centres. In Gubin, most economic entities were located in the city centre, while in Guben they were located near the border in the eastern part of the city. In Gubin, the entities within the studied area were characterised by large dispersion, with a concentration of areas along the main streets and on the Main Square. In Guben, however, economic entities were clearly concentrated along Frankfurter Strasse and Berliner Strasse, which lead from the border crossing to the city centre.

The spatial dispersion of companies in the studied areas is a result of historically determined processes of spatial development of the cities. Comparing the location of economic entities in both studied cities, one can notice that in both cases greater dispersion can be found on the Polish side, while on the Czech and German sides the companies are concentrated mainly along main streets. This generally originates from the urban structure (the market on the Polish side, the main street leading from the border crossing to the centres of neighbouring cities), and also in the case of German Guben from the features of trade, characterised by a lower share of small retail shops.

Taking into consideration the generic structure of the studied companies, it is clearly visible that entities of retail trade were dominant, which is common in the generic structure of economic entities in cities. In Cieszyn/Český Těšín, on the Polish side, 70% of all studied companies belonged to the G section (trade), while on the Czech side of the border it was almost 75 per cent. Similarly in the Polish-German twin towns of Gubin/Guben, the majority of entities were connected to trade: on the Polish side they comprised 60 per cent of the studied institutions, on the German side it was about 52 per cent. The German Guben had a visibly larger share of service providers in the field of, inter alia, gastronomy, real-estate agencies, travel agencies, while the field of trade was smaller. This results mainly from the nature of the trade network (the domination of supermarkets, a lower share of small trade units) and from certain differences in demand, e.g. in the case of restaurants or real-estate agencies. Characteristic regularities can be seen when taking into consideration the percentage of the chosen kinds of service providers (Tab. 1).

The characteristic feature in Polish Gubin was the share of grocery shops (near the bridge connecting the cities), which is a result of both local demand, but also the demand of German customers for Polish food items, due to their quality, but mostly because of their price[6]. A similar feature can be found in alcohol shops in Český Těšín, where the products sold are particularly popular among Polish customers and are a common reason for cross-border shopping trips. The direct reason for such a large share of hairdressers' shops

Type of economic entity	Cieszyn	Český Těšín	Gubin	Guben
clothing shops	20%	7%	15%	10%
restaurants, bars, coffee shops	8%	15%	7%	16%
grocery shops	6%	13%	15%	5%
hairdressers' shops and beauty parlours	6%	2%	12%	4%
furniture shops	4%	–	4%	–
banks	4%	2%	4%	3%
shoe shops	4%	2%	3%	–
pharmacy	2%	2%	2%	2%
jewellery shops	2%	2%	3%	3%
currency exchange	2%	–	3%	–
children's accessories shops	2%	–	1%	–
travel agencies, tourist information	2%	2%	1%	6%
cosmetic, toiletry and fragrance shops	2%	2%	1%	4%
stationery and gifts shops	2%	2%	2%	5%
alcohol shops	1%	12%	2%	–
real-estate agencies	1%	–	–	%
casino	–	2%	–	1%
Other	35%	36%	25%	37%

Tab. 1: Share of economic entities in selected categories in central areas of the border twin towns of Cieszyn/Český Těšín and Gubin/Guben in 2011. Source: author's elaboration

[6] The share of grocery shops would be larger if not for the fact that the majority of the local demand and the German demand for food products is satisfied by supermarkets located outside the range of the study, further away from the border bridge, and not included in the study.

and beauty parlours in Gubin (near the border bridge) is satisfying the demand of German customers (12%, the majority of which are hairdressing services). Lower prices than in German shops and a satisfying quality are common reasons for German Guben citizens to visit Polish Gubin. In Cieszyn such shops comprised only six per cent (three per cent being barber shops and three per cent beauty parlours). In Guben, however, there were many more restaurants, coffee shops, and travel agencies than on the Polish side (they were more often visited by Germans than Poles, mostly due to their higher income), as well as real-estate agencies (greater demand resulting from the depopulation of Guben and a large number of properties for sale or rent).

Despite not being shown by this study, it needs to be said that the citizens of Polish Gubin also go shopping in Guben. Polish customers commonly buy electronics and household equipment, chemicals, and clothes (because of the belief that these articles are of better quality or lower price), but such shopping trips are realised in shopping malls, which were not included in this study due to the chosen methodology.

It was visible that among the studied towns, Gubin had the least diversity among economic entities, with a dominating share of grocery shops, clothing shops, and hairdressers' shops. As it was stated before, this was largely a result of these entities being directed at the population of the other town, which originates in the demand of the German neighbours for these services. Analysis of the structure of service providers, however, shows that Gubin, to a greater degree than Cieszyn and Český Těšín (and definitely than Guben), is aimed at the foreign customer. This seems to be a result of the demand of German Guben customers for services such as hairdressers, as well as the prices of such services being lower on the Polish side. One can say that price difference is the main reason for the shopping trips. The quality and wide range of products is also important.

Considering the features of the cross-border openness of companies under analysis, there were considerable differences visible between the studied towns (Fig. 3). By collectively analysing the companies from both parts of the city divided by the border regarding the four trans-border features, it can be seen that in Gubin/Guben the percentage of companies that possess these features is slightly higher than in Cieszyn/Český Těšín. This appears to be a result of the great cross-border openness of Polish companies in Gubin, whereas in German Guben the percentage of companies characterised by any of the features was very small. This means that there is a considerable asymmetry in this aspect. In Gubin/Guben, the presence of all four features was considerably higher among Polish companies. Thirty-seven per cent of the companies had a shop sign in German, 32% had information materials in this language, almost 80% allowed payment in Euros, and nearly every company could communicate in German. On the German side, however, the share of companies characterised by being open to clients from Poland was very low, with none of the studied features appearing among even 10 per cent of the services providers. The most common feature was the ability to speak Polish (mostly due to the fact that workers there are Polish).

In Cieszyn/Český Těšín, on the other hand, there is a relative symmetry in the openness to clients from the other side of the border. A basic knowledge of the language was common in both parts of the city, while the presence of other features was slightly more common in Czech services providers. There were generally low percentages of companies that had a shop sign (6% of Polish and 14% of Czech companies) and information materials (7% of Polish and 16% of Czech companies) in the neighbour's language. It seems that this is a result of the ability to speak the language: in a situation when direct communication is not a problem, there is no need to introduce such features.

In analysing the dependencies between the features of cross-border openness, some regularity can be observed. In the case of Cieszyn/Český Těšín, there was a visibly strong co-dependence between the studied attributes, both on the Polish and Czech side. If a given service provider had one of

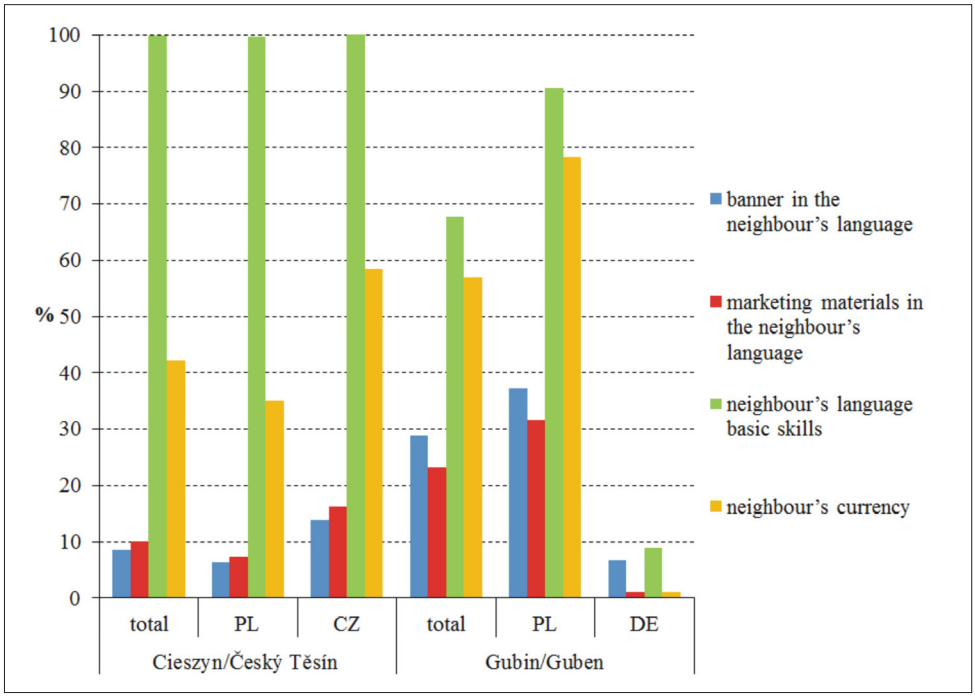

Fig. 3: Service providers of the border twin towns Cieszyn/Český Těsín and Gubin/Guben by the share of trans-border characteristics. Source: author's elaboration

the features, it usually possessed the remaining three: that is, providers that had a shop sign in 97% of the cases on the Polish side, and in 72 per cent on the Czech side, also had information materials, and almost all of them allowed payment in the neighbour's currency (the ability to speak the language, due to its common occurrence, was not analysed). In Gubin/Guben, such regularities were also strongly visible on the Polish side, while on the German side having one of the studied cross-border attributes did not guarantee the existence of the others. This observation mainly resulted from the fact that German providers were generally characterised by a very low level of cross-border openness.

The spatial distribution of economic entities according to the individual categories indicating cross-border openness was shaped differently in individual towns (Figs. 4 and 5). This was a direct result of a greater number and dispersion of companies on the Polish side, both in Cieszyn and in Gubin, and a greater concentration of them in Czech Český Těšín and German Guben. Considering the issue of openness in both parts of twin towns, there were similarities between Cieszyn and Český Těšín, while Gubin and Guben showed large differences. In the town on the Polish/Czech border there were entities on both sides which had a shop sign in their neighbour's language, located mainly near the border crossing and along the main streets leading to the city centre (Fig. 4).

A similar situation could be observed in the spatial distribution of having information materials in the neighbour's language. When it comes to the ability to pay in the currency of the neighbouring country, it was common practice both in Cieszyn and Český Těšín. The spatial distribution of the ability to speak the neighbour's language was very interesting, as having this communicative ability, both on the Polish and Czech side, was very common and

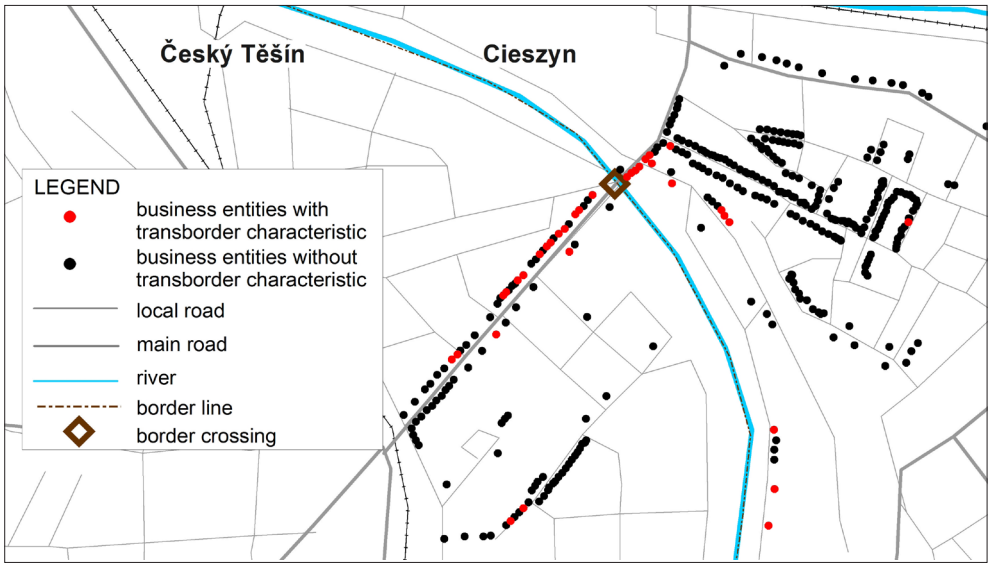

Fig. 4: Cross-border openness of service providers of the border twin towns Cieszyn/Český Těsín by trans-border category: Banner in neighbour's language. Source: author's elaboration

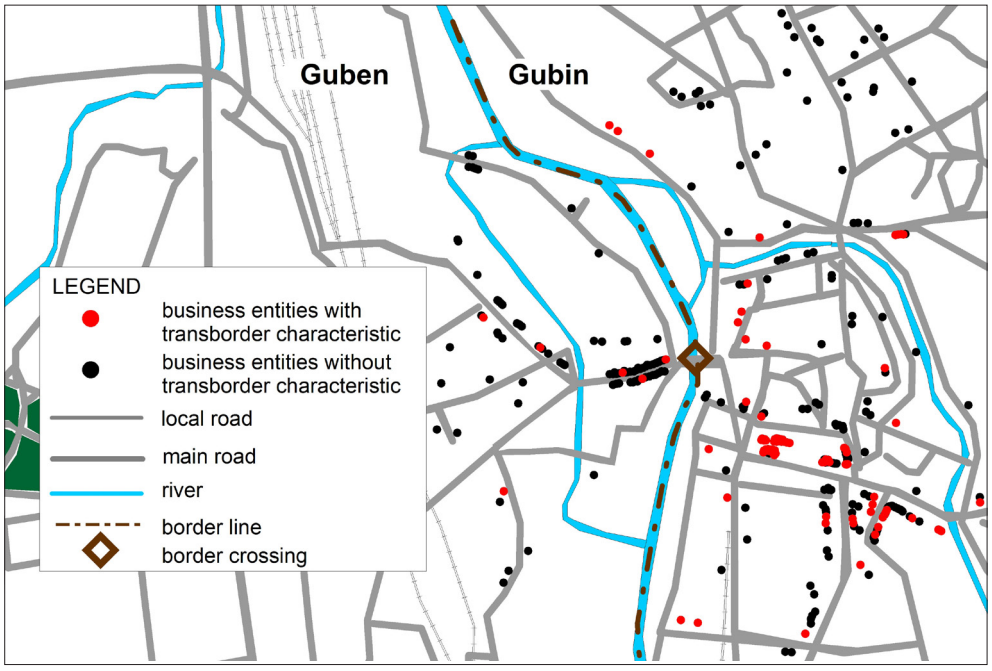

Fig. 5: Cross-border openness of service providers of the border twin towns Gubin/Guben by trans-border category: Banner in neighbour's language. Source: author's elaboration

could be observed in almost all of the studied companies. It can be safely said that cross-border openness in Cieszyn/Český Těšín was generally symmetrical.

A completely different picture was revealed after analysing the spatial distribution of companies regarding cross-border openness in Gubin/Guben (Fig. 5). On the Polish side, the share of companies having a shop sign or information materials in the German language was significant, especially in the centre and along the main street leading from the border crossing to the city centre. On the German side, however, such entities were rare and only occurred near the border bridge. The situation was similar with the ability to pay in the currency of the neighbour and to speak their language: it was common practice in Gubin, while in German Guben it was very rare (only a few providers near the border crossing). The spatial distribution of cross-border openness was very asymmetrical, with a noticeably large openness among Polish companies and very small openness among German ones.

The analysis of the spatial distribution of economic entities with the inclusion of the features of cross-border openness, allows one to identify a few regularities. It was clearly visible that closeness to the border crossing influenced cross-border openness. The providers that were located near the bridge on the border river were more often characterised by openness to customers from the other side of the border, than providers further away from it. This regularity could also be observed in German Guben, where these few providers having any feature of openness were located near the border crossing.

7. Conclusion

The cross-border openness of service providers was shaped differently in the border twin towns in this analysis. In the Polish-Czech Cieszyn/Český Těšín case, it was generally symmetrical in nature with a large observable openness in both parts of the city to customers from the other side of the border. For the Polish-German Gubin/Guben case, however, the nature of openness was definitely asymmetrical, with a visibly large openness of Polish companies to German customers and the lack of it among companies in German Guben. On the basis of this analysis, it may be assumed that the symmetry of cross-border openness was not influenced by the relative symmetry of the cities from the point of view of their size, number of citizens, or closeness of the city centres. These similarities exist both in Cieszyn/Český Těšín and in Gubin/Guben, but the nature of their openness is completely different. The broad availability and ease of moving between both parts of the town divided by the border, influenced the process of generating shopping trips; this process was not necessarily bilateral and it did not influence the cross-border openness of companies in both city centres. It seems that the level of openness was most influenced by price differences of selected products and services, as well as cultural differences.

The observed asymmetry in the openness of the Polish-German Gubin/Guben case confirms the results of previous analogous studies conducted in Zgorzelec/Gorlitz. It is worth noting that the great significance of cultural asymmetry and its influence on trans-border relationships (including the possibility of economic integration) was also observed in other regions. For example, research concerning co-operation networks in the tri-national metropolitan region of Basel points to the significance of language differences (Walther and Reitel, 2012), similar to the city-pair Valga-Valka (Joenniemi and Sergunin, 2011). Even in cross-border metropolitan regions, where integration processes are advanced, the border effect is strongly felt (Dörry and Decoville, 2012). The significance of cultural differences, as well as large discrepancies in the level of socio-economic development, strongly affects the integration possibilities of border cities (Decoville et al., 2013; Lundén, 2004).

It may be said that cultural closeness (including knowledge of the language) may influence the processes of spatial and socio-economic integration in towns divided by a border in a far greater way than any price differences of goods and services. Although such differences generate shopping trips, they do not influence the citizens of border twin towns to become closer together, nor, more broadly, spatial integration. Their existence must be assessed positively, however, because they directly influence the ability to generate profit from trade and services[7], and they also indirectly affect the acquisition of knowledge by the citizens of a border city, with the spaces of the neighbouring city. In turn, this may influence any future processes of spatial integration. It also seems that in the case of two neighbouring societies, being closer together due to their cultural and socio-economic determinants (e.g. because of the existence of national minorities and through this, mixed families, and the ability to speak the language), the chances for these processes to happen are greater. It must be said that in the context of the ability to shape mutual development processes for an entire town divided by a border, a symmetrical structure is definitely more advantageous in many ways, including the cross-border openness of service providers.

References:

ACKLESON, J. (2005): Constructing Security on the U.S.-Mexico border. Political Geography, 24: 165–184.

AGNEW, J. (2008): Borders on the mind: reframing border thinking. Ethics and Global Politics, 1(4): 175–191.

ARREOLA, D. (1996): Border-City Idee Fix. Geographical Review, 86(3): 356–369.

BRUNET-JAILLY, E. (2011): Special Section: Borders, Borderlands and Theory: An Introduction. Geopolitics, 16: 1–6.

BUTTIN, F. (2006): The Polish-Czechoslovak Conflict over Teschen Silesia (1918–1920): a case study. Perspectives, 25: 63–78.

BUURSINK, J. (2001): The Binational Reality of Border-crossing Cities. GeoJournal, 54(1): 7–19.

BYGVRÅ, S., WESTLUND, H. (2004): Shopping Behaviour in the Řresund Region Before and After the Establishment of the Fixed Link between Denmark and Sweden. GeoJournal, 61: 41–52.

CAPPELLIN, R. (1993): Interregional cooperation in Europe: an introduction. In: Cappellin, R., Batey, P. W. J. [eds.] Regional Networks, Border Regions and European Integration. London, Pion.

[7] In order to determine the mutual influence of the economies of border twin towns in terms of financial aspects, one would require separate, large-scale studies (the availability of such data is limited, hence lack of such studies to date).

CBOS (2011): Polacy o Niemcach, Centrum Badania Opinii Społecznej, BS/79/2011, Warszawa, CBOS.

DOLIŃSKA, K. et al. (2013): Instrumentalność vs autoteliczność praktyk transgranicznych mieszkańców Zgorzelca i Gubina. Opuscula Socjologica 2 (forthcoming).

DOŁZBŁASZ, S. (2012): Transborder relations between territorial units in the Polish-German borderland. Geographia Polonica, 85(3): 23–36.

DOŁZBŁASZ, S. (2013): Cross-Border Co-Operation in the Euroregions at the Polish-Czech and Polish-Slovak Borders. European Countryside, 5(2): 102–114.

DOŁZBŁASZ, S., RACZYK, A. (2012): Transborder openness of companies in a divided city. Zgorzelec/Görlitz case study. Tijdschrift voor economische en sociale geografie, 103(3): 347–361.

DÖRRY, S., DECOVILLE, A. (2012): Transportation policy networks in cross-border regions. First results from a social network analysis in Luxembourg and the Greater Region. CEPS/INSTEAD Working Paper No. 2012-22.

DECOVILLE, A., DURAND, F., SOHN, C., WALTHER, O. (2013): Comparing cross-border metropolitan integration in Europe: towards a functional typology. Journal of Borderlands Studies, 28(2): 221–237.

FIRST ESPON SYNTHESIS REPORT, 2013, New Evidence on Smart, Sustainable and Inclusive Territories, European Union.

GERBER, J., LARA, F., DE LA PARRA, C. (2010): Re-imagining the U.S.-Mexico Border: Policies towards a More Competitive and Sustainable Transborder Region. Global Economy Journal 10(4): 1–17.

JAŃCZAK, J. [ed.] (2009): Conflict and Cooperation in Divided Cities. Thematicon, 14. Berlin, Logos Verlag.

JAŃCZAK, J. (2013): Border Twin Towns in Europe. Cross-border Cooperation at a Local Level, Berlin: Logos Verlag.

JOENNIEMI, P., SERGUNIN, A. (2011): When two aspire to become one: city-twinning in Northern Europe. Journal of Borderlands Studies, 26(2): 231–242.

KNIPPSCHILD, R. (2011): Cross-Border Spatial Planning: Understanding, Designing and Managing Cooperation Processes in the German–Polish–Czech Borderland. European Planning Studies, 19(4): 629–645.

KRÄTKE, S. (1999): Regional Integration or Fragmentation? The German-Polish Border Region in a New Europe. Regional Studies, 33(7): 631–641.

KRÄTKE, S., BORST, R. (2007): EU Eastern Enlargement and the Configuration of German-Polish Inter-Firm Linkages. Tijdschrift voor Economische en Sociale Geografie, 98: 621–640.

KULCZYŃSKA, K. (2010): The Gubin-Guben transborder urban complex as an arena of consumer behaviour. Bulletin of Geography Socio–economic Series, 14: 79–89.

KULCZYŃSKA, K., MATYKOWSKI, R. (2008): Struktura przestrzenno-handlowa przygranicznego zespołu miejskiego Česky Těšin-Cieszyn. Dokumentacja Geograficzna, 36: 202–207.

KULCZYŃSKA, K., MATYKOWSKI, R. (2011): Images of the urban spaces of Cieszyn. Bulletin of Geography Socio–economic Series, 15: 83–94.

KURKOWIAK, B. (2013): Comparative price levels for food, beverages and tobacco, Statistics in focus, 15/2013, Eurostat.

LEIMGRUBER, W. (2005): Boundaries and transborder relations, or the hole in the prison wall: On the necessity of superfluous limits and boundaries. GeoJournal, 64: 239–248.

LUNDÉN, T. (2004): On the boundary. About humans at the end of territory. Södertörns högskola. Huddinge.

MOSAKOWSKA, A. (2012): Relacje transgraniczne w mieście podzielonym Cieszyn/Český Těšín, Master's thesis, Uniwersytet Wrocławski, Wrocław.

NACE (2008): Rev. 2. Statistical classification of economic activities in the European Community. Eurostat. Methodologies and Working papers. European Communities.

NELLES, J., DURAND, F. (2014): Political rescaling and metropolitan governance in cross-border regions: comparing the cross-border metropolitan areas of Lille and Luxembourg. European Urban and Regional Studies, 21(1): 104–122.

NEWMAN, D. (2006): The lines that continue to separate us: borders in our borderless' World. Progress in Human Geography, 30(2): 143–161.

NEWMAN, D. (2010): Territory, Compartments and Borders: Avoiding the Trap of the Territorial Trap. Geopolitics, 15(4): 773–778.

O'DOWD, L. (2010): From a 'borderless world' to a 'world of borders': bringing history back in. Environment and Planning D: Society and Space, 28(6): 1031–1050.

PAASI, A. (2011): Border theory: an unattainable dream or a realistic aim for border scholars? In: Wastl-Walter, D. [ed.]: A Research Companion to Border Studies (pp. 11–31). Aldershot, Ashgate.

POKLUDA, F. (2005): Orlicko: a rural microregion on the Czech-Polish state border. In: Komornicki, T., Czapiewski, K.L: New spatial relations in new Europe. (pp. 173–184). EUROPA XXI, 13. Warszaw, Institute of Geography and Spatial Organization.

REITEL, B. (2006): Governance in Cross-border Agglomerations in Europe – The Examples of Basel and Strasbourg. Europa Regional, 14(1): 9–21.

REITEL, B. (2013): Border Temporality and Space Integration in the European Transborder Agglomeration of Basel, Journal of Borderlands Studies, 28(2): 239–256.

RIPPL, S. et al. (2010): Crossing the Frontier: Transnational Social Integration in the EU's Border Regions. International Journal of Comparative Sociology, 51(1– 2): 5–31.

SIWEK, T. (2008): Nazwiska jako indykator pochodzenia ludności miasta Český Těšín. Dokumentacja Geograficzna, 36: 196–201.

SOHN, C. (2013): The Border as a Resource in the Global Urban Space: A Contribution to the Cross-Border Metropolis Hypothesis. International Journal of Urban and Regional Research, DOI: 10.1111/1468-2427.12071.

SOHN, C., LARA-VALENCIA, F. (2013): Borders and Cities: Perspectives from North America and Europe. Journal of Borderlands Studies, 28(2): 181–190.

SPIERINGS, B., VAN DER VELDE, M. (2008): Shopping, Borders and Unfamiliarity: Consumer Mobility in Europe. Tijdschrift voor Economische en Sociale Geografie, 99: 497–505.

TOPALOGLOU, L. et al. (2005): A Border Regions Typology in the Enlarged European Union. Journal of Borderlands Studies, 20(2): 67–89.

VAISHAR, A., DVOŘÁK, P., HUBAČÍKOVÁ, V., ZAPLETALOVÁ, J. (2013): Contemporary development of peripheral parts of the Czech-Polish borderland: case study of the Javorník area. Geographia Polonica, 86(3): 237–253.

VAN DER VELDE, M., SPERINGS, B. (2010): Consumer mobility and the Communication of Difference: Reflecting on Cross-border Shopping Practices and Experience in the Dutch-German Borderland. Journal of Borderlands Studies, 25: 191–205.

VAN HOUTUM, H. (1999): Internationalisation and mental borders. Tijdschrift voor Economische en Sociale Geografie, 90: 329–335.

WALTHER, O., REITEL, B. (2012): Cross-border policy networks in the trinational region of Basel. CEPS/INSTEAD Working Papers No. 2012-26.

WIĘCKOWSKI, M. (2013): Eco-frontier in the mountainous borderlands of Central Europe. The case of Polish border parks. Journal of Alpine Research,101(2), DOI: 10.4000/rga.2107.

ZENDEROWSKI, R. (2002a): Stosunki między mieszkańcami miast podzielonych granicą państwową na przykładzie Cieszyna i Czeskiego Cieszyna (Český Těšín). Studia Regionalne i Lokalne, 1(8): 49–78.

ZENDEROWSKI, R. (2002b): Cieszyn jako miasto podzielone granicą państwową. Przyczyny i konsekwencje podziału z 1920 r. Sacculum Christianum, 9(1): 107–126.

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The impact of selected planned motorways and expressways on the potential accessibility of the Polish-Slovak borderland with respect to tourism development

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Abstract

Further tourism development in the Polish-Slovak borderland, as well as its overall economic development, depends on the construction of a motorway and expressway network. This paper analyses the impact of selected planned motorways and expressways (D1, A4, D3/S69, R1/R3/S7, and R4/S19) on the potential accessibility of the Polish-Slovak borderland with respect to the development of tourism. The most important investment project in Slovakia is the completion of the (started) D1 motorway. The R4/S19 and the R1/R3/S7 expressways and the D3 motorway/S69 expressway are expected to contribute to improved cross-border connections.

Keywords: *transport infrastructure, motorway and expressway network, potential accessibility, tourism development, Polish-Slovak borderland*

1. Introduction

Good quality transport infrastructure and the related transport accessibility are part of the most important prerequisites for the economic development of regions. Good accessibility of the region can help to attract new investors, who create new jobs and maintain existing ones. Transport accessibility influences many economic sectors and plays an important role in the development of tourism. The notion of accessibility can be simply defined as the ease of achieving a predetermined destination. Such destinations may be different places in which people realize key activities. From the tourists' point of view, accessibility plays an important role also in the choice of tourist destinations, such as tourist centres or tourist resorts.

Tourism is considered in many regions a key sector which should ensure socio-economic development. Besides the necessary natural and/or cultural-historical preconditions and material-technical base of tourism in tourist resorts, transport accessibility significantly contributes to the development of the region (Więckowski et al., 2012). Good transport accessibility of the region contributes to the overall attractiveness of the area from the perspective of its potential visitors and frequency of visits. On the other hand, an unfavourable level of accessibility of the region may lead to lack or outflow of tourists to better accessible regions offering similar conditions.

The significance of accessibility for the development of tourism results from the close relationship between transport and tourism. Transport is an integral part of activities in the sector of tourism. Hall (1999) identified four general spatially expressed roles of transport in tourism: transport links the source market with the host destination; it provides mobility and access within a destination area/region/country; it facilitates mobility and access within an actual tourism attraction; and, it enables travel along a recreational route which is itself the tourism experience.

Transport accessibility is often the factor that influences choice of tourist destination. When we analyse accessibility in relation to the development of tourism, it is possible to distinguish external and internal accessibility. The external accessibility of a region is the accessibility of a region from places of residences (tourist emission areas) to a place or region of stay (destination). The internal accessibility of region is the accessibility within the region or place of tourist stay, where it concerns accessibility of tourist attractions in the region or if they are large (e.g. attraction parks), it is the accessibility within the attraction. The directions and volumes of these flows are determined by a range of factors, notably attractiveness for visitors, accessibility by various means of transport, and price.

Munteanu (2010) differentiates four major types of accessibility: spatial/territorial, economic, psychological and social. Spatial/territorial (or geographical) accessibility involves the physical distance between the origin and destination places. It could be measured at least as distance accessibility (km), time, price or potential (related to the gravity models). Economic accessibility is measured in the probable travel cost paid by the individual/group of individuals. Psychological accessibility can be expressed by the travel effort of an individual/group of individuals willing to invest in order to reach the destination, but also by the level of comfort the individual feels, by the risks they assume, etc. Social accessibility reflects the age, educational level of the individual/group of individuals, by personal and/or social experience.

Michniak (2014) discussed selected approaches to the study of accessibility in relation to the development of tourism, which are distance-based accessibility, isochrones-based accessibility, transport infrastructure-based accessibility, accessibility based on direct public transport connections, potential accessibility, and individual accessibility. Each of these approaches has its pros and cons and their use depends

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on a particular research problem (e.g. its spatial scale). For the best accessibility assessment of a tourist region or centre it is necessary to combine several approaches and to use different methods of accessibility assessment. Some of them have been presented by Križan and Gurňák (2008).

Tourism has been considered an important branch of the economy in the Carpathians for many decades now, and also one that is often treated as the sole opportunity for socio-economic development. There are favourable preconditions for the development of various kinds of tourism on the Polish-Slovak borderland and for stimulating regional development in general. The Polish-Slovak borderland is one of the regions with high tourist potential in both countries, because of the attractive natural environment (landscape morphology, rivers, lakes, caves, Protected Areas), and historical, cultural landmarks and monuments (wooden churches, castles, chateaus and native folk architecture). Tourism plays a very important role in the economy of the Polish-Slovak borderland. The number of tourists visiting this area is approximately 3.2 million a year. On the Polish part of the borderland, it exceeds 2 million tourists per year (more than 85% of them citizens of Poland). The Slovak part of the borderland was visited by almost 1.27 million visitors in 2010. Domestic visitors made up almost two-thirds of the visitors (65.9%), followed by tourists from the Czech Republic and Poland. On both sides of the borderland tourist flows are concentrated in the Tatra region. Other frequently-visited regions are mountainous areas such as Pieniny (including rafting), the Nízke Tatry, the Malá Fatra, the Veľká Fatra and the western part of the Beskides, mainly on the Polish side (the Beskid Śląski and the Beskid Żywiecki). On the other hand, the natural environment is also a certain barrier to the development of the boundary area, for example in terms of the further development of settlement and of transport infrastructure (Więckowski, 2013). Recreational and active tourism dominates in the Polish-Slovak borderland – in particular, mountain hiking and climbing, skiing, cyclotourism, spa and health tourism. The mountains influence the development of specific kinds of tourism in the Carpathians. The forms of contemporary tourism in these areas are first and foremost provided by various forms of nature-oriented, leisure, adventure, health (medical), transit, cultural, gastronomic and event-oriented tourism.

There is some tourist activity going on at nearly all times of the year, but seasonality matters, with peaks in summer and winter. These peaks have been observed to extend and shift, i.e. the summer season extends towards the autumn (into October) and the winter season lasts until spring (April). Weekend and bank holiday trips have been growing in importance. Cultural tourism has also become significant, as people discover the rich cultural heritage of the mountains. In the countryside and in areas of outstanding natural beauty, countryside and nature-based tourism has developed, with agritourism and eco-tourism in particular. Traditional spa tourism is growing where mineral springs occur, but a still underestimated wellness type of development has recently supplemented this. In the area near the Polish-Slovak border, congress tourism and business trips are of secondary importance, while event tourism is significant, if underestimated. Shopping and transit tourism complete the picture in this region. Especially for new kinds of tourism in the Polish-Slovak borderland, accessibility plays an important role.

After 1989, investments in transport infrastructure in the borderland improved cross-border accessibility (newly-built cross-border roads, see Michniak, 2011) and provided an easier access from the south-west and west (new sections of the D1 motorway in Slovakia and the A4 in Poland). Further development of tourism in the Polish-Slovak borderland and the overall economy require building a motorway and expressway network in the territories of the two countries, which will communicate with the larger centres of these and neighbouring countries. The principal sources of tourists coming to this region are from the largest emission areas, such as the capitals of the two countries (Warsaw and Bratislava), and other agglomerations (e.g. Kraków, Silesia). Transport improvement is important especially for short- and medium-term tourism. Better and faster connections could facilitate decisions made by the citizens of these cities to spend a weekend in the mountains. From this point of view, the development of new infrastructure is an important process influencing tourism.

The aim of this paper is to analyse the effect of selected planned motorways and expressways on the potential accessibility of the Polish-Slovak borderland with regard to tourism development. The article presents the results of the analysis of road accessibility to the tourist destinations on the Polish-Slovak borderland. Opportunities for enhancing tourist potential through improved selected road plans are noted. Theoretical and methodological bases are introduced in the first part of the article, and then the effect of selected planned motorways and expressways (D1, D3/S69, R1/R3/S7, R4/S19) on potential accessibility for medium-term tourism is discussed.

The Polish-Slovak borderland is defined as the area receiving support from the Cross-border Cooperation Programme, Poland–Slovak Republic 2007–2013. This area includes the entire Žilina and Prešov regions in Slovakia, and southern parts of the Silesian, Małopolskie and Podkarpackie Voivodeships in Poland (Fig. 1).

2. Theoretical and methodological basis of potential accessibility

One of the concepts used in defining the notion of accessibility is the concept of spatial interactions. Accessibility in this case relates to the conception of simplicity or ease of spatial interaction, the potential capacity of interaction or potential contacts with various services and functions. Goodall (1987, p. 11) reports that accessibility summarises the relative opportunity for interaction. According to Rosik (2012), potential accessibility indicates the potential of interaction between an origin and a series of destinations. It is measured by the number of activities that can be achieved in a certain time or at a certain distance, presuming decreasing linkages with increasing distance for the whole population. It is assumed that an individual preferably chooses destinations at a shorter distance. The nature of the decreasing attractiveness of a destination with increasing distance is expressed by the distance decay function, which has different shapes for different activities. McKercher and Lew (2004) and Więckowski et al. (2012) discussed the distance decay function for tourist trips. Halás et al. (2014) identified distance-decay functions for the daily travel-to-work flows.

Potential as the accessibility measure is most frequently used in the form of population (demographic) potential and as economic potential. American astrophysicist

Fig. 1: The Polish-Slovak borderland. Source: authors' elaboration

Stewart (1941, 1942) formulated and disseminated the notion of population potential, defining it as a measure of a population's effect at certain distances. The population potential at a certain point represents the proximity of population to this point, i.e. the rate of possible interactions between a selected point and other points in a set of points (Goodall, 1987, p. 366).

Potential as the measure of accessibility of a certain place is the measure based primarily on gravitation (Gutiérrez, 2001), hence it inherently contains decrease of interactions with increasing distance for that particular place. Application of the potential as the accessibility measure is therefore suitable for the study of accessibility of such socio-economic activities, use of which is subject to market principles. The main drawback of the potential is the fact that the results are expressed in units which are difficult to interpret (Geertman and van Eck, 1995). For this reason potential accessibility is often expressed in percentages of mean accessibility for all zones (Spiekerman et al., 2011), or if changes in accessibility are studied, it is in percentages expressing values in the salient year (100%) and in the target year. Establishment of the self-potential whose values are important for the overall value of potential, is also problematic (Frost and Spence, 1995; Gutiérrez and Gómez, 1999).

Following the methodology of potential accessibility computation, it is assumed that the probability of the arrival of tourists decreases with the increasing length of transport time from the place of departure to the target region. Distance-decay functions have different shapes (see, e.g. McKercher and Lew, 2003) and depend, for example, on the length of tourist stays (see Więckowski et al., 2012). The distance-decay function for medium-term tourism (2–4 days) looks like a (truncated) Gaussian curve (Fig. 2). This function could be modifiable, depending of many factors such as motivation, the type of transportation and the quality of transport networks. There are also many differences between nations and cultures. As shown by research in Western countries, people are willing to spend two to three hours travelling. Beyond this time limit, motivation to travel for leisure purposes drops dramatically. In Poland, due to the bad condition of roads and slow construction of faster motorways and expressways, the acceptable travel time is longer, namely approximately four hours (240 minutes) (Więckowski et al., 2014).

Medium- and long-term tourist stays are the only journeys for which the weight of the destination attractiveness is not expressed by a decreasing function with increasing travel time. This is caused by the fact that

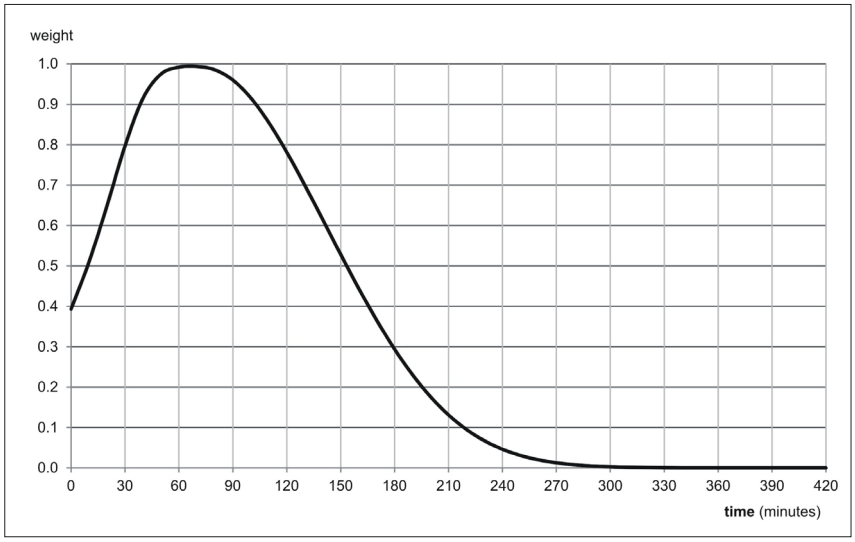

Fig. 2: Distance-decay function for medium-term tourism (2–4 days)
Source: authors' proposition

for this type of tourism, only a limited number of tourists are willing to spend a weekend at a destination at a distance of only 30 minutes from their place of residence. This is based on the assumption that people living at a distance of 45–90 minutes drive from a destination will decide most likely for a weekend stay. The probability of selecting a more distant destination (more than 90 minutes travel) for weekend tourism decreases: at a distance of 3 hours it drops to 30% and at a distance of 5 hours it approaches zero. Very few people decide to travel by car for a weekend trip of more than five hours. Surveys have shown, however, that Poles are willing to travel even longer by car to spend a weekend in a place attractive to tourists. The curve (Fig. 2) has been modulated by using data obtained from the survey (Więckowski et al., 2012).

The potential accessibility of a tourist region refers to its accessibility by potential visitors from all over the studied area. For the analysis of potential accessibility of the Polish-Slovak borderland by car, all inhabitants of Europe were considered potential tourists, regardless of their income and real mobility.

All of Europe, together with the Polish-Slovak borderland, was divided into 133 regions, including 49 regions in the borderland (25 in Poland and 24 in Slovakia)[1]. Each of these 133 regions was given a mass, equivalent to the population living there. This mass was assumed to be the number of potential tourists. Centres in each region were identified. For each centre, the travel time from all centres in the Polish-Slovak borderland (49) was calculated in accordance with the time accessibility model.

The potential accessibility A_i of a transport region i in the borderland was calculated using the following formula:

$$A_i = M_i f(t_{ii}) + \sum_j M_j f(t_{ij}) + \sum_k M_k f(t_{ik})$$

where

A_i = potential accessibility of the *i-th* transport region;

M_i = mass (population size) of the *i-th* transport region;

M_j = mass (population size) of the *j-th* transport region in the Polish-Slovak borderland;

M_k = mass (population size) of the *k-th* transport region located outside the Polish-Slovak borderland;

$f(t_{ii})$ = value of the distance decay function for travel time t of an internal journey within the *i-th* transport region;

$f(t_{ij})$ = value of the distance decay function for travel time t between the transport regions i and j; and

$f(t_{ik})$ = value of the distance decay function for travel time t between the transport regions i and k (c.f. Więckowski et al., 2012).

This formula describes the general potential accessibility of 49 regions (poviats in Poland and districts in Slovakia) in the Polish-Slovak borderland. The potential accessibility measure (A_i) sums its own potential, internal potential, and external potential of the *i-th* transport region in the borderland.

3. The impact of planned motorways and expressways on the potential accessibility of the Polish-Slovak borderland

The base year used for the analysis of potential accessibility was 2010. Figure 3 shows values for accessibility potential for individual transport regions (LAU 1 regions – poviats in Poland and districts in Slovakia). The most accessible area (for medium-term tourism) is in the western part of the region, gradually declining to the east. The highest values of the potential accessibility index were found for the regions of Cieszyn, Bytča, Čadca, Pszczyna, Bielsko-Biała – generally in the western part of the borderland – and Žilina; and the lowest were established for the regions of Sanok, Snina, Lesko, Przemyśl, Lubaczów, and Ustrzyki Dolne – generally in the eastern part of the borderland. Values of the potential accessibility index depend on geographical position with respect to the principal settlement centres as modified by their demographic potential. In the case of the Polish-Slovak boundary, the most influential areas, in this sense, are the agglomerations of Upper Silesia and Kraków in Poland and the agglomeration of Ostrava in the Czech Republic. People from regions in the Czech Republic have a very short distance to the tourist destinations in Poland and Slovakia, but their personal choices are much more diversified, and the Carpathians, especially in Poland, do not constitute an important tourist region for them.

One of the issues that can be addressed using potential accessibility is the analysis of changes in accessibility due to investments in transport infrastructure (see, e.g. Stępniak and Rosik, 2013). In such cases, it is possible to compare the potential accessibility values before and after the investments. This paper analyses the impact of selected planned motorways and expressways (D1, A4, D3/S69, R1/R3/S7, R4/S19) on potential accessibility of the Polish-Slovak borderland. Selected simulations for the most important projects are shown in Fig. 4. First, two of the selected routes (D1 and A4 motorways) are parallel to the Polish-Slovak border, and last three routes (D3/S69, R1/R3/S7, R4/S19) represent cross-border transport connections. The results show the impact on a national level (both cases) and the cross-border effect. In this contemporary meaning, inside the Schengen area, where the borders are fully open (with the exception of some examples, see Wieckowski, 2013), an interesting process shows the growth of potential accessibility to the other side of the borderland.

In the Polish-Slovak borderland, after the construction of some new expressway crossing a border, an increased potential accessibility is very visible on the Slovak side. A very large number of Polish tourists living in Kraków and from the Upper Silesian conurbation, will be located in the isochrone of two hours from the mountainous area surrounding the Tatras in Slovakia. The centres located south of the Tatras will find themselves within the reach of several-day visits from Kraków and from the Upper Silesian conurbation, as a result of the decrease in travel times. The greatest "winner" in connection with these investments will be the area of Liptovský Mikuláš. This large change will be due to the construction of the route Kraków–Chyżne–

[1] In the Polish-Slovak borderland, transport regions were 24 districts in Slovakia and 25 poviats in Poland. The remaining territory of Poland and Slovakia was divided into transport regions represented by NUTS 3 regions (voivodeships and regions). In the Czech Republic, Hungary and Ukraine, transport regions were defined as the NUTS 3 regions neighbouring Poland and the Slovak Republic, and the remaining areas of these countries constituted other transport regions. Each of the other European countries was regarded as a transport region.

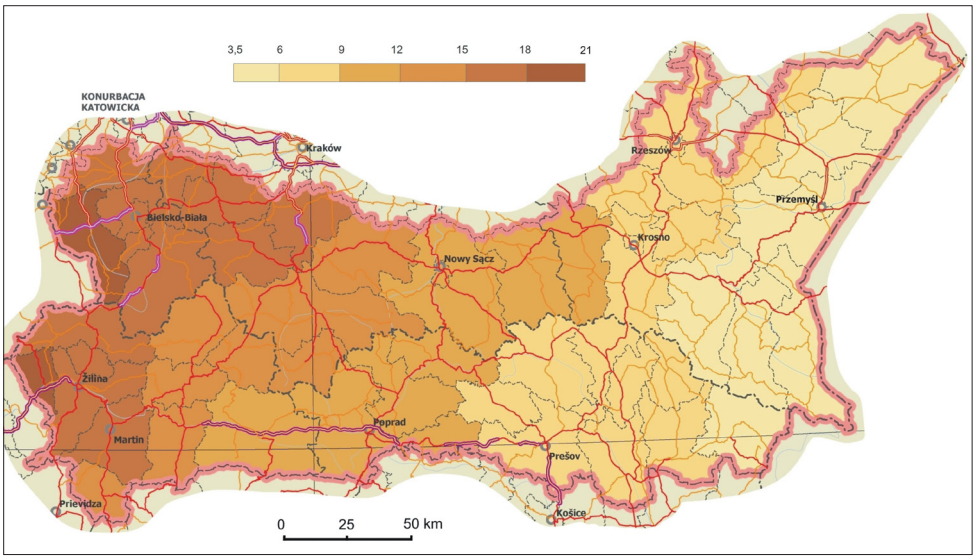

Fig. 3: Potential road accessibility in medium-term tourism in 2010 (in thousands). Source: authors' calculations

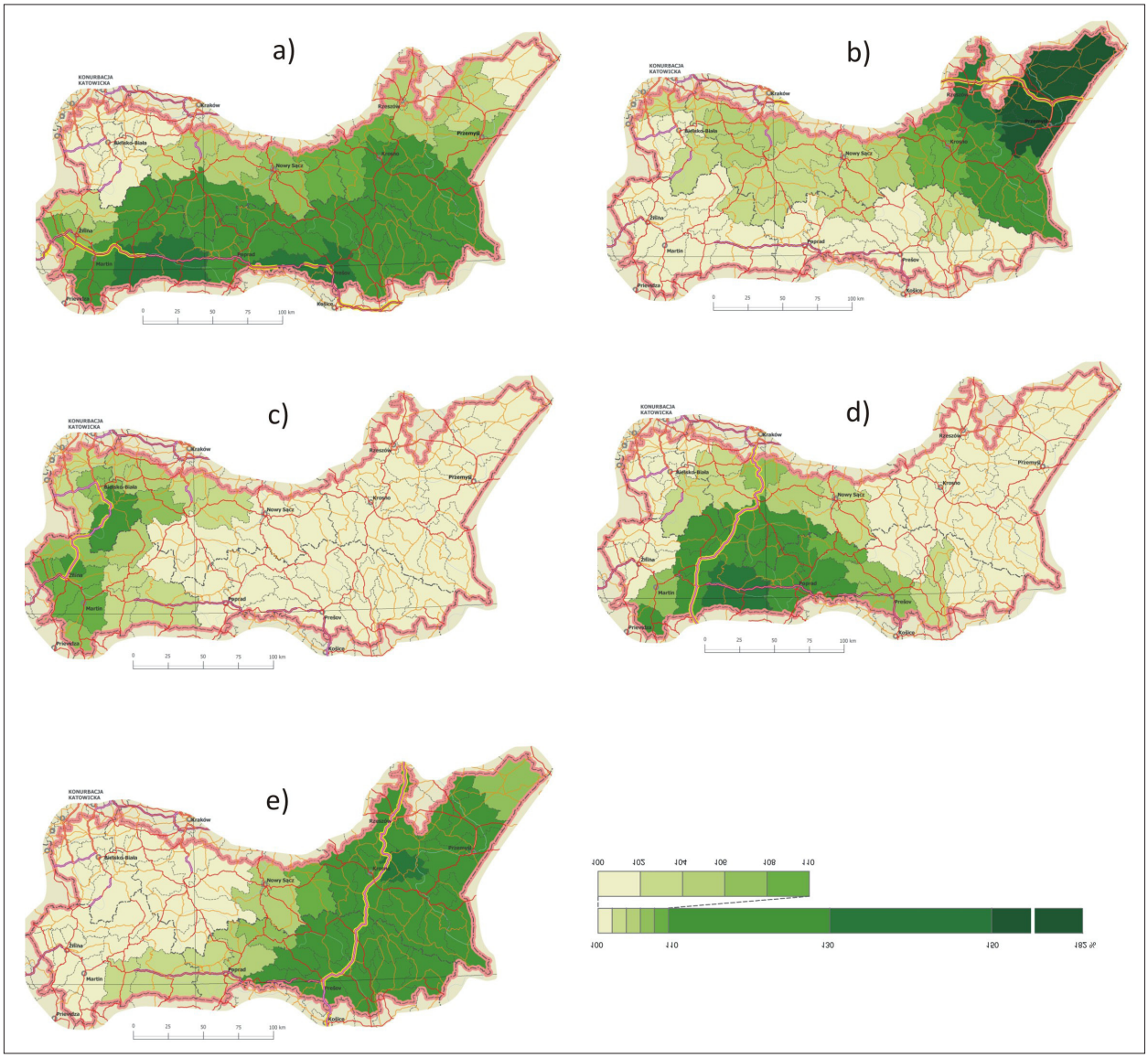

Fig. 4: Simulation of changes in potential accessibility for medium-term tourism as a result of completion of selected road infrastructure (changes in %, 2010 = 100%) – a) D1 motorway Hričovské Podhradie–Košice–the Ukrainian border; b) A4 motorway Kraków–Rzeszów–the border with Ukraine; c) S69 expressway and the D3 motorway Bielsko-Biała–Žilina; d) S7/R3/R1 Kraków–Chyžne–Ružomberok–Banská Bystrica expressway; e) S19/R4 Rzeszów–Prešov expressway). Source: authors' calculations

Ružomberok–Banská Bystrica expressway (S7 expressway in Poland, and R3/R1 expressways in Slovakia, as shown in Fig. 4d). Analysis of this investment shows extensive spatial benefits with respect to the improvement in accessibility for medium-term tourism, and that the Slovak regions are the main beneficiaries of this investment.

The results that were obtained clearly show that the completion of the Slovak D1 motorway (Fig. 4a) will considerably contribute to the improvement of accessibility, mainly on the Slovak side of the borderland practically in all parts of the area, especially in the regions of Liptovský Mikuláš, Levoča, Prešov, and Ružomberok. The improvement of accessibility owing to this investment will also take place in the Polish part of the study area. This primarily concerns the Podhale region and peripheral regions like the Bieszczady Mountains.

It is almost exclusively Polish regions that will benefit from the completion of the parallel A4 motorway Kraków–Rzeszów–the border with Ukraine (Fig. 4b). The biggest improvement is observable in the northeast part of the study area near the town of Przemyśl. This investment is unimportant for cross-border tourism development. Thus, we may risk making the statement that the Slovak D1 route may result in equalisation of the potential of attractive tourist areas on both sides of the border, and potentially bring closer to the Slovak side, Vienna and even Budapest, to the Polish side of the borderland (e.g. after construction of the complete D1, the time distance from Bratislava to the Polish border in Barwinek will be approximately about 3.5 hrs).

The completion of the entire Bielsko-Biała–Žilina route (the S69 expressway in Poland and D3 motorway in Slovakia) would improve accessibility of the western part of the borderland, mainly the regions of Kysucké Nové Mesto, Żywiec, Bytča and Žilina (Fig. 4c).

The construction of the Rzeszów–Prešov–Košice–Slovak/Hungarian border expressway (S19 expressway in Poland and R3/R1 expressways in Slovakia), brings about considerable benefits to areas on both sides of the borderland. When the entire route is completed (Fig. 4e), significant improvement in accessibility would also be visible in the central part of the Slovak side of the borderland (Poprad), which becomes more accessible from the relatively densely-populated areas in south-eastern Poland.

It is possible to compare the importance of individual investments in road infrastructure in terms of the number of transport regions, where the selected investment is the most important or the second most important (Fig. 5). The importance of individual investment has been assessed on the base of the potential accessibility value change. An investment that brought the highest improvement of the accessibility was regarded as the most important.

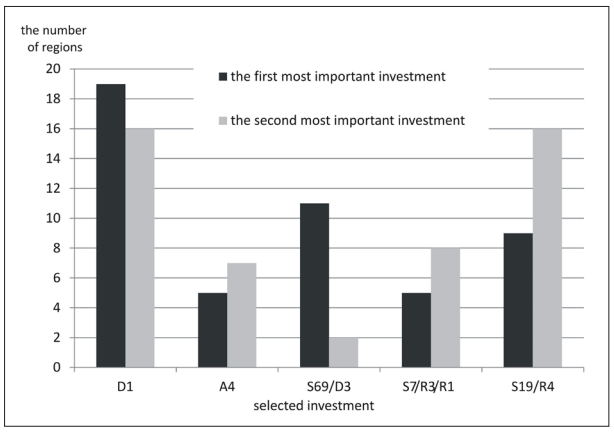

Fig. 5: Comparison of the importance of individual investments in road infrastructure
Source: authors' calculations

4. Discussion and conclusions

Each of the accessibility change simulations results from the comparison of the situation before completion of the expressway or motorway construction and the situation after commissioning of a given investment. It should be noted that the simulations of the influence of road network investments on potential accessibility changes in the area, were carried out on the basis of the assumption ceteris paribus, i.e. the invariability of other factors (especially in the population counts: only the current population without changes resulting from natural population increase and/or migration, were taken into account).

Therefore, it is assumed that the accessibility change results exclusively from the fact that a given road was built (or upgraded) and the speed was improved, and as result the largest part of the population will be found in the same isochrone. Other transformations resulting, for instance, from the network in terms of social or economic changes, were not part of the analysis.

The objective of the detailed simulations was to determine which of the planned investments are most significant for the particular sub-regions and tourist centres. The results obtained may be used as the basis for transport policy on the national and regional level. They may also constitute an important guideline for the policies of local authorities with respect to the development of future tourist functions (traffic forecasts), and also for lobbying for particular central government-funded investments using European Union funds. The results show the differences in tourist development potential and indicate the role of competitiveness, between tourist centres and regions, as well as countries.

The transport conditions in the entire eastern part of the Polish-Slovak borderland are unsuitable for the development of short-term tourism (Wieckowski et al., 2014). The construction of large infrastructure projects (motorways and expressways) is crucial for further development of the eastern part of the borderland. The motorways to the Ukrainian border, the D1 in Slovakia and the A4 in Poland and the Rzeszów–Prešov–Košice–Hungarian border with an expressway (the S19 and R4) should be completed first.

Out of the individual planned investments, the construction of roads belonging to the Kraków–Trstená–Ružomberok–Banská Bystrica traffic route (the S7, R3 and R1) is highly significant, especially for weekend tourist traffic. This will produce an improvement in accessibility from Kraków and Upper Silesia, i.e. from the areas from which the largest groups of potential tourists come.

Comparison of the advancing construction (terms of completion) of the planned expressways and motorways with the level of their effect on tourism development is rather interesting. Pursuing the existing plans, motorways D1 and A4, which are most important in terms of overall development of the whole borderland, should be finished first. Completion of the D1 is the most important investment also in terms of tourism development. As far as cross-border communications are concerned, motorway D3 and expressway S69, which are parts of the Baltic-Adriatic Corridor within the TEN-T Core Network, should be finished first, albeit this communication

is not so important for the development of tourism. Later, the completion of expressways R4 and S19, followed by expressways R3 and S7, is planned. For the eastern part of the Polish-Slovak borderland, the construction of large infrastructure projects (the D1 and A4 motorways, and the S19/R4 expressways) is crucial in terms of the development of tourism, but also in terms of overall economic development. In the light of development of tourism in boundary areas, the expressway S7/R3/R1, planned to run close to the Tatras which is the most important tourist region in both countries, is especially important. It should be noted that the criterion of the development of tourism is not considered as the most important in planning the construction of cross-border communications. Motorways and expressways are built mainly in corridors with the largest existing and planned demands on transport, and the EU transport policy is also taken into account.

Improving accessibility does not always lead to the development of tourism activities. Good accessibility is only one of the important prerequisites for the development of tourism, which is affected by a number of different factors. Tourists tend to select destinations based on local possibilities and attractions in the first place. Good accessibility itself does not represent a source of competitiveness (Tóth and Dávid, 2010). Additionally in our differentiating world many other factors play important roles, such as the commodity of transport, price, mode, and the symbolic value of the tourism centre or region.

This article has dealt with accessibility as a positive characteristic of a region from the point of view of tourism development. But accessibility may have also negative implications. Gutiérrez (2009) states that high-value natural spaces may be in danger if a new highway is built in the area to facilitate access for the population, and that maintaining the inaccessibility of certain natural spaces is a means of protecting them. This factor underlines the role of the increasing number of potential tourists visiting the national parks (Więckowski et al., 2012; Więckowski, 2013). This is true especially in the case of tourism in protected areas, and when tourism is based on natural values. Tourism as a client-pleaser industry is in danger of destroying the environment (Sorupia, 2005). According to this author, accessibility can make or break a destination. Too much access brings in a larger number of people that can increase the level of degradation, decrease the experience, and impact the natural state of the resources. Therefore the issue of the carrying capacity of tourist regions has real importance. Another important problem related to too much access is the congestion problem. In some cases, congestion problems in high tourist seasons are a negative factor of tourism development and marketing recognition. This problem is very visible on the Polish side of the borderland, especially in the Tatras region.

In the years to come, the development of transport and an increased amount of free time, etc. will lead to more intensive competition between regions, both in terms of seeking out investors with a view to expanding tourist infrastructure (as well as other – e.g. transport – infrastructure) in order to ensure changes in the functions performed by respective centres and regions, and also in terms of attracting tourists. One specific issue is that the areas in question still have large reserves for the development of tourism at their disposal and broader dispersion of tourist traffic is essential, not only for economic growth of rarely-visited areas, but also for a reduction in congestion in those in which traffic is excessive.

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References:

FROST, M. E., SPENCE, N. A. (1995): The rediscovery of accessibility and economic potential: the critical issue of self-potential. Environment and Planning A, 27(11): 1833–1848.

GEERTMAN, S. C. M., van ECK, J. R. (1995): GIS and models of accessibility potential: an application in planning. International Journal of GIS, 9(1): 67–80.

GOODALL, B. (1987): The Penguin dictionary of human geography. Harmondsworth: Penguin.

GUTIÉRREZ, J. (2001): Location, economic potential and daily accessibility: an analysis of the accessibility impact of the high speed line Madrid-Barcelona-French border. Journal of Transport Geography, 9(4): 229–242.

GUTIÉRREZ, J. (2009): Transport and accessibility. In: Kitchin, R., Thrift, N. [eds.] International Encyclopaedia of Human Geography, (pp. 410–417). Amsterdam, Elsevier.

GUTIÉRREZ, J., GÓMEZ, G. (1999): The impact of orbital motorways on intra-metropolitan accessibility: the case of Madrid's M-40. Journal of Transport Geography, 7(1): 1–15.

HALÁS, M., KLAPKA, P., KLADIVO, P. (2014): Distance-decay functions for daily travel-to-work flows. Journal of Transport Geography, 35(2): 107–119.

HALL, D. R. (1999): Conceptualising tourism transport: inequality and externality issues. Journal of Transport Geography, 7(3): 181–188.

KRIŽAN F., GURŇÁK D. (2008): Vybrané kartografické metódy znázorňovania dostupnosti. Acta Geographica Universitatis Comenianae, 51: 71–82.

McKERCHER, B., LEW, A. (2003): Distance decay and the impact of effective tourism exclusion zones on international travel flows. Journal of Travel Research, 42(2): 159–165.

MICHNIAK, D. (2011): Rozvoj cezhraničnej dopravnej infraštruktúry v slovensko-poľskom pohraničí po roku 1989. In: Andráško, I., Ira, V., Kallabová, E. [eds.]: Časovo-priestorové aspekty regionálnych štruktúr ČR a SR (pp. 81–86). Bratislava, Geografický ústav SAV.

MICHNIAK, D. (2014): Vybrané prístupy k hodnoteniu dopravnej dostupnosti vo vzťahu k rozvoju cestovného ruchu. Geografický časopis, 66(1): 21–38.

MUNTEANU, A. (2010): Conceptualizing and composing tourism accessibility. Lucrările Seminarului Geografic "Dimitrie Cantemir", 30: 125–133.

ROSIK, P. (2012): Dostępność lądowa przestrzeni Polski w wymiarze europejskim. Prace Geograficzne 233, Warszawa, IGiPZ PAN.

SORUPIA, E. (2005): Rethinking the role of transportation in tourism. Proceedings of the Eastern Asia Society for Transportation Studies, 5: 1767–1777.

SPIEKERMANN, K., WEGENER, M., KVĚTOŇ, V., MARADA, M., SCHÜRMANN, C., BIOSCA, O., ULIED SEGUI, A., ANTIKAINEN, H., KOTAVAARA, O., RUSANEN, J., BIELAŃSKA, D., FIORELLO, D., KOMORNICKI, T., ROSIK, P. (2011): TRACC Transport accessibility at regional/local scale and patterns in Europe: applied research 2013/1/10. Luxembourg, ESPON & Spiekermann & Wegener, Urban and Regional Research.

STĘPNIAK, M., ROSIK, P. (2013): Accessibility improvement, territorial cohesion and spillovers: a multidimensional evaluation of two motorway sections in Poland. Journal of Transport Geography, 31(7): 154–163.

STEWART, J. Q. (1941): An inverse distance variation for certain social influences. Science, 93(2404): 89–90.

STEWART, J. Q. (1942): A measure of the influence of population at a distance. Sociometry, 5(1): 63–71.

TÓTH, L., DÁVID, L. (2010): Tourism and accessibility: An integrated approach. Applied Geography, 30(4): 666–677.

WIĘCKOWSKI M. (2013): Eco-frontier in the mountainous borderlands of Central Europe. The case of Polish border parks. Journal of Alpine Research / Revue de géographie alpine, 101(2): [cit. 02.06.2014]. Available at: URL: http://rga.revues.org/2107

WIĘCKOWSKI, M., MICHNIAK, D., BEDNAREK-SZCZEPAŃSKA, M., CHRENKA, B., IRA, V., KOMORNICKI, T., ROSIK, P., STĘPNIAK, M., SZÉKELY, V., ŚLESZYŃSKI, P., ŚWIĄTEK, D., WIŚNIEWSKI, R. (2012): Polish-Slovak borderland: Transport accessibility and tourism, Prace Geograficzne, 234, Warszawa, Instytut Geografii i Przestrzennego Zagospodarowania PAN.

WIĘCKOWSKI, M., MICHNIAK, D., BEDNAREK-SZCZEPAŃSKA, M., CHRENKA, B., IRA, V., KOMORNICKI, T., ROSIK, P., STĘPNIAK, M., SZÉKELY, V., ŚLESZYŃSKI, P., ŚWIĄTEK, D., WIŚNIEWSKI, R. (2014): Road accessibility to tourist destinations of the Polish-Slovak borderland: 2010–2030 prediction and planning. Geographia Polonica, 87(2): 5–26.

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The development of regional differentiation of office construction in the Czech Republic: 1990–2010

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Abstract

The factors that were crucial for the construction of administrative buildings in the regional capitals of the Czech Republic are subject to examination in this article. One primary question is whether the development of office construction reflects the qualitative importance of the cities, or whether there are some other regularities in the spatial distribution of construction. To identify the key factors, controlled interviews with experts professionally involved in the construction of administrative buildings were carried out, and these data were then extended as part of a large-scale questionnaire survey with other experts on the issue. The results have confirmed the dominant position of the capital city of Prague in terms of its qualitative importance, as the remaining regional capitals have less than one-tenth of the volume of modern office building areas. The greatest differences in the construction of administrative buildings have been noted in Brno and Ostrava, despite the fact that they exhibit similar characteristics when considered in the light of respondent-determined factors.

Keywords: *administrative buildings, regional differentiation, localisation, office construction, Czech Republic*

1. Introduction

There have been a number of changes in the Czech economy after 1989 due to transformation processes (Hampl et al., 2001; Hampl, 2005; Hampl, 2010; Bičík and Jančák, 2006; Stanilov, 2007). As one example, the country witnessed a considerable inflow of foreign firms from the progressive tertiary sector, as well as the establishment of a number of domestic companies in this economic segment. "Progressive", in this context, refers to the niche in the tertiary sector which has the highest added value, at the notional peak of the pyramid of services: e.g. banking, insurance services, etc. (for further elaboration, see Blažek, 2001). These entities started to apply new approaches, not only to the implementation of their business activities but also to the operation of their businesses, aiming to increase work efficiency and improve employee work environment. Therefore, they started to use modern office premises which shape a firm´s prestige and provide employees with a comfortable environment to deliver required performance. As a result, office demand was one of the impulses for the development of construction of administrative buildings in Czech towns since the first years of economic transformation (Sýkora, 1999; Sýkora, 2007; Stanilov, 2007). The construction of office buildings, however, is not based solely on demand. Rather, it is a complex process of interaction of many inter-related factors in time and space, and one that has significant regional impacts (Fisher and Collins, 1999; Fisher, 2005; Rebelo, 2010).

The construction of office buildings in the Czech Republic has reached the point of substantial regional differences over the last twenty years, in common with most socio-economic phenomena. Aside from overall macroeconomic and political conditions, the essence of the regional differences needs to be sought in diverse, mostly qualitative, characteristics at meso-regional, micro-regional and perhaps also local levels. The development of construction of office buildings has also significantly affected the physical, functional and social structure of cities (Stanilov, 2007; Sýkora, 2007). This important theme of regional differentiation, however, has not been sufficiently addressed in existing research. The current situation with respect to the structure of demand for office spaces for various branches of the tertiary sector in the Czech Republic is illustrated in Figure 1.

This article aims to describe and explain the spatial diffusion of the construction of international top-quality standard rental administrative buildings (hereinafter the "office buildings") in Czech regional capitals over the past twenty years. We ask two questions in connection with this objective. First, we would like to find out whether the increasing construction reflects the qualitative importance of designated cities, or whether there are some irregularities in the expected pattern of the spatial distribution of modern offices. Second, we would like to find out what factors influenced the construction of administrative buildings in Czech regional capitals, as well as their spatial distribution.

2. Approaches to the study of construction of office buildings

Research on the construction of office buildings can be primarily understood as part of real estate research in general: for example, Bertz (2002), Adair et al. (1999), Carn, Rabianski, Racster and Seldin (1988). Some research, however, focuses on the retail segment (Des Rosiers and Thérault, 2014), while other works deal with industrial real estate properties, whether in the form of brownfields (Garb and Jackson, 2010) or in the form of greenfields and logistics parks. Last, but not least, a considerable amount of research has focused on non-commercial real estate in the Czech Republic, especially the residential market (Lux and Sunega, 2011; Nedomová [ed.], 1999).

In our review of the literature, we put particular emphasis on understanding the wider context of the construction of office buildings. Therefore, research dealing with the causes

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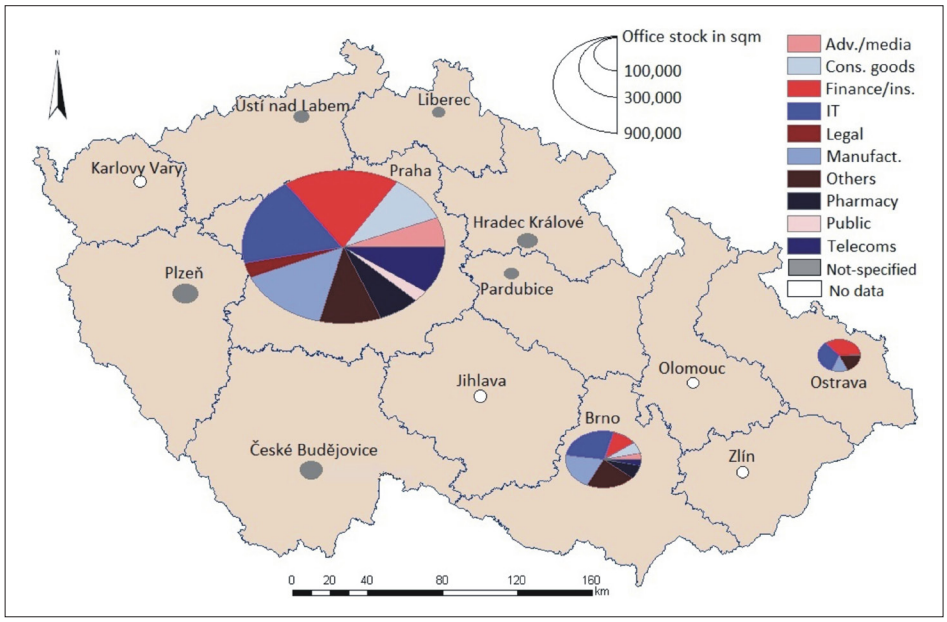

Fig. 1: Office stock in the Czech Republic and structure of the demand for office spaces

and consequences of concentration processes in the context of wider socio-geographical and economic changes in society provided us with useful findings (e.g. Sassen, 1995). The current situation in the Czech Republic can be characterized by the "*increasing importance of major cities acting as centres thanks to the concentration of the control functions*" (Hampl, 2005, p. 21; original Czech text translated to English by the authors). Following this idea, one can assume that the most important (progressive) economic activities, information and power are concentrated in areas smaller than those concentrating the population and other (non-progressive) activities. We assume, as well, that these tendencies create optimum conditions for the development of a physical, social and functional city environment, which is reflected in the increasing construction of modern office buildings.

Many of the research contributions address the impacts of socio-geographical and economic changes on the market for administrative premises. Sýkora (2007) explains that governmental reforms (privatization, liberalization of prices and deregulation of rents), the increasing demand for modern office premises by newly-emerging Czech firms and an inflow of foreign companies and investors, represented an important stimulus for the development of the real estate market. This author assumes that this subsequently led to the commercialization, revitalization and regeneration of urban zones. In broader contributions on post-socialist metropolises (Stanilov, 2007, and others), an emphasis is placed on the growing interest of foreign investors in Central and East European markets, who saw advantageous and returnable investments behind the growing demand for commercial real estate properties. General issues related to the development of commercial real estate properties are dealt with by Gotham (2006) and Parsa, McGreal, Keivani (2000), for example, who stress the role of State policy and the effect of the global economy on the construction of administrative buildings. Rebelo (2010) and Aarhus (2000) highlight the influence of community policy and other local institutions. Wood (2004), Sýkora (2007), D'Arcy and Koegh (1997), McGough and Tsolacos (1997) consider economic factors to be the most important impulses for the construction of office buildings. Factors viewed as the most fundamental include, in particular, GNP structure and growth rate (D'Arcy and Koegh, 1997), level of industrial production, employment, rent prices, investment environment maturity (McGough and Tsolacos, 1997), or the development of new financial mechanisms (Wood, 2004).

Using the specific example of the Prague district of Smíchov, Temelová (2007) has described the forces and mechanisms which led to the substantial deindustrialization of the area and its subsequent commercialization and the construction of prestigious and representative projects (flagship developments). As well, Ilík and Ouředníček (2007) focused on the metamorphosis of Prague's Karlín district in the context of transformation processes, and mention also the importance of the development of office buildings during this process (Fig. 2 – see cover p. 4).

Much less attention has clearly been paid to the classification of localization factors of office construction in Czech language literature. For the purposes of this article and, in particular, to offer our own categorization of localization factors, we built on the methodological bases published in work by Fisher and Collins (1999) and Fisher (2005). Fisher and Collins (1999) identified four dimensions which determine the construction of office buildings by mutual interaction. They are (i) structure, (ii) actors, (iii) events, and (iv) location. They consider 'structure' to be the most important dimension and understand it as a set of contextual forces (economic forces, technologies, external environment, social forces, political and government forces) determining the behaviours of participants, the sequence of events, and use of individual lands. Fisher (2005) elaborates on this model of localization factors and presents a network model. It is based on seven essential elements: long-term trends, economy, the situation in real estate markets, participants, governmental activity, land localities and the sequence of events. These elements are further classified into sub-elements that are inter-related in the form of functional relations. It should be mentioned as well that the classification of localization factors is dealt with in other works (e.g. Wilkinson and Reed, 2008; Birell and Gao, 1997; Bertz, 2002). This research, however, usually concerns general development models with very limited applicability to the conditions of Czech towns.

In summary, evaluation of the construction of office buildings has so far been made against the background of a broad spectrum of socio-economic factors. We assume, based on knowledge available in the research literature, that the development of office construction in Czech towns is dependent on the improving economic and legislative requirements of the State, on the one hand, and, predominantly, on the development of the economic and social characteristics of individual regions and their centres, on the other hand.

3. Research methodology

First, we analysed office construction data. The reporting twenty-year period was divided into several phases, depending on the extent of construction in individual regional capitals in the Czech Republic. The phasing principle relied on assigning the towns to size categories and, subsequently, on defining the year in which the individual towns or size categories had entered the administrative market (i.e. the first office projects had been finished and the development had continued in the following years). An explanation of the individual phases was based on an analysis of key localization factors. These localization factors had been established on the basis of controlled interviews with real estate experts, and assigned a level of importance by a broader range of real estate professionals.

3.1 Data base to describe office development

To provide a description of the construction of new administrative international top-quality standard buildings, it was necessary to use appropriate and accurate data. For this purpose, we used data from Cushman & Wakefield Ltd., keeping records of the construction of "A" standard buildings (see Table 1) in the Czech Republic from 1990. The choice of the data source relied on the fact that renowned international real estate agencies (such as Jones Lang LaSalle, CBRE, Colliers, Knight Frank, DTZ, and Cushman & Wakefield) had carefully processed databases of this (commercially attractive) building segment as opposed to various public sources.

It must be noted, however, that there are other categories of lower-standard office areas, but it is not realistic to collect the data in terms of their completeness. The problem of data credibility and completeness is mentioned also by Sýkora (2007), who points out that data on administrative areas published by real estate agencies do not include, for example, non-refurbished offices built before 1990, refurbished buildings not offered for letting in the real estate market, buildings built by companies to serve their own purposes, and a huge amount of small and 'not-too-good' offices. Office buildings under construction that were expected to be finished during 2011 or 2012 were not taken into account in describing this construction.

3.2 Procedure in determining key localization factors

The starting point for determining key localization factors was a network model of elements and sub-elements affecting commercial development according to Fischer (2005): see Table 2. One disadvantage of this model for our research is, in particular, its excessive generality and universality, as it can be applied to the development of not only office buildings but also of retail areas and other commercial areas. Another disadvantage of the Fisher model can be seen in not

I. Good transport accessibility (public transport, connection to the main highways, railway corridors and the airport)
II. Sufficient public amenities within the location
III. Top-quality technical and user standard of the office building (modern cable management; a building must feature one of the following: raised floors / suspended ceilings with power poles or cable trays / compartment trunking / provision for under-floor cabling, a modern air handling system (2 or 4 pipe air conditioning), adequate provision of secure dedicated car parking (a building location is considered when assessing this criteria), 24-hour access and security, a high quality standard finish, modern lift(s), good accessibility by public transport (walking distance to metro station max. 15 minutes), clear ceiling height of at least 2.65 m, prestige / quality reception area, flexible design partitioning, sufficient lighting, sprinkler system / fire security, amenities in the building / immediate vicinity, well-managed property).

Tab. 1: Definition of administrative international quality standard buildings (standard "A" – this top quality technical standard building must fulfil criteria I., II., and at least 70% of indicators of criterion III.)
Source: adjusted according to Prague research forum, 2014

Elements	Sub-elements
Long-term Trends	Population, society, technology, transport, politics, environment
Economy	Business sectors, finance and investment markets, economic cycle, regional economies
Property Markets	Property letting markets, property finance markets, property investment markets, construction markets, land markets, housing markets
Actors	Banks, occupier, investor, contractor, property consultant, design consultant, lawyer, landowner, utility, developer
Government	Legislation, economic policy, policy, agency, local government, local planning authority
Events	Inception, market research, financing, feasibility, site investigation, design, town planning, site purchase, procurement, construction, promotion, letting, sale, completion
Site	Location, physical characteristics, ownership, construction, new property

Tab. 2: Property development web model. Source: Fisher, 2005

distinguishing between the weights of individual indicators (for example, the roles of a building design and the real estate market situation, represent completely different important categories in the development process). Nevertheless, the model is beneficial with respect to its complexity – i.e. it defines all potential spheres of influence on commercial development. Therefore, the model was used as a basis for controlled interviews with professionals from the area of construction of administrative buildings.

These controlled interviews aimed at identifying a set of factors influencing the construction of office buildings in Czech regional capitals. The interviews were made with Mrs. Radka Novak (Head of Office Agency, Cushman & Wakefield, and formerly the Letting Manager, SKANSKA), Mr. Alexander Rafajlovič (Head of Research, Cushman & Wakefield), Mrs. Alexandra Tomášková (Letting and Development Manager, SKANSKA), Mr. Pavel Skřivánek (Letting director, CPI), and Mr. Přemysl Chaloupka (Managing Director, Knight Frank), from 14 July 2011 to 30 July 2011. This is a selection of reputable experts with many years of experience in the construction of office buildings and commercial real estate. The interviews took place separately. Discussions with the interviewees first concentrated on the validity of the elements and sub-elements as outlined in the Fisher model, for the conditions of the Czech Republic. The experts were asked to identify sub-elements they considered to be important for office construction. Then they were asked about what other factors beyond the Fisher model played a role in the development of office buildings. The result of the controlled interviews was a list of 32 localization factors.

The next step was a questionnaire survey aimed at identifying a narrower range of key localization factors out of the initial set of 32. The questionnaire survey was conducted in the form of e-mailed questionnaires from August 1, 2011 to September 30, 2011.

We approached a total of 102 respondents, of which 54 answered. In the survey we asked developers, employees of international real estate agencies and other experts on office construction, to assess the individual factors and rate them by their importance for development in regional capitals in the Czech Republic on a scale 1 to 10 (where 1 = low-importance factor for the construction of office buildings, …, and 10 = high-importance factor for the construction of office buildings). The respondents had an option to give and rate other factors which they considered being significant and which were not listed among the 32 factors, and to comment on the individual factors. An average point score (alpha-section/trimmed mean) was subsequently calculated for the individual factors based on the questionnaires completed.

The questionnaire survey results, however, did not establish that there was a narrower range of more significant factors. The point scores of the individual factors indicated relatively small differences (Tab. 3), as evidenced by the minor difference between the highest-importance factor ("Demand" = 8.84) and the lowest-importance factor ("Levels of Unemployment Rate of University Graduates" = 4.82). For this reason, we had to abandon the idea of identifying a narrow range of factors with significantly higher importance levels. As a result, we decided to evaluate all relevant factors with a score higher than 5.00. In addition to the low-score factors, we left aside also factors which, in our opinion, were general, i.e. of the same function at the macro-regional level of the development system. There were 26 factors left from the original set after these eliminations.

There were minor differences between answers from men and women (less than 0.2 points), but a significant difference was found between groups of experts in evaluation of the importance of "Government investment incentives" (developers marked them 3 points less than advisors, and 1.5 less than other experts), and evaluation of "The important real estate agencies", as advisors see their business as much more important than the other experts.

These factors were classified into six groups (aggregates) based on their similarity from the point of view of their impacts on the construction of office buildings. For further comparison of the aggregates in terms of their importance, we defined their size (= sum of the weights of the relevant factors) and weight (the size of an aggregate was standardized to the sum of all 26 factors as equivalent to ten). The resulting values reveal interesting findings. According to the developers and real estate professionals, the most important role for the construction of office buildings in regional capitals is played by the situation in real estate markets (2.99). On the other hand, environmental quality is the least important (0.7). The remaining aggregates range between 1.29 and 1.79 and are approximately of similar significance. The results can be interpreted logically as follows: developers make their decisions about the construction of administrative buildings mainly on the basis of the real estate market situation and its expected future development. They consider the other aggregate factors to be equally important, and reflect on them in a complex decision-making process. Environmental quality is paid the least importance, probably because they think it to be sufficient enough in all regional capitals in the Czech Republic and thereby less limiting for office construction.

The classification of the factors and their subsequent weighted aggregation are used in the next section to explain the development and regional differentiation of the construction of office buildings. Regarding the extensive need for data which, in our case, cannot be obtained in their completeness, we are not able to make a sophisticated quantitative analysis. Therefore, we seek to explain construction in the individual towns using a description of the development of the individual aggregates, factors or their proper substituents if monitored by the Czech Statistical Office, in particular. The incompleteness of the source data for the reporting regional capitals is dealt with by using some of the data for the entire region, i.e. roughly the catchment areas of the regional capitals. More specifically, we used data for the following factors / substituents: at the level of the capitals – number of citizens; at the level of the regions – general rate of unemployment, average wages, percentage of employees in the progressive tertiary sector (of ratios of those employed in financial services and insurance, real estate, information and communication), number of university students, access of the regional capitals to the motorway and railway network, and presence of an international airport. Save for traffic signs, Prague was evaluated independently of the Středočeský Region because it is perceived by interviewed experts as a separate region. Also, values of the analysed indicators for this Region are significantly lower in comparison to Prague, and do not enhance the importance of the Czech Capital on the commercial real estate market.

3.3 Construction phasing principle

The regional capitals were divided into three size categories (Tab. 4): towns with more than 500 thousand inhabitants (Prague), towns with more than 250 thousand

and less than 499 thousand inhabitants (Brno, Ostrava), and towns with up to 249 thousand inhabitants (remaining regional capitals).

From the available construction data, we determined in which years the construction of modern office buildings was carried out. We emphasize, in connection with this principle of categorization of the towns, that we are aware of the fact that this hierarchical division of the towns does not replicate other hierarchical patterns, such as the rank-size rule established by the number of inhabitants (e.g. Hampl, 2005), or the quality of the business environment (Viturka, 2010). The individual phases of construction are analysed in the following section. The text is structured by these indicated hierarchical groups of towns or their current involvement in the real estate market for office properties.

4. Development of construction of administrative buildings in the Czech Republic, 1990–2010

Following the evaluation of the data on office construction in Czech towns and cities, we identified three phases (see Fig. 2), differing not only in construction intensity but also in the spatial distribution of finished modern office buildings.

Aggregate	Factor	Weight of factor	Size of aggregate	Weight of aggregate*
Accessibility	The international airport	6.74		
	Transport accessibility	8.14		
	The city transport infrastructure	8.20	23.08	1.29
Local activities	City promotion	5.66		
	Local actors	6.22		
	The image of the city	7.10		
	Local self-government support	7.44	26.42	1.48
Economy	Unemployment rate of university graduates**	5.04		
	The ratio of employed in progressive services	5.98		
	Levels of unemployment rate	6.10		
	Low labour costs	6.62		
	Acquisition of the development site	7.46	31.20	1.75
Environment	Environment	6.18		
	Social environment	6.34	12.52	0.70
Real estate market	The important real estate agencies - letting	5.52		
	A well-established office market	7.44		
	Levels of office rent	7.68		
	Competition	7.84		
	Levels of office vacancy	7.90		
	The activity of the investment market	8.24		
	Demand	8.84	53.46	2.99
Social and human capital	Science-technology parks	5.08		
	Number of university students	6.06		
	The ratio of university graduated	6.30		
	Public amenities	7.14		
	Population size	7.40	31.98	1.79
Factors not further analysed	**Factor**	**Weight**	**Reason of elimination**	
	Unemployment rate of university graduates***	4.82	Weight < 5.00	
	The proximity to the borders	4.90	Weight < 5.00	
	The accessibility of debt financing	8.18	general effect	
	Knowledge of foreign languages	6.32	general effect	
	Government investment incentives	5.70	general effect	
	Opportunities for expats	4.88	Weight < 5.00	

*Tab. 3: Questionnaire survey results and subsequent data. Notes: *on the condition that the sum of all 26 factors is equivalent to ten; **in terms of high levels as a possible source of labour; ***in terms of low levels as an indicator of economic conditions of a city and its catchment area.*
Source: Expert survey 2011, calculations by the authors

It must be noted, in connection with the definition of the individual phases, that it is not possible to exactly determine the 'break-point' years between the periods because the consecutive phases overlap to a certain extent. The planning and development of a single administrative building may take from two to three years. Thus, the status of construction in 2004 reflects the situation in the real estate market as it was in approximately 2002.

As regards construction intensity, we can see in Figure 3 that the market for administrative premises in Czech underwent, during these twenty years of development, a creation or low-intensity period (Phase I), a development or growing-intensity period (Phase II–III), and a stagnation or decreasing-intensity period (Phase III), where the stagnation period is visible in the persistent, greatly limited construction of office buildings. From our point of view, however, it is important to divide this period by the involvement of the individual towns or size categories of the towns we have defined, in the market for office buildings.

A) 1990–1996 (creation of the administrative market)

There were not any fundamental differences among Czech regions and towns shortly after 1990 due to the previous long-term and State-controlled levelling of regional differences (Havlíček, Chromý, Jančák, Marada, 2005). There had been changes, primarily in the socio-economic area, including the real estate market, shortly after the transformation of the political situation and simultaneously with the implementation of the first economic reforms.

Until 1996 offices were built in the Capital City of Prague only. The first modern building there was finished in 1993, followed by several completed buildings in subsequent years. The process was explained by Stanilov (2007), Sýkora, Kamenický, Hauptmann (2000), and Sýkora (1999, 2007), who relate the origins of the Czech real estate market especially to post-revolutionary developments in Prague, where there was a dynamic growth of private firms, both Czech and foreign companies demanding modern offices, as a result of the transformation and transformation-conditioned processes (e.g. liberalization of trade and prices, gradual deregulation of rents, privatization). Prague was perceived by those companies mainly as the chance to expand their activities and as a "gate to Central and Eastern Europe" (Sýkora, 1999; Sýkora, 2007; Drbohlav and Čermák, 1998). Sýkora's observations on 'demand' are confirmed by

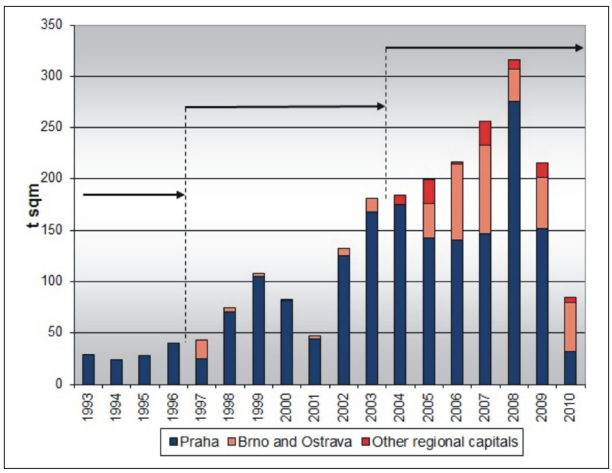

Fig. 3: Office construction in the regional capitals of the Czech Republic: 1990–2010. Source: Cushman & Wakefield, 2011

Category	City ranking (rank-size rule)	Regional capitals	Number of inhabitants (31.12.2010)	Year of completion of the first office building of "A" standard	Phase when particular size category entered the real estate market	Totally built sq. metres of "A" standard offices in 1990–2010	Number of sq. metres of offices per inhabitant as of December 31, 2010
I	1.	Praha	1,257,158	1993	1990–1996	1,804,448	1.44
II	2.–4.	Brno	371,371	1997	1997–2003	270,924	0.73
	2.–4.	Ostrava	303,609	2003		101,200	0.33
III	2.–4.	Plzeň	168,808	2004	2004–2010	32,015	0.19
	5.–12.	Liberec	101,865	2008		10,300	0.10
	5.–12.	Olomouc	100,233	x		0	x
	5.–12.	Ústí nad Labem	95,464	2009		8,790	0.09
	5.–12.	České Budějovice	94,754	2007		15,500	0.16
	5.–12.	Hradec Králové	94,318	2005		12,717	0.13
	5.–12.	Pardubice	90,401	2008		7,600	0.08
	5.–12.	Zlín	75,469	x		0	x
	13.–34.	Jihlava	51,154	x		0	x
	13.–34.	Karlovy Vary	51,115	x		0	x

*Tab. 4. Basic data on regional capitals and realised office construction over the past 20 years (Note: *rank-size rule according to Hampl, 2005)*
Source: Czech Statistical Office (2011), Cushman & Wakefield (2011), calculations of the authors

Blažek (1996) and his finding that the headquarters of the major firms and firms from within the progressive tertiary sector, were significantly concentrated in Prague (or its metropolitan area) in the mid-1990s compared to the rest of the CR. These firms are perceived as an important source of potential demand for modern offices, and the concentration (and cooperation) tendencies in the progressive tertiary sector can be thought of as another demand-stimulating factor.

Office development in the Capital City is underlain not only by growing demand (the most important factor of the "property markets" aggregate) but by other factors as well. The potential generated by the emerging real estate market had attracted a number of foreign development companies and might have served as a basis for the creation of Czech developers (frequently, major Czech construction companies, such as Metrostav, expanded their business to include the development of office buildings), which might have resulted in the implementation of the first projects. The unique position of Prague in terms of its social structure – in our questionnaire survey, human and social capital was identified by the developers and other real estate professionals as the second most important aggregate affecting construction – played an important role in the Czech Republic as well. In this aggregate, the respondents laid emphasis on two relatively stable factors – population size and civic amenities. Thus, we believe that the development of the office market in Prague was further affected mainly by the population size of the Capital City (concentrating more than one tenth of the State's population) and an adequate offer of services. The dominant position of Prague in the Czech administrative market was also strongly supported by the high percentage of employees in the progressive tertiary sector ("Economy" aggregate)[1]. This indicator reached 9.77% in the Capital City in 1996, which was more than double the second one – Brno (or the Jihomoravský Region) with 4.4%.

Combined with (long-term) low registered unemployment and considerably higher average wages compared to other regions, it meant a substantial comparative advantage on the basis of which Prague had probably got a permanent jump on other capitals with respect to its economic position in the Czech Republic. Besides the comparative advantages referred to above, Prague also benefitted from being located centrally both in the State and Central Europe and, as far as transport is concerned, from the presence of an international airport and motorways to Moravian and Slovak metropolises, although motorway construction after 1990 lagged behind the growing demand for road infrastructure (Marada, 2006).

There was no construction in progress in other Czech regional capitals for several reasons. First of all, there was no local demand for modern offices and foreign companies concentrated exclusively on Prague in this period. The fact that other capitals were unprepared to absorb progressive tertiary sector companies certainly played a role, too: most out-of-Prague regions had to cope with the 'socialist heritage' – 'inconvenient' industry structure (e.g. the mining industry in basin areas – e.g. Ostrava, Ústí nad Labem, Karlovy Vary; the textile industry – Liberec; heavy machinery industry – Brno, Plzeň, etc.), underdeveloped infrastructure (only Prague, Brno and Jihlava had access to the Czech motorway network in 1991), etc. Last but not least, the low proportion of employees in the progressive tertiary sector in out-of-Prague regions and growing unemployment outside Prague suggest that, economically, all out-of-Prague regions had lagged considerably behind Prague in this period (Blažek, 2001). This can be therefore perceived as 'lagging behind' in terms of office construction potential.

B) 1997–2003 (administrative market development or growing construction intensity)

In this phase, office construction in Prague becomes intensive and expands in Brno and Ostrava, i.e. the second category of towns we have defined.

On average, 88 thousand m^2 of offices were annually built in Prague during this period, while in the first phase it was just 30 thousand m^2. The significant increase in built administrative buildings and the further strengthening of Prague´s position in the real estate market were predominantly backed by high demand for modern offices and the overall economic development of the Czech Republic stimulating the expansion of the private sector (ARTN, 2002). Sýkora (2007) clarifies this situation – while demand had been shaped by the entrance of firms to the Czech market until 1997, it was more strongly driven by the expansion of already-established Prague companies in the second half of the 1990s. As mentioned by Blažek (2001), Prague or the Prague metropolitan area maintained a dominant position at the beginning of the previous decade in terms of the concentration of the headquarters of major firms and progressive tertiary sector firms, compared to the rest of the Czech Republic.

One of the possible interpretations is that Prague continued to keep its dominant position from the point of view of a source of potential demand as opposed to other Czech towns and cities. This consideration is confirmed by Czech Statistical Office data showing another increase in the proportion of progressive tertiary sector employees in that period against the previous period. Apart from the growing demand, office construction growth was supported by the creation of an investment market (the "Property Markets" aggregate factor and generally one of the most highly-rated factors by the developers in our research) – the first let office building was sold to a foreign investor in Prague in 1998. While the first phase was characterized only by the establishment of developers in the real estate market in Prague, actual development was an element of the second phase. Concurrently, renowned real estate agencies that had established themselves in the Czech real estate market, started to educate the market. The education was based on presenting the advantages of newly-built offices which used integrated facility management services, were space-efficient and less energy-intensive, compared to old buildings or partially rehabilitated buildings (Trend Report, 2004).

The first modern office buildings in Brno and Ostrava were finished in 1997 and 2003, respectively. The construction of administrative buildings in both of these towns developed in connection with a trend of relocating some of the supportive business departments (such as call centres and back-up departments), the expansion of IT firms outside Prague (ARTN, 2002, 2004) and, above all, with an altered attitude of developers and real estate investors towards these areas. The most frequent motive for relocation was mainly high rent (see Tab. 4), increasing labour costs and the low unemployment rate in Prague, which encouraged a lot of

[1] Blažek and Csank (2007) reported, based on monitoring the unemployment rate development, GNP, entrepreneurial activity and revenues from tax on the income of natural persons, which inter-regional differences or differences between Prague and the remaining regions, ceased to deepen after 2000.

foreign companies to choose these towns to cut costs and find employees for newly-created jobs more easily. Further, both of the towns offered a large number of students of information technologies and other fields convenient for firms requiring modern offices, and, last but not least, put extraordinary emphasis on science, research and university education development and image improvement.

On the other hand, developers sought substantially less expensive lands outside Prague (Sýkora, 2007), and by expanding to other towns and cities they aimed to eliminate growing competition in the form of newly-accomplished administrative projects, as well as the partial saturation of the market in the Capital City (ARTN, 2004; 2006)[2]. Looking more closely at data for selected indicators, one might

Category	City	Commercial real estate indicator	Phase I**	Phase II**	Phase III**	The most active industries in case of take up (2005-2010)	Ratio on the total net take up (in %)
I	Prague	average prime office rent	48.8 DEM/sqm/month	21.8 EUR/sqm/month	20.0 EUR/sqm/month	finance, banking, insurance	21.5
		average annual vacancy rate	7.20%	15.58%	10.67%	IT	16.6
		average annual take up ****	28,255 sqm	74,669 sqm	135,720 sqm	manufacturing/construction	14.9
		average annual supply	30,447 sqm	88,449 sqm	151,931 sqm	outsourcing, back up	11.9
II	Brno	average prime office rent	X	12.20 EUR/sqm/month	12.40 EUR/sqm/month	IT	28.1
		average annual vacancy rate		18.60%	22.05%	outsourcing, back up	23.8
		average annual take up ****		4,819 sqm	25,555 sqm	manufacturing/construction	18.1
		average annual supply		5,920 sqm	32,784 sqm	finance, banking, insurance	11.2
II	Ostrava	average prime office rent	X	X***	12.20 EUR/sqm/month	finance, banking, insurance	37.1
		average annual vacancy rate			22.75%	IT	29.2
		average annual take up ****			10,285 sqm	outsourcing, back up	17.4
		average annual supply			13,314 sqm	manufacturing/construction	15.2
III	other regional capitals*	average prime office rent	X	X	10.25 EUR/sqm/month	X	
		average annual vacancy rate			not monitored		
		average annual take up ****			not monitored		
		average annual supply			12,417 sqm		

*Tab. 5: Real estate fundamentals per each category (Note: *the cities without any office building completed yet are not incuded; **some indicators were not monitored due to non-existent data basis; ***only one building completed in this phase; ****net take up for A class office stock calculation based on a relation of supply and vacancy rate)*
Source: Knight Frank, CBRE, JLL, DTZ, Cushman&Wakefield, calculations of authors

[2] In the second phase, the vacancy rate for offices in Prague was 15.58% annually on average, and supply exceeded demand for a long time (Table 5). According to the PRUPIM's methodology of vacancy rate calculation (www.prupim.com), vacancy rates higher than 6.7% in Europe are considered a competitive environment. Therefore, high vacancy rates in Prague at the beginning of previous decade can be perceived as highly competitive for office development.

wonder why there was a six-year delay in the development of office construction in Ostrava compared to Brno. We believe that it was caused by the interplay of several factors. Unlike Brno, Ostrava was perceived quite negatively in the 1990s. Firstly, firms and developers were confronted, in the case of Ostrava, with the poor image of a structurally handicapped region without the presence of a larger number of services. Developers were discouraged from their activities also by the greater availability of lower-standard office areas previously used by former industrial businesses. The better accessibility to Prague, Bratislava or Vienna from Brno by road, played an important role, too, while Ostrava did not have any access to the motorway network or high-speed railway.

For other towns, this phase was notable in that it brought a reform of local governments and the formation of new Regions, as of 1 January, 2000. Olomouc, Liberec, Pardubice, Zlín, Karlovy Vary and Jihlava became new regional capitals, which enhanced their regional importance. This change had no impact on the construction of office buildings at first, however, because no modern administrative building was finished in these towns in this period. Nevertheless, some developers started to prepare construction projects for areas outside of Prague, Brno and Ostrava, owing to the favourable economic development of the Czech Republic and the related increasing demand of firms for offices in smaller towns (due to savings). The relocation of firms' supporting departments from Prague to these towns was motivated, in a similar fashion to that of Brno and Ostrava, by the minimization of costs and better availability of labour than in Prague, where there had been the lowest unemployment rate on a long-term basis and considerably higher wages. The developers' motivation to carry out projects in these towns was analogous to the cases of Brno and Ostrava, i.e. better availability of cheaper lands and an escape from the highly competitive environment in Prague. The gradual improvement of transport accessibility to the towns outside Prague is considered another impulse to increase their attractiveness in terms of future demand and development. In the period 2001–2004 railway corridors connecting Prague with Ústí nad Labem, Pardubice, Olomouc, Ostrava and Brno were reconstructed, and new motorways were built. Although motorway construction was far more intensive after 1998, no motorways were finished at that time.

C) 2004–2010 (most intensive construction, its decrease and subsequent stagnation)

In the last period we have defined, the market for administrative premises went through a phase of continuing development and then a rapid construction drop after 2009. Similar trends were recorded in other CEE capitals, such as Budapest or Warsaw. This period is characterised with office buildings being constructed in towns other than Prague, Brno and Ostrava – those we have assigned to the third size category – Plzeň, Hradec Králové, České Budějovice, Liberec, Pardubice and Ústí nad Labem. Only in Olomouc, Zlín, Karlovy Vary and Jihlava were there no international top-quality standard rental administrative units built.

Accession of the Czech Republic to the EU in 2004 appears to be an important milestone, as it strengthened the belief of institutional investors in the real estate market. After 2004 the average annual volume of investments in administrative buildings increased to almost 700 million EUR per year, compared to about 150 million EUR per year in the previous period. Almost all of the investment transactions, however, were in Prague. Contributing to the further reinforcement of the Capital City's dominant position in the administrative market, the increased capital inflow helped implement a larger number of development projects there. On average, about 151 thousand m^2 of offices were annually built in Prague in the period 2004–2010, which is twice the amount in the previous period (see Tab. 4).

Of course, investment market activities were just one of the impulses intensifying construction in Prague. As in the previous phases, an essential role was played by demand for offices (ARTN, 2010), which was driven, analogously to the previous period, by the further expansion of companies, the need to raise user standards for offices, and the relocation of supporting departments of international firms to Prague. The increased activity of firms and the related need for more premises was driven especially by economic growth, foreign trade development, the further development of services and growing consumption by the population (ARTN, 2006; 2008; 2010). The trend of growing demand for offices in Prague is evidenced by another increase of the proportion of employees in the progressive tertiary sector, as opposed to most of the remaining regions. In this period, the development of other reporting indicators – the number of university students and average wages – confirms that Prague was well ahead of other regions in these categories, which we perceive as another comparative advantage of the Capital City for further office construction.

Construction in Brno in this period was motivated by the demands of IT firms (e.g. ICZ, IBM, Honeywell, Acer, Seznam), out-sourcing firms (e.g. Giga Byte), and financial institutions (e.g. Volksbank CZ) (ARTN, 2006; 2008; 2010). Brno's attractiveness was supported by the fact that it was an important European trade-fair centre, as well as an important base for research and development and technological centres, which influenced a number of companies in their location decisions (Fig 4, see cover p. 4). In Ostrava or the Moravian-Silesian Region (Ostrava's catchment area, with approximately 1 million inhabitants), demand for offices was driven by IT firms (TIETO), supporting bank departments (HSBC), large industrial holdings or companies providing support to these holdings. Demand for offices had been largely encouraged by the development of sub-contractor and advisor firms in the region, due to the opening of a Hyundai plant in Nošovice and a KIA plant in nearby Žilina. The town became even more alluring to firms and developers in 2006 when a regular link (with high-speed Pendolino trains) was opened up to Prague, and the town was connected to the Czech motorway network in 2010. New airport terminals were finished in both towns in 2006. The new terminal had almost doubled the capacity of the international airport in Brno-Tuřany; the new airport hall at Ostrava-Mošnov´s Leoš Janáček Airport had the same impact on the airport's terminal capacity.

Construction development in the remaining regional capitals (i.e. the third category defined above) after 2004 in fact reacted to newly-emerging demands for supporting units and call centres outside Prague, Brno and Ostrava (ARTN, 2006, 2008, 2010). The demand for such units mostly came from financial institutions (Raiffeisenbank in the Ústí nad Labem Region, ČSOB in Hradec Králové, Česká Spořitelna and KBC in Brno, etc.), and telephone operators (e.g. T-Mobile in Hradec Králové). Another important source of regional demand were the requirements of State institutions, especially bodies in charge of the European Union agenda (ARTN, 2008). Office construction in Plzeň developed in this

phase mainly because a very large number of logistics and industrial parks had been built in the town's vicinity from the mid-1990s, which brought a need for offices by firms operating in the parks, as well as companies cooperating with the park tenants. Technological research and development traditions at the local university and the presence of IT fields of study played a role, too. Therefore, interest in the locality had been shown by a number of IT firms or companies with business links to Germany (ARTN, 2008).

Significantly less office areas were built in the other towns of the same category – Ústí nad Labem, Hradec Králové, Pardubice and Liberec (Tab. 4). This can be explained not only by low demand for the product but also by developers' mistrust of construction in areas lagging significantly behind in terms of social and human capital, and economic factors, despite the continuously improving transport accessibility of the towns and incomparably lower company operating costs than in Prague, including rent. Factors that had undoubtedly contributed to the increased attractiveness of these towns in this period may include a significant growth in the number of university students and improving transport accessibility. At the beginning of the period, railway corridors connecting Prague and Pardubice and Prague and Ústí nad Labem were finished (they were the first links to be served by Pendolino trains). The D11 Motorway was completed to the outskirts of Hradec Králové and Pardubice in 2006, which resulted in much better transport accessibility to both regional capitals. The R10 was finished a year later, together with the follow-up R35, and this improved Liberec's connection to the main road network. In comparison, Zlín has not seen Motorways R55 and follow-up R49 finalized yet, but the former one ends at Zlín's outskirts and has significantly reduced the travelling time from this town to other Czech towns.

Not a single building of concern for this study, however, was built in four regional capitals in this phase: Olomouc, Karlovy Vary, Zlín and Jihlava. In the case of Olomouc and Zlín, this is a surprising finding because both towns, or their regions show similar values for the reporting indicators as the other towns in this third size category, but where construction had started in this period. We believe that this is largely due to the closeness of these two towns to Ostrava and Brno (note: Olomouc and Zlín Regions used to be parts of the North Moravian and South Moravian Regions, respectively, until 2000, providing them with additional support), and related lagging behind Ostrava and Brno in all size and importance criteria. Thus, it is only logical for both companies demanding modern offices and developers to prefer Ostrava or Brno, which have historically made up significant ground in terms of business development conditions and factors affecting construction (especially social and human capital, and economy), compared to Olomouc and Zlín.

As far as Jihlava and Karlovy Vary are concerned, both towns meet some of the criteria for the construction of administrative buildings – they are connected to major roads, have low labour costs, and a general unemployment rate not much different from the other towns. Moreover, Karlovy Vary had the hall of its international airport modernized in 2006 and is a sought-after spa centre, as well as the scene of international cultural events. There might be several reasons why construction has not been launched in the four towns at this time. A low population size (about 50 thousand inhabitants) or the size of the catchment/work-commuting region, are seen to be essential limiting factors in Jihlava and Karlovy Vary. Neither of these towns has a university of its own, and there is a low number of university students in these regions compared to the other regions. The lowest unemployment rate in the progressive tertiary sector on a long-term basis has also contributed to the situation in Jihlava or Vysočina Region.

There has been a drop in the overall volume of office construction in all reporting size categories in the Czech Republic after 2008, due to the financial and economic crisis (see Fig. 3). The primary cause was not only universal factors, especially restrictions on the debt financing of construction by banks and the reduced inflow of capital from institutional investors to the Czech Republic or Prague, but also a drop in demand for modern offices, with considerable regional differences (ARTN, 2010).

5. Discussion and conclusions

Office construction is a dynamic process reflecting the qualitative importance of towns. Such quality has been partially explained, using several aggregates and an example of indicators representing selected factors. Yet it is obvious that there are other factors for the localization of construction of administrative buildings that have not been defined by the developers in our questionnaire survey. The volume of office construction has been increasing in Prague in the last twenty years proportionately to its increasing primary position as the Capital City. In other words, Prague has kept well ahead of other Czech towns in terms of the intensity and extent of this phenomenon. Certain differences among the rest of the towns have been reflected by the demand situation and the towns' socio-economic development. When comparing the total volumes of office construction, Prague's volume is approximately seven times higher than what has been built in Brno and more than twenty times higher than what has been built in Ostrava, in these twenty years.

Expressed in terms of office construction, differences in the quality of Czech towns partially coincide with the results of Hampl (2005), who represented the quality of towns with the aggregate "Qualitatively Adjusted Complex Size", calculated using the number of inhabitants and the number of job opportunities weighted by the proportion of quaternary activities. The largest difference between these two types of qualitative monitoring of Czech towns is, in particular, in the perception of Brno and Ostrava: considering the total office area, time of creation of the office market, and presence of the investment market, Brno is at a significantly higher level than Ostrava, whereas Hampl (2005) classifies these towns as similar (see below). These differences might be attributed to the insufficiently long period of development of construction of modern office buildings: we have analysed a developing process whereas Hampl analysed a "state" situation, which had been forming for a significantly longer period of time.

When explaining regional differentiation in the construction of administrative buildings, it is worth noting the 'horizontal' geographical location of the individual towns. Regional capitals in close proximity to more developed European countries ("European Core") are endowed with office space, but some of the Moravian towns showing similar values for the reporting characteristics, have not recorded the trend of construction of modern office buildings (e.g. Olomouc and Zlín). The absence of the trend could have been expected in regional capitals with low population and regional importance (Karlovy Vary, Jihlava).

The questionnaire survey results revealed that the real estate market experts participating in the survey include the following factors among the most important for the localization of office construction: the situation in the real estate market (especially demand and investment markets), those indicators aggregated in the groups "Social and Human Capital" and those in "Economy". Respondents in general laid less emphasis on transport accessibility and the role of local activities, and least emphasis on environmental conditions Although the conclusions are determined by the number of indicators obtained from the controlled interviews and by excluding universal factors, the derived aggregation provides an alternative to the models of Fisher and Collins (1999) and Fisher (2005), moving them forward by additionally specifying the importance of individual factors or groups of factors (aggregates), although the assigned weights are only approximate and applicable only for this example of the Czech Republic. The role of these individual aggregates has been confirmed in the subsequent interpretation of data for the construction of office buildings.

In the Czech Republic, the first period was characterised by the creation of the real estate market in the reporting towns and the gradual trend of accepting the construction of modern office buildings. The development of the reporting indicators, substituents of individual factors evaluated within the questionnaire survey, was interesting, too. Prague has maintained its lead in all reporting indicators (population size, proportion employed in the progressive tertiary sector, registered unemployment rate, number of university students, and access to the transport network), in particular in the last ten years, with its leading position established approximately by 2002.

Brno has profiled itself as a town with developing services, research and development from the beginning of the transformation, and the number of university students and progressive tertiary sector employees has significantly increased in the adjacent region in the last ten years. Moreover, the town has been perceived well in terms of its transport accessibility and international recognition (trade fairs). By contrast, Ostrava with a similar number of inhabitants, was associated by the developers with heavy industry and a poor environment. The negative image of the North Moravian city has been brought on also by other factors, such as a substantially lower number of university students than in Brno, worse transport accessibility until 2006, increased unemployment rate, an under-qualified labour force in the Region and a large amount of free lower-standard offices in the town itself. This might provide an explanation why about 2.7 times more modern offices were built in Brno than in Ostrava in the reporting period.

Far less office buildings have been built in the remaining towns, broadly after 2004, and they are lagging appreciably behind the three largest Czech towns in most of the reporting indicators. Due to the short time horizon over which the construction of administrative buildings has been monitored, while accompanied by a range of "unexpected" macroeconomic and political changes, and a certain immaturity or non-existence of regional markets of administrative premises in some of the towns, we believe that the qualitative differentiation of Czech towns using this example of office construction, will require an analysis over a substantially longer time horizon. Even the state and development of several of the reporting indicators suggest that there is still potential for further construction of modern office buildings in the second and, in particular, third category of the towns.

It has been confirmed from the example of Prague (and Brno and Ostrava, to a much smaller extent) that progressive tertiary services are strongly concentrated in the most important towns (Blažek, 1996; Blažek, 2001). Our findings regarding office development suggest that while offices in Prague were generally researched by Czech companies' headquarters or national firms' branches (for more, see Blažek, 2001), usually lower-ranked departments within a corporate hierarchy (call centres, development centres, out-sourcing services, etc.) were placed into other towns. This implies that we may observe patterns of the spatial distribution of work also using the example of the spreading construction of administrative buildings and its related structure of demand (see Massey, 1995; Blažek, 1996; Blažek, 2001).

Our objective was to study the construction of administrative buildings in the regional centres of the Czech Republic. We have explained some basic regional differences and their development over the last twenty years. Nonetheless, we are aware that the development of individual aggregates (and thus the overall construction volume in the country) was dependent particularly on the evolution of macroeconomic characteristics (e.g. the credit crunch in 2007–2009), and the political situation (e.g. the accession of the Czech Republic to the EU) at hierarchically higher levels. Therefore, further research on office construction in the Czech Republic should be carried out more broadly in the context of Central and Eastern Europe, and, most importantly, it should examine the interconnections between construction and the global economy, above all, the investment markets (e.g. Clark, Hebb and Wójcik, 2007; Engelen and Faulconbridge, 2009; Porteous, 1995).

References

AARHUS, K. (2000): Office location decisions, modal split and the environment: the ineffectiveness of Norwegian land use policy. Journal of Transport Geography, 8(4): 287–294.

ADAIR, A., BERRY, J., MCGREAL, S., SÝKORA, L., GHANBARI, P. A., REDDING, B. (1999): Globalisation of real estate markets in Central Europe. European Planning Studies, 7(3): 295–305.

ARTN (2002): Trend Report 2002 [online]. Prague: Association for Property Markets Development [cit. 14.10.2011]. Available at: http://artn.cz/cz/aktivity/trend-report/obecne-informace

ARTN (2004): Trend Report 2004 [online]. Prague: Association for Property Markets Development [cit. 14.10.2011]. Available at: http://artn.cz/cz/aktivity/trend-report/obecne-informace

ARTN (2006): Trend Report 2006 [online]. Prague: Association for Property Markets Development [cit. 14.10.2011]. Available at: http://artn.cz/cz/aktivity/trend-report/obecne-informace

ARTN (2008): Trend Report 2008 [online]. Prague: Association for Property Markets Development [cit. 14.10.2011]. Available at: http://artn.cz/cz/aktivity/trend-report/obecne-informace

ARTN (2010): Trend Report 2010 [online]. Prague: Association for Property Markets Development [cit. 14.10.2011]. Available at: http://artn.cz/cz/aktivity/trend-report/obecne-informace

BERTZ, S. (2002): The peripheralisation of office development in the Dublin metropolitan area – the interrelationship between planning and development interests. Irish Geography, 35(2): 197–212.

BIČÍK, I., JANČÁK, V. (2006): Czech agriculture in the integrating Europe. Acta Geographica Universitatis Comenianae, 48(2): 155–165.

BIRELL, J., GAO, S. (1997): The property development process of phases and their degrees of importance. Cutting edge 1997, RICS.

BLAŽEK, J. (1996): Nové institucionální rámce ekonomiky a regionální rozvoj. In: Hampl, M et al.: Geografická organizace společnosti a transformační procesy v České republice (pp. 303–314). Univerzita Karlova v Praze, Přírodovědecká fakulta, katedra sociální geografie a regionálního rozvoje, Prague.

BLAŽEK, J. (2001): Velké firmy a subjekty progresivního terciéru jako aktéři regionálního rozvoje v České republice. In: Hampl, M. et al.: Regionální vývoj: specifika české transformace, evropská integrace a obecná teorie (pp. 227–249). Univerzita Karlova v Praze, Přírodovědecká fakulta, katedra sociální geografie a regionálního rozvoje, Prague.

BLAŽEK, J., CSANK, P. (2007): Nová fáze regionálního rozvoje v ČR? Sociologický časopis/Czech Sociological Review, 43(5): 945–965.

CARN, N., RABIANSKI, J., RACSTER, R., SELDIN, M. (1988): Real estate market analysis – Techniques and applications. Prentice Hall, Boston.

CLARK, G. L., HEBB, T., WÓJCIK, D. (2007) Institutional investors and the language of finance: the global metrics of market performance. In: Godfrey, J., Chalmers, K. [eds.]: Globalisation of Accounting Standards (pp. 15–33). Edward Elgar, Cheltenham.

CUSHMAN & WAKEFIELD (2011): Internal database of office stock in the Czech Republic. Unpublished material.

CZSO (2011): Regional statistics, Czech Republic in Figures: Czech statistical office, 2011 [cit. 10.11.2011]. Available at: http://www.czso.cz/csu/2013edicniplan.nsf/engp/1410-13

D'ARCY, É., KEOGH, G. (1997): Towards a property market paradigm of urban change. Environment and Planning, 29(4): 685–706.

DES ROSIERS, F., THÉRIAULT, M. (2014): Retail Real Estate. In: Baker, H.K, Chinloy, P. [eds.]: Private Real Estate Markets and Investments: An Overview (pp. 87–106). Oxford University Press, New York.

DRBOHLAV, D., ČERMÁK, Z. (1998): International Migrants in Central European Cities. In: Enyedi, G. [ed.]: Social Change and Urban Restructuring in Central Europe (pp. 87–107). Akadémiai Kiadó, Budapest.

ENGELEN, E., FAULCONBRIDGE, J. (2009): Introduction: financial geographies-the credit crisis as an opportunity to catch economic geography's next boat? Journal of economic geography, 9(5): 587–595.

FISHER, P. (2005): The property development process: Case studies from Grainger Town. Property Management, 23(3): 158–175.

FISHER, P., COLLINS, T. (1999): The commercial property development process. Property Management, 17(3): 219–230.

GARB, Y., JACKSON, J. (2010): Brownfields in the Czech Republic 1989–2009: The Long Path to Integrated Land Management. Journal of Urban Regeneration and Renewal 3(3): 263–276.

GOTHAM, K. F. (2006): The secondary circuit of capital reconsidered: globalization and the US real estate sector. American Journal of Sociology, 112(1): 231–275.

HAMPL, M. (2010): Regionální diferenciace společnosti: obecné typy vývojových procesů. Geografie, 115(1): 1–20.

HAMPL, M. (2005): Geografická organizace společnosti v České republice: transformační procesy a jejich obecný kontext. Praha, Univerzita Karlova v Praze, Přírodovědecká fakulta, Katedra sociální geografie a regionálního rozvoje.

HAMPL, M. et al. (2001): Regionální vývoj: specifika české transformace, evropská integrace a obecná teorie. Praha, Univerzita Karlova v Praze, Přírodovědecká fakulta.

HAVLÍČEK, T., CHROMÝ, P., JANČÁK, V., MARADA, M. (2005): Vybrané teoreticko-metodologické aspekty a trendy geografického výzkumu periferních oblastí. In: Novotná, M. [ed.]: Problémy periferních oblastí (pp. 6–24). Praha,Univerzita Karlova v Praze, Přírodovědecká fakulta, katedra sociální geografie a regionálního rozvoje.

ILÍK, J., OUŘEDNÍČEK, M. (2007): Karlín a jeho proměny v souvislostech postsocialistické transformace Prahy. Geografie-Sborník ČGS 112(3): 292–314.

LUX, M., SUNEGA, P. (2011): Labour Mobility and Housing: The Impact of Housing Tenure and Housing Affordability on Labour Migration in the Czech Republic. Urban Studies, 49(3): 489–504.

MARADA, M. (2006): Dopravní vztahy v Pražském městském regionu. In: Ouřednícek, M. [ed.]: Sociální geografie Pražského městského region (pp. 64–78). Praha, Univerzita Karlova v Praze, Přírodovedecká fakulta, katedra sociální geografie a regionálního rozvoje.

MASSEY, D. (1995): Spatial Divisions of Labour: Social Structures and the Geography of Production. (2. ed.) London, Macmillan.

McGOUGH, A. J., TSOLACOS, S. (1997): The stylised facts of the UK commercial building cycles. Environment and Planning, 29(3): 485–500.

NEDOMOVÁ, E. [ed.] (1999): Trh bydlení, jeho regionální diferenciace a sociální souvislosti. Praha, Sociologický ústav AV ČR.

PARSA, A, McGREAL, S, KEIVANI, R. (2000): Globalisation of Real Estate Markets and Urban Development in Central Europe. RICS Cutting Edge Conference.

PORTEOUS, D. J. (1995): The geography of finance: spatial dimensions of intermediary behavior. Avebury, Aldershot.

PRAGUE RESEARCH FORUM (2014): Office Market Figures for Q2 2014 [cit. 15.8.2014]. Available at: http://www.czech-office.cz/novinky/prague-research-forum-announces-the-office-market-figures-for-q2-2014/

PRUPIM (2011): Information about real estate investments [cit. 10.11.2011]. Available at: http://www.prupim.com

REBELO, E. (2010): Urban planning in office markets: A methodological approach. Land Use Policy, 28(1): 83–95.

SASSEN, S. (1995) On concentration and centrality in the global city. In: Knox, P. L., Taylor, P. J., [eds.]: World Cities In a World-system (pp. 63–78). Cambridge University Press.

STANILOV, K. (2007): The restructuring of non-residential uses in the post-socialist metropolis. In: Stanilov, K. [ed.]: The Post-Socialist City: Urban Form and Space Transformations in Central and Eastern Europe after Socialism (pp. 73–99). Dordrecht, Springer.

SÝKORA, L. (2007): Office development and post-communist city formation. In: Stanilov, K.: The Post-Socialist City: Urban Form and Space Transformations in Central and Eastern Europe after Socialism (pp. 117–145). Dordrecht, Springer.

SÝKORA, L., KAMENICKÝ, J., HAUPTMANN, P. (2000): Changes in the spatial structure of Prague and Brno in the 1990s. Acta Universitatis Carolinae Geographica 35(1): 61–76.

SÝKORA, L. (1999): Changes in the internal spatial structure of post-communist Prague. GeoJournal, 49(1): 79–89.

TEMELOVÁ, J. (2007): Flagship developments and the physical upgrading of post-socialist inner city: The Golden Angel project in Prague. Geografiska Annaler, 89B(2): 169–181.

VITURKA, M. (2010) Regionální disparity a jejich hodnocení v kontextu regionální politiky, Geografie, 115(2): 131–143.

WILKINSON, S., REED, R. (2008): Property development. (5. ed.) Abingdon, Routledge.

WOOD, A. (2004): The Scalar Transformation of the U.S. Commercial Property-Development Industry: A Cautionary Note on the Limits of Globalization Author(s). Economic Geography, 80(2): 119–140.

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Transformations of spatial relationships in elementary education: A case study of changes in two Czech rural areas since the second half of the 20th century

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Abstract

Transformations in the spatial organization of elementary education in the Czech Republic over the last 50 years are examined in this article, via case studies of two rural regions (Turnov district and Zábřeh district). The aim of the study is to investigate the impact of general development trends in elementary schools in territorial detail. Changes in the spatial distribution of schools, the size of school catchment areas, and the main education-related commuter flows are analyzed and visualized in cartographic form, in the context of educational policy and management.

Keywords: *elementary education; educational policy; school patterns; catchment areas; rural areas; Turnov district; Zábřeh district; the Czech Republic*

1. Introduction

With the evolution and expansion of transportation options during the 20th century, demographic changes and the depopulation of peripheral rural areas, there were pressures on restricting the "costly luxury" of the smallest villages having their own school. Many experts and scientists were already dealing with this issue in the 1980s. For example, Tricker and Mills (1987, p. 37) accurately summarized the fact that "educational provision in rural areas has been progressively withdrawn from the smallest settlements and concentrated in larger centres further up the urban hierarchy." This necessarily led to the transformation of access to elementary education and of spatial relationships between communities and schools, municipalities and schools, as well as mutually between educational institutions. In the Czech Republic, several general trends related to this process have been repeatedly identified, e.g. by Hampl, Gardavský, Kühnl (1987), Hampl (2004), etc. The social consequences of school closures, which had the strongest impacts on rural areas, are also well known and were discussed by Bell and Sigsworth, 1987; Nitta, Holley, Wrobel, 2010; Witten, McCreanor, Kearns, Ramasubramanian, 2001, etc.

Nevertheless, the spatial organization of the elementary education system is still undergoing transformation in most developed countries. According to recent research, in many countries this transformation process is still continuing and becoming stronger, as its qualitative characteristics develop (e.g. Łberg-Bengtsson, 2009; Kearns, Lewis, McCreanor, Witten, 2009). The provision of elementary education is a relatively important political issue, which, in the context of overall state governance and economic development, changes over time. The provision of elementary education in rural areas is now often debated in the context of the sustainable development of rural areas, or identities of rural communities in the context of broadly understood spatial policy, planning and management (Kvalsund, 2009; Ribchester, Edwards, 1999; Walker and Clark, 2010).

Most scholarly studies of this issue refer to quantitative data to document the transformation of school patterns and the process of school closures. Some refer to the number of closed schools (Łberg-Bengtsson, 2009) over a short period of time and to local study areas. Other studies focusing on similar time intervals and locations provide a basic comparison of the number of schools at various points in time (Dowling, 2009). Sometimes they are supplemented with an illustration of trends by means of graphs (Kalaoja and Pietarinen, 2009) or, in exceptional cases, by maps (Basu, 2007). The overall scope of these changes at a macro-regional scale, however, is usually not presented (but see Bell and Sigsworth, 1987 for an exception). These are factors that are assumed rather than actually documented by long-term statistics. What do the "dramatic wave of school closures" and the "closure of hundreds of them [schools]", as described by Karlberg-Granlund (2009), mean in the context of changes in larger territorial units, for example, in an entire country?

In our previous studies, we attempted to use the case of the Czech Republic to provide an analysis of school pattern changes on a macro-regional scale for the whole country, approximately in the last 50 years (Kučerová, 2012; Kučerová and Kučera, 2012; Kučerová, Mattern, Štych, Kučera, 2011). Thus, the main trends in school pattern changes have already been documented. Nonetheless, the detailed territorial impact of these changes still has to be presented adequately. This is particularly true for those rural peripheral areas that have been affected most by the school closures. The goal of this article is to use examples at the micro-regional level to demonstrate how the territorial organization of elementary education, as well as the related spatial relationships in access to education in the Czech countryside, changed in the above-mentioned period.

We aim to answer the following questions: What percentage of elementary schools in our model areas have been closed since the mid-20th century? What extensive changes have occurred in the delimitation of the catchment regions of

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individual schools? How have commuter flows changed in specific areas? The findings will be visualized in cartographic form and discussed in the context of overall changes in the Czech Republic as a whole. With the help of these analyses, we aim to acquire a relevant base for a further study of how the provision of education works in the countryside and what are the relationships between actors in elementary education. Far from just involving changes in the temporal and spatial organization of commuting, we presume this transformation was part of a much larger reorganization of territorial, institutional, and social relationships.

The structure of this study, one small part of a larger whole, corresponds with each of our research goals. Within the general framework of providing education, we will first turn our attention to several concepts in educational policy in relation to education at a regional and local level. It is educational policy which creates the legislative, organizational and financial framework for the spatial organization of the educational system. Then, we shift our focus to the methodology of data collection and cartographic visualization of school patterns and commuter flows in the case study areas. The second part of the paper presents an interpretation and generalization of the results.

2. Policy of providing elementary education

2.1 Providing elementary education

The state is responsible for establishing a system of elementary education in its territory, which is centrally guaranteed to ensure a qualified labor force for the national economy and to maintain a society with certain knowledge, skills, and attitudes valued at the given time and by the given culture (Brown, Halsey, Lauder, Wells, 1997). Therefore, it is in the interest of the state that this service is provided uniformly throughout its entire territory at the same level of quality. All students should have an equal access to it regardless of gender, ethnicity, faith, social standing, health status, etc. (see, for example, the Czech School Act No. 561/2004 Coll., or similar legislation in other countries). What do we understand by 'equal access' in physical terms – of distance and other geographical characteristics?

Since the idea of compulsory education became established in the majority of European countries, networks of state-guaranteed schools were slowly built. They more-or-less equally covered the entire territory of the countries. In addition to this public school network, a less thoroughly planned network of educational institutes exists, including those organized by churches and various forms of higher education (Váňová, 2007). General spatial patterns of the organization of activities, as described by Hampl (1998) or Maryáš (1983), for example, tended to be reported with the school network expanding and growing denser. Even non-commercial services can be provided only if certain conditions are met; therefore, some services could be provided only in certain locations (population centres). The inequality in the territorial distribution of services at a micro-regional scale is therefore relatively high. Every educational institution has a defined service provision region. The higher and more specialized the form of education involved, the greater its territorial concentration.

In the school system, therefore, a hierarchy that corresponds with the hierarchy of the significance and size of population centres, can be observed. A similar – yet less progressive – hierarchy can be observed in the elementary school system itself. In most countries with developed educational systems, elementary education is broken down into two levels of education. These two levels may be combined into one institution. On the one hand, there are full elementary schools (hereinafter FES) with all grades of compulsory education. On the other hand, an elementary school can be incomplete (hereinafter IES), which is more common in rural areas with smaller populations of school-aged children. Such schools offer only primary education or perhaps even just several years of primary education. Then pupils must commute to larger schools situated in local centres in order to complete their lower secondary education. This higher level of compulsory schooling is territorially concentrated, as it is provided in a lower number of settlements.

The discussion in many educationally-developed countries is about the position and function of IESs in the school system (White and Corbett, [eds.], 2014). Are IESs fully-fledged components of the educational system, or are they just unequal and inferior partners to FESs? Should IESs be subject to and serve the needs of FESs, or do they have the right to set their own educational goals and function as independent units (Dvořák, Starý, Urbánek, Chvál, Walterová, 2010)? Although most researchers working on small rural schools are in agreement that IESs are culturally-specific educational entities (e.g. Bell and Sigsworth, 1987; Kalaoja and Pietarinen, 2009; Karlberg-Granlund, 2009; Walker and Clark, 2010), IESs are, particularly in educational policy, perceived as lower-level versions of larger urban schools (Kvalsund, 2009). FESs thus serve as the models of "school normality", and various criteria indicating performance, organization, facilities, etc., are presented in relation to and in comparison with FESs. IESs cannot meet the standards expected of urban schools. Therefore, they are necessarily imperfect and perceived as providing lower quality education (Bell and Sigsworth, 1987). This unequal relationship is then projected in school choice preferences and in the characteristics of catchment areas.

2.2 Policy in the management of catchment areas

Since elementary education is compulsory, its accessibility is ensured by legislation establishing the maximum distance – both physical distance and travel time – at which an elementary school could be for pupils who attend it. These limits are usually contained in most school-related legislations.

It was necessary to bring schools as close as possible to their "customers" – to fill the schools without pupils having to overcome transportation difficulties to get there. Thus, pupils were assigned to schools generally according to the school's catchment area, which included the surrounding built-up area, the village, and the nearby isolated homes. Therefore, the elementary school network used to be characterized as being very dense, with at least an IES even in small settlements. As transportation became more effective and less expensive in the 20th century, however, it became easier for pupils to get to schools that were farther away. The ratio between the material inputs per pupil for education at a local school versus transportation elsewhere, changed. Schools with too few pupils quickly found themselves in a very disadvantaged position due to this situation. Moreover, they were often located in buildings in poor technical shape that were difficult to maintain, in small peripheral villages.

One of the priorities of centralized educational policy in most countries is to ensure the quality of elementary education, while maintaining as much financial effectiveness

as possible (Kvalsund, 2009). This, measured by short-term profits, means a guarantee of maximum output (i.e. educated pupils) with minimum input. When these criteria are applied, IESs are clearly less advantaged. If technical and financial means allow for appropriate transportation opportunities, it is more effective for pupils to be concentrated in a smaller number of educational institutes and to ensure their transportation to these centres.

The growing interrelations between individual locations in space created by transportation have resulted in educational policy facing a dilemma in the management of providing education in all regions. Regions that were originally comprised of small catchment areas that were more or less homogeneous are increasing significantly in size and are becoming more heterogeneous. When families consider where to send their children to school, many factors come into play: the nature of the parents' journey-to-work, existing regularly-scheduled public transportation connections, the existence of two schools of different quality at the same distance, etc. (e.g. Walker and Clark, 2010). Due to the limited capacity of particular educational institutes or attempts to distribute public services evenly, most countries originally adopted a policy of delimiting clear catchment areas for each individual settlement unit including a school.

Spatial calculations based on gravitational models were used very often (Marsden, 1977). This directed provision of education does bring schools short-term client stability and greater ease of forecasting market developments in specific areas (e.g. by calculating changes in the number of pupils through population forecasts). In situations where the number of pupils declines or where the age structure of pupils is irregular, however, schools are at a great risk of closure without being able to attract other clients. This only strengthens competitive relationships that lack transparency (e.g. schools "fighting for" pupils). In such educational policies, the unit of interest is not the school (as a single institution). Rather, a school pattern is considered to be an equalitarian unit: a tool for education, in which every school is ideally replaceable by another, if reorganized. This kind of policy does not take into account the specifics of each educational institute nor the local relationships between schools and local communities (Kvalsund, 2009).

Since the 1980s, as a result of population change pressures (declining numbers of pupils), liberalization policies, and attempts at cutting costs while increasing effectiveness in the public sector, many countries have begun to openly support a (quasi-) market environment in the school system (Bradford, 1991; Nekorjak, Souralová, Vomastková, 2011). Strictly defined catchment areas for elementary schools have been abandoned, and parents have been given the possibility to choose which school to send their children to. This type of educational policy openly declares competition between schools, legalizes such competition, and supports a heterogeneous school pattern. It also helps, however, to widen the rapidly increasing gap between "successful" and "unsuccessful" schools – based on generally measurable criteria, such as better test results in statewide tests, contests, etc. The unit of interest has become the individual school, as each school receives generally different funds based on its results (Bradford, 1991; Bajerski, 2011). This once again boosts differences between institutions as well as the territorial inequality in the quality of services provided, as the "ghettoization" of unsuccessful schools occurs (Warrington, 2005; Kovács, 2012).

It is implicit, based on many studies of the issue that small rural IESs are at a disadvantage in comparison to FESs, when it comes to both policies for managing the catchment areas. In the former type of policy, when the school system was managed as a whole unit that is supposed to be as high performing and materially effective as possible, IESs were the most vulnerable during reorganization. As a rule, they were the first to be removed from the system. In the later policy, in which quasi-market mechanisms are introduced into the educational system, FESs are once again more preferred by clients. These schools are often located in the same place where the parents commute to work, or they are found in generally more strategically advantageous locations. Importantly, urban schools also have a persisting image of providing education of higher quality, although this "quality" of education at large schools has never been proven by any data (see Ĺberg-Bengtsson, 2009; Ribchester and Edwards, 1999). We shall keep these conditions in mind during our analyses of model micro-regions in the Czech Republic, where educational policy has also shifted from the first type of management to the second 'quasi-market' type.

3. Methodology and cartographic visualization

In order to assess the transformation of the territorial organization of elementary schools and commuting patterns in a given area and time, it is necessary to understand (1) characteristics of the spatial structure of schools, and (2) commuter flows. The chosen model areas were two Czech administrative regions, so-called MEC (municipality with extended competencies) districts: Turnov and Zábřeh (see Fig. 1). The aim of our research was to examine the transformation of school system organization between different eras of educational policy, particularly during the centrally-planned Socialist regime and during the period of transformation after 1989. The availability of relevant data posed the greatest limitations to the research project.

3.1 School pattern analysis

To analyze the school patterns, it is important to know the number, type and spatial distribution of schools (whether they are FESs or IESs) in the study area at a certain time. This work utilised a database containing information about the presence of elementary schools at a municipal level in the Czech Republic. This database was compiled by Kučerová (2012) and covers four periods: 1961, 1976, 1990 and 2004. For all municipalities in the case study areas, the number of schools and their types were ascertained at the four mentioned time points. The database was also expanded to include current data from 2011, based on the Database of Statistical Data on Towns and Municipalities.

Fig. 1: Location of study area. Source: authors

Nonetheless, studying the location of schools at the municipal level proved to be insufficient. Particularly at the first studied time point, an elementary school occurred in almost every larger settlement unit, and therefore, there was more than one school in each administrative district of each municipality. Thus, it was necessary to define the exact geographical position of each school precisely. For schools that are still in operation, the address was found either on their webpage or on the webpage of the municipality in which they are located. For schools that were closed during the second half of the 20th century, the information about their location was searched in various types of region-specific documents. Former school buildings were often identified because of their typical architecture. This was done through field research and with the help of applications available on-line (orthophotomaps on the map servers Mapy.cz and Google Maps, and using the Street View application in Google Maps).

3.2 Commuter flow analysis

Commuter flows to each school were constructed based on the information about the number of commuters and the directions of their journey. In order to understand commuter patterns and their diversity within a given area, daily movements of individuals or groups of individuals were followed from their starting points (their homes, e.g. permanent addresses of commuters) to their destinations (schools). Thus, the number and significance of links between different parts of the study area and the locations of educational institutions were examined. Other authors constructed regional relationships in a similar way, including Hampl, Gardavský, Kühnl (1987), Hampl (2004, 2005), and most recently Mulíček and Kozel (2012). When combined with the information about settlement characteristics in the studied area, an initial view of service provision in the area is obtained. Thus, we can infer some qualitative characteristics of these relationships (e.g. stability, diversity of commuter situations, and competition between schools).

Most of the above-mentioned publications deal with macro-regional and meso-regional commuter patterns. Therefore, for such studies it is sufficient to work with the territorial administrative unit of the municipality. Many studies focusing on the micro-regional level of territorial administrative units, however, (e.g. Dokoupil, 2008), do not deal with relationships between individual settlements. Data about commuting to school are collected once every ten years as part of the population census. Relevant data from the last census (2011) were not available at the necessary territorial detail at the time when this research was conducted. Therefore, older data from the 2001 census were used. The acquisition of these data was commissioned specifically from the Czech Statistical Office, as publicly available statistics publish only commuter flows involving ten or more people. Although the data were used at the municipal scale, in most cases it was possible to determine simple relationships between the commuter flows and the particular schools. The reduction of the school network in the second half of the 20th century was so significant that, with the exception of regional centres (Turnov and Zábřeh), there was not a single municipality in the study areas that would have more than one school in 2001.

It was not possible to acquire comparable data on commuting to schools from before 1989. As the educational policy in that period assigned each pupil to a school that they had to attend based on their domicile, it can be assumed that there were 'no' commuter flows originating from the school catchment area elsewhere. It was not possible, however, to acquire information about the delimitations of school districts in the entire area of both MEC districts. According to personal interviews with employees from regional archives and representatives from local government and schools, there was no single rule in the past for recording how the school districts had been delimited. No cartographic depictions of these districts could be found. Generally, each former municipal office had a list of settlements that belonged to each school. Only a few of these lists have been preserved in the archives. Therefore, data from the 1961 census contained in the Statistical Lexicon of Municipalities of Czechoslovakia 1965, were selected. In its methodology section, it is stated that the publication contains data about the location of elementary schools provided by former local authorities. Crucially, it was found that the data are listed for all municipal parts, since in most areas, there was more than one school in that era. The state of the school network in 1961 also reflects how it had looked before it underwent a massive reduction in later years (Kučerová, 2012).

3.3 Cartographic visualization of data

For cartographic visualization, data layers from the ArcČR 500 3.0 digital vector geographical database were used, as well as the authors' original layer indicating the locations of schools. Attributes of the existence and types of schools at the two mentioned time points were added to these layers, as well as the proportion of commuting students aged 6–14 from the total number of children of this age outside municipal borders in 2001, and data about where pupils went to FESs and IESs in 1961.

For each studied area, a separate project was created in ArcGIS 10.2. In the first phase, a map scale (1:200,000) and a map projection were selected (Albers equal area conic map projection using two undistorted parallels and with a cartographic meridian intersecting the depicted area). In ArcGIS, shading was also used to classify the territorial units and schools and for the distribution of composition elements. Then, these layers were exported to Corel DRAW X5 and modified. Figures 2–7 show the resulting maps. Creating the commuter outflow arrows (Fig. 4 and 7) for 2001 was the most time-consuming task. It was necessary to compare the commuting database with the data layer tables. The arrows were manually inserted into the maps to make them illustrative, readable and clear. Based on the number of commuting pupils, arrows of six thicknesses were created for each map. This allowed the comparison of the situation depicted in different maps. Arrows indicating the commuter flows to schools within a MEC district are blue, whereas those indicating flows outside of a MEC district are grey. At the intersection points of the arrows, weaker arrows are interrupted. The same solution is used for places where descriptions intersect arrows. On the map, the percentage of pupils commuting to school from each municipality is expressed using a choroplet map.

4. School system transformation during the last 50 years in territorial detail

4.1 General trends in the Czech Republic

Before we turn attention to the rural case study regions, it is necessary to present the main trends in changes happening in the elementary school network in the Czech Republic

over the last 50 years. The elementary school network in the mid-20th century can be characterized as very dense with many rural IESs and multi-age classes, even in the smallest settlements (Trnková, Knotová, Chaloupková, 2010). Nevertheless, several factors in the second half of the 20th century were not favourable for maintaining a dense network of elementary schools. Over the course of merely twenty years, the number of elementary schools fell by one half. While there were approximately 8,000 schools in the Czech Republic at the beginning of the 1960s, in the 1980s there were only 4,000 (Kučerová, 2012).

A range of other factors aided these developments. Some are locally specific to the Czech Republic (e.g. the comprehensive policy of planned development for settlements, reforms in the organization of the educational system and schooling). Other factors are of a more general nature (e.g. demographic changes, world-wide trends in teaching concepts, the transformation from an industrial society to the post-industrial one, and related improvements in the effectiveness, speed and accessibility of transportation). Since this massive reduction in the school network several decades ago, the development of the elementary school network has remained stable. There is only a negligible decrease in the number of schools. Each year, the number of school closings has been usually in single digits, although some years have seen several dozen schools cancelled. The decline in the number of schools has also slackened due to a short-term birth rate increase in recent years, which has produced an adequate number of school-aged children (Hulík and Tesárková, 2009).

In the first half of the study period, the Communist regime (1948–1989) determined the educational policy in the Czech Republic. This policy of central planning created a school system that was managed based on directives featuring strictly-defined catchment regions known as "school districts". Each area was assigned a school to which all school-aged children with a permanent address in the area had to attend to complete their compulsory education. Subsequently, during the post-communist period of transformation, the practice of assigning schools was abandoned. The School Act (Act No. 561/2004 Coll.) currently in force uses the term "district school", and every elementary school operated by a municipality must be assigned a certain coverage area for which this school is a district school. But it does not specify that children domiciled in one school district should only attend the elementary school in that district.

District schools are only intended to ensure that pupils can complete compulsory education. Headmasters of district schools are required to prioritize the acceptance of pupils with permanent residence in their school districts. If the maximum occupancy of the school is not met in this way, then any remaining vacancies can be taken by pupils from other regions. Pupils, however, cannot be legally forced to complete their compulsory education in the school, which the municipality of their permanent residence has established for that purpose. Pupils, or their legal guardians, can decide for themselves which elementary school to attend.

Thus, this system is a combination of strictly-defined catchment areas and free market mechanisms. It should be added that most elementary schools in the Czech Republic have been established by non-commercial entities (90% are run by local governments), and only 2% of such schools are private (Kučerová, 2012). Therefore, the school system is financed largely from public budgets. Many questions are raised about those schools that are financed by a local government that are attended not only by pupils residing in that particular school's district, but also by students from other localities who attend based on their parents' choice.

4.2 Spatial relationships in providing elementary education in rural areas

Both model areas, the Turnov MEC district and the Zábřeh MEC district, cover an area of approximately 250 km^2. Turnov and Zábřeh are towns with similar populations (approximately 14,000 inhabitants) and are both micro-regional centres of rural areas. The number of pupils commuting to schools in Zábřeh was affected by the presence of a nearby town of similar size: Mohelnice. Both Turnov and Zábřeh are located in dales by rivers. Nevertheless, the catchment areas of these regional centres extend into the surrounding highlands with several rural settlements. The most significant difference between the study areas is population density. While Turnov is surrounded by a dense network of very small settlements of less than 100 inhabitants, the population density of the Zábřeh region is much lower and features settlements with more than 200 inhabitants. Already this factor, the size structure of settlements, significantly affects the school pattern.

In 1961, at the beginning of the study period, the number of elementary schools in the two regions was nearly identical: 35 IESs in the Turnov MEC district and 36 in the Zábřeh MEC district, and 7 FESs in each of them. Considering the function of FESs in the school system, it is understandable the number of the schools of this type was less than that of the smaller IESs, which were located in small rural settlements. As a consequence of the fragmented nature of the settlement network in the Turnov region, many settlements in this region did not have their own elementary school in the 1960s. Therefore, many pupils commuted, most often afoot, to schools in the neighbouring villages.

In the following decades, many factors began to contribute to changes in the school patterns. Primary factors included the declining number of pupils in the 1960s, which had a particularly strong impact on rural areas, and the contemporary policies. These policies attempted to concentrate most functions and investments into selected centres with large populations by creating "a centre-based system of settlement". School reforms in the 1960s and 1970s had a non-negligible impact. New educational concepts recommended the closure of IESs, especially small schools with mixed classes (Trnková, 2006). The transport infrastructure in rural areas slowly began to improve with regular bus services (Kučerová, Mattern, Štych, Kučera, 2011) that allowed pupils to travel greater distances to schools. As a result of all these factors, a massive and yet-to-be repeated reduction in IESs took place across the Czech Republic, which deepened the unequal distribution of schools that began to appear in the second half of the 1960s and all through the 1970s (Kučerová, 2012).

Although the school pattern changes in both study areas corresponded with the above-described countrywide trends, the intensity and course of these changes slightly differed in some aspects. While only six schools were closed in the Turnov region before 1976, only 23 of the original 36 schools remained in the Zábřeh region in 1976. The school network in the Zábřeh MEC then stabilized with approximately 20 IESs and 7 FESs. Turnov experienced a period of radical school closures in the second half of the 1970s. The number

of schools was reduced by more than one half. While there were 29 IESs in 1976, only 12 were recorded at the following point in time (1990). In 2011, there still were seven FESs. The number of IESs in the Zábřeh region increased by seven and numbered 18, as compared to 11 in the Turnov region. Thus, the current number of schools in the Zábřeh MEC district amounts to approximately one half of that recorded in the 1960s, while in the Turnov region there is only one third of the number of schools.

These changes significantly influence commuter relationships, which are depicted in Figs. 2–7. Figures 2, 3, 5 and 6 depict the state of school catchment districts in the Turnov and Zábřeh regions in 1961: Figures 2 and 5 depict the settlements falling in the catchment areas of IESs in 1961, and Figures 3 and 6 depict the settlements falling into the catchment areas of FESs. Both areas are highly fragmented in terms of the assignment to IESs in the 1960s. Every IES provides services in a small catchment area in which the distance to the nearest school rarely exceeds 3 km in a beeline. In the Zábřeh region, the catchment districts mainly cover the area of just one settlement, whereas in the Turnov region, pupils from multiple settlement units attended one IES. This was influenced by the already-mentioned differences in the settlement patterns of these case study areas.

As far as the FES catchment areas are concerned, most of the area studied is covered by district schools that are located in regional centres, i.e. in Turnov and Zábřeh. The Turnov school district, however, is much larger than the Zábřeh school district. The reason for this is not only that in 1961 there were three FESs in Turnov and only two in Zábřeh, but also that Turnov had always served as a stronger micro-regional centre to which bus routes led from various directions, which made it possible for pupils even from the periphery to commute directly to school by bus without having to change. The broadly-defined borderlands of both regions include a ring of areas falling in the catchment areas of FESs in smaller micro-regional centres. These were the largest villages in the micro-region with populations of up to 1,000. Zábřeh has more such potential "competitors". It can be observed that the Turnov region, as opposed to Zábřeh, is a more compact, easy-to-define unit that is held together by a dominant and important centre. For school pattern variability, this type of pattern is not beneficial, as IESs face strong competition from easily accessible "opponents": FESs located in the town.

Thus, the dominant position of Turnov had a stronger impact on school closings in the 1960s and 1970s. Figures 4 and 7 depict commuter flows in 2001. It is clear from the depictions that even early elementary education in the catchment areas of former IESs is now covered by FESs in Turnov: see, for example, the municipalities of Klokočí and Mírová pod Kozákovem to the east of Turnov, or the coverage of the municipality of Pěnčín, split between Kobyly and Turnov.) The commuter outflow from oscillating regions in the Zábřeh area was often directed towards the closest small FES in local centres: see the commuter flow from Jedlí to Štíty, not to the actual centre of the region, Zábřeh. Commuter flow directions for pupils completing upper elementary school outside of municipalities that have maintained an IES, generally respect the catchment districts of the FESs to which these municipalities had been assigned in the past. The statistical data about the commuter inflow and outflow do not make it possible to determine how many lower elementary school pupils from municipalities with IESs attend FESs outside of their municipality. This information can be acquired only by directly asking the inhabitants of such municipalities or school officials.

5. Conclusions

In accordance with Tricker and Mills (1987), cited in the Introduction, and based on the two case studies of rural Czech micro-regions (i.e. MEC Turnov district and MEC

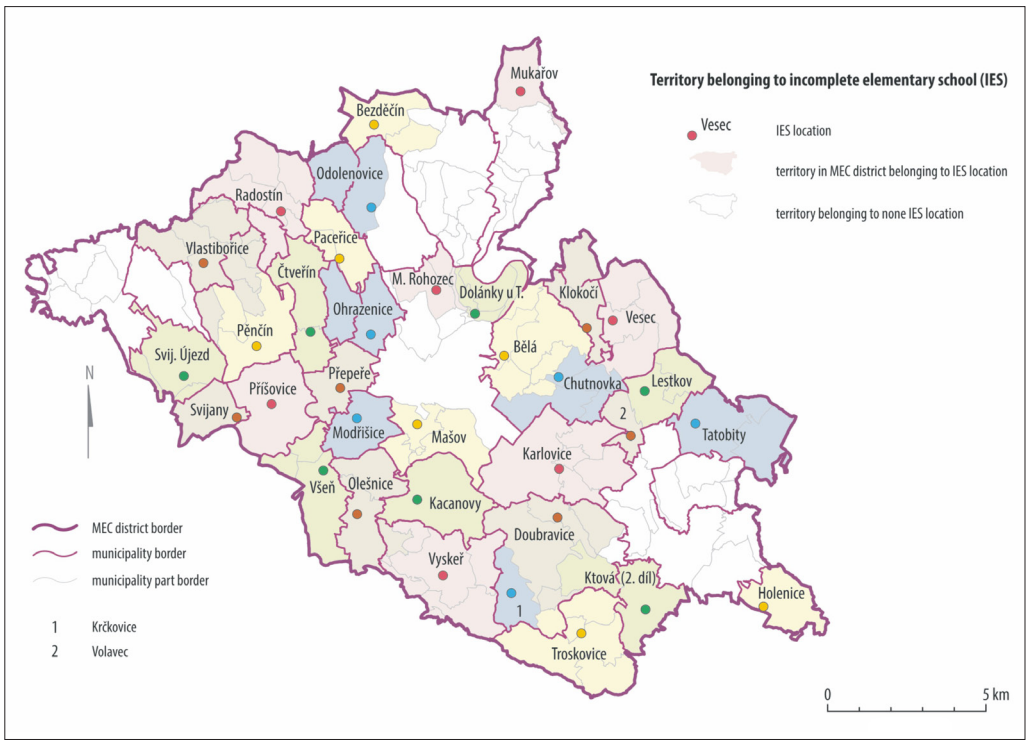

Fig. 2: Catchment areas of incomplete elementary schools (IES) in 1961, Turnov MEC district
Source: authors, based on the Statistical Lexicon of Municipalities of Czechoslovakia 1965

Zábřeh district), we can confirm that this 50-year time period saw: (1) a massive reduction in small rural schools; and (2) strengthening of the functional significance of large settlements (towns).

In both of the model micro-regions, direct commuter links to the regional centres, as well as partially to other larger settlements in these areas, have strengthened. Most rural settlements have lost their educational functions, and have become fully dependent on towns at higher levels of the settlement hierarchy.

The school system is more concentrated in the MEC Turnov district than in the Zábřeh region, mainly because of its fragmented settlement pattern. The distance for commuting to school, even by younger pupils, is greater

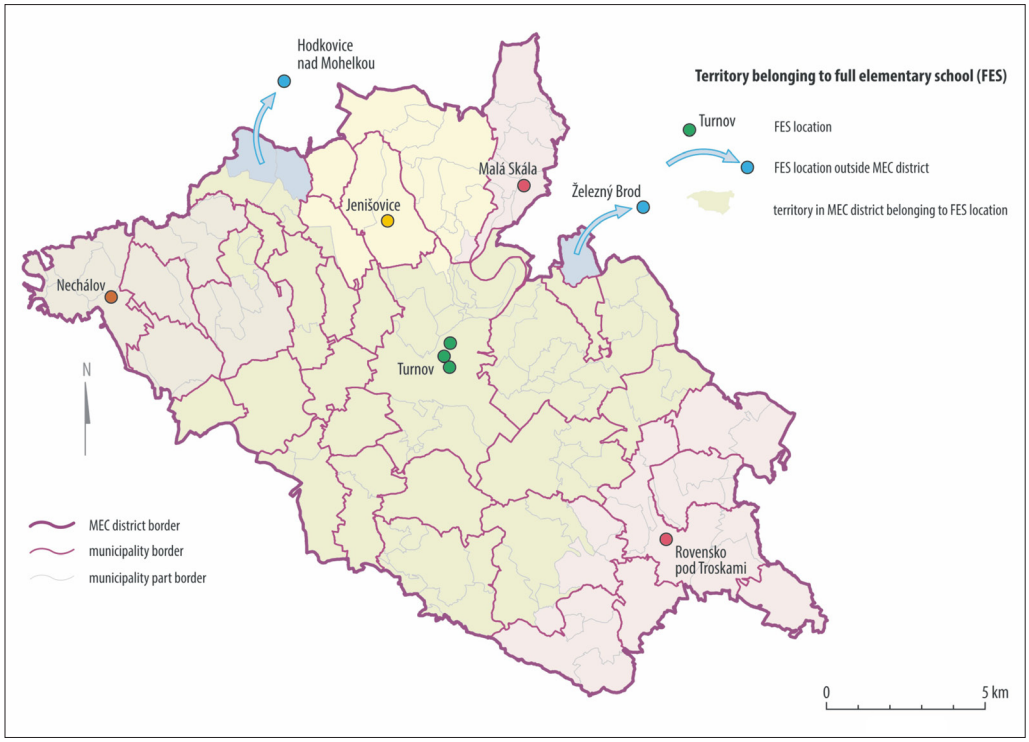

Fig. 3: Catchment areas of full elementary schools (FES) in 1961, Turnov MEC district
Source: authors, based on the Statistical Lexicon of Municipalities of Czechoslovakia 1965

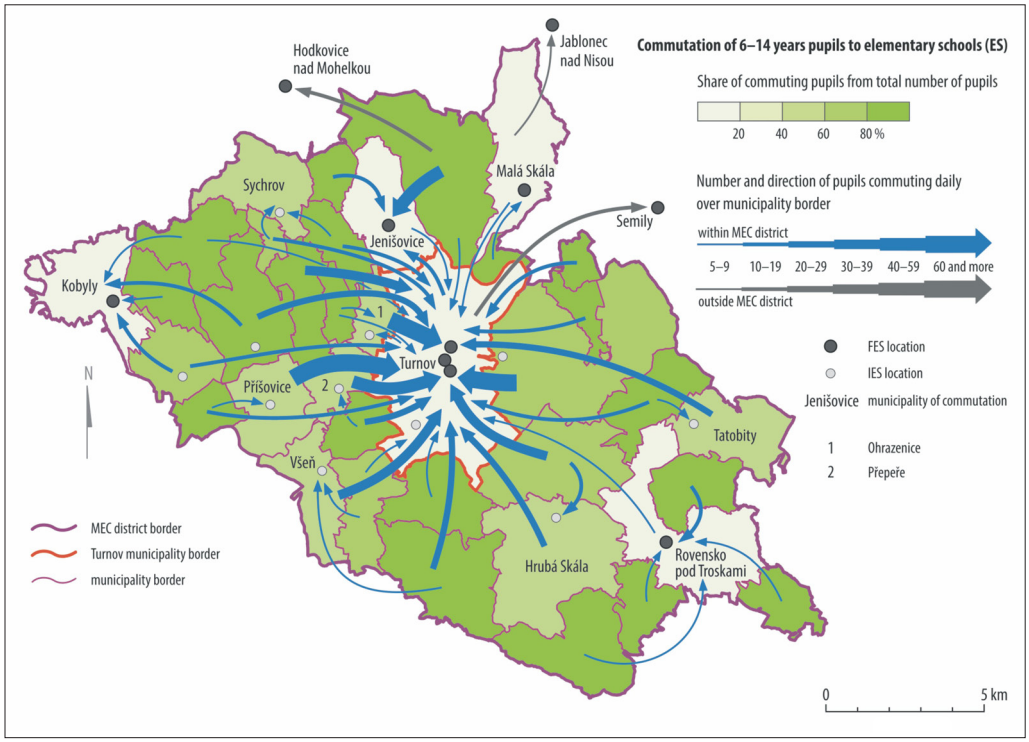

Fig. 4: The number of pupils commuting daily to elementary schools outside of their places of permanent residence and commuter flow directions in 2001, Turnov MEC district
Sources: authors, based on data from the Czech Statistical Office

and the children enter environments different from their place of residence. In addition, the settlement pattern character of the Turnov region affects its overall transport accessibility. In such areas, it is always more difficult to operate mass public transit that is accessible to all and that has connections suitable for getting to and leaving school on time. Therefore, it could be assumed that when selecting schools, many parents in the Turnov MEC district will consider how they can combine their children's commute with their own spatial and temporal movement within their region, which often involves travelling to the micro-regional centre (Temelová, Novák, Pospíšilová, Dvořáková, 2011; Chromý, Jančák, Marada, Havlíček, 2011). This may result in parents choosing a school in the centre, and

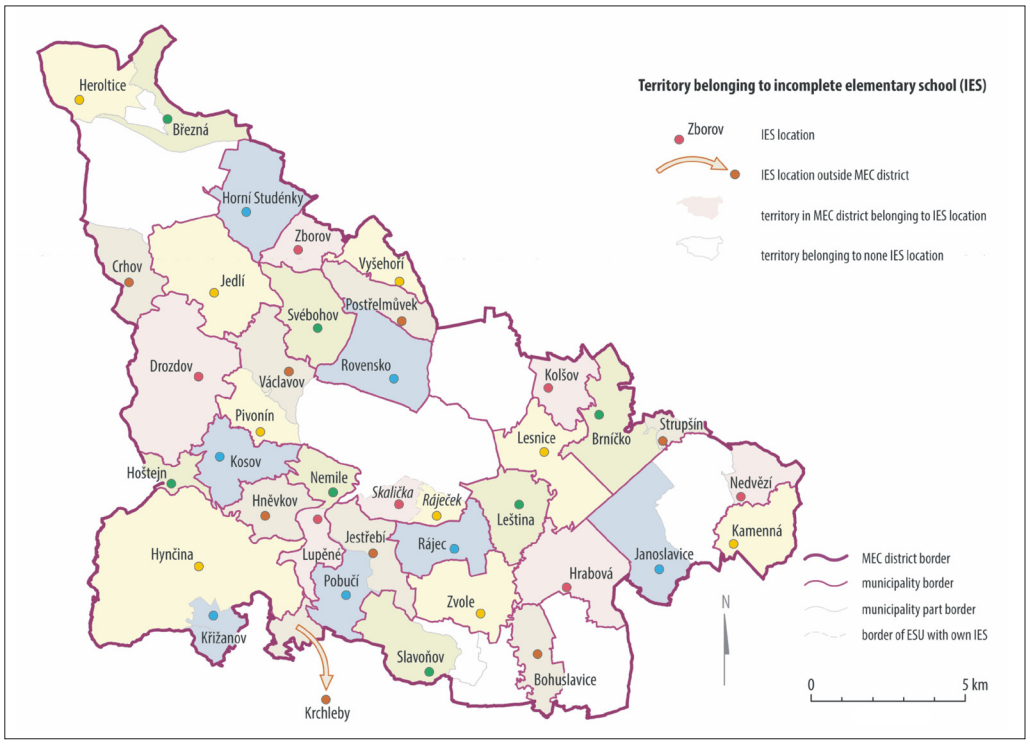

Fig. 5: Catchment areas of incomplete elementary schools (IES) in 1961, Zábřeh MEC district (note: ESU = Elementary settlement unit (a type of territorial statistical unit)
Source: authors, based on the Statistical Lexicon of Municipalities of Czechoslovakia 1965

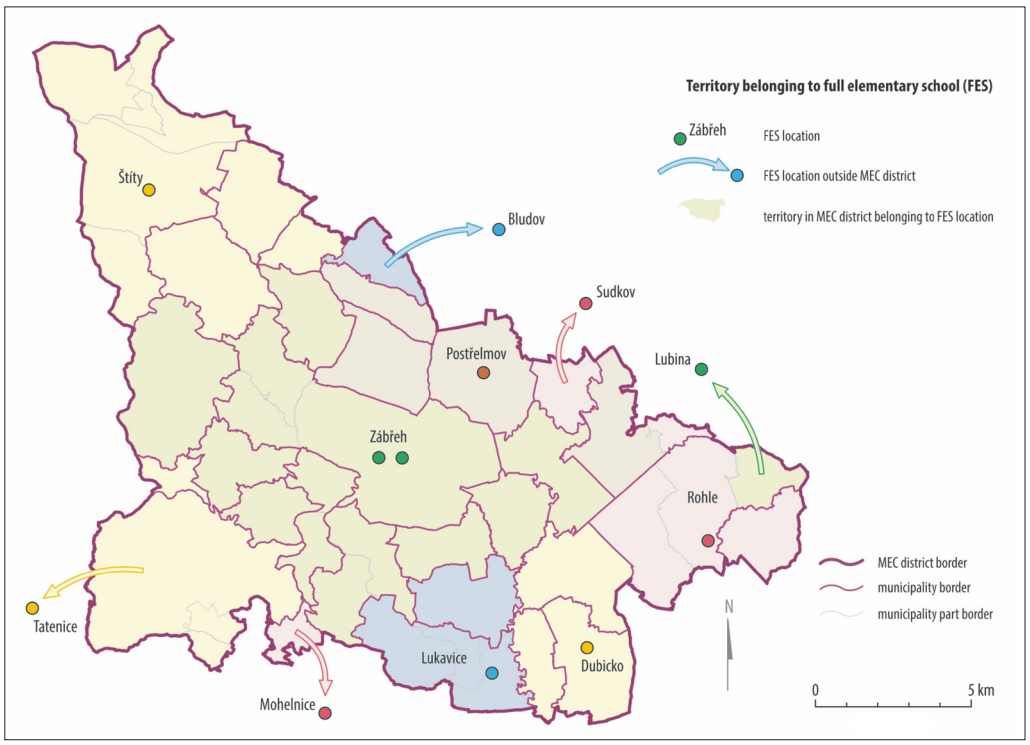

Fig. 6: Catchment areas of full elementary schools (FES) in 1961, Zábřeh MEC district
Source: authors, based on the Statistical Lexicon of Municipalities of Czechoslovakia 1965

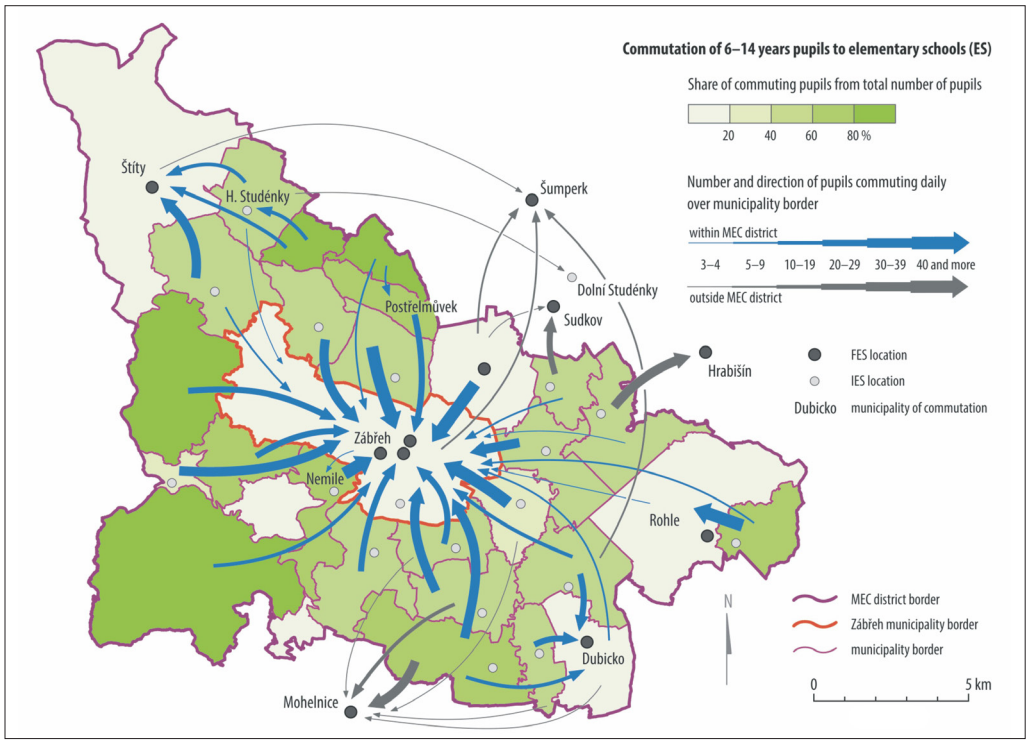

Fig. 7: The number of pupils commuting daily to elementary schools outside of their places of permanent residence and commuter flow directions in 2001, Zábřeh MEC district
Sources: Authors, based on data from the Czech Statistical Office

thus regional links to the centre are strengthened. This is, however, still just an unsubstantiated hypothesis that must be confirmed.

The policies of the Communist regime in the Czech Republic accelerated and reinforced both identified processes of reduction and concentration. In particular, those policy measures geared towards governing the settlement system and distributing investments were significant, and of course the concept of educational policy. The object of interest for educational policy was the school pattern, which was considered an egalitarian unit. This concept of educational policy corresponded with the approaches taken to the educational system in most countries (including western ones). The system was guaranteed to ensure an educated labour force for the economy. In Communist Czechoslovakia, it was also supposed to produce citizens loyal to the state. In order to sustain the elementary school system with a lack of pupils in rural peripheral settlements, a conscious, planned and state-directed liquidation of a large number of IESs was launched (Trnková, Knotová, Chaloupková, 2010). Over the course of twenty years, one half of the schools were closed in one of our study micro-regions and the other area witnessed a two-thirds decrease in the number of schools. As a result, school commuting distances multiplied.

The introduction of a market economy after the fall of the Communist regime in 1989 also introduced elements of competition into a new educational policy. Local government functions have been returned to the municipalities, so that they can once again make decisions about what happens in their territory. Municipalities thus became, among other things, responsible for running elementary schools. Even though a vast majority of the monies needed for the operation of schools comes from the state in the form of redistributed tax revenues, local governments can support their schools by providing additional funds from the municipal budget necessary for operating "less effective schools". Therefore, municipalities are free to decide whether they will finance a school in their jurisdiction, even a school with a small number of students. The fact that there are schools that have been preserved in the case study areas (particularly IESs) can be viewed as an expression of each municipality's support for its school, and the municipality's attempts at maintaining that school.

Another consequence of the free market has an antagonistic effect: parental choice. The increasingly strong links between rural municipalities and micro-regional centres do not just result from the reduction of IESs that took place before 1989. They are also largely the result of parents' preferences in selecting the most suitable elementary school for their children today. These schools can be preferred due to their easy accessibility or due to their better image. Commuter flows from smaller municipalities (Figs. 4 and 7) that have their own elementary school may be evidence of this. In the future, could this approach to educational policy lead to more extensive IES closures, as reported, for example, by Bell and Sigsworth (1987)?

These questions lead to further research. One question that requires more research is: how have the changes in the school patterns, discussed above, been reflected in the relations between the schools in the region? On the one hand, this question particularly applies to relations between IESs in rural areas, but also to relations between rural IESs and the larger FESs in towns, on the other hand. The situation in the Zábřeh MEC district, where a larger number of IESs remained in operation, may put these schools in the position of strong competitors. They are dependent upon local demand, especially as birth rates and the number of pupils decline (Hulík and Tesárková, 2009). In contrast, IESs in the Turnov region may come up against more competition with urban FESs in the micro-regional centre. The relatively large distances between the small numbers of IESs in the Turnov MEC district, perhaps,

does not necessarily lead to an overlap in catchment areas. Therefore, a "common enemy" in the form of FESs could act as a bonding agent among these IESs. It could result in the formation of a counter-weight to the strong FES competitors, and to searching for joint development and cooperative strategies. To answer this type of question, however, more purely qualitative research is required.

Acknowledgement

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References:

ÅBERG-BENGTSSON, L. (2009): The Smaller the Better? A Review of Research on Small Rural Schools in Sweden. International Journal of Educational Research, 48: 100–108.

Act No. 561/2004 Coll., the School Act, from 24 Sept. 2004.

ArcČR 500. Digital Vector Geographic Database of the Czech Republic. [online] [cit. 05.03.2014]. Available at: http://www.arcdata.cz/produkty-a-sluzby/geograficka-data/arccr-500/

BAJERSKI, A. (2011): Organizacja przestrzenn i funkcjonowanie usług edukacyjnych w aglomeracji poznańskiej. Poznań, Bogucki Wydawnictwo Naukowe.

BASU, R. (2007): Negotiating Acts of Citizenship in an Era of Neoliberal Reform: The Game of School Closures. International Journal of Urban and Regional Research, 31: 109–127.

BELL, A., SIGSWORTH, A. (1987): The Small Rural Primary School: A Matter of Quality. London, Routledge.

BRADFORD, M. (1991): School-performance Indicators, the Local Residential Environment, and Parental Choice. Environment and Planning A, 23: 319–332.

BROWN, P., HALSEY, A. H., LAUDER, H., WELLS, A. S. (1997): The transformation of education and society: An introduction. In: Halsey, A. H., Lauder, H., Brown, P., Wells, A. S. [eds.]: Education. Culture, Economy, and Society (p. 1–44) Oxford, Oxford University Press.

Database of Statistical Data on Towns and Municipalities. Czech Statistical Office, 2004, 2005 and 2011 [online] [cit. 13.10.2013]. Available at: http://www.czso.cz/lexikon/mos

DOKOUPIL, A. (2008): Spádovost za službami ve vybraném mikroregionu. Diploma thesis. Brno, Masarykova univerzita, Ekonomicko-správní fakulta.

DOWLING, J. (2009): Changes and challenges: Key issues for Scottish rural schools and communities. International Journal of Educational Research, 48: 129–139.

DVOŘÁK, D., STARÝ, K., URBÁNEK, P., CHVÁL, M., WALTEROVÁ, E. (2010): Česká základní škola: Vícepřípadová studie. Praha, Karolinum.

Google Maps. [online] [cit. 01.12.2013]. Available at: http://maps.google.com

HAMPL, M. (1998): Realita, společnost a geografická organizace: hledání integrálního řádu. Praha, Karolinum.

HAMPL, M. (2004): Současný vývoj geografické organizace a změny v dojížďce za prací a do škol v Česku. Geografie, 109(3): 205–222.

HAMPL, M. (2005): Geografická organizace společnosti v České republice: transformační procesy a jejich obecný kontext. Praha, Univerzita Karlova v Praze, Přírodovědecká fakulta, katedra sociální geografie a regionálního rozvoje.

HAMPL, M., GARDAVSKÝ, V., KÜHNL, K. (1987): Regionální struktura a vývoj systému osídlení ČSR. Praha, Univerzita Karlova v Praze.

HULÍK, V., TESÁRKOVÁ, K. (2009): Dopady demografického vývoje na vzdělávací soustavu v České republice. Orbis Scholae, 3(3): 7–23.

CHROMÝ, P., JANČÁK, V., MARADA, M., HAVLÍČEK, T. (2011): Venkov – žitý prostor: regionální diferenciace percepce venkova představiteli venkovských obcí v Česku. Geografie, 116(1): 23–45.

KALAOJA, E., PIETARINEN, J. (2009): Small rural primary schools in Finland: A pedagogically valuable part of the school network. International Journal of Educational Research, 48: 109–116.

KARLBERG-GRANLUND, G. (2009): Att förstĺ det stora i det lilla. Byskolan som pedagogik, kultur och struktur (Understanding the great in the small. Pedagogy, culture and structure of the village school). Dissertation. Vaasa, Pedagogiska fakulteten, Ĺbo Akademi in Vasa.

KEARNS, R., LEWIS, N., McCREANOR, T., WITTEN, K. (2009): 'The Status Quo Is Not an Option': Community Impacts of School Closure in South Taranaki, New Zealand. Journal of Rural Studies, 25: 131–140.

KOVÁCS, K. (2012): Rescuing a Small Village School in the Context of Rural Change in Hungary. Journal of Rural Studies, 28: 108–117.

KRAFT, S. (2012): Dopravní klasifikace středisek osídlení České republiky: Využití metod shlukové analýzy. Moravian Geographical Reports, 20(3): 38–49.

KUČEROVÁ, S. (2012): Proměny územní struktury základního školství v Česku. Praha, ČGS.

KUČEROVÁ, S., KUČERA, Z. (2012): Changes in the Spatial Distribution of Elementary Schools and Their Impact on Rural Communities in Czechia in the Second Half of the 20th Century. Journal of Research in Rural Education, 27: 1–17.

KUČEROVÁ, S., MATTERN, T., ŠTYCH, P., KUČERA, Z. (2011): Změny dostupnosti základních škol v Česku jako faktor znevýhodnění regionů a lokalit. Geografie, 116(3): 300–316.

KVALSUND, R. (2009): Centralized Decentralization or Decentralized Centralization? A Review of Newer Norwegian Research on Schools and Their Communities. International Journal of Educational Research, 48: 89–99.

Mapy.cz [online] [cit. 01.12.2013]. Available at: http://www.mapy.cz

MARSDEN, W. E. (1977): Historical Geography and the History of Education. History of Education, 6(1): 21–42.

MARYÁŠ, J. (1983): K metodám výběru středisek maloobchodu a sfér jejich vlivu. Zprávy Geografického ústavu ČSAV, 20(3): 61–77.

MULÍČEK, O., KOZEL, J. (2012): Metodika vymezení vztahově uzavřených funkčních regionů. Brno, Polyreg.

NEKORJAK, M., SOURALOVÁ, A., VOMASTKOVÁ, K. (2011): Uvíznutí v marginalitě: vzdělávací trh, „romské školy“ a reprodukce sociálně prostorových nerovností. Sociologický časopis, 47(4): 657–680.

NITTA, K. A., HOLLEY, M. J., WROBEL, S. L. (2010): A Phenomenological Study of Právní výklady (Law construction) 1/2005, Č.j. 20 556/2005-14, MŠMT.

Rural School Consolidation. Journal of Research in Rural Education, 25(2): 1–19.

RIBCHESTER, C., EDWARDS, B. (1999): The Centre and the Local: Policy and Practice in Rural Education Provision. Journal of Rural Studies, 15(1): 49–63.

TEMELOVÁ, J., JAKUB N., POSPÍŠILOVÁ, L, DVOŘÁKOVÁ, N. (2011): Každodenní život, denní mobilita a adaptační strategie obyvatel v periferních lokalitách. Sociologický časopis, 47(4): 831–858.

TRICKER, M., MILLS, L. (1987): Education services. In: Cloke, P. [ed.]: Rural Planning: Policy into Action? (pp. 37–55). London, Harper and Row.

TRNKOVÁ, K. (2006): Vývoj malotřídních škol v druhé polovině 20. století. Sborník prací FF Masarykovy univerzity, U 11 (pp. 133–144), Brno.

TRNKOVÁ, K., KNOTOVÁ, D., CHALOUPKOVÁ, L. (2010): Malotřídní školy v České republice. Brno, Paido.

Ústřední komise lidové kontroly a statistiky a ministerstvo vnitra (1966): Statistický lexikon obcí ČSSR 1965. Praha.

VÁŇOVÁ, R. (2007): Školský systém v českých zemích – vývoj a současný stav. In: Vališová, A., Kasíková, H. et al.: Pedagogika pro učitele (pp. 69–90). Praha, Grada.

WALKER, M., CLARK, G. (2010): Parental choice and the rural primary school: Lifestyle, locality and loyalty. Journal of Rural Studies, 26: 214–249.

WARRINGTON, M. (2005): Mirage in the Desert? Access to Educational Opportunities in an Area of Social Exclusion. Antipode, 37(4): 796–816.

WHITE, S., CORBETT, M. (2014): Doing Educational Research in Rural Settings: Methodological issues, international perspectives and practical solutions. London and New York, Routledge.

WITTEN, K., McCREANOR, T., KEARNS, R., RAMASUBRAMANIAN, L. (2001): The Impacts of a School Closure on Neighbourhood Social Cohesion: Narratives from Invercargill, New Zealand. Health & Place, 7: 307–317.

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The distribution of selected CORINE land cover classes in different natural landscapes in Slovakia: Methodological framework and applications

Róbert PAZÚR [a], Ján OŤAHEĽ [a], Martin MARETTA [b]

Abstract

The distribution of selected CORINE land cover classes in different physical conditions was subject to modelling, analysis and evaluation in this article. In three regions with different geo-relief, the occurrence of land cover classes was analysed by using determinants commonly used in land-use models. Using three different modelling frameworks, the importance of methodological design in land-cover modelling was demonstrated. High levels of explanatory power for the factors defined here were found in landscapes of high heterogeneity. Findings derived from the statistical models highlight the importance of landscape disaggregation by natural conditions in complex land-cover or land-use models.

Keywords: *land cover, land use, regression modelling, neighbourhood effect, physical properties, Slovakia*

1. Introduction and research framework

If we assume that land cover (LC) at some location represents the materialisation of natural and socioeconomic conditions, then the location of each LC class relies on particular spatial relationships. According to Overmars et al. (2003), these spatial relationships can be caused by either a trend or gradient produced by the dependence of a dependent variable (e.g. LC class) upon one or more explanatory factors (independent variables), that are spatially structured, or by the interaction between the sites. It is therefore possible, to some extent, to express these spatial relationships functionally with certain related factors.

Many modelling studies, especially in the field of land use/cover change (LUCC), consider natural and socioeconomic conditions to be the most appropriate factors. The gap between both conditional groups is often filled by derived factors, such as accessibility functions. According to Verburg et al. (2004b), all factors (also called conditions, determinants, properties or driving forces) can have biophysical, economic, social, interactive, neighbourhood or political characteristics. The influence of these factors differs widely in different conditions, however. All landscapes are historically contingent geo-systems, the structure and dynamics of which reflect continuous modifications of pre-existing systems (Demek et al., 2012).

General accessibility factors, spatial policies and neighbourhood interactions are time-varying factors and are, therefore, more important for LUCC models for the defined time periods. Identification of the distribution of LC classes is related more to the historical background of particular locations. One can compare the same territory at different times or different territories at the same time (Balej and Anděl, 2011). It is, therefore, important also to consider the research framework, which requires a strong theoretical background.

A meaningful alternative for the identification of influencing factors is the empirical investigation of factors affecting LUCC at disaggregated level / systematically stratified examples. This approach could facilitate the generalisation of a theoretical framework or the consideration of assumptions prior to the evaluation of any factor's importance. LU/LC research is struggling to develop a conceptual framework, however, that is general enough to overcome disciplinary boundaries or the complexities of comparisons beyond specific locations (Cassidy et al., 2010).

Previous studies (e.g. Ueema et al., 2008; Balej and Anděl, 2011; Pazúr et al., 2012) have shown that landscapes in common natural types have a particular landscape structure. Ueema et al. (2008), for example, showed that the spatial relationship between patches of the same LC class is lower in landscapes with a complex structure and high contrast. A physical regional boundary represents the most significant change section of natural complex characteristics, with distinct differences between the two sides of the boundary (Haibo et al., 2012). Especially in the Central European region, the transition from central planning to a market economy made the suitability of natural conditions crucial for the location of different LC classes (Balej and Anděl, 2011; Pazúr et al., 2014). The incorporation of natural properties in LU/LC studies and modelling techniques is, therefore, highly desirable.

In addition to auxiliary explanatory factors, LUCC models can be enhanced by using neighbourhood factors. Neighbourhood factors reflect forces that cannot be entirely captured by other LUCC drivers, and that are necessary to provide a statistically sound model that deals with spatial autocorrelation (Dendoncker et al., 2007).

Spatial autocorrelation is an important feature of statistical modelling with auxiliary variables and is largely influenced by spatial structures. Regression techniques employed are often cell-by-cell methods in which each pixel is treated as independent (Atkinson and Massari, 2011). Such models reflect only the global distribution and dependencies and do not reveal the self-organising nature of land development, e.g. the clustering of land uses at a local scale (Wu, 2002). To overcome these shortcomings, various

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studies in the LUCC field integrate structural functions into regression (Braimoh and Onishi, 2007; Hengl, 2004; Hengl et al., 2007), or local estimates as in geographically-weighted regression (Brunsdon et al., 2010), or non-parametric estimates as in generalised additive models (Brown et al., 2002), neural networks (Pijanowski et al., 2005), or Bayesian models (Bogaert, 2002). Furthermore, the selection of an appropriate methodology should consider the trade-off between optimising accuracy and optimising generality (Guisan and Zimmermann, 2000).

The main aim of this paper is to investigate and properly describe the distributional agreements and differences of selected CORINE land cover classes in different natural conditions of Slovakia. For this purpose, we studied the spatial relationships of general factors that are frequently used in LUCC studies, with LC composition in three study areas that differ in their natural landscape structure.

In land use models, multiple processes can generate the same pattern, whereas the same process can generate different patterns (Verburg and Veldkamp, 2005). Therefore, land use models can be potentially improved by different parameterisations of simulation models (Lin et al., 2011). To describe these statistical relationships in the most effective way, we compare results from the application of different spatial and non-spatial models. The success or failure of the resulting models is identified in the evaluation process. From this point of view, this paper proposes a combination of methods that can be used accurately in various phases of the modelling process.

2. Materials and methods

2.1 CORINE land cover

Land cover (LC) is the materialised projection of natural spatial assets and land use, whereby natural, recreated (cultivated) and created (artificial) objects of the real landscape are identified as the physical landscape state (Oťaheľ et al., 2004). To identify and delimit the classes of LC in this paper, we used the LC layer generated under the CORINE LC (CLC) Project, often considered the standard European land cover map (Gallego et al., 2011).

The areal features represent the landscape state and consist of the 44 LC classes (31 in Slovakia), mapped to the lowest level (the third level) at a scale of 1:100 000. We used the CORINE LC 2006 data layer, which was derived from the modification of the CORINE LC 2000 data layer and by the computer-aided visual interpretation of IRS and SPOT-5 satellite images, as part of the all-European Global Monitoring for Environment and Security (GMES) Programme (Feranec and Nováček, 2009). Modifications in the data were applied if change from the previous state was greater than 5 ha or if a new patch of at least 25 ha appeared. For details of the CORINE LC methodology, see, e.g. Heymann et al. (1994), Bossard et al. (2000), or EEA (2007).

To increase representativeness, we merged the LC classes to the second classification level, which is limited to a maximum of 13 unique LC classes in the study areas. These classes are listed in Figure 1. In this paper, we particularly focused on identifying the occurrence of urban fabric, arable land, forest, and shrub or herbaceous vegetation associations, classes that are commonly present and cover most of the study areas.

2.2 Study areas

The diverse physical conditions of Slovakia played a primary role in the delimitation of study areas. We used boundaries of natural landscape types that characterize areas of native natural conditions in the present cultural landscapes. This approach is close to the mapping of the potential natural vegetation (Michalko et al., 1986).

Three study areas representing three regions of the main natural landscape types of Slovakia (lowland, basin, and highland) were selected for the purpose of this analysis (Fig. 1). Their basic statistics are listed in Table 1.

In the lowland case study (351,172 ha), biophysical conditions largely influenced the formation of the most developed area in the whole country, including the capital city of Slovakia. This is partly due to proximity to the Danube River, which was historically a major force of development throughout the whole of Europe. The river, together with climatic and soil conditions, was the basis for one of the most productive agricultural areas in this region.

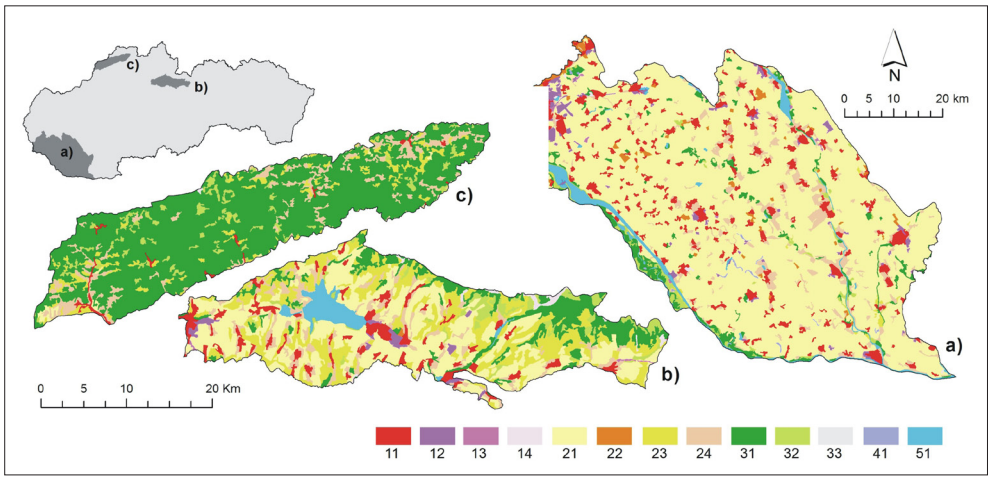

Fig. 1: LC distribution of selected study areas located in (a) lowland, (b) basin, and (c) highland landscapes. The coding of CLC classes is as follows: (11) Urban fabric; (12) Industrial, commercial and transport units; (13) Mine, dump and construction sites; (14) Artificial, non-agricultural vegetated areas; (21) Arable land; (22) Permanent crops; (23) Pastures; (24) Heterogeneous agricultural areas; (31) Forests; (32) Scrub and/or herbaceous vegetation associations; (33) Open spaces with little or no vegetation; (41) Inland wetlands; (51) Inland waters.
Source: authors´ compilation

Statistics	Case study area		
	(a) lowland	(b) basin	(c) highland
Area (ha)	351,172	59,924	50,073
Proportion (LC: %)			
Urban fabric (11)	7.40	6.72	1.10
Arable land (21)	74.71	35.91	0.83
Forest (31)	3.49	12.56	76.49
Shrubs or herb. veg. associations (32)	1.59	4.80	5.16
Other LC class	12.81	40.01	16.41
Average patch size (LC; ha)	368.12	18.44	161.06
Patch density (LC; n/ha)	0.27	0.84	0.62
Edge density (LC; m/100 ha)	23.45	51.99	40.52
Elevation (m)			
Average	116.89	709.71	663.07
Minimum	102.93	465.95	318.62
Maximum	241.80	1,158.76	1,073.83

Tab. 1: Basic statistics of selected case study areas
Source: authors´ calcultaion

Due to high bounding mountains, the basin case study area (59,924 ha) formed the centre of a specific historical, cultural and ethnic region with multifunctional land uses. Contrasting LC classes, such as urban fabric (11) and shrub and/or herbaceous vegetation associations (32), occurred there in relatively close proximity.

The highland case study (50,073 ha) represents the flysch landscape, which is a typical landscape type for this part of Europe. Hilly areas are divided here by valleys, which emphasize their morphological heterogeneity. Forests that dominated on rough and steep sites constitute a fragmented mosaic with heterogeneous agricultural areas (24), shrub and/or herbaceous vegetation associations (32) or pastures (23). Except a small patch of green urban area (part of LC class 14), the urban fabric (11) there was the only LC class characterising artificial surfaces in the CORINE LC nomenclature.

2.3 Logistic regression and determinants for the occurrence of land cover class

Land use factors that best describe land use patterns quantitatively are often selected through (logistic) regression analysis (Overmars et al., 2003). What makes logistic regression especially suitable for LUCC studies is its ability to account for binary dependent variables – the LC classes in our case.

In logistic regression, land use factors are evaluated as independent variables. A variable with the positive sign increases the probability of the occurrence of the evaluated LC class, and the negative sign has an opposite effect. If independent variables were mutually correlated and collinear, we excluded those that were less important for the modelling process in a particular case.

To identify the relevant LC determinants in the different landscapes, we only incorporate general factors that are frequently identified in LC distributional or LC change studies (Lin et. al, 2011) (Tab. 2).

Contour data were interpolated in ArcGIS 10.1 software by using the Topo to Raster tool that ensures proper preservation of the hydro-geomorphic properties of the output digital elevation model (ESRI, 2012). Soil datasets (percentages of clay, sand and silt content in top soils) were generated from the data layer of soil types. We obtained three different soil maps with identical boundaries. We assumed that the continuous nature of this subdivision would improve the forecasting potential of these datasets.

Because of complex 'cause-effect' relationships, some accessibility and socio-economic factors may be unsuitable for describing LU patterns over long time-scales (Dendoncker et al., 2007). Since we assumed that proximities to important

Dataset	Description
CORINE land cover	aggregated to level 2
Clay content (clay)	percentage generated from the soil dataset
Sand content (sand)	percentage generated from the soil dataset
Silt content (silt)	percentage generated from the soil dataset
Elevation (elevat)	digital elevation model grid with the original resolution of 20 m
Slope (slope)	digital elevation model grid with the original resolution of 20 m
Distance to towns of specific importance (city)	cost path distance; centroids of specific towns polygons
Distance to towns (town)	cost path distance; centroids of town polygons
Distance to main rivers (river)	cost path distance; rivers more than 20 m wide

Tab. 2: Datasets used. Source: authors´ calculation

rivers or urban cores represent proxies for market access and trade (Verburg, 2004b; Dendoncker et al., 2007), and therefore have an important role in accounting for urban development, we incorporated these factors into our model. For the regions located in the Slovak basins and foothills, the proximity to rivers and urban cores was especially important during the period of industrialisation. The overall accuracy of these accessibility variables was improved with the digital elevation model.

Prior to the model evaluation, all independent variables were standardised and transformed according to the following formula: $(y - \min) / (\max - \min)$, where y is the initial value and *min* and *max* are the minimum and maximum of the original value of the independent variable (Cheng and Masser, 2003; Ondoš, 2010).

For all modelling methods we used procedures implemented in the R software environment and related packages (R Core Team, 2013).

To ensure the independence of variables, which is one of the prerequisites for the logistic regression model, we investigated the mutual correlation and co-linearity of the variables employed. For this purpose, we calculated a (Pearson) inter-correlation matrix, and validated the results by using the variance inflation factor, which measures how much the variance (square of standard error) of a coefficient is increased because of co-linearity: the higher the value of the variance inflation factor, the more serious the impact of co-linearity on the accuracy of the slope estimate (Ott et al., 2010). Because it was difficult to apply some threshold values or prejudgment rules in both quantifications, the final choice of independent variables was a subjective consideration.

2.4 Purely autoregressive model and enrichment factor

To investigate the location of the selected LC classes, we also analysed a model where the proportion of the surrounding cells occupied by the LC under study was the only independent variable. In the literature, this type of model is considered as a specific purely autoregressive (Dendoncker et al., 2007). For the neighbourhood calculations, we considered the King's case neighbourhood, which equally takes into account all eight neighbourhood cells.

In addition, for the description of the spatial interactions of selected LC classes with the whole range of LC classes, we calculated the enrichment factor. This measure describes the over- and/or under-representation of different LC classes in the particular neighbourhood of the LC class under study (Verburg et al., 2004a). Previous studies showed that the incorporation of this measure significantly improves the accuracy of LUCC models (Verburg et al., 2004a, Verburg et al., 2004b). In using the enrichment factor in the modelling framework, however, one needs to select a specific distance of the neighbourhood for each evaluated class, which may be very subjective. Incorporating multiple distances in the model causes high co-linearity. Therefore, we used the enrichment measure independently and only for informative purposes.

2.5 Spatial autocorrelation

Logistic regression is a spatially homogenous form of the generalised linear model. The per-unit effect of explanatory variables is constant across the landscape (McDonald and Urban, 2006). The spatial autocorrelation, if present, violates the statistical assumptions of independence and can lead to biased inferences (Munroe et al., 2007). Therefore, we identified the autocorrelation by analysing Moran's I index of spatial contiguity, a standardised measure of correlation between observations in neighbouring areas (O'Sullivan and Unwin, 2012; Shortridge, 2007). The neighbourhood definition was similar to a neighbourhood defined in the purely autoregressive model. Negative values of this statistical measure are interpreted as indicating a negative spatial autocorrelation, a value near 0 indicates no spatial relationship, and positive values indicate a positive spatial autocorrelation (Shortridge, 2007).

2.6 Regression kriging

When violations of independence do occur, alternative models that account for dependence in the residuals need to be used (Keitt et al., 2002). Spatial structures, such as spatial dependency, can be described through structure functions, of which the most commonly used are correlograms, variograms and periodograms. (Overmars et al., 2003). In this study, we used the regression kriging described in detail in Hengl (2004) and Hengl et al. (2007). A simplified version of this algorithm could be described in the following steps: (1) determining the logistic model; (2) modelling the covariance structure of the logistic model residuals as a variogram; (3) interpolating logistic model residuals using simple kriging; and (4) adding the interpolated residuals surface to the logistic model surface at each prediction point. In general, the results of regression kriging might be similar to the results of logistic regression analysis in cases where spatial autocorrelation is not present.

2.7 Suitable pixel size

Prior to the analysis, all datasets were unified to the common resolution of the raster data format. The pixel size was selected by investigating the amount of the original information in the unified raster resolution. Applying the approach described in Hengl (2006) and Pazúr (in review), we finally achieved an optimal resolution of the raster cell at 80 metres.

2.8 Evaluation

The modelling procedure was performed using a split-sample approach, where the dataset was randomly divided into two groups with given proportions. The first so-called training sample (70% of all cells in the raster) was used for model calibration and parameter derivation. The quality of the model was evaluated by applying the model parameters in the second so-called test sample (30% of cells). The agreement is expressed as a proportion of the correctly allocated cells of studied LC class presence/absence.

To enhance the robustness of the evaluation we also employed other measures: the area under the curve (AUC) statistics and difference in probability. The AUC statistics expresses the model's ability to predict the probability of the occurrence of the evaluated LC class at various locations in the landscape (Braimoh and Onishi, 2007). The lower bound of the AUC statistics (0.5) expresses the entirely random assignment of modelled probabilities, while the maximum value (1.0) expresses perfect accuracy of the model. To compare the different outcomes of the different modelling approaches, we visualised the AUC values with bar-plots, an approach that was adopted from the study of Lin et al. (2011).

Statistically, more robust results of measuring the model accuracy can by achieved by quantifying the distribution and skewness of the probability values (Atkinson and Massari, 2011; Eastman et al., 2005; Sangermano et al., 2012). Therefore, we used histograms of frequencies for exploring the accuracy of probability values in the areas of occurrence

and absence of particular LC class. In this case, a perfect model would obtain the probability values of 1 in all the areas of occurrence, and the probability values of 0 in all the areas of absence (Sangermano et al., 2012).

3. Results and discussion

Initial results are presented in Table 3. Because of high mutual correlation and co-linearity, we excluded the silt content variable in all study areas from further analysis. Furthermore, for the same reason, we excluded the distance to towns or distance to towns with specific importance in the basin and highland study areas (Fig. 2).

3.1 Lowland case study

The present extension of urban land in this study area was largely determined by the proximity of the capital and existing urban areas. This spatial effect has become more noticeable since the late 1990s, when processes such as suburbanization emerged in this area (Vigašová et al., 2010; Šuška, 2012; Šveda and Križan 2012; Kopecká et al., 2014).

The spatial relationships of urban proximities were also confirmed by our models and enrichment factors. The purely autoregressive model with a simple neighbourhood variable predicted the presence of urban fabric almost perfectly (Fig. 4, Fig. 5). The same is true for the purely autoregressive predictions of all LC classes under study. Regarding the evaluation of selected factors in the logistic model, only the distance to towns and the distance to towns of specific importance partly determined the presence of the urban fabric. The negative values of these coefficients confirm the expected trend of decreasing probabilities of the occurrence of urban fabric with increasing distance from urban centres. The low explanatory power of this model, however, was confirmed by the distribution of probability values (Fig. 5), as well as by the AUC statistics (0.645).

Additionally, the high autocorrelation of model residuals (Tab. 4) illustrates that for the prediction of the urban fabric, much more complex system models are necessary. The interpolation of logistic regression residuals with regression kriging into the test dataset, and their integration into the logistic regression model, increased the accuracy as confirmed by all assessment methods employed.

The evaluation of the urban neighbourhood enrichment clearly expresses how the existence of the capital ity attracted industrial, commercial and transport units (LC class 13, Fig. 6). Climate and historical reasons had conditioned the formation of vineyards near large urban areas, which is expressed by substantial enrichment of permanent crops (LC class 22) at a relatively small distance from urban cores.

Productive soil properties in the rural part of this region determined the large occurrence of arable land. As the logistic regression model tends to predict the location of arable land almost everywhere in the lowland, it was much more difficult to predict the absence of this LC class rather than its occurrence. This trend also reflects in the distribution of purely autoregressive model probabilities. The high proportion of presence pixels also led to a high overall accuracy, stable self-enrichment values and their low standard deviations.

The interpolation of logistic regression model residuals in the regression kriging mode had a large effect on the absence identification (Tab. 4). The proportion of correctly classified absence cells (absence model accuracy) increased in this case from 8.48% to 88.40%. This example only confirms the limitation of reporting the general percentage of correctly classified cells in cases where the proportion of presence or absence of some event (LC class in our case) is small.

Mainly due to the relatively high production potential of the lowland, none of the soil variables here was selected for the logistic regression model. The most important variable in this case is slope. Since there are only a few steeper locations in this area, interpreting the distance to the town centres and the distance to open water surfaces as important variables would be more objective. Both distance factors positively influence the location of arable land. One possible explanation for the relevance of the distance to town variable is utility

		Intercept	Elevation	Slope	Clay	Sand	Silt	City	Town	River	*Intercept	*% in neighbour.
Lowland	11	−1.29	x	x	x	x	--	−2.47	−1.33	x	−7.85	16.13
	21	0.35	x	−14.72	x	x	--	1.40	x	2.12	−7.99	15.70
	31	−3.22	x	8.51	x	x	--	x	2.02	−6.41	−8.31	16.89
	32	−4.28	x	7.10	x	x	--	x	2.97	−8.32	−8.57	17.37
Basin	11	0.06	−3.47	−6.85	x	x	--	−3.67	--	x	−7.68	15.84
	21	0.65	x	−3.04	x	x	--	−2.69	--	0.27	−7.80	15.57
	31	−6.53	8.04	6.03	x	−0.930	--	x	--	x	−7.24	14.73
	32	−6.06	5.71	1.19	−1.66	x	--	1.25	--	−0.81	−7.94	16.50
Highland	11	2.38	−11.01	−5.43	2.24	x	--	−1.13	--	−5.18	−8.08	16.91
	21	−3.11	−4.78	−5.00	x	−0.895	--	x	2.42	1.99	−8.16	16.93
	31	−1.85	2.22	3.85	x	x	--	x	--	0.74	−6.53	12.77
	32	−4.85	3.12	x	1.01	x	--	1.19	--	−0.65	−7.09	14.59

*Tab. 3: Logistic regression and purely autoregressive models for selected land cover classes. Note: All presented entries for variables have the significance level at least at p = 0.05; * intercept and explanatory variable of purely autoregressive model; x = non-significant variable; -- variable not included*
Source: authors' calculations

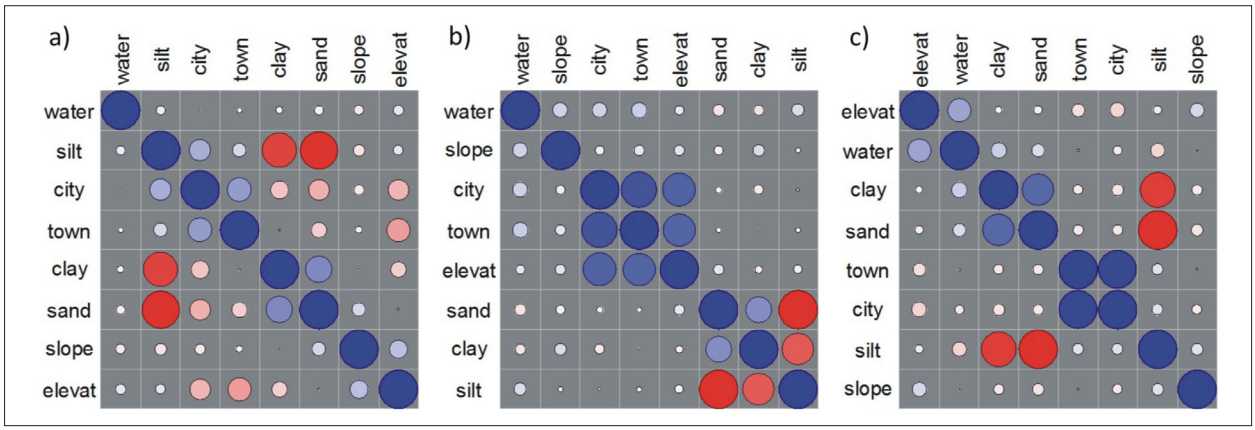

Fig. 2: Inter-correlation matrices of independent variables in (a) lowland, (b) basin, and (c) highland landscapes: blue colour indicates positive correlation; red colour indicates negative correlation. The size of the circles indicates the strength of the correlation (r). Variables are reordered by using principal component analysis.
Source: authors' calculations

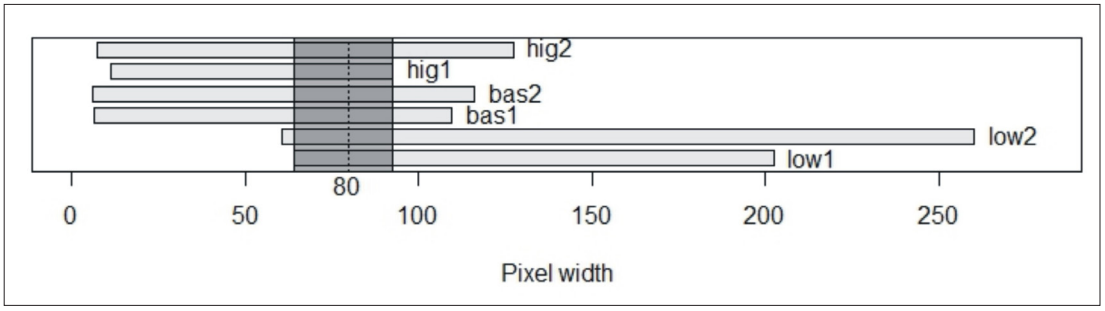

Fig. 3: Intervals of appropriate pixel resolution: (low1) LC in lowland case study; (low2) soils in lowland case study; (bas1) LC in basin case study; (bas2) soils in basin case study; (hig1) LC in highland case study; and (hig2) soils in highland case study. Source: authors' calculations

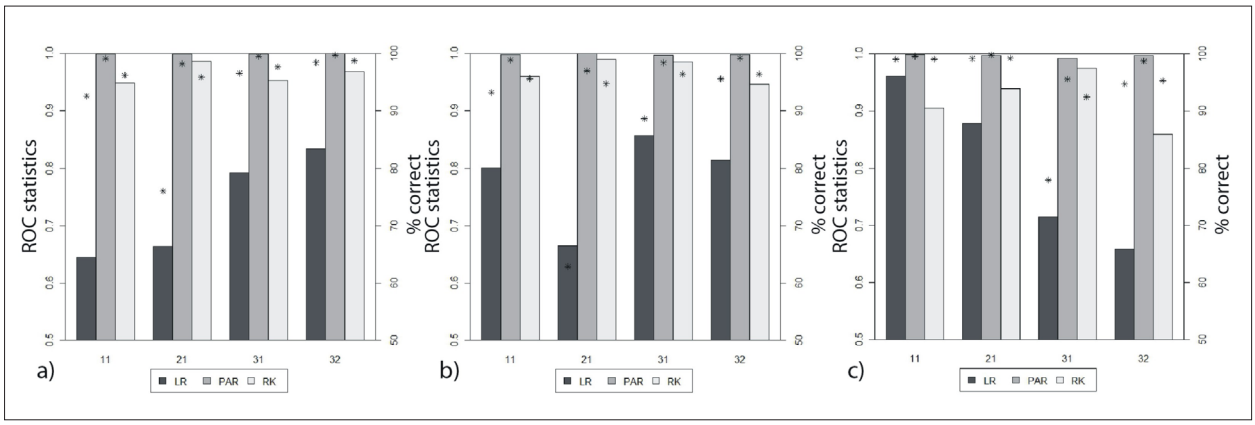

Fig. 4: AUC statistics (bars) and the proportion of correctly classified cells (star dots) for three models (LR – logistic regression, PAR – purely autoregressive, RK – regression kriging) used in three landscapes (a – lowland, b – basin, c – highland). Source: authors' calculations

maximisation and the importance of transportation costs in the overall spatial pattern of land use, as described originally by Von Thünen (von Thünen, 1966; Munroe et al., 2002). Furthermore, the importance of flood control and flood risk may be another factor contributing to the higher probabilities of the location of arable land farther from watercourses.

In this region, results that were more accurate were obtained by modelling the forested areas. Only the regression kriging model, however, resulted in valuable accuracy. Flood-plain forests were located in the neighbourhood of watercourses, mainly the Danube River. The proximity of the river in forest neighbourhoods is also confirmed with a higher than average enrichment, especially at smaller distances. The enrichment factor also shows that areas close to the forest are frequently occupied by pastures (23) or transitional woodland/shrubs (part of the 32 LC class). Forests also cover steeper sites, and according to the logistic model, it is more probable to find forested areas here farther from the towns.

Regarding the accuracy measures, the best result for our lowland case study was obtained by the logistic prediction of shrub and/or herbaceous vegetation associations (32). The

probability distributions show, however, the highest absence prediction among all real presence samples of this LC class. Adjustments of the presence allocation with regression kriging substantially increase the probability estimations. The AUC statistics here are 0.834 for the logistic regression and 0.969 for the regression kriging. The high clustering of this LC class was confirmed by its self-enrichment and location similarities with the forests. To some extent, it was possible to model this LC class as a function of steep sloping sites that are far from the town centres of specific importance and close to the main watercourses. The signs of significant coefficients confirmed the natural character of this LC class.

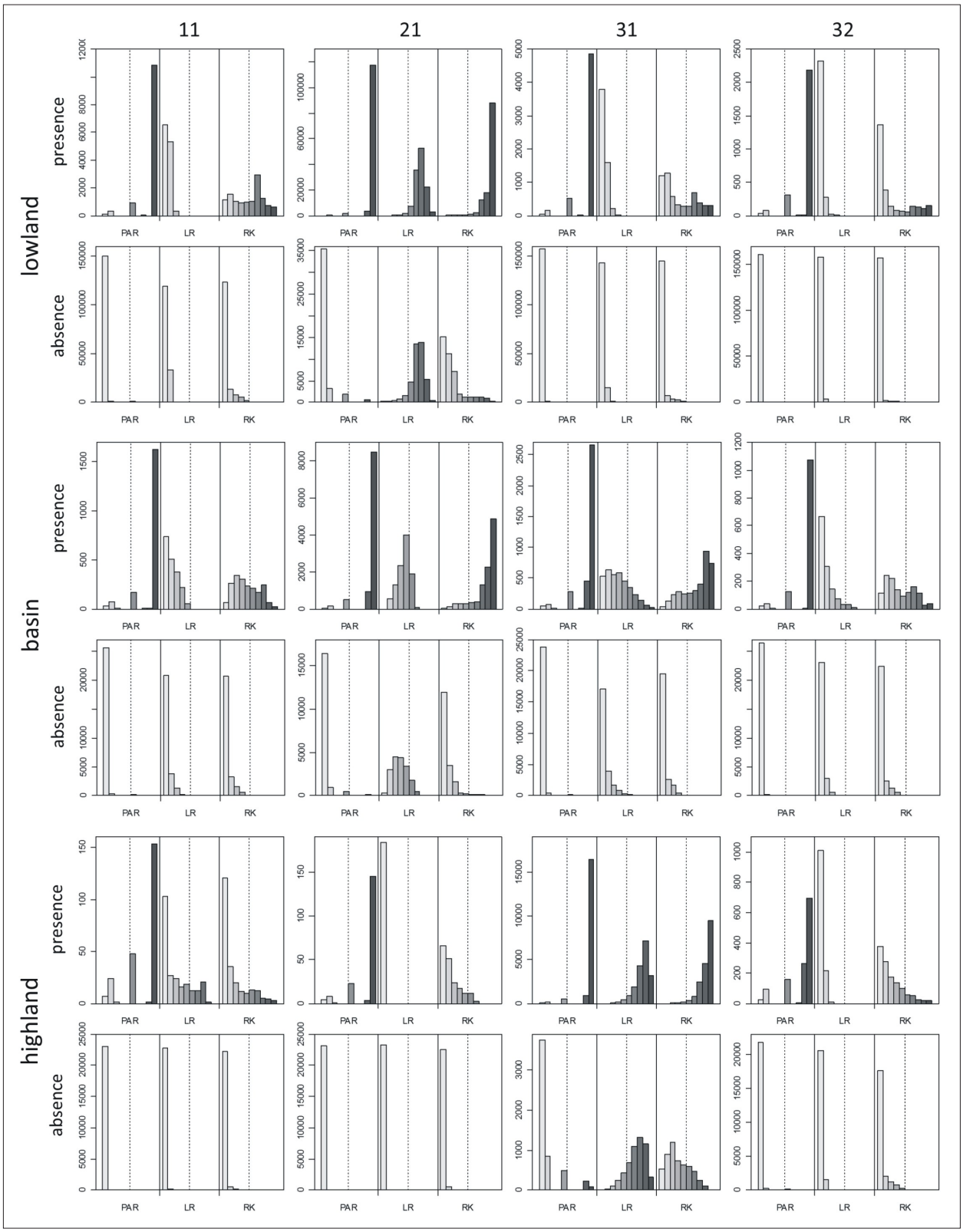

Fig. 5: Frequencies of the probability of the occurrence of selected LC classes in areas of presence and absence using different modelling approaches (LR- logistic regression, PAR – purely autoregressive, RK – regression kriging). Frequencies are binned in 10 bins within the interval 0–1. The dashed line shows the 0.5 value that represents the presence prediction threshold. Note: the y-axis is case specific. Source: authors' calculations

3.2 Basin case study

Multifunctional land use in the basin case study was confirmed by the enrichment values. High neighbourhood self-enrichments were supported with the purely autoregressive models. The AUC statistic values for the autoregressive models ranged between 0.997 and 1.0. Acceptable probabilities also resulted from the other two modelling approaches. In the logistic model, the occurrence of the urban fabric in the basin model was determined by small slope and elevation, as well as by proximity to town centres. High model accuracy was also confirmed by the AUC statistics. The shift of the probabilities towards real values is

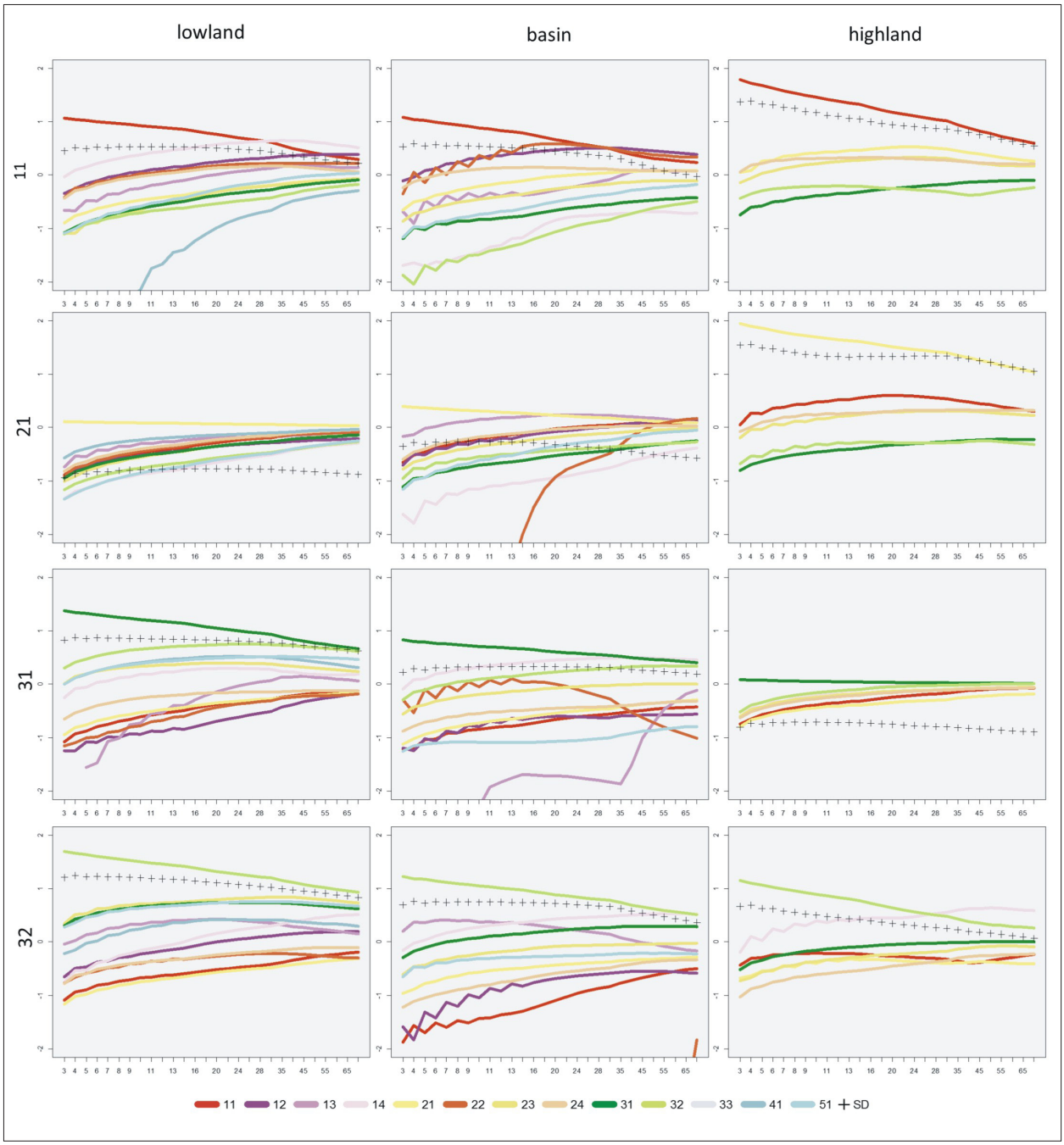

Fig. 6: Enrichment of selected LC classes and their standard deviations (SDs) at different distances. The codes are shown in Fig. 1. Note that the y-axis is at a logarithmic scale; dotted line shows standard deviation
Source: authors´ calculation

LC class	Lowland	Basin	Highland
11	0.796	0.708	0.558
21	0.822	0.781	0.657
31	0.747	0.708	0.666
32	0.718	0.716	0.687

Tab. 4: Moran I index autocorrelation values for logistic regression model residuals. Source: authors´ calculation

clear also from the distribution histograms. As demonstrated in the enrichment plot, the urban forms in this region were also positively related to the location of industrial and commercial zones (12).

Less predictable here was the absence of arable land. Similar to the urban fabric zones, some portion of the variability was explained by the selected factors, especially by elevation, distance to towns and to a smaller extent by the proximity to watercourses. The small AUC values and the close shapes of enrichment factor curves in this region, show that due to homogenous conditions arable land can occur in each locality of the study area. The global autocorrelation value (0.78) indicates the strong spatial relation of logistic model residuals. The interpolation of these residuals with the regression kriging, therefore, significantly increased the model accuracy.

In contrast to the results for arable land, the logistic model is the model for the forested area occurrence, determined by elevation, slope and silt content. Regarding the AUC statistics and probability distributions, this was the best basin logistic regression model.

In reality, forests are mainly clustered and highly enriched by themselves in northern parts of this region. Most forests in these parts occur on lands that were previously maintained for costly agricultural production. The occurrence of forests on high-reaching slopes documents that these locations were hardly suitable for agricultural activities. The residuals of the forest logistic model increased in areas where this LC class occurred. Spatial relationships are expressed with relatively high values of the Moran I global autocorrelation index. Interpolation with regression kriging improved the forest occurrence prediction from 22.13% to 73.95%, resulting in a better overall accuracy.

The occurrence of the shrub and/or herbaceous vegetation associations (32) in the basin is strongly related to forests. Positional and model similarities with forests likely indicated abandonment in the sense of transition from agricultural to forests lands (Kopecká et al., 2012; Pazúr et al., 2014). The remoteness of these locations was expressed particularly by the enrichment factor, where the urban fabric shows the lowest enrichment at almost all distances. It is also interesting that the enrichment of relatively close neighbourhoods of this LC class to garden slots is represented by the artificial, non-agricultural vegetated areas of the LC class (14). Due to the generally lower proportion of forests, the enrichment of this LC class with the other LC classes became higher only at some larger neighbourhood size.

Compared to forests, the logistic regression model for the shrub and/or herbaceous vegetation (32) was more complex. According to modelling results, we infer that the probability of the occurrence of shrub and/or herbaceous vegetation associations (32) in the basin increased in areas characterised by high elevation, slope and clay content, located farther from town centres and closer to main watercourses.

3.3 Highland case study

The urban fabric is clustered here in a few valleys across the landscape, mainly in the south-western part. Such clustering resulted in high self-enrichment and high standard deviation of the self-enrichment values. The significance of the biophysical conditions was confirmed by the logistic model, where the urban fabric could be predicted as a function of elevation, slope, distance to water, distance to town centre and by soil conditions, namely by the high clay content. Half-value logistic regression probabilities correctly predict as much as 99.06% of all urban cells, with an AUC statistic value of 0.961. These accuracies in the results are the best among all LR models. Except for soil properties, all significant variables were negatively correlated with the occurrence of urban land. Most urban fabric cells were predicted in south-western areas, where this LC class was truly concentrated. In those valleys with a low prevalence of this LC class, however, the model failed to predict its occurrence.

The high occurrence of arable land in urban neighbourhoods indicates that the two LC classes share the same conditions as described by our factors. The small overall proportion, however, makes the prediction of arable land occurrence in the mountainous landscape rather difficult. Arable land was highly enriched with itself, but the fields exhibited a considerable variability in terms of neighbourhood. Although our model correctly predicts 99.19% of all arable land occurrence, none of the predicted values exceeds even the smallest plotted probability interval of 0–0.1. Substantial adjustment of these values was provided by the interpolation of model residuals into the test sample dataset. Using the regression kriging approach, the occurrence model accuracy for this LC class increased from zero to 7.6%.

Despite the prediction errors, we obtained a good model performance with the AUC statistics. The occurrence of arable land here is significantly influenced by geo-relief (elevation, slope), soil conditions (percentage of silt content), distance to important urban centres and distance to main watercourses. Contrary to the geo-relief and soils, both accessibility variables increase the probability of the arable land occurrence in a positive way.

Elevation, slope and distance to the river were the only relevant geo-relief characteristics from the database that positively influence the location of forests. Note that such positive influence is opposite to the influence of these factors on the other LC classes under study. The results indicate that forests are inclined to occur in areas that are less suitable for intensive land use. Areas occupied by forests comprised also sites where agricultural usage had become un-economical (Demek et al., 2012). Enrichment factors and their standard deviations demonstrate that the other LC classes occur in the forest neighbourhood only rarely. A sizeable increase in forest absence prediction accuracy was obtained with the regression kriging.

The model fit for the presence of shrub and/or herbaceous vegetation associations (32) was highly inaccurate in the case of mountains (32). The general logistic model, which accounts for elevation, clay content, distances to watercourses and towns as explanatory factors, was able to predict correctly 94.73% of absence cells. Elevation, as the most significant independent variable, documented that this LC class tends to occur at higher elevations.

4. Conclusions

The composition of LC classes in diverse natural landscapes in Slovakia has been analysed in this article. In all cases, we used a similar group of factors, whose selection was based on a literature review in the field of LUCC studies. This means that we did not account for factors that might be most important for LUCC in particular cases or regions. Furthermore, we characterize the spatial distribution of LC classes in a particular region by neighbourhood enrichments.

For the modelling, we used three different regression methods. In agreement with previous modelling attempts, we found that regression kriging and purely auto-logistic regression methods have great modelling potential. Both methods can be successfully applied, for example, to improve LC change models or to improve the quality of input variables. Previous research has shown that regression kriging could efficiently improve the spatial prediction of soil variables (Hengl, 2004). One of the advantages of using purely autoregressive models is that neighbourhood-based variables can be derived using a single land-use dataset (Dendoncker et al., 2007).

Our modelling results showed that factors such as elevation and slope are strongly related to landscape heterogeneity and have, therefore, great prediction potential. If these morphometric parameters significantly vary across the landscapes, they can be used in LC modelling regardless of the landscape structure. This fact was highlighted by the agreement of coefficients that represented these factors in models of the same LC classes among different natural landscapes. A similar agreement was documented in Moravia, for example (Opršal et al., 2013).

From the LC class modelling perspective, the prediction of forests as a function of water proximities appears interesting. In lowland landscapes, forests form the surroundings of large rivers, likely for ecological (floodplain forests of high ecological value) and economic (flood risk control) reasons. In contrast, forests in highland regions, where the main watercourses form valleys with suitable living conditions, are situated mostly in remote areas with difficult access.

In using the selected variables, our predictions lead to a few broad conclusions:

- the prediction potential of more artificial LC classes increases with increasing natural heterogeneity. For LC classes of high naturalness, however, the prediction potential generally decreases with increasing heterogeneity;
- logistic regression was found to be an accurate modelling technique only in cases where models determined by the assumed factors reach high accuracies. Modelling efficiency was improved with the subsequent incorporation of autocorrelation into the model. If the aim is the prediction of the occurrence of a certain event and not knowledge about the importance of the predictors employed, then non-parametric modelling approaches, such as neural networks, may be more appropriate –especially when attempting to generalise information across data sets (Atkinson, 2004; Pijanowski et al., 2005);
- cross-sectional analysis, as a report of overall model accuracy measured in cases of rare occurrences (or rare absence), appeared to be useless. The measurement of the AUC statistics engendered more insights. Reporting model accuracy with just one value, however, tends always to be inexact (King, 1986). Respecting this caveat, we used probability histograms that were an easy-to-follow approach with high evaluation ability. On the other hand, we found such methods to be very rigid. For example, evaluation by the distribution of probability values in presence and in absence cases did not account for increasing probability trends, even if they were located in the direct neighbourhood of presence cells; and
- a common practice in LUCC research is the application and evaluation of different modelling approaches. Previous research has confirmed that case-specific testing of alternative methods is preferred to choosing a method based on arbitrary criteria or habit (Lin et al., 2011), but the role of proper evaluation appears to be underestimated. Our suggestion is to use a combination of different evaluation techniques, from which at least one will be based on a proper visualisation of the probability distribution. A good example in this regard is to follow the "good practice" recommendations described by Olofsson et al. (2014).

In this study, the models were evaluated in three different natural landscapes. We believe that these general findings about the occurrence of LC classes in different landscapes are valid and applicable for a broad range of scales and in different areas with similar natural conditions. More insights into this field may result in the extension of such models with the semantic characteristics of LC classes (Ahlqvist, 2008; Pazúr et al., 2012; Feranec et al., 2014) and/or the comparison of real and artificially generated landscapes (Kun, 2006).

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Supplements

Supplementary data associated with this article can be found at http://www.geography.sav.sk/personal/pazur/analysis/distribution.html

References:

AHLQVIST, O. (2008): Extending post-classification change detection using semantic similarity metrics to overcome class heterogeneity: A study of 1992 and 2001 U.S. National Land Cover Database changes. Remote Sensing of Environment, 112(3): 1226–1241.

ATKINSON, P. (2004): Spatially weighted supervised classification for remote sensing. International Journal of Applied Earth Observation and Geoinformation, 5(4): 277–291.

ATKINSON, P. M., MASSARI, R. (2011): Autologistic modelling of susceptibility to landsliding in the Central Apennines, Italy. Geomorphology, 130(1–2): 55–64.

BALEJ, M., ANDĚL, J. (2011): The role of region delimitation in a study of land cover changes: case study from the Czech Republic after 1990. Moravian Geographical Reports, 19(2): 2–17.

BOGAERT, P. (2002): Spatial prediction of categorical variables: the Bayesian maximum entropy approach. Stochastic Environmental Research and Risk Assessment, 16(6): 425–448.

BOSSARD, M., FERANEC, J., OTAHEL, J. (2000): CORINE land cover technical guide–Addendum 2000. Technical report, 40. Copenhagen, European Environment Agency.

BRAIMOH, A., ONISHI, T. (2007): Geostatistical techniques for incorporating spatial correlation into land use change models. International Journal of Applied Earth Observation and Geoinformation, 9(4): 438–446.

BROWN, D. G., GOOVAERTS, P., BURNICKI, A., LI, M. Y. (2002): Stochastic simulation of land-cover change using geostatistics and generalized additive models. Photogrammetric Engineering and Remote Sensing, 68(10): 1051–1061.

BRUNSDON, C., FOTHERINGHAM, A. S., CHARLTON, M. E. (2010): Geographically Weighted Regression: A Method for Exploring Spatial Nonstationarity. Geographical Analysis, 28(4): 281–298.

CASSIDY, L., BINFORD, M., SOUTHWORTH, J., BARNES, G. (2010): Social and ecological factors and land-use land-cover diversity in two provinces in Southeast Asia. Journal of Land Use Science 5(4): 277–306.

CHENG, J., MASSER, I. (2003): Modelling urban growth patterns: a multiscale perspective. Environment and Planning A, 35(4): 679–704.

DEMEK, J., MACKOVČIN, P., SLAVÍK, P. (2012): Spatial and temporal trends in land-use changes of Central European landscapes in the last 170 years: a case study from the south-eastern part of the Czech Republic. Moravian Geographical Reports, 20(3): 2–21.

DENDONCKER, N., ROUNSEVELL, M., BOGAERT, P. (2007): Spatial analysis and modelling of land use distributions in Belgium. Computers, Environment and Urban Systems, 31: 188–205.

EASTMAN, J. R., VAN FOSSEN, M. E., SOLORZANO, L. A. (2005): Transition Potential Modelling for Land Cover Change. In: Maguire, D., Batty, M., Goodchild, M. [eds.]: GIS, Spatial Analysis and Modelling (pp. 357–385). California, ESRI Press.

EEA (2007): CLC2006 technical guidelines – European Environment Agency, Copenhagen.

ESRI (2012). ArcGIS desktop: Release 10.1. Redlands, CA: Environmental Systems Research Institute.

FERANEC, J., NOVÁČEK, J. (2009): The role of region delimitation in a study of land cover changes: case study from the Czech Republic after 1990. Moravian Geographical Reports, 17(3): 2–9.

FERANEC, J., SOLÍN, L., KOPECKÁ, M., OŤAHEĽ, J., KUPKOVÁ, L., ŠTYCH, P., BIČÍK, I., KOLAŘ, J., ČERBA, O., SOUKUP, T., BRODSKÝ, L. (2014): Analysis and expert assessment of the semantic similarity between land cover classes. Progress in Physical Geography, 38(3): 301–327.

GALLEGO, F. J., BATISTA, F., ROCHA, C., MUBAREKA, S. (2011): Disaggregating population density of the European Union with CORINE land cover. International Journal of Geographical Information Science, 25(12): 2051–2069.

GUISAN, A., ZIMMERMANN, N. E. (2000): Predictive habitat distribution models in ecology. Ecological Modelling, 135(2–3): 147–186.

HAIBO, D., ZHENGFANG, W., MING, L., SHENGWEI, Z., XIANGJUN, M. (2012): Quantitative division of vegetation ecotones in Northeast China. Applied Ecology and Environmental Research, 10(3): 319–332.

HENGL, T. (2004): A generic framework for spatial prediction of soil variables based on regression-kriging. Geoderma, 120(1–2): 75–93.

HENGL, T. (2006): Finding the right pixel size. Computers and Geosciences, 32(9): 1283–1298.

HENGL, T., HEUVELINK, G. B. M., ROSSITER, D. G. (2007): About regression-kriging: From equations to case studies. Computers and Geosciences, 33(10): 1301–1315.

HEYMANN, Y., STEENMANS, C., CROISSILLE, G., BOSSARD, M. (1994): CORINE land cover. Technical guide. Luxembourg, Office for Official Publications of the European Communities.

KEITT, T. H., BJORNSTAD, O. N., DIXON, P. M., CITRON-POUSTY, S. (2002): Accounting for spatial pattern when modelling organism-environment interactions. Ecography, 25(5): 616–625.

KING, G. (1986): How Not to Lie With Statistics: Avoiding Common Mistakes in Quantitative Political Science, American Journal of Political Science, 30: 666–687.

KOPECKÁ, M., VATSEVA, R., FERANEC, J., OŤAHEĽ, J. STOIMENOV, A., NOVÁČEK, J., DIMITROV, V. (2012): Selected changes of arable land in Slovakia and Bulgaria during the period 1990–2006. Moravian Geographical Reports, 20(1): 43–54.

KOPECKÁ, M., VATSEVA, R., FERANEC, J., OŤAHEĽ, J., ROSINA, K. (2014): Urban land cover changes: case studies Trnava (Slovakia) and Burgas (Bulgaria). In: Bičík et al. [eds.]: Land Use/Cover Changes in Selected Regions in the World (pp. 49–55). Volume IX. International Geographical Union Commission on Land Use/Cover Change. Prague, Charles University in Prague, Faculty of Science.

KUN, Á. (2006): Generation of heterogeneous landscapes for models of population dynamics. Applied Ecology and Environmental Research, 4: 73–84.

LIN, Y. P., CHU, H. J., WU, C. F., VERBURG, P. H. (2011): Predictive ability of logistic regression, auto-logistic regression and neural network models in empirical land-use change modelling – a case study. International Journal of Geographical Information Science, 25(1): 65–87.

MCDONALD, R., URBAN, D. (2006): Spatially varying rules of landscape change: lessons from a case study. Landscape and Urban Planning, 74(1): 7–20.

MICHALKO, J., BERTA, J., MAGIC, D. (1986): Geobotanická mapa ČSSR. Veda, Bratislava.

MUNROE, D. K., SOUTHWORTH, J., TUCKER, C. M. (2002): The dynamics of land-cover change in western Honduras: exploring spatial and temporal complexity. Agricultural Economics, 27: 355–369.

MUNROE, D., NAGENDRA, H., SOUTHWORTH, J. (2007): Monitoring landscape fragmentation in an inaccessible mountain area: Celaque National Park, Western Honduras. Landscape and Urban Planning, 83(2–3): 154–167.

OLOFSSON, P., FOODY, G. M., HEROLD, M., STEHMAN, S. V., WOODCOCK, C. E., WULDER, M. A. (2014): Good practices for estimating area and assessing accuracy of land change. Remote Sensing of Environment, 148: 42–57.

ONDOŠ, S. (2010): Bunkový model súčasnej urbánnej morfogenézy na území Bratislavy, Ph.D. thesis. Bratislava, Comenius University.

OPRŠAL, Z., ŠARAPATKA, B., KLADIVO, P. (2013): Land-use changes and their relationships to selected landscape parameters in three cadastral areas in Moravia (Czech Republic). Moravian Geographical Reports, 21(1): 41–50.

O'SULLIVAN, D., UNWIN, D. J. (2010): Geographic Information Analysis. Hoboken. John Wiley & Sons, New York.

OTT, R. L., LONGNECKER, M. T. (2010): An Introduction to Statistical Methods and Data Analysis. Duxbury Press, 6th edition.

OŤAHEĽ. J., FERANEC, J., CEBECAUER, T., PRAVDA, J., HUSÁR, K. (2004): The landscape structure of the district of Skalica: assessment of changes, diversity and stability. Geographia Slovaca, 19, Bratislava, Institute of Geography.

OVERMARS, K. P., DE KONING, G. H. J., VELDKAMP, A. (2003): Spatial autocorrelation in multi-scale land use models. Ecological Modelling, 164(2–3): 257–270.

PAZÚR, R., OŤAHEĽ, J., MARETTA, M. (2012): Analýza priestorovej heterogenity tried krajinnej pokrývky v odlišných prírodných podmienkach. Geografie, 117(4): 371–394.

PAZÚR, R., LIESKOVSKÝ, J., FERANEC, J., OŤAHEĽ, J. (2014): Spatial determinants of abandonment of large-scale arable lands and managed grasslands in Slovakia during the periods of post-socialist transition and European Union accession. Applied Geography, 54: 118–128.

PAZÚR, R. (in review): Capturing the effective cell size in vector-to-raster conversion: methodological framework and its application on CORINE land cover dataset. Transactions in GIS.

PIJANOWSKI, B., PITHADIA, S., SHELLITO, B., ALEXANDRIDIS, K. (2005): Calibrating a neural network-based urban change model for two metropolitan areas of the Upper Midwest of the United States. International Journal of Geographical Information Science, 19(2): 197–215.

R Core Team (2013). R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing. [online] [cit. 19.04.2014]. Available at: http://www.R-project.org/

SANGERMANO, F. TOLEDANO, J. EASTMAN, J. R. (2012): Land cover change in the Bolivian Amazon and its implications for REDD+ and endemic biodiversity. Landscape Ecology, 27(4): 571–584.

SHORTRIDGE, A. (2007): Practical limits of Moran's autocorrelation index for raster class maps. Computers, Environment and Urban Systems, 31(3): 362–371.

ŠUŠKA, P. (2012): Produkcia vybudovaného prostredia v postsocialistickej Bratislave: podmienky, dynamika a územný prejav. Geografický časopis, 64(2): 155–179.

ŠVEDA, M., KRIŽAN, F. (2012): Prejavy komerčnej suburbanizácie vo vybraných odvetviach hospodárstva v zázemí Bratislavy. Ekonomický časopis, 60(5): 460–481.

UUEMAA, E., ROOSAARE, J., KANAL, A., MANDER, Ü. (2008): Spatial correlograms of soil cover as an indicator of landscape heterogeneity. Ecological Indicators, 8(6): 783–794.

VERBURG, P., DENIJS, T., RITSEMAVANECK, J., VISSER, H., DEJONG, K. (2004a): A method to analyse neighbourhood characteristics of land use patterns. Computers, Environment and Urban Systems, 28(6): 667–690.

VERBURG, P. H., ECK, J. R. R. V., NIJS, T. C. M. D., DIJST, M. J., SCHOT, P. (2004b): Determinants of land-use change patterns in the Netherlands. Environment and Planning B: Planning and Design, 31(1): 125–150.

VERBURG, P. H., VELDKAMP, A. (2005): Introduction to the Special Issue on Spatial modelling to explore land use dynamics. International Journal of Geographical Information Science, 19(2): 99–102.

VIGAŠOVÁ, D., PAPAJOVÁ-MAJESKÁ, Ľ., KRÍŽOVÁ, L., ŠVEDA, M. (2010): Land use changes in the suburban zones of Banská Bystrica and Zvolen (Slovakia). Moravian Geographical Reports, 18(3): 43–52.

VON THÜNEN, J. H. (1966): Von Thünen's Isolated State, Pergamon Press, Oxford, UK (P. Hall, [ed.], trans.: originally published as Der Isolierte Staat in Beziehung der Landwirtschaft und National ökonomie Wissenschaftliche Buchgesellschaft, 1875 Darmstadt).

WU, F. (2002): Calibration of stochastic cellular automata: the application to rural-urban land conversions. International Journal of Geographical Information Science, 16(8): 795–818.

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MORAVIAN GEOGRAPHICAL REPORTS

Aims and Scope of the Journal

Moravian Geographical Reports [MGR] is an international peer-reviewed journal, which has been published in English continuously since 1993 by the Institute of Geonics, Academy of Sciences of the Czech Republic, through its Department of Environmental Geography. It receives and evaluates articles contributed by geographers and by researchers who specialize in related disciplines, including the geosciences and geo-ecology, with a distinct regional orientation, broadly for countries in Europe. The title of the journal celebrates its origins in the historic land of Moravia in the eastern half of the Czech Republic. The emphasis for MGR is on the role of 'regions' and 'localities' in a globalized society, given the geographic scale at which they are evaluated. Several inter-related questions are stressed: problems of regional economies and society; society in an urban or rural context; regional perspectives on the influence of human activities on landscapes and environments; the relationships between localities and macro-economic structures in rapidly changing socio-political and environmental conditions; environmental impacts of technical processes on bio-physical landscapes; and physical-geographic processes in landscape evolution, including the evaluation of hazards, such as floods. Theoretical questions in geography are also addressed, especially the relations between physical and human geography in their regional dimensions.

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Fig. 2: Amazon Court building close to Prague city center designed by Schmidt Hammer Lassen (Photo: H. G. Esch)

Fig. 4: View to the new administrative buildings in Brno (Photo P. Klein)

Illustrations related to the paper by P. Domalewski and J. Baxa