

WHAT CAN WE LEARN FROM BROWNFIELD DATABASES? EXPLORING SPECIFICS OF THE LOCATION OF BROWNFIELDS IN THE CZECH REPUBLIC

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DOI: 10.21163/GT_2020.152.18

ABSTRACT:

The aim of this paper is to advance our understanding of brownfield locations in municipalities and cities situated in the Czech Republic. The data on brownfields was obtained from the National Brownfield Database which is coordinated by the CzechInvest Agency in the Czech Republic. The analysed period of the paper are the years 2018 and 2020. In 2018, 460 brownfields were analysed with an area of 2,334.65 hectares and in 2020 there were 572 abandoned buildings and sites with a total area of 2,320.09 hectares. The data on brownfields are based on the regions of NUTS 3 level. Each brownfield was then divided according to its location, i.e. whether it is located in the centre, in the inner part, outer part or within the development area of the municipalities and cities of the given regions. Based on the obtained data, relative proportions within each region were calculated on the NUTS 3 level for the years 2018 and 2020. It was discovered that brownfields are mostly located in the outer parts of municipalities and cities in both analysed years (2018, 2020). Such finding may influence also the possibility of potential brownfield regeneration. Abandoned buildings and sites that are located in the centres or the inner part of municipalities and cities are generally better preconditioned for a potential regeneration and utilization compared to brownfields that are located in the outer parts or on the margins of the cadastral areas of municipalities and cities of the given country.

Keywords: *Brownfields, NUTS 3, Location, Spatial Analysis, Czech Republic*

1. INTRODUCTION

Spatial planning is considered to be one of the key tools of how to increase the sustainability of cities and contribute to their development on a global scale (UN, 2015). One of the key aspects of sustainable spatial planning is sustainable land use, i.e. more deliberate approach towards which type of land is used for the development of cities. It is particularly necessary with cities with a growing population to take a decision which areas are most suitable for future development. A promising approach seems to be a re-development of formerly used sites that are now vacant, such as brownfields, for new projects of city developments, especially the ones that are situated in central localities (Bartke & Schwarze, 2015). Brownfields are defined as „any land which was formerly used or developed and is now not fully used, even though it can be partially occupied or used as well as unoccupied, vacant or contaminated“ (Alker et al., 2000). Another definition emphasizes the need for location and development and it indicates that brownfields are predominantly located in developed urban areas and require some intervention in order to be used repeatedly (CABERNET, 2006).

Brownfields represent significant social and environmental issues across the world (Thornton et al., 2007), and are recognized by the international association (OSN, 2015) and the European Union (EC, 2012). Brownfields are of various origin, are distributed across the entire country, yet they represent a significant issue in densely urbanized areas, such as cities in particular (Burinskiene et al., 2017). Abandoned buildings and sites are an integral part of cities in Central Europe (Tureckova et al., 2017). Brownfields that are located in the inner city, in the vicinity of the inner city or near other municipal subcentres are generally well-connected with the current technical and social infrastructures (Koch et al., 2018). The level of brownfield regeneration reflects the cultural and

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economic development of the country, region, city or village as it reflects the strategies of sustainable development of sites (Wedding & Crawford-Brown, 2007).

Tools for dealing with disagreements between the interests of involved parties and the aims of sustainable development are rare (Bartke et al., 2016). Former studies showed that the location of brownfields in the inner city is influenced by the type of regeneration (Bjelland, 2004; Temelova, 2007). The type of regeneration may or may not reflect the opinions of local inhabitants (De Sousa, 2006) and sustainability (Bleicher & Gross, 2010). However, while planning brownfield regeneration, opinions of the local inhabitants should be taken into consideration (Meyer & Lyons, 2000), especially if the regeneration is co-financed using public funds (Rizzo et al., 2015). A major argument in favour of brownfield regeneration is the necessity to retain the compactness of cities and thus prevent their uncontrolled and non-regulated expansion (Tureckova et al., 2018). The planning of brownfield regeneration according to the principles of sustainable development presents a significant challenge, especially with rural brownfields that have small chances of attracting private investment (Sardinha, Craveiro & Milheiras, 2013). The balance between the development of cities and countryside is not only a common trend, but it is also a common objective for all countries in order to achieve sustainable integration between cities and countryside. Even though the countries across the world have a distinct history, culture, ideology, economic growth and other aspects, they also suffer from uneven growth between municipal and rural areas (Abraham, 2011; Dong et al., 2011; Gurrutxaga, 2013; Zitti et al., 2017). In the past, the rural countryside was perceived mainly as a tool for agricultural production. One of the most important values of the landscape was thus soil fertility, accessibility of field and suitability of the field for agricultural purposes and use of machines (Prishchepov et al., 2012). The current approach allows for agricultural, residential and tourist functions of the landscape. One of the most important functions of the landscape are the characteristic of the landscape, aesthetics of the landscape, diversity and function of the environment. Some parts of rural landscape are undergoing serious changes, especially the landscape in the vicinity of large cities (Stastna et al., 2018). Despite all this effort, the loss of agricultural soil in certain European countries is still rather dramatic. Agricultural land needs to be protected against several threats. This is deeply influenced by the development of agriculture and its adaptation to the changing domestic as well as global driving forces, including the volatility of the market, climate disruption of global food supply and a growing demand for local foodstuffs (Connell et al., 2013).

Urbanization belongs to one of the biggest trends of this century across the world, which means that the most important factor that changes urban landscape is the expansion of built-up sites, which is connected to urban sprawl (Luck & Wu, 2002; Van Eetvelde & Antrop, 2004). Urban sprawl has plenty of negative impacts on the environment, such as higher energy consumption, higher air pollution, reduced regional open space, loss of agricultural land, reduced species variety and fragmentation of ecosystems (Johnson, 2001). Green areas suitable for recreation must be preserved within urban regions as by creating large parks, green belts and local recreational areas mental and physical well-being of inhabitants of the cities is improved (von Hertzen, Hanski & Haahtela, 2011).

Brownfields remain one of the biggest challenges of contemporary urbanists and developers (Frantal et al., 2015). With ongoing global economic stagnation, many industrial sectors either disappear or are moved to countries with lower labour costs – new brownfields emerge and their sustainable development is still restricted by many obstacles (Alexandrescu et al., 2014; Frantal & Martinat, 2013; Ganser & Williams, 2007; Payne, 2013; Vojkovska et al., 2013). As global economic stagnation continues, the investments fall and many industries disappear or are moved to countries with lower labour costs – new brownfields emerge, and their sustainable redevelopment is still constrained by many barriers and associated with several dilemmas (Alexandrescu et al., 2014; Frantal & Martinat, 2013; Ganser & Williams, 2007; Payne, 2013; Vojkovska et al., 2013). Abandoned buildings and sites left without any effort to find some alternative use prevent a further development of built-up sites, unfavourably influence the environment and have a bad impact on the given region in general (Tureckova et al., 2019).

The aim of the paper is to better understand the shift in the location brownfields in municipalities and cities in the Czech Republic as is evidenced in official brownfield databases in the years 2018

and 2020. The paper is structured as follows: after the introduction, a chapter follows focusing on data on brownfields in the Czech Republic, focusing particularly on their number and location. The next chapter deals with the methodology of the contribution. The fourth chapter deals with the results that were achieved by the author. The conclusion at the end summarizes existing findings.

2. DATA

The second chapter focuses on the number and size of brownfields in the Czech Republic. The Czech Republic is situated in Central Europe and has an area of 7,886,600 hectares. Currently (2020), approximately 10,694,364 inhabitants are living in the Czech Republic (CSO, 2020). There are 14 regions of NUTS 3 level (Eurostat Database, 2020). The Figure below (**Fig. 1**) displays the mentioned regions of NUTS 3 level in the Czech Republic.



Fig. 1. NUTS 3 regions in the Czech Republic (Source: Eurostat, 2020).

For the purposes of the paper, the data on brownfields was obtained from the National Brownfield Database which is coordinated by the CzechInvest Agency in the Czech Republic. Prague is not included in the results as there is only one abandoned building registered according to the database and it does not reflect the reality and problematics of the brownfield incidence in the capital city of Prague. In 2018, a total of 460 abandoned buildings and sites with an area of 2,335 hectares were registered. In 2020, the number of brownfields increased to 572, yet the area was reduced to 2,320 hectares. It follows that the number of registered abandoned building and sites between the two analysed years increased by 112, yet the total area decreased by 15 hectares.

In the Czech Republic, there are approximately 10 to 12 thousand brownfields with an area of 25 to 35 thousand hectares (National Brownfield Regeneration Strategy, 2019). The reason for the non-existence of these buildings and sites in the National Brownfield Database is influenced by the owners of the individual land and sites who are not interested in registering the involved sites as brownfields.

The table below (**Table 1**) focuses on information regarding the area of individual regions of NUTS 3 level in the Czech Republic, on the number of brownfields in 2018 and 2020 and their area. The highest occurrence of these abandoned buildings and sites is predominantly in Ústí nad Labem Region, Liberec Region and South Moravian Region. The largest area of brownfields is recorded mainly in Central Bohemian Region, Ústí nad Labem Region and Moravian-Silesian Region.

Table 1.

The number of brownfields and their size in individual regions of NUTS 3 level.

NUTS 3	Area of the region in (ha)	Number of brownfields (2018)	Area of brownfields in (ha) (2018)	Number of brownfields (2020)	Area of brownfields in (ha) (2020)
Karlovy Vary Region	331,400	32	216	43	183
Ústí nad Labem Region	533,500	62	209	80	220
Liberec Region	316,300	61	188	58	166
Pardubice Region	451,900	28	66	25	35
Hradec Králové Region	475,900	24	110	34	166
Vysočina Region	679,600	24	29	30	35
South Bohemian Region	1,005,700	33	74	37	56
Plzeň Region	756,100	24	103	34	195
Central Bohemian Region	1,101,500	30	774	38	768
Olomouc Region	526,700	35	160	44	107
South Moravian Region	718,800	52	186	67	122
Zlín Region	396,400	15	18	13	8
Moravian-Silesian Region	542,700	40	203	69	260
Total	7,836,500	460	2,335	572	2,320

Source: CzechInvest, 2018; 2020, adopted.

Another table (**Table 2**) describes the share of the area of brownfields on the area of the given region where the abandoned building or site is located. The data on the area of brownfields and regions is adopted from the previous table (Table 1). Information in the table below (**Table 2**) is in relative numbers. In both years (2018, 2020), the largest share of brownfield area on the area of the given region is mainly in Central Bohemian Region, Karlovy Vary Region and Liberec Region. In 2018, the total proportion of the area of brownfield sites registered in the National Brownfield Database in the Czech Republic was 0.0298% in relative terms; two years later, the proportion was 0.0296%. It should be emphasized that the proportion of acreage involved is actually larger, as most abandoned properties and sites are not on the register.

Table 2.
Share of the area of brownfields on the area of individual regions of NUTS 3 level.

NUTS 3	Share of BF area in NUTS 3 region area (2018) in %	Share of BF area in NUTS 3 region area (2020) in %
Karlovy Vary Region	0.0651	0.0551
Ústí nad Labem Region	0.0391	0.0413
Liberec Region	0.0593	0.0523
Pardubice Region	0.0146	0.0088
Hradec Králové Region	0.0232	0.0349
Vysocina Region	0.0037	0.0050
South Bohemian Region	0.0074	0.0056
Plzeň Region	0.0136	0.0257
Central Bohemian Region	0.0700	0.0698
Olomouc Region	0.0302	0.0202
South Moravian Region	0.0258	0.0169
Zlín Region	0.0044	0.0020
Moravian-Silesian Region	0.0373	0.0480
Total	0.0298	0.0296

Source: based on own survey, 2020.

3. METHODOLOGY

The third chapter is focused on the methodology of the paper. The aim of the paper is to better understand the shift in the location brownfields in municipalities and cities in the Czech Republic as is evidenced in official brownfield databases in the years 2018 and 2020. The reason for choosing this topic is that the author wishes to locate the abandoned buildings and sites within the structure of municipalities and cities in individual regions of the Czech Republic. For the purposes of the paper, the data on brownfields from 2018 and 2020 was obtained from the National Brownfield Database. As it was mentioned above, in 2018, 460 abandoned buildings and sites were registered and in 2020, it was 572.

For the purposes of the paper, brownfields were localized using an exact location of brownfields that are mentioned with every registered abandoned building and site in the database. The data on brownfields is based on the regions of NUTS 3 level. Each brownfield was then divided according to its location, i.e. whether it is located in the centre, in the inner part, outer part or within the development area of the municipalities and cities of the given regions. Based on the obtained data, relative shares within individual regions on the NUTS 3 level were calculated for the years 2018 and 2020. The table below (**Table 3**) shows the characteristics of the parts.

Table 3.**The characteristic of parts**

Centre	<ul style="list-style-type: none"> The center, or also the central zone, is the accumulation of all functions, areas prevail here and areas of higher public amenities serving residents. The functional composition is accompanied by a varied structure of public spaces made up of equally varied constructions with a range of architectural values.
Inter Part	<ul style="list-style-type: none"> This section is mainly characterised by functionally mixed multi-storey development with a higher proportion of built-up areas. Usually one of the basic functions prevails in these parts of cities, most often housing.
Outer part	<ul style="list-style-type: none"> Within this section, it is a territory that is mixed. This applies not only in functional but also spatial terms. The mixture of functional areas and objects is supported by a loose-knit form of construction mostly of individual architectural design and without the ambition of creating a public space or an architectural file.
Development area	<ul style="list-style-type: none"> Immediately following link into stoppable territory. However, these are hugely important areas and spaces that convey the optimal transition of urbanised environments and free economically exploited landscapes.

Source: URR, 2020; adopted.

4. RESULTS

The next part of the paper will be dealing with the localization of brownfields. First, the results for 2018 and 2020 in relative numbers will be mentioned and at the end of this chapter, the summary of the results will be performed. The table below (**Table 3**) displays the results of the localization of abandoned buildings and sites in 2018 in individual regions on NUTS 3 level in the Czech Republic. It can be seen from the table that the majority of brownfields in all analyzed regions of the country are largely located in the outer parts of municipalities and cities. The majority of such abandoned buildings and sites are located in Olomouc Region, Moravian-Silesian Region and Central Bohemian Region. The second largest group is represented by abandoned buildings and sites located in the outer parts of municipalities and cities. The largest number of localized brownfields in this group are mainly in Karlovy Vary Region. Another group is represented by abandoned buildings and sites that are located in the inner parts of municipalities and cities. The largest number of localized abandoned buildings and sites in this group is predominantly in Hradec Králové Region. Brownfields that are located in the centres of municipalities and cities belong to the last group. It is evident that in this group the largest localization is mainly in Zlín Region.

The following table (**Table 4**) displays the results of localization of brownfields in 2020. The largest relative shares of localized abandoned buildings and sites are mainly in the outer parts of municipalities and cities, such as in 2018 (see Table 3). Within this group, Moravian-Silesian Region, Pardubice Region and Olomouc Region dominate. Next, it was discovered that the second group of brownfields is represented by the ones located in the inner parts of municipalities and cities. Here, Karlovy Vary Region, South Bohemian Region and Central Bohemian Region dominate. The third part involves abandoned buildings and sites that are located on the margins of cadastral areas of municipalities and cities. This includes mainly Liberec Region and Vysočina Region. The last group includes abandoned buildings and sites that are localized in the centres of municipalities and cities. This group includes mainly brownfields localized in Zlín Region, Ústí nad Labem Region and Central Bohemian Region.

Table 4.
Localization of brownfields within the regions on NUTS 3 level in the Czech Republic in 2018 in %.

NUTS 3	Centre	Inner part	Outer part	Development area
Karlovy Vary Region	0	6.3	65.6	28.1
Ústí nad Labem Region	14.5	12.9	66.1	6.5
Liberec Region	8.2	21.3	59	11.5
Pardubice Region	10.7	17.9	64.3	7.1
Hradec Králové Region	16.7	25	45.8	12.5
Vysocina Region	17.4	21.7	52.2	8.7
South Bohemian Region	12.1	18.2	51.5	18.2
Plzeň Region	16.7	12.4	54.2	16.7
Central Bohemian Region	6.7	13.3	70	10
Olomouc Region	0	11.8	76.4	11.8
South Moravian Region	15.7	9.8	56.9	17.6
Zlín Region	21.4	7.1	57.1	14.4
Moravian-Silesian Region	5.3	2.5	71.1	21.1

Source: based on own survey, 2020.

Table 5.
Localization of brownfields within the regions on NUTS 3 level in the Czech Republic in 2020 in %.

NUTS 3	Centre	Inner part	Outer part	Development area
Karlovy Vary Region	9.3	32.6	41.9	16.2
Ústí nad Labem Region	16.5	21.5	50.6	11.4
Liberec Region	6.9	22.4	50	20.7
Pardubice Region	12	20	64	4
Hradec Králové Region	14.7	17.7	52.9	14.7
Vysocina Region	13.8	17.2	48.3	20.7
South Bohemian Region	8.1	27.1	45.9	18.9
Plzeň Region	14.7	23.5	52.9	8.9
Central Bohemian Region	15.8	26.3	44.7	13.2
Olomouc Region	7	20.9	58.1	14
South Moravian Region	13.4	19.5	53.7	13.4
Zlín Region	16.7	25	58.3	0
Moravian-Silesian Region	7.5	13.4	64.2	14.9

Source: based on own survey, 2020.

The figure below (**Fig. 2**) presents the complete results of the localization of brownfields in the Czech Republic in 2018 and 2020. The values shown in the chart below show the relative expression of localized abandoned objects and areas in given parts (Center, Inter part, Outer part, Development area) following the period. It is evident from the figure that within the analysed period the abandoned buildings and sites are to be found mainly in the outer parts of municipalities and cities.

During the year 2018, it involves 61.7% of localized brownfields in the area of the Czech Republic. In 2020, it oscillates around 52.3%. The second group is represented by abandoned buildings and sites located in the inner parts of municipalities and cities. In 2018, the relative number was 13.9% and in 2020, it reached 21.4%. It was discovered that the third group was represented by brownfields located in the outer parts of municipalities and cities where the relative number was 13.9% in 2018 and in 2020, the number was similar to the previously analysed year, i.e. 14%. The last group is formed by abandoned buildings and sites localized in the centres of municipalities and cities. The relative number reached 10.5% in 2018 and increased to 12.3% in 2020.

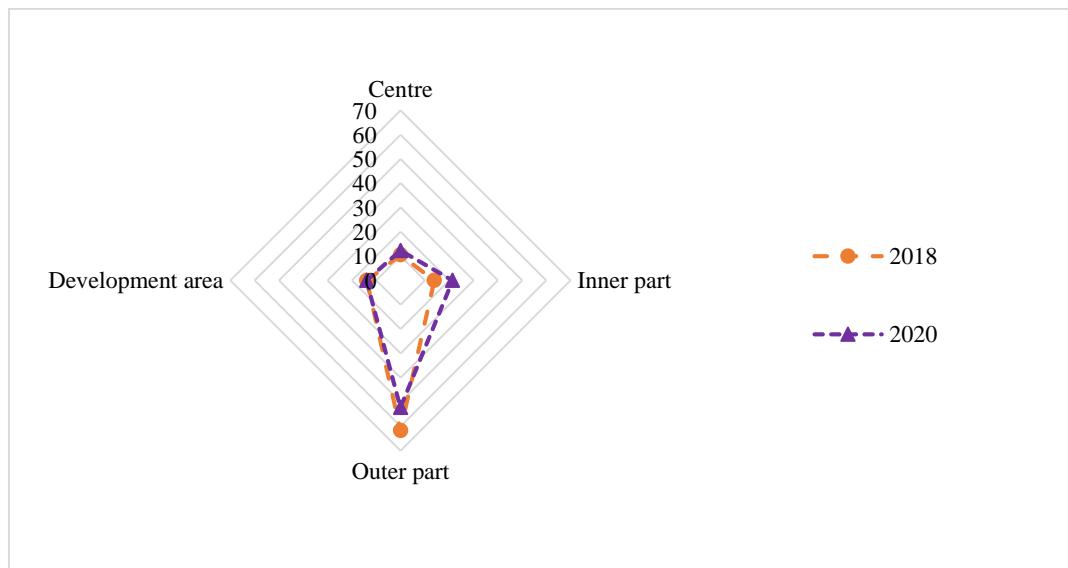


Fig. 2. The resulting evaluation of localized brownfields for the years 2018 and 2020 in the Czech Republic.
(Source: based on own survey).

5. CONCLUSION

The paper dealt with the issue of brownfields in individual regions of NUTS 3 level in the Czech Republic based on the localization using an exact location of brownfields. The aim of the paper was to better understand the shift in the location brownfields in municipalities and cities in the Czech Republic as is evidenced in official brownfield databases in the years 2018 and 2020. The analysed period of this contribution covered the years 2018 and 2020. It was discovered that the largest number of abandoned buildings and sites is mostly in Ústí nad Labem Region, Liberec Region and South Moravian Region.

The paper then analysed the area of NUTS 3 regions in the Czech Republic and the area of the individual abandoned buildings and sites in the analysed years. It was discovered that the largest share of brownfield area on the area of the given region is primarily in Central Bohemian Region, Karlovy Vary Region and Liberec Region. In addition, the author examined the localization of abandoned buildings and areas based on an exact location of brownfields that are quoted with each registered brownfield in National Brownfield Database.

It was discovered that brownfields are mostly located in the outer parts of municipalities and cities in both analysed years (2018, 2020).

The mentioned finding may also impact potential brownfield regeneration. Abandoned buildings and sites that are located in the centres or the inner parts of municipalities and cities generally stand a better chance to be potentially regenerated and reused. Abandoned buildings and sites located in the outer parts of municipalities and cities are rather little attractive for potential investors and developers who are interested in the opportunity to regenerate and reuse brownfields. These include primarily areas more distant from the centres that are of no added value for the investors.

Generally, it can be stated that the most attractive localities with the biggest chance to be regenerated are the ones in the vicinity of the centres with accessible transport infrastructure. There is a huge difference regarding the utilization opportunities of abandoned buildings and sites depending on whether they are located in the cities or municipalities. Cities are more suitable for brownfield regeneration than municipalities. Potential investors and developers primarily search abandoned buildings and sites that are located near the city centres as these are attractive due to their location and transport accessibility. By contrast, brownfields located within municipalities do not feature any added value for their potential investors regarding their reuse.

The paper managed to locate brownfields within the structure of municipalities and cities in individual regions of the Czech Republic based on an exact location of brownfields. As it was mentioned above, abandoned buildings and sites are primarily located in the outer parts of municipalities and cities. Here, they can be possibly regenerated and reused provided that the potential investors or developers are interested in those particular brownfields.

As part of the contribution, it should be noted that there are limited data sources that also influence the existence of the results. As mentioned in the post above, the registration of abandoned objects and sites in the National Brownfield Database in the Czech Republic is influenced by the owners of the brownfield sites concerned, who are not interested in the registration and declaration of the brownfield properties. This may also have an effect on the results achieved in the post.

ACKNOWLEDGMENT

This paper was supported by the project SGS/20/2019 “Brownfields in urban and rural space: geographic, economic, business and public administrative contexts and their importance for regional development (BURAN 2)”.

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