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Selected Types of Infrastructure in the Czech Republic: A Regional Perspective

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Abstract: Transport, social as well as some other types of infrastructure represent an important component of system macrostructures. In advanced countries, these system macrostructures are usually – though not necessarily – approximately bound to the existing settlement system. There are only little doubts that the role of infrastructure in local and/or regional development is an indispensable one. Activities of local and/or regional actors can be substantially facilitated or hampered by existing spatial distribution of infrastructure. The same – with even higher intensity – applies to also to post-transition countries among which the Czech Republic can be ranked. Thus, the main objective of this article consists in the analysis and interpretation of the quality and distribution of selected transport, education, research, health, technical and information infrastructure in the Czech Republic. Modern approaches to territorial development typically consider the relative harmony between spatial distribution of population and corresponding infrastructure as guaranteed. This may be the case of leading advanced nations, however less frequently it applies to their post-transition counterparts. Subsequently, the article attempts to disclose both strengths and weaknesses of the spatial profile of infrastructure in the Czech Republic. Spatial analysis of infrastructure in this country will be pragmatically conducted at NUTS III level covering self-governing regions. Selection of indicators as well as territorial scale has been influenced also by qualitative and quantitative limitations still existing in the Czech regional statistics.

Key Words: infrastructure, NUTS III regions, settlement system, regional development, Czech Republic

JEL Codes: R10, R40, H54, O18

Introduction

The role of infrastructure in the development of regions and localities is an indispensable one. Spatial distribution of main kinds of infrastructure should be in consonance with the spatial distribution of population and socioeconomic importance of individual territories on the one hand and efficiency requirements on the other hand. Infrastructure is manageable in the sense that it is formed on the basis of particular political-economic decisions (Buček, Rehák, Tvrdoň, 2010, Viturka, 2002 or Wokoun, Malinovský, Damborský, Blažek et al, 2008)

Social infrastructure has much to do with the provision of widely perceived education or health services, which are increasingly important for the whole societal life and development and can help to improve the image of individual territories (e.g. Rumpel, Slach, Koutský, 2008). And the same applies also to research and development (e.g. Skokan, 2004). The importance of physical – and namely transport – infrastructure for territorial economies is rightly compared to the circulation of blood in human body.

Undoubtedly, infrastructure considerably delimitates developmental possibilities and limitations of particular territories (see for instance Vanhove and Klaasen, 1987, Hudec et al, 2009, Ježek et al 2007 or Sucháček, 2008). The purpose of this article is not to monitor widest possible scope of indicators; this approach would lead towards gathering the enormous quantity of data with rather differentiated features as well as quality. Indicators that were selected reflect qualitative and quantitative constraints that unfortunately still exist in Czech regional statistics. Thus, the main objective of this paper is to analyze and interpret the quality and distribution of selected transport, education, research, health, technical and information infrastructure in the Czech Republic.

Czech Republic in Brief

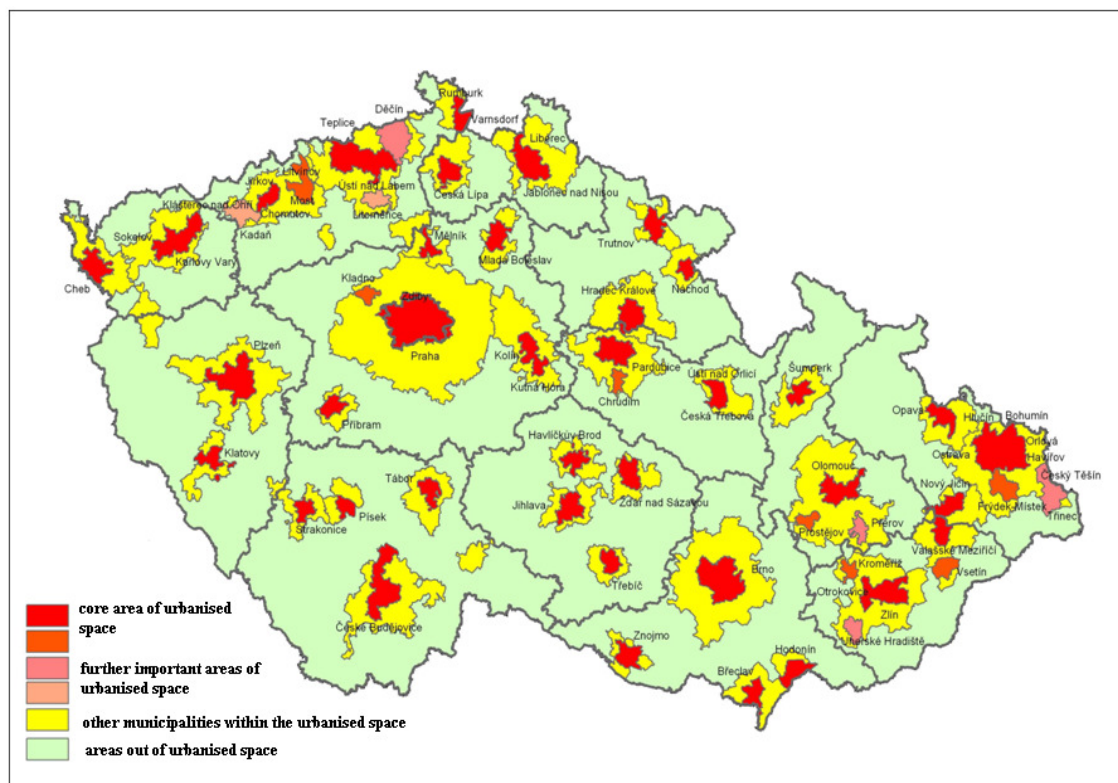
For the purposes of this paper, it is of crucial importance to notice the essential demographical characteristics of Czech regions. Number of inhabitants in the given territory always constitutes very important factor for the description and explanation of spatial socioeconomic developments. This is mainly due to the fact that various activities are always connected with the population present in the given spatial framework (e.g. Sucháček, Petersen et al, 2010). Economic, social, institutional and other systems would not come into existence without human factor.

Table 1: Basic Demographic Characteristics of Self-Governing Regions NUTS III in the Czech Republic (as per 6/2010)

Region	Number of Inhabitants	Inhabitants in %
Prague	1 251 072	11.9
Central Bohemia	1 256 850	12.0
South Bohemia	637 723	6.1
Plzeň	571 831	5.4
Karlovy Vary	307 380	2.9
Ústí	835 814	7.9
Liberec	439 458	4.2
Hradec Králové	554 370	5.3
Pardubice	516 777	4.9
Vysočina	514 805	4.9
South Moravia	1 152 819	11.0
Olomouc	641 555	6.1
Zlín	590 527	5.6
Moravian-Silesian	1 244 837	11.8
The Czech Republic in Total	10 515 818	100

Source: Czech Statistical Office

Figure 1: Settlement Structure of the Country



Source: <http://www.mmr.cz> + author's modifications

The number of inhabitants can be thus perceived as an approximate indicator of the volume of activities in the analyzed area and various territorial policies should take it into account. Table 1 shows the shares of NUTS III self-governing regions on the total Czech population. Figure 1 presents settlement structure of the country, which is relatively a homogenous one, and just this fact is of crucial importance for further evaluations.

One of the principal problems of contemporary territorial development in the Czech Republic (as well as in other post-transition countries) that stems from the tension based on the application of modern conceptions of local and regional development in the framework of inadequately organized system macrostructures has been discussed elsewhere (Sucháček, 2008 or Sucháček, Petersen et al, 2010). This unfavourable situation forms the framework, in which spatial distribution and quality of infrastructure in the Czech Republic should be assessed.

Transport Infrastructure

Road infrastructure that represents important condition of local and regional development is distributed quite unevenly in the Czech Republic. Highway infrastructure is concentrated mainly in the western part of the country and is directed primarily into two largest cities in the country. Regional metropolises still lack efficient highway interconnectedness. However, taking into account recent developments, the above mentioned problems seem to disappear gradually (see also Table 2).

Railway network in the country is more homogenous, which is based on historical development. And just these evolutionary mechanisms lie behind the fact that contemporary Czech Republic has one of the densest railway networks in Europe that faces almost negligible changes in time. It should be stated that in comparison with the importance of highway transportation, Czech railways witness a relative decline.

In a sensu stricto, air transportation is not infrastructure but rather one of manifestations of existing spatial infrastructural organisation. Regular air lines can be considered as a specific kind of 'soft' infrastructure just for the sake of their periodicity. The dynamic growth of Ruzyně airport in Prague is remarkable. On the contrary, development of the amount of passengers and cargo in other Czech airports can be generally characterized as very moderate increase.

Table 2: Absolute Length of Highways in Operation and Length of Highways in Operation per Square Kilometer

Region\Year	1995		2003		2010	
	Length in km	Length per Sq. km	Length in km	Length per Sq. km	Length in km	Length per Sq. km
Prague	10	0.020	11	0.022	11	0.022
Central Bohemia	157	0.014	172	0.016	194	0.018
South Bohemia	0	0	0	0	15	0.001
Plzeň	26	0.003	89	0.012	109	0.014
Karlovy Vary	0	0	0	0	0	0
Ústí	4	0.001	29	0.005	53	0.010
Liberec	0	0	0	0	0	0
Hradec Králové	0	0	0	0	17	0.003
Pardubice	0	0	0	0	7	0.001
Vysočina	93	0.013	93	0.013	93	0.013
South Moravia	124	0.017	124	0.017	134	0.019
Olomouc	0	0	0	0	22	0.004
Zlín	0	0	0	0	7	0.002
Moravian-Silesian	0	0	0	0	28	0.005
Czech Republic	414	0.005	518	0.006	690	0.008

Source: Road and Motorway Directorate of the Czech Republic

Table 3: Absolute Length of Railways and Length of Railways per Square Kilometer

Region\Year	2010	
	Length in km	Length per Sq. km
Prague	191	0.385
Central Bohemia	1398	0.127
South Bohemia	959	0.095
Plzeň	718	0.095
Karlovy Vary	438	0.132
Ústí	1038	0.195
Liberec	548	0.173
Hradec Králové	588	0.123
Pardubice	531	0.117
Vysočina	629	0.091
South Moravia	786	0.111
Olomouc	749	0.148
Zlín	343	0.086
Moravian-Silesian	677	0.120
Czech Republic	9586	0.121

Source: Ministry of Transport, CZ

Table 4: Number of Passengers at Czech International Airports

International Airport\Year	1991	2004	2010
Prague-Ruzyně	1 500 000	9 696 400	11 556 858
Brno-Tuřany	87 000 ¹	171 888	396 589
Ostrava-Mošnov	113 300	197 400 ²	279 973
Karlovy Vary	1 328	38 704	70 903
Pardubice	n.a.	46 999	62 302

Source: Prague airport, Brno airport, Ostrava airport, Karlovy Vary airport, Pardubice airport

Passengers from various parts of the country are largely forced to go to Prague airport if they want to get to major world cities. Karlovy Vary, Pardubice, Brno and Ostrava have primarily charter flights and virtually no regular flight connections. Prague airport thus embodies almost exclusive gate for more distant international visitors or investors. At the same time, passengers from remote Czech regions suffer from higher transaction costs.

Social Infrastructure

Social infrastructure influences social characteristics of the population on the one hand and co-determines social developments in the observed territories on the other hand. Taking into account wide spectrum of largely positive socioeconomic effects, universities play substantial role in life of every region.

Table 5: Regional Differentiation in the Number of Universities in 2004

Region	Total Number of Universities	Public and State Universities	Private Universities
Prague	29	9	20
Central Bohemia	3	0	3
South Bohemia	3	1	2
Plzeň	2	1	1
Karlovy Vary	1	0	1
Ústí	2	1	1
Liberec	1	1	0
Hradec Králové	1	1	0
Pardubice	2	1	1
Vysočina	1	0	1
South Moravia	9	6	3
Olomouc	2	1	1
Zlín	2	1	1
Moravian-Silesian	4	3	1
Czech Republic	62	26	36

Source: Czech Statistical Office

¹ In 1995.

² In 2003.

Table 6: Regional Differentiation in the Number of Universities in 2010

Region	Total Number of Universities	Public and State Universities	Private Universities
Prague	33	9	24
Central Bohemia	3	0	3
South Bohemia	5	2	3
Plzeň	1	1	0
Karlovy Vary	1	0	1
Ústí	2	1	1
Liberec	1	1	0
Hradec Králové	1	1	0
Pardubice	1	1	0
Vysočina	2	1	1
South Moravia	14	6	8
Olomouc	3	1	2
Zlín	2	1	1
Moravian-Silesian	5	3	2
Czech Republic	74	28	46

Source: Czech Statistical Office

Table 7: Research and Development Personnel in Regions in 2004 and 2010³

Region\Year	2004	2010
Prague	26 658	28 921
Central Bohemia	5 044	6 238
South Bohemia	2 430	3 079
Plzeň	2 286	3 443
Karlovy Vary	151	154
Ústí	957	1 260
Liberec	1 604	1 872
Hradec Králové	2 271	3 028
Pardubice	2 632	3 259
Vysočina	845	972
South Moravia	11 391	14 017
Olomouc	2 998	3 470
Zlín	2 226	2 474
Moravian-Silesian	3 886	5 716
Czech Republic	65 379	77 903

Source: Czech Statistical Office

One can contemplate a dominant role of the capital city in this sphere. The next position is occupied by South Moravia, whose capital is Brno, an important centre of education. Moreover, these two centres even strengthened their positions in the course of analysed period, i.e. between 2004 and 2010 (see also tables 5 and 6). Other regions remained at about

³ Instead of “physical-infrastructurel” research and development establishments, for which the statistics available is far from sufficient, research and development personnel was chosen.

the same level. A very similar spatial pattern with similar developmental tendencies can be contemplated also in the sphere of employees in research and development (see table 7).

Table 8: Beds in Hospitals per 1000 Inhabitants in 2004 and 2010

Region\Year	2004	2010
Prague	8.9	8.0
Central Bohemia	5.0	4.7
South Bohemia	6.1	5.5
Plzeň	6.5	6.1
Karlovy Vary	5.7	5.2
Ústí	6.9	6.1
Liberec	6.2	6.1
Hradec Králové	6.8	6.4
Pardubice	5.3	5.1
Vysočina	3.7	5.4
South Moravia	7.2	6.8
Olomouc	5.8	5.3
Zlín	5.7	5.2
Moravian-Silesian	6.1	5.3
Czech Republic	6.4	5.9

Source: Czech Statistical Office

Public health establishments constitute one of the most relevant components of social infrastructure. Health as one of the most important domains of human life (if not the most important one) is the target of great attention not only in the Czech Republic. Certain degree of regional differentiation is existing nonetheless it does not reach the level we observed in previous domains. Dominant positions are occupied by territories, in which the largest cities are located (with exception of Moravian-Silesian region). Aside from Vysočina, rationalization tendencies can be seen in practically all regions.

Other Types of Infrastructure

Information and technical infrastructure creates last but not least part of infrastructural empirical analysis. Table 9 shows that capital city enjoys the best position as for the households with access to personal computer and internet. This can be accounted for by qualitative difference of the city of Prague from other regions comprising the wide spectrum of territorial structures. In contrast to previous indicators, regional differentiation did not reach high degree here.

Table 9: Households with Access to Selected Information and Communication Technology in 2004 and 2010

Region	2004		2010	
	Personal Computer	Internet Access	Personal Computer	Internet Access
Prague	41.5	34.7	67.6	62.2
Central Bohemia	28.8	22.3	58.8	55.9
South Bohemia	31.5	18.6	57.4	51.5
Plzeň	28.2	16.0	59.9	56.5
Karlovy Vary	27.4	17.1	58.4	54.7
Ústí	22.1	15.4	53.7	51.7
Liberec	26.8	17.0	49.4	47.6
Hradec Králové	30.6	21.9	62.3	59.5
Pardubice	27.5	14.1	61.1	55.7
Vysočina	30.6	16.7	57.5	53.0
South Moravia	33.3	18.7	62.4	59.6
Olomouc	18.2	12.8	55.2	51.6
Zlín	27.2	13.7	59.2	54.2
Moravian-Silesian	27.8	16.0	56.7	53.1
Czech Republic	29.5	19.4	59.3	56.0

Source: Czech Statistical Office

As to the regional disparities in the share of flats in new houses equipped by sewer connection, the differences can be attributed namely to settlements peculiarities. There is a certain qualitative start of Prague, which is again explainable by its urban character. Level of 70 % of new apartments equipped by sewer connection has been exceeded also in South Bohemia, Karlovy Vary and Ústí regions. On the contrary, less than one half of new apartments had a sewer connection in Liberec and Moravian-Silesian regions.

Indicator showing dwellings completed per 1000 inhabitants provides us with further useful information. Completed dwellings reflect the economic situation of households on the one hand as well as their positive expectations on the other hand. Distinctiveness of Prague and Central Bohemia in the framework of the Czech Republic is apparent. Plzeň, South Bohemia and South Moravian region also reached above the average level of the country.

Table 10: Share of Flats in New Houses Equipped by Sewer Connection between 1997 and 2010

Region	Family Houses				Apartment Blocks			
	1997–2000	2001–2005	2006–2010	1997–2010	1997–2000	2001–2005	2006–2010	1997–2010
Prague	80,4	90,0	95,1	89,2	99,8	99,9	99,9	99,9
Central Bohemia	47,0	59,8	71,2	64,1	97,2	96,8	99,2	98,2
South Bohemia	74,4	74,5	73,6	74,0	98,6	99,2	100,0	99,4
Plzeň	60,0	57,7	66,2	62,1	98,9	94,8	98,9	97,3
Karlovy Vary	78,2	78,3	82,5	80,3	96,3	100,0	97,1	98,3
Ústí	70,8	72,6	69,1	70,6	98,7	96,4	96,9	97,5
Liberec	55,1	46,9	47,5	48,8	98,6	99,0	99,1	99,0
Hradec Králové	68,0	48,7	53,0	54,9	95,0	96,5	94,0	95,1
Pardubice	63,2	58,6	64,2	62,2	99,0	95,2	94,5	96,0
Vysočina	61,8	57,0	61,9	60,3	85,4	97,3	98,3	96,0
South Moravia	53,4	64,0	75,2	67,0	94,4	96,8	98,8	97,5
Olomouc	52,2	57,8	68,6	61,4	97,0	94,1	98,9	97,1
Zlín	56,9	56,5	62,9	59,1	96,4	95,6	99,0	97,1
Moravian-Silesian	34,8	29,0	34,8	32,9	98,7	93,5	97,6	97,0
Czech Republic	57,6	59,9	66,3	62,6	97,6	97,9	99,0	98,4

Source: Klíma, J. (2011)

Table 11: Dwellings Completed per 1000 Inhabitants between 1997 and 2010

Region	Dwellings Completed per 1000 Inhabitants			
	1997–2000	2001–2005	2006–2010	1997–2010
Prague	2,72	4,13	5,65	4,28
Central Bohemia	2,56	4,19	6,17	4,49
South Bohemia	2,08	2,98	3,47	2,90
Plzeň	2,24	3,37	3,76	3,19
Karlovy Vary	1,51	2,10	2,08	1,92
Ústí	1,05	1,22	1,31	1,20
Liberec	2,00	2,55	2,90	2,52
Hradec Králové	2,46	2,59	2,99	2,70
Pardubice	2,42	2,79	3,31	2,87
Vysočina	2,21	2,85	3,15	2,77
South Moravia	2,32	3,07	4,19	3,26
Olomouc	2,31	2,33	2,68	2,45
Zlín	2,59	2,61	2,51	2,57
Moravian-Silesian	1,36	1,63	1,91	1,65
Czech Republic	2,14	2,83	3,56	2,89

Source: Czech Statistical Office

In case we compare the issued number of building permits per 1000 inhabitants concerning dwellings, which can be treated as an approximate indicator of future developments in this sphere, we get rather similar spatial pattern.

Conclusions

Local and regional development in the Czech Republic as well as elsewhere is heavily dependent upon the spatial structure and distribution of both physical and social infrastructure. Infrastructure in the Czech Republic is only partly in compliance with country's settlement system and is strongly path-dependent.

The investments into highways that create an important part of transport infrastructure concentrated mainly around two largest cities as well as in territories connecting the capital city with Germany. On the contrary, railway network is spread much more evenly mainly due to its historical development. However, a great part of railways in the country requires modernization. As to the air transportation, Prague international airport is a distinct leader among Czech international airports in both the number of passengers and investments.

Examination of social infrastructure confirmed afore mentioned heterogeneous spatial profile of infrastructure in the country with prevailing centripetal pattern. Country's differentiation is nonetheless less visible in the sphere of information and communication technologies and dwellings.

Last but not least we have to bear in mind the importance of system macrostructures, i.e. relevant structures creating the framework of local and regional development. Harmonic system macrostructures, which are determined also by quality and spatial distribution of infrastructure constitute a condition sine qua non for successful accomplishment of contemporary modern neo-endogenous approaches towards territorial development. Moreover, integration of socioeconomic systems can be reached especially through functional interconnectedness of their individual parts, which is fully valid also for particular countries. Above mentioned findings could contribute to the formulation of future topics related to the qualities and spatial organization of infrastructure in the Czech Republic.

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