

Brownfield database in light of the BIM method

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Abstract. The paper deals with two very current topics – brownfields and BIM models, building information models. While BIM models of buildings and their interconnection to other systems (GIS) are both, in the Czech Republic and internationally, the issue discussed not only by the professional public, but also by politicians, brownfields and their databases are at the edge of interest in political-decision-making. It can be said that the brownfield database, ie areas with predominantly defective and unused buildings, with the data contained therein can form the basis for data models of these building and areas. This article outlines the information, data and knowledge of brownfields used by all professions in the AEC industry and examines their compatibility with BIM models of building or areas, that go hand in hand with the current BIM transition in the Czech Republic.

1 Introduction to problematic of brownfields

Brownfields revitalization is very current topic in the world and in the Czech Republic at these times. This topic, however, encounters few obstacles, as for example complex property-law relations, financing of revitalization [1], compliance of the project with landscape-use planning documentation, and others. The absolute fragmentation when registration of sites classified as brownfields is one of the most significant revitalization problems in the Czech Republic is. This fragmentation happens due to the absence of the legislative framework for brownfields in the Czech Republic, where the term “brownfield” is not defined in this legislation. Each organization/institution, therefore, uses its own definitions, which differs more or less [2]. Problematic of brownfields is further fragmented and unclear at the stage of cataloguing/databasing due to differences of their own definitions.

As mentioned above, the basic legislative background for brownfields is missing in the Czech Republic. Term brownfield, used in Decree No. 500/2006 Coll., on landscape analytical data, landscape planning documentation and the way of landscape planning activity evidence, which is one of implementing decrees of the Act No. 183/2006 Coll., on landscape planning and building regulations (Construction Act), is the only legislative reference [3]. Brownfield is referred as item 4a in the list of monitored phenomena in the

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attachment No. 1 “Content of analytical backgrounds landscape data base” of Decree No. 500/2006.

2 Brownfield Databases in the Czech Republic

Brownfields’ databases can be divided by many ways. For the purpose of this contribution, databases are divided according to the financial sources in the Czech Republic, thus into two groups: databases acquired by private sector (private funding) and databases funded by public financial sources, when acquirer is subject financed by taxpayers’ sources. This contribution is purposefully dealing with publicly funded databases only.

2.1 Brownfield Databases from aspect of acquirer and content

Subject funded by taxpayers’ money are bound by Czech Republic’s legislation in their activities, documentation procuring and data disclosure. Representative examples of such subjects dealing with brownfields in the Czech Republic include CzechInvest - Investment and Business Development Agency, regional authorities, municipalities with extended powers and municipalities, specifically their units dealing with landscape planning (e.g. departments of landscape planning or regional development, etc.). Many of these subjects have established their own brownfield databases.

Brownfield database is even a statutory obligation in the context of the acquisition activity for some of these authorities. However, besides the brownfield definition, there is no way nor form of information in legislation, which should be contained in such database. Therefore, each of these subjects has adapted their own forms of databases and their content to its current need and purpose. Typically, this is either a register of municipalities’ landscape analytical data or it is purpose database mainly serving as supply catalogues for business investment.

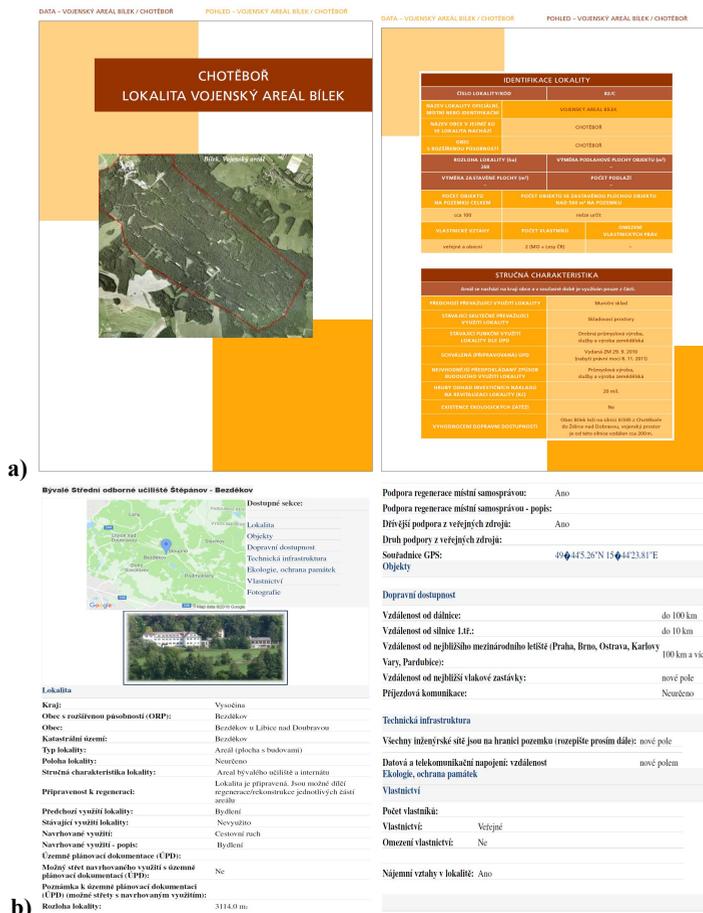
Information in these databases is different, very arduous, and even the same information are often viewed in a different way, as it is illustrated by examples of data sheets of these databases in Table 1 [4,5,6]. The situation with data of the evidence of phenomenon No. 4a in landscape analytical data (given by Decree No. 500/2006 Coll.) is usually even worse. Building Act or Decree No. 500/2006 Coll. do not give which brownfield’s data should be registered. Therefore, most processors of the municipality landscape analytical documents minimize the information from the both reasons: the reason of time and financial reason. Usually, only the sequence number, location, and size, eventually name and owner, are registered. Only in a very minor number of cases, data are extended by, for example, the technical and transport infrastructure or ecological burden or other limits on site use. This is also set due to the overall large scope of landscape analytical data, where brownfields are only one of the 119 observed phenomena in the territory. It is clear from this, municipalities landscape analytical document can’t replace nor contain brownfield databases, but should only be referred to, as the more detailed material they cover. The reality in the territory is quite opposite – the municipalities and municipalities with extended powers issue a brownfield database the evidence of phenomenon 4a (before the amendment of Decree No. 500/2006 Coll., before year 2018, it was phenomenon 4 – area to restoration or re-use of degraded territory).

At following Table 1, there is the example of comparing the three selected databases with respect to the monitored information. Relative or very similar characteristics in different databases have been merged into a comparison table as a single item with a different name but are a major complication for machine data transfer to land data models. In other databases, other items are mentioned, such as the site serial number, the drawing of the cadastral map, the technical infrastructure by individual networks, etc.

Table 1. The example of comparing the three selected databases with respect to the monitored information (Source: author according to data [4,5,6])

Monitored information	ChezcInvest [4]	Vysočina [5]	Mor.-Sil. Region [6]
Name	x	x	x
Site code / identification number		x	x
Site type	x		
GPS coordinates	x		
Parcel numbers			x
Cadastral territory	x		x
Name of municipality / municipality (LAU 2)	x	x	x
Municipality with extended competence	x	x	
District (LAU 1)			x
Region (NUTS 3)	x		
Site location	x		
Site area	x	x	x
Floor area of the building		x	
Built-up area		x	x
Number of floors		x	
Total number of objects on site / number of objects in the locality		x	x
Number of buildings with built-up area over 500 m ² on site		x	
Ownership	x	x	x
Number of owners	x	x	x
Ownership restrictions / property rights restrictions	x	x	
Rental relations in the locality	x		
Brief characteristic of the site / site description / basic information		x	x
Readiness for regeneration	x		
Promoting regeneration by local government	x		
Promoting regeneration by local government - description	x		

Monitored information	ChezcInvest [4]	Vysočina [5]	Mor.-Sil. Region [6]
Previous use / previous prevailing use of site / former use	x	x	x
Existing utilization / existing prevailing real use of the site	x	x	
Existing functional use of the site according to the TPD / use according to the TP		x	x
Territorial planning documentation (TPD) / approved (prepared) TPD	x	x	
Possible conflict of proposed use with territorial planning documentation	x		
Proposed use / the most appropriate anticipated mode of site future use	x	x	
Note to the TPD	x		
Proposed use - description	x		
Rough estimate of investment costs for site revitalization		x	
The existence of ecological burdens / contamination rates		x	x
Evaluation of transport accessibility		x	
Distance from the nearest international airport / transport accessibility – airport	x		x
Distance from the nearest train station / transport accessibility - railway	x		x
Accessibility – 1 st class road or motorway			x
Distance from the motorway	x		
Distance from the 1 st class road	x		
Driveway	x		
Networking			x
All utilities are at the property's border (please describe below)	x		
Data and telecommunication connections - distance	x		
Earlier support from public	x		
Type of support from public sources	x		
Ecology	x		
Protection of monuments	x		
Drawing over map of broader relationships	x		x
Drawing over orthophoto map		x	
Photo documentation / photos	x		x



legislative conditions for the frequency of update and, above all, from the lack of financial resources for these updates. The acquisition of database may be funded from the budgets of individual entities, but the maintenance costs can be very difficult for funding from public finances – they are usually described as wasting money by the opposition. The easiest way is to re-cover the databases under the territorial analytical documents of the municipalities (hereinafter referred to as TAD), which are updated every four years as a result of the Building Act. This frequency is not the most appropriate (the ideal state is about 2 years), but it is sufficient. Unfortunately, as already mentioned above, it is not possible to implement the brownfield database only in TAD. On the other hand, there is no authority in the Czech Republic responsible for their registration, therefore no updating is possible within the TAD because this update can not be carried out by the processor – it only summarizes and evaluates the data supplied by individual owners, administrators, etc.

2.3 Brownfield Databases from aspect of registered sites in land

List of problems associated with Brownfield databases and thus their transfer under any other covering database continues by detail and completeness of the monitored sites. This is mainly the definition of the brownfield itself and also the criteria by which the site is identified.

As an exemplary area, the administrative territory of the Chotěboř municipality with extended competencies (hereinafter referred to as “Chotěboř MEC”) will be used. For comparison, the database of the Investment and business development Agency – CzechInvest (hereinafter referred to as “the CzechInvest database”) and the database of Vysočina region (hereinafter referred to as “region database”). There are two brownfields in Chotěboř MEC territory – the Castle in Libice nad Doubravou site and Former Secandry Vocational School Štěpánov-Bezděkov site - according to CzechInvest database. In the same territory, there are also two brownfields – the Military Complex Bílek site and the site Castle according to the region database. At first glance, there are four brownfields, but in reality, there are three brownfields, because site Castle and Castle in Libice nad Doubravou is on and the same site. However, there are much more brownfields in this area, according to own research (own territory surveys). If we consider only “bigger” localities, we can find here also the Agricultural building in Nemojov, the Abandoned Villa in Chotěboř, the production area in Bezlejev, the agricultural area in Malč, etc. There is also a large number of medium-sized and small brownfields in the area, in the form of abandoned or unused buildings of small shops, family houses or family farms and small businesses.

This example shows that the databases are not complete in the current form, so they don't have the correct information and their data analysis is significantly distorted.

3 How to treat with Brownfields?

For the reasons set above, it is important to designate a body responsible for the registration of brownfields in the territory. In the Czech Republic, the CzechInvest agency is informal institution of that purpose yet, and it records and supports only some selected large sites. This is not optimal at all and it rather confuses the issue and misinterprets the information when it is evaluated. If a uniform and sufficiently detailed form of cataloguing is established and such database is created, it will not only have good information capability, but it will also react responsibly to the solution of the revitalization issue, than it will help to target financial support efficiently, and provide a suitable basis for further information sources, for example, as a basis for building land data models (BIMs).

4 Connections to BIM

Problems with data recorded and used from individual brownfield database are just a representative example of issues, that can be solved by proper implementation of BIM Technology. Strategy for BIM implementation in Czech Republics legislation is being developed now. This issue is more complicated than it seems to be on a first view [8]. BIM data, its use, wide and accessibility, touches many different branches and public responsibilities. Some processes that may be improved with using BIM technologies are described in [8, 9]. To find a proper strategy for BIM implementation which aims to meet needs of many involved authorities, not just the field of Legislation in construction but also its impacts to everyday life of us all.

4.1 Brownfield Databases from aspect of BIM data

Brownfield databases and the study of their issue mentioned above as it is in up-to-date state and form, is a very good example of actual discontinuity, insufficient quantity of rules or customs, and inefficient work in such branch of construction, which could be solved by rising BIM Technology. All processes, fields, and issues in construction industry should be more effective with the BIM Technology if these processes are designed in an effective way [10, 11, 12].

Urban and landscape planning could be very effectively influenced by BIM implementation. Three-dimensional visualization, virtual reality, is the most demonstrative tool for precise and most clear description of an area. BIM Technology is more than that. There is amount of information and data containing many important data that can be updated according to the development of a territory [13]. As Wei, Bonenberg, Zhou, Wang and Wang (2017) wrote, “BIM delivers benefits the building project life-cycle in every aspect” [13].

Brownfield database is one of areas, which could be enhanced by BIM implementation. It is necessary to find the most proper way, study current situation of information related to brownfields current use, money spending or monument degrading problems with these localities, its restoration or potential future use, financing, and connection to National Infrastructure of Spacing Information, rising from GeoInfoStrategy.

4.2 National Infrastructure of Spacing Information, rising from GeoInfoStrategy

National GeoInfoStrategy reveals from the Government Resolution No. 815 of 8 October 2014. This strategy elaborates the basic principles of the development of public administration and eGovernment in the sphere of spatial information, focuses on solving specific problems in the given area in the Czech Republic and proposes provision of quality guaranteed spatial information and services over spatial data not only for the efficient performance of public administration but also for the needs of the entire society [14].

Strategy said: “Spatial data are of particular importance for state security, population protection, to prevent accidents and natural disasters and to address emergencies. Current, unified and quickly available spatial data are necessary for good operational and crisis management at all levels. To ensure the sharing and efficient use of spatial data and spatial information is necessary to create an adequate set of principles, knowledge, institutional measures, technology, data and human resources, which is referred to as an infrastructure for spatial information. In many countries, the National Infrastructure for Spatial Information (NIPI) is modified and defined, in the Czech Republic (CZ) so far integrated, clear, systematic and formally anchored the NIPI is missing.” [14].

Brownfield issue is one of problems that should be solved within the creation of National Infrastructure for Spatial Information (NIPI).

5 Conclusions

Revitalization of brownfields is very hot topic these days. The methodology the methodology for uniform cataloguing and also how to treat them are missing in the Czech Republic. This paper reveals an example of differences between brownfields catalogue provided by different institutions. These differences among recorded data are compared from many aspects within this paper. Monitored data, recorded data and also its comparison could be the inspiration for future methodology of creation these catalogues of brownfields which should be use in the same way on the entire national territory. However, the information in the catalogues does not end up with brownfield issues and their records. Other problem is in data actualization. This lies on the border of structure of brownfield catalogues and the National Infrastructure for Spatial Information using Building Information Modelling as common tool. The issue is not just about the brownfields data itself, but also about the data input, sharing, exchange and output in the scale of brownfields databases and national databases of spatial information.

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