

The Spatial Delimitation of Agglomerations in the Czech Republic: The Case of Northwestern Bohemia

Václav Novák

Jan Evangelista Purkyně University in Ústí nad Labem

Abstract

This contribution has a purpose to introduce a method of spatial delimitation of the agglomerations in the Czech Republic. A model territory was chosen in the borderland territory of northwestern Bohemia, which is, on Czech terms, strongly urbanized. In this area, with five larger cities, a high potential of agglomeration with surrounding settlements is supposed.

The data about intercommunal commuting to work, from the Census 2011 were representing the fundamental data complement used for delimitation of agglomerated areas. The algorithm used for defining agglomerations was based on necessity of existence of reciprocal work commuting interactions. It was approached by progressive merging of municipalities with agglomeration, limited by threshold values of preselected relativized commuting criteria.

Except the city of Děčín, the only core of agglomeration that does not lay in the coal field, there were quite extensive agglomerated areas defined. They are not only spatially closed, but they are even neighbors. Except the Ústí agglomeration, delimited agglomerations are reporting low attractivity, in terms of commuting to work. The most significant regional concentration of inhabitants having a high grade of integration are the Ústí and Teplice agglomerations. This finding is in agreement with the regional spatial planning documentation.

Keywords: agglomeration, commuting to work, northwestern Bohemia.

Introduction

One of the objects of study of geography is the identification and study of territory types. That supposes the existence of similar spatial units, with respect to their geographic or functional organization. In this case a contribution follows on a brilliant study by

Stejskalová (2011) dedicated to landscape structures and functional landscape utilization.

Agglomerations, or more precisely agglomerated areas represent the type of area showing a high rate of territorial built-up, and/or high intensity of connections, functional concentration and autonomy. Agglomerations therefore can be defined on the basis of territorial morphology (only continuously built-up area) or on the basis of the interaction intensity between spatially closed settlements units.

For delimitation of larger urbanized complexes a complex quantitative methods can be used, which use geographic information systems (Liu, Dong and Chi 2010). These approaches are used in the Southeast Asia, where population and large-scale metropolitan areas have grown.

For the existence of agglomeration, many authors assume the existence of one dominant centre, around which settlement units are grouped, with high connection on its core. High rate of connectivity is quantitatively given by high intensity of commuting to schools and to services (Halás 2012). The agglomeration is defined similarly by Votrubec (1980), who presumes the existence of one main centre, around which the smaller settlement units are clumped, which profit on the attractiveness of the dominant centre, thanks to it and in its closed hinterland (in the agglomerated municipalities) the number of inhabitants grows. In the agglomerations, with higher or lower intensity, the suburbanization processes connected to both residential and working functions of the agglomerated municipalities, are proceeded.

Intensity of commuting, in case of agglomerations, is not given only by one way movement of inhabitants from agglomerated municipalities to dominant center, but also in the opposite way. With the reciprocity of links between centre and hinterland has worked, for example, Tonev (2013) to identify local labor markets.

This contribution aims to spatially define agglomerations in extensively urbanized region of Northwestern Bohemia, using the data about daily commuting to work. The model territory represents, on Czech circumstances a highly urbanized and industrialised area of northwestern Bohemia, passing mainly due to foreign investments by restructuring the economic base (Hlaváček 2009). A similar transformation of the urbanized areas was described also in other eastern European countries, such as Poland (Krzysztofik 2016). Therefore, attention should be paid to these types of lands. Methodically, it is based on mutual effect of center and agglomerated municipalities. The approaches of a group of Czech authors dealing with processes of suburbanization and organization of geographic area of the Czech Republic were incorporated. Some of Czech authors compared their own method-defined agglomerated territories of the higher order (metropolitan areas) with the definition made in official documents of the public administration (Tonev 2017). Also, in this article, the presented research results were compared with existing national planning documentation, on national level.

Materials and Methods

Mulíček and Sýkora (2009) replace the concept of agglomeration with the expression „functional urban area“ (FUA), which is formed by core and suburbanized zone. The suburbanized zone is represented by municipalities, of which, daily at least 25 % of employed people living in municipality, are commuting to work in each day. At the same time, at least 1000 occupied working places must exist in the centre. Limited usability of this method can be, for example, documented by allowing the creation of FUA, whose center was a municipality with less than 1000 inhabitants (Dukovany). The reason is the fact, that in the area of cadastre of the mentioned municipality is a nuclear power plant. The impact of Mulíček's and Sýkora's work can be seen in the understanding of spatial processes of strongly urbanized areas. City can not be understood in limits given by borders of its cadastre and real spatial dimension of cities and city agglomerations can be identified on the basis of commuting intensity.

Hampl (1996, 2005) also works with the concept of agglomeration by defining the microregional structures of the Czech Republic, based on identification of prevailing flow of commuting to work. Marada and Hampl (2015) used a similar method for spatial definition of microregions of the Czech Republic, but in the addition he also used commuting to schools. Hampl in his monography (2015) admits the seriousness of definition of settlement agglomerations, while himself, as he states, performed merging of municipalities in minimum range. In other words, at least he admits that spatial extent of city agglomerations in the Czech Republic can be assumed to be larger. Kraft, Marada and Popjaková (2014) also point to the lack of standard methods for defining urban agglomeration areas.

Therefore, we will try to compile a universal algorithm for a definition of agglomerations, with the use of daily commuting to work data, from Census of 2011. In the beginning, there is a need to handle the problem of incompleteness of the data bases, because, as Hampl and Marada (2015) state, the Census in 2011 caught up about 600 000 less commuters to work than in the year 2001, while the size of caught up commuting was in total 1.5 milion cases in the year 2011. Hampl and Marada presumes a flatly uniformed incompleteness of data bases and the file of caught up commuting cases as sufficiently predicative and applicable for defining of the regions.

The algorithm applied for spatial identification of agglomerations exists, similarly as in the work of Tonev (2013), from the aggregation method, when in each merging of new municipality with already agglomerated area, the matrix of currents of daily commuting to work is recalculated, within agglomeration, to agglomeration and out off agglomeration.

The combining parametr has, in light of commuting to work, bi-directional character and forms a sum of two shared values:

- share of commuting out to work from the municipality daily to agglomeration, on total number of daily commuting out to work from the municipality (%);

- share of commuters to work to the municipality from the agglomeration on total number of commuters to work to municipality daily (%).

Similarly as in regionalizations conducted for example by Hampl, here also applies that the enclaves and exclaves are excluded. That is why tested municipalities have to, with their cadastral area, neighbour with already defined agglomeration. It also applies, that total number of all commuters to work to tested municipality (both daily and not-daily) must be minimally 10. This condition was estimated for technical reasons, because selected method would be significantly devalued in cases, when units of individuals are commuting to the municipality. Another reason is an assumption, according to which, with the process of agglomeration is related the process of suburbanization connected to above average intensity of jobs allocation into urban hinterland. To this process, to a large extent, contributes the relocation of jobs from the centre to the hinterland. This also leads to interconnection of the core with its immediate agglomerated surroundings. Municipalities with less than 10 commuters to work into municipality can be agglomerated only in case, that they are neighbour upon agglomerated municipalities only so they do not create enclaves inside the agglomerated area.

Tab. 1: The threshold values of combining parameter (the sum of shares of daily commuting and commuting out on total commuting and commuting out) by total number of commuters to work and the commuting index of tested municipality

Commuting Index	Total Numbers of Commuters to Work					
	10-100	100-500	500-1000	1 000-2 000	2 000-5 000	5 000 a více
0-30	130	125	120	115	110	105
30-50	125	120	115	110	105	100
50-70	120	115	110	105	100	95
70-90	115	110	105	100	95	90
90-110	110	105	100	95	90	85
110-150	105	100	95	90	85	80
150-200	100	95	90	85	80	75
200-500	95	90	85	80	75	70
500 and more	90	85	80	75	70	65

Source: Author

They were determined different threshold values of combining parameter. Maximal value of total share values mentioned above was by multiplying empirical testing of agglomerations in the whole Czech Republic established to 130, and that for municipalities with lower number of commuters to work at total (less than 100) and with higher overhang of commuting out upon commuting, when the value of commuting index is lower than 30, whereas the commuting index represents the proportion between total commuting to work to the municipality and total commuting out to work from the municipality multiplied by 100.

The municipality which has higher number of commuters to work and the higher the commuting index, the threshold value of the combining parameters is lower. The stepping reduction of the combining parameter was as well defined by numerous empirical testing of the agglomerations in the Czech Republic, so that the defined agglomerations satisfy minimally such a definition of the great majority of agglomerations, with which Hampl (2005) has worked.

Results

With the method used, were defined agglomerations, that by their number of agglomerated municipalities are outreaching the spatial scope given by Hampl (2005). Agglomerated areas are geographically closed or adjoined. All the agglomerations are geographically located inside its districts of administration of municipalities with extended terms of reference.

Special case presents the agglomeration of Most-Litvínov. The city of Most with its 67 thousand inhabitants is, by population, more than twice as larger as Litvínov (26 thousand inhabitants), but the commuting attraction of Most (4,2 thousand commuters to work) and Litvínov (2,9 thousand commuters to work) is considerably more balanced than the population predominance of Most. Litvínov is presented by commuting index 133,5 whereas Most only 91,0. It means that more inhabitants are commuting out to work from Most than commuting in. The commuting flow from Most to Litvínov is higher than the opposite. In relation to appreciable cohesion of both cities, which besides the commuting circumstances is given also by the existence of mutual cohesion of public transportation, we are naming this concentration of inhabitants, as the agglomeration of Most-Litvínov.

Pic. 1: Northwestern Bohemian agglomerations by the Census 2011



Source: Census, 2011

By both, the number of municipalities and the population size, from the analysed agglomerations, surpasses the Děčín agglomeration. Děčín as the only core of agglomeration does not lay down in pelvic region. The interactional character of combining parameter did not allow Děčín to agglomerate more than two municipalities. A great importance represented the condition of minimal 10 commuters to the municipality, which did not accomplish to join most of the municipalities to Děčín.

The agglomerations of Ústí nad Most-Litvínov are, according to the population size, two of the most important agglomerated areas. They are comparable with the number of inhabitants. With both, the expanse and number of municipalities, the agglomeration of Most- Litvínov, which, with the agglomeration of Chomutov, reports extremely low values of density of population of non-core zone. The reason are an extensive areas of mining zones of surface, where mining of the brown coal leads to depopulation of settlement immediate surroundings of Most, Litvínov and Chomutov. The settlement units around these cities, although have strong commuting connections tn their cores, however the level of suburbanization of brutal surface mining devastated area is minimal here.

Considerably much higher rate of (sub)urbanization reports the non-core zone of both Ústí and Teplice agglomerations, which is also confirmed by the data of population density. Both spatial concentrations of inhabitants are neighboured together and are by mutual commuting interactions strongly integrated. These two agglomerations are representing the core of strongly urbanized area of Northwestern Bohemia.

Tab. 2: Basic territorial characteristics of Northwestern Bohemian agglomerations by census 2011

Agglomeration	Number of Municipalities	Population	Area (km²)	Density of Population (Population/km²)
Chomutov	18	79 862	345,7	231,0
Core	1	49 784	46,4	1 072,9
Non-core Zone	17	30 078	299,3	100,5
Most-Litvínov	21	112 922	369,3	305,8
Core	2	93 271	127,6	731,0
Non-core Zone	19	19 651	241,7	81,3
Teplice	11	84 659	159,1	532,1
Core	1	50 728	23,8	2 131,4
Non-core Zone	10	33 931	135,3	250,8
Ústí nad Labem	11	113 378	228,2	496,8
Core	1	95 003	94,0	1 010,7
Non-core Zone	10	18 375	134,2	136,9
Děčín	3	56 108	174,1	322,3
Core	1	50 620	117,7	430,1
Non-core Zone	2	5 488	56,4	97,3

Source: Census 2011, Author

Tab. 3: Basic characteristics of commuting to work of Northwestern Bohemian agglomerations by census 2011

Agglomeration	Number of Commuters-in	Number of Commuters-out	Commuting index
Chomutov	6 221	8 344	74,6
Core	4 253	3 497	121,6
Non-core Zone	1 968	4 847	40,6
Most-Litvínov	9 151	10 103	90,6
Core	7 143	6 828	104,6
Non-core Zone	2 008	3 275	61,3
Teplice	7 927	8 757	90,5
Core	5 093	4 281	119,0
Non-core Zone	2 834	4 476	63,3
Ústí nad Labem	9 764	6 975	140,0
Core	7 554	4 130	182,9
Non-core Zone	2 210	2 845	77,7
Děčín	2 938	3 692	79,6
Core	2 702	2 753	98,1
Non-core Zone	236	939	25,1

Source: Census 2011, Author

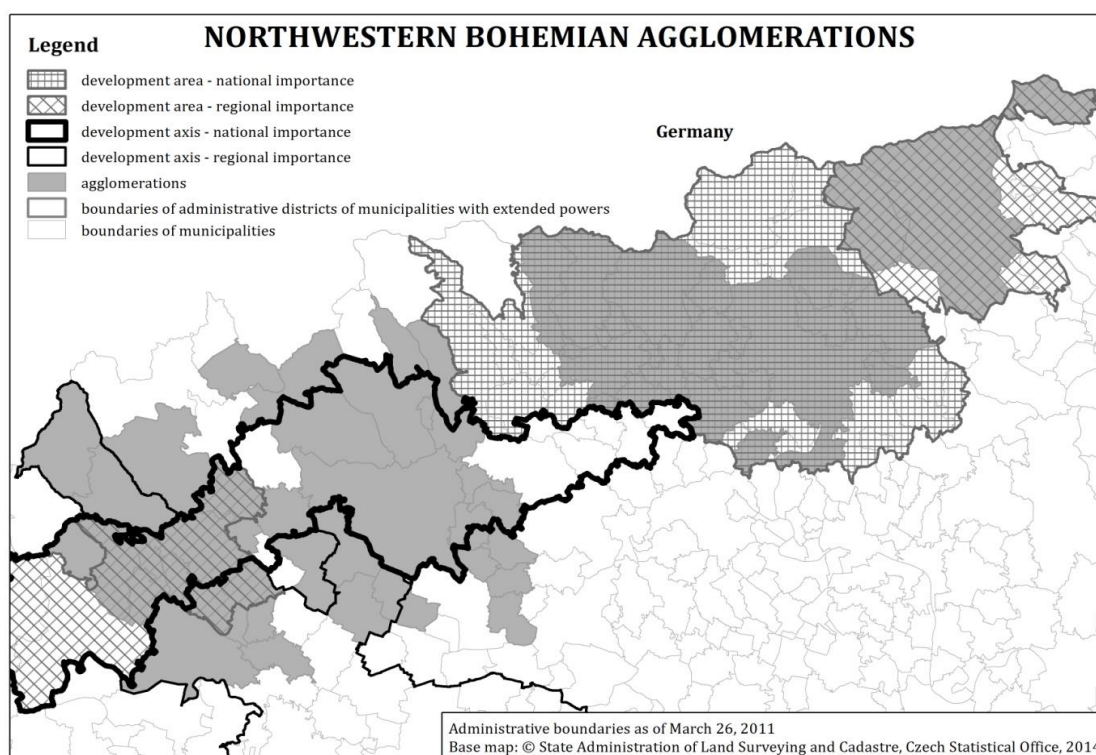
The commuting conditions indicate that the agglomerations of Northwestern Bohemia have been significantly weakened since the transformation of the Czech economy. It is generally known that the Ústí Region suffers with longterm unemployment and above all, with depopulation of its territory. All of the agglomerations, except the Ústí agglomeration, had reported, in the year 2011, an overhang of work commuting out over commuting in. Together, these agglomerated areas reported negative commutative balance of 1.8 thousand people. Absolutely unprecedented is the position of Děčín, as the core of agglomeration. This city with almost 50 thousand inhabitants reported actually very weak aggregated work commute, and thus the number of commuters out to work from Děčín had exceeded the number of commuters into work. A very low value of commuting index had also been reported in the core of Most- Litvínov agglomeration.

Discussion

The Czech geographical institutions had in last 25 years been focused on the changes in geographic organization of areas with different geographic level, from the perspective of regions, including commuting regions. The authors had conclusively identified the trends of concentration (Hampl and Marada 2015). Concentration processes are pointing to the cores of regions, which are capable of agglomerating the settlements in its surroundings.

The result of conducted delimitation of agglomerated areas could be compared with regional spatial planning documentation determining, within the Ústí Region, which territories should be preferred in the allocation of development activities. It is assumed, that the determination of development areas and axis should reflect the existing concentration of population and economic activities. The picture 2 presents the territorial agreement of delimitation of agglomerations and both development areas and axis in the analyzed territory.

Pic. 2: The comparison of definition of Northwestern Bohemian agglomerations with the development areas and with development axis.



Source: Principles of spatial development of the Ústí region

Almost the entire territory of defined agglomerations is a part of development area or axis. In most cases, it is about regions with preference of national scale. Thorough, 10 municipalities of total 21 in the agglomeration of Most-Litvínov are not included in any of the development area or axis. On top of that, 2 such agglomerations are located also in the Chomutov agglomeration. All these municipalities are, in the regional spatial planning documentation, included in specific areas reporting some problems and requiring special attention. Specifically, it is primarily the case of municipalities that are part of brown coal mining sites or in its closed proximity.

Conclusion

The method used for delimiting of agglomerations, based on reciprocation of work and commuting interactions has introduced relatively soft limiting combining parameters.

All of the agglomerations were delimited in larger range, compared to used definition in existing Czech geographic literature.

The largest spatial range had reported the agglomerations on the west of the Ústí Region. Specifically, it is about the Chomutov agglomeration and Most-Litvínov agglomeration. The settlement structure in the Most coal basin has been greatly destroyed and is manifesting in the commuting conditions. On one side, mutual strong interconnection with the municipalities in greater distances from the core of agglomerations exists here, on the other side are these municipalities reporting, on a wider scale, lower attractiveness of its labor markets.

The agglomerations of Ústí and Teplice have a higher territorial integration. Their commutative cohesion is also much higher than in case of Most-Litvínov and Chomutov agglomerations. The agglomerations of Ústí nad Labem and Teplice are legitimately identified as the most significant concentrations of inhabitants in the Ústí Region, as a development area of national importance.

The delimitation and analysis of the Děčín agglomeration has brought about a very surprising results. From all monitored agglomerated areas, it has presented the lowest number of both agglomerated municipalities number of inhabitants, despite that the city of Děčín is by population comparable with cities Teplice and Chomutov. A weak position of the Děčín city is involved with its extremely low work commutative attractiveness.

Presented conclusions can answer the other academic discussion focused on organization of the geographic area and its dynamics. At the same time, it has been proved that the used approach has a potential for both creation and evaluation of regional strategic documents, having a territorial impact.

Acknowledgement

This article was elaborated on the basis of support by a student grant project in terms of a special university research at the University of Jan Evangelista Purkyně in Ústí nad Labem.

References

- HALÁS, M., P. ROUBÍNEK and P. KLADIVO, 2012. Urbánní a suburbánní prostor Olomouce: teoretické přístupy, vymezení, typologie. *Geografický časopis*. **64**(4), 289-310. ISSN 0016-7193.
- HAMPL, M. et al., 1996. *Geografická organizace společnosti a transformační procesy v České republice*. Praha: DemoArt. ISBN 80-902154-2-4.
- HAMPL, M., 2005. *Geografická organizace společnosti v České republice: transformační procesy a jejich obecný kontext*. Praha: DemoArt. ISBN 80-86746-02-X.

HAMPL, M. and M. MARADA, 2015. Sociogeografická regionalizace Česka. *Geografie*. **120**(3). ISSN 1212-0014.

HLAVÁČEK, P., 2009. The foreign direct investments in the Usti Region: theory, actors and space differentiation. *E+M (Ekonomie a Management)*. **12**(4), 27-39. ISSN 1212-3609.

KRAFT, S., M. MARADA and D. POPJAKOVÁ, 2014. Delimitation of Nodal Regions Based on Transport Flows: Case study of the Czech Republic. *Quaestiones Geographicae*. **33**(2), 139-150. ISSN 2081-6383.

KRZYSZTOFIK, R. et al., 2016. Some dilemmas of post-industrialism in a region of traditional industry: The case of the Katowice conurbation, Poland. *Moravian Geographical Reports*. **24**(1), 42-54. ISSN 1210-8812.

LIU, L., X. DONG, X. and S. CHI, 2010. Quantitative delimitation of metropolitan areas based on a synthetic method: Case study in the Lanzhou Metropolitan area. *Journal of Urban Planning and Development*. **136**(4), 357-364. ISSN 0733-9488.

STEJSKALOVÁ, D. et al., 2011. Prostorová a časová diferenciacie krajinných struktur – podklad územně plánovací dokumentace. *Littera Scripta*. **4**(2), 235-255. ISSN 1805-9112.

SÝKORA, L. and O. MULÍČEK, 2009. The micro-regional nature of functional urban areas (FUAs): lessons from the analysis of Czech urban and regional system. *Urban Research and Practise*. **2**(3), 287-307. ISSN 1753-5069.

TONEV, P., 2013. *Změny v dojížděce za prací v období transformace: komparace lokálních trhů práce*. Brno. Dissertation Thesis. Masaryk University, Faculty of Economics and Administration.

TONEV, P. et al., 2017. Different approaches to defining metropolitan areas (case study: Cities of Brno and Ostrava, Czech Republic). *Geographia Technica*. **12**(1), 108-120. ISSN 2065-4421.

ÚSTECKÝ KRAJ., 2014-11-25/Ústecký kraj. Zásady územního rozvoje Ústeckého kraje. In: www.kr-ustecky.cz. [online]. Ústí nad Labem: Ústecký kraj, 2011-10-20. [accessed: 2017-11-26]. Available at: <http://www.kr-ustecky.cz/zasady-uzemniho-rozvoje-usteckeho-kraje-dokumentace/ds-99030>.

VOTRUBEC, C., 1980. *Lidská sídla – jejich typy a rozmístění ve světě*. Praha: Academia. ISBN 21-016-80.

Contact address of the author:

RNDr. Václav Novák, Ph.D., Department of Regional Development and Public Administration, Faculty of Social and Economic Studies, Jan Evangelista Purkyně University in Ústí nad Labem, Moskevská 54, 400 96 Ústí nad Labem, Czech Republic, e-mail: vaclavn@email.cz

NOVÁK, V., 2017. The Spatial Delimitation of Agglomerations in the Czech Republic: The Case of Northwestern Bohemia. *Littera Scripta* [online]. České Budějovice: Institute of Technology and Business in České Budějovice, **10**(2), 73-83 [accessed: 2017-12-15]. ISSN 1805-9112. Available at: http://journals.vstecb.cz/category/littera-scripta/10-rocnik-2017/2_2017/.