

# A MODEL OF COMPREHENSIVE ASSESSMENT OF DERELICT LAND AS A SUPPORT FOR SUSTAINABLE SPATIAL AND DEVELOPMENT PLANNING IN SLOVENIA

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## Abstract

This paper investigates the characteristics of functionally derelict areas in Slovenia, criteria for their identification, typology and arguments for further monitoring, and regular updating of this new spatial and data layer. Both specifying the precise location and knowledge of characteristics of derelict areas, i.e. brownfields, are an important step towards sustainable planning and placement of activities. In 2017, we recorded 1081 functionally derelict areas in Slovenia in a total area of 3423 ha, with a prevalence of areas of industrial activities.

**Keywords:** functional derelict area (FDA), records, identification criteria, typology, monitoring, spatial planning, sustainable development

## I INTRODUCTION

The rapid spatial development dynamics is strongly affected by increasingly fast social and economic changes. On the one hand, we are faced with increasing requirements of investors for new areas to develop activities and, on the other hand, the increasing dynamics in suspending the already established activities, which leads to various types of degradation, particularly physical deterioration of space.

Derelict land, i.e. a brownfield site, is most commonly defined as any site that has been affected by its former use or human activities; it may be vacant or not fully

utilized, it may also be contaminated (Alker et al., 2000; Bergatt Jackson et al., 2006; Špes et al., 2012). Although spatial degradation poses a certain (e.g. environmental, financial) burden, given the shortage of undeveloped land that can be used to build on, such areas can be instrumental in providing further development, particularly in densely populated urban areas (Špes et al., 2012). Placement of activities in previously used sites also reduces the pressures of expansion of activities into agricultural or forest land (i.e. greenfield development), which is an important contribution to achieving the goals of sustainable spatial development (Lampič et al., 2016; Lampič et al., 2017a), no net land take (Science for Environment Policy, 2016), and rational land use.

The efforts undertaken in Slovenia so far to address the problem of various types of spatial degradation have been unsuccessful, as there has been a lack of a comprehensive approach both to understanding the phenomenon and the identification or definition thereof. As a consequence, it was difficult to identify and properly spatially delineate derelict areas, establish quality spatial records and databases, and to adequately monitor the spatial dereliction phenomenon. The approaches used so far therefore did not allow for activation of spatial and development potentials of many derelict areas in Slovenia that resulted from structural changes in economy. The process of their occurrence accelerated after 2010 when the impacts of the global financial and economic crisis became apparent in Slovenia as well: the gradual closing down of various companies continued while, at the same time, many other development initiatives remained unfinished (construction of new residential neighbourhoods, new business zones, etc.). In the aftermath of the crisis, new investments were largely directed into undeveloped agricultural and forest land. The estimated loss of land in the period from 1992 to 2017 is about 45,000 ha, which means that over the recent 25 years Slovenia lost on average 5 ha of agricultural or forest land per day (Grčman, 2017). To prevent such processes in the future and to provide for a clearer realisation of sustainable development principles in the introduction of new activities, along with creating appropriate spatial records and databases on the existing derelict areas in Slovenia, it is necessary to activate the available knowledge in spatial and development planning and set up functioning mechanisms of priority placement of activities in functionally underutilised or degraded space.

A critical condition to appropriately address the problem of derelict areas in Slovenia is to identify them – to recognize and record their number, surface area, and other geographical characteristics. By defining the model to comprehensively address functionally derelict areas, which are understood as underutilised or abandoned areas with evident impact of preceding use, the purpose of this paper is to overcome the theoretical and methodological gaps in their evaluation in Slovenia. The goals of this paper are thus the following: (1) To present in detail the methods for appropriate identification and recording of functionally derelict areas (hereinafter: FDA), (2) based on extensive data acquired by inventorying FDAs in Slovenia in 2016 and 2017, to define their main geographical characteristics, and (3) based on our experience with FDAs, to provide guidelines for their treatment, which will contribute to a more efficient spatial and development planning in Slovenia. Using theoretical, methodological, and practical experience from the study, we want to contribute to the development of mechanisms

and measures allowing for a minimum emergence of new FDAs along with a relatively successful regeneration of existing ones.

This paper first provides an analysis of the literature and other resources, including theoretical and methodological aspects of addressing derelict areas and their typology. A result of this analysis is, among other things, the definition of the term (functionally) derelict areas. Using the latest findings in this field, we supported other phases of the study, which are indicated below: the method of FDA identification (typology and capture criteria), analysis of results of FDA inventory in Slovenia, evaluation of current FDA development possibilities, and critical assessment of previous practices in managing functionally derelict sites.

## 2. CURRENT EXPERIENCE IN DEALING WITH DERELICT AREAS

### 2.1 Definition of (functionally) derelict areas

The subject matter of derelict areas, i.e. brownfields, is related to the studies and evaluations concerned with the spatial dimensions of structural changes in economy, including agriculture, and also in housing construction and other activities. These are reflected in the occurrence of abandoned or partially abandoned sites, or disused sites, because the activities therein were shut down. Despite the relatively many attempts at treating this spatial phenomenon in various countries and in scientific research, there is still no consensus regarding the understanding and treatment of brownfields (Lampič et al., 2016; Lampič et al., 2017a). Brownfields are defined differently across individual countries, while there are no organisations or initiatives at the global level that would collect methodologically comparable data on the types, number, surface area, or possibilities of their rehabilitation (Špes et al., 2012). The definition of brownfields is generally intricately connected with the purpose and goals of research and development approaches, while problems with their regeneration are often left to regional and/or national governance.

The analysis of definitions of the term of brownfields in individual countries (Bergatt Jackson et al., 2006; Encyclopedic Dictionary of Landscape and Urban Planning, 2010; Špes et al., 2012; Lipovac, 2014; Klančičar Schneider, 2014, etc.) reveals that brownfields are typically linked to contamination and reduced environmental quality. Thus in Spain, brownfields are understood as former industrial sites/zones that are contaminated (or there is suspicion of contamination) in urban and suburban areas. Similar is true for Canada (Dasgupta, Tam, 2009) and the United States (Encyclopedic Dictionary of Landscape and Urban Planning, 2010), where brownfields are considered as properties whose expansion, redevelopment or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant. Dasgupta and Tam (2009) further state that in Canada brownfields are defined as abandoned, idle or underutilized commercial or industrial properties where past

actions have caused environmental contamination (or contamination is suspected to have occurred), but which still have potential for redevelopment. United Kingdom is one of the countries where brownfields are treated the most systematically. This basis is provided by the regularly updated National Land Use Database of Previously Developed Land (NLUD-PDL, 2004), while a special handbook has also been prepared (The Brownfield Guide), which addresses the problem of brownfield regeneration (Bergatt Jackson et al., 2006).

Brownfields have been addressed also under several international research projects and initiatives (CLARINET – Ferber, Grimski, 2002; RESCUE, 2002; CABERNET, 2006; COBRAMAN, 2009; DIGISOIL, 2011; TIMBRE, 2011; RETINA, 2012, etc.). CABERNET and CLARINET projects are most commonly cited in the literature. Under the CABERNET project (2006), brownfields were defined as sites that have been affected by the former uses of the site and surrounding land, are derelict and underused, may have real or perceived contamination problems, and are mainly in developed urban areas. The CLARINET project (Ferber, Grimski, 2002) took a similar stance to addressing brownfields. The RESCUE project developed a definition that relates to sustainable brownfield regeneration as the management, rehabilitation and return to beneficial use of the brownfield land in such a manner as to ensure satisfaction of human needs by taking into account environmental vulnerability (Vojvodíková, Potužník, Bürgermeisterová, 2011). Under the RETINA project (2012), a brownfield is considered as an abandoned, idle, or underused industrial site that emerged after the process of regional economic restructuring, where expansion, reuse or revitalisation may be complicated. The COBRAMAN project defines brownfields as sites (1) that have been affected by the former uses; (2) are derelict or underused; and (3) are mainly in developed urban areas and require intervention to bring them back to beneficial use (Klančičar Schneider, 2014).

In the recent decade, in Slovenia several projects and studies were carried out, which dealt with the definition of the term, types of dereliction, or they focused on specific brownfields. Koželj (1998) addressed the criteria and various types of brownfields, while the first systematic inventory of selected brownfield types of Slovenia was done as part of a wider project on sustainable rehabilitation of environmental burden in Slovenia. In this project, the phenomenon of derelict areas, in a total area of 979 ha (Špes et al., 2012), was quantified for the first time at the national level. The latest research efforts in connection with brownfields have been directed toward brownfields in urban areas (Koželj et al., 2016) or they addressed regionally specific problems of brownfields (Lampič et al., 2015; diploma and Master's theses, e.g.: Hribernik, 2012; Dolinšek, 2016; Zupan, 2016; Udovič, 2017). In 2017, the first systematic inventory was completed and a brownfields database was created, which comprehensively shows and evaluates, in terms of the possibility of regeneration, functionally vacant or derelict sites in Slovenia (Lampič et al., 2017a).

In Slovenia, brownfields are also defined in strategic documents and legislation, particularly those concerned with spatial planning, e.g. Spatial Development Policy of the Republic of Slovenia and Spatial Development Strategy of Slovenia (Politika

urejanja prostora, 2001; Strategija prostorskega razvoja Slovenije, 2004), and environmental protection, e.g. the Environmental Protection Act (Zakon o varstvu okolja, 2004), where they are defined as unutilised space with potential for settlements' inner spatial development. Rather than referring to brownfields, the new Spatial Management Act (Zakon o urejanju prostora, 2017) uses the term derelict sites, which have due to their inappropriate or abandoned use lower economic, social, environmental and/or visual value, and are in need of renovation. The Environment Protection Act (2004) addresses brownfields in terms of environmental burden.

In most of the analysed studies and sources, derelict areas are defined as abandoned or partially abandoned areas or areas that are no longer in use, where the activities were suspended. Brownfields typically, yet not exclusively, occur in urban or urbanised areas. The common characteristics of various definitions of brownfields are the following:

- impact of preceding use of the area is evident,
- abandonment and negligence,
- underutilisation of the site,
- contamination,
- lower value (of space and structures),
- differently manifested development potential, and
- the need for rehabilitation and revitalisation (regeneration).

A significant confusion regarding derelict areas in Slovenia stems from terminology. Namely, only the term *degradirano območje* is known in the Slovenian language, which relates either to environmental contamination or any other type of degradation, such as social and visual degradation. In our opinion, this is where the most difficulties in defining the term stem from, as it is impossible to have a single definition that would consider all the different shades of meaning related to degradation of space and the environment. Thus an accurate definition of the term asks for additional explanation, which includes criteria for identification of derelict areas (e.g. physical degradation, degradation of the environment/environmental elements, social degradation).

## 2.2 Typology of derelict areas

To a certain degree, the fundamental definitions of derelict areas, i.e. brownfields, distinguish between various types thereof (e.g. Dasgupta, Tam, 2009; Lipovac, 2014), and various typologies have been created for their detailed description. Brownfields typology thus describes their basic characteristics and allows for their systematic treatment and easier identification (Adams, De Sousa, Tiesdell, 2010).

In the literature, a functionally derelict area (Table 1) commonly refers to an abandoned industrial site or an area occupied by a disused industrial plant (Encyclopedic Dictionary of Landscape and Urban Planning, 2010). They include abandoned warehouses and closed-down commercial buildings (Brownfield Action, 2015; Landscapes2 ..., 2015; Lange, McNeil, 2004). Martinec (2006; in: Vojvodíková, Potužnik, Bürgermeisterová, 2011) distinguishes between five types of derelict areas: along

with industrial, there are also mining, agricultural, military, and the so-called social brownfields. The spatial database on brownfields in the Czech Republic classified brownfields according to their former use as follows: residential, tourist, transport, industrial, mining, agricultural and military sites, public services areas, and other (Vojvodíková, Potužník, Bürgermeisterová, 2011). A similar typology, but with some specificities, was also proposed by Bergatt Jackson et al. (2006). Along with industrial and infrastructural (particularly railway land) and commercial sites, they also added the following types: agricultural (remnants of the era of collective farming), institutional (public services, such as schools, prisons, hospitals), cultural (cultural heritage sites, cinemas), and sports and leisure brownfields. The presence of this latter type was also underlined by Gauchon (1997), particularly abandoned cableways. COBRAMAN project uses a similar typology (COBRAMAN Brownfield Types, 2016), by defining six brownfield types: industrial, military, mining, railway land, waterfront sites, and former city services sites.

In the Slovenian literature we can also find various typologies of derelict areas. In the first systematic treatment of urban brownfields in Slovenian towns and cities, Koželj (1998) defined seven basic types: industrial, port and railway areas, mining, military, greyfields, residential areas, suburbs, and historic city cores. Later, in establishing the first comprehensive records of brownfields in Slovenia, Špes et al. (2012) stemmed from four key types (industrial, mining, infrastructural, and military brownfields), while in practice field investigations confirmed the need for expanding the set, which was later done as part of the study on functionally derelict areas in the Gorenjska statistical region (Lampič et al., 2015). In their inventory, the authors proposed a typology of 11 types of functionally derelict areas. Industrial, mining, infrastructural, and military brownfields were accompanied with tourist and recreation FDAs, FDAs of cultural heritage sites, agricultural FDAs, commercial FDAs, residential FDAs, old village centres, and waste disposal sites. The typology is an upgrade of the approach from 2012 (Špes et al., 2012) and underlines the specific spatial challenges of the Gorenjska statistical region. In 2017 an amended system for FDA identification was created and tested in pilot statistical regions (Lampič et al., 2017b).

Koželj's experience (1998) in addressing brownfields and the study by Špes et al. (2012) were also upgraded in 2016, when in urban parts of Slovenian city municipalities non-revitalised urban areas (NERUOs) were inventoried. NERUOs in the city municipalities were combined into 10 types. Their definition was based on zoned land use: residential areas, areas of central activities, areas of production activities, areas for tourism and recreation, green areas, infrastructural areas, areas for defence and protection against natural and other hazards, agricultural production areas, areas of mineral extraction, and areas of transitional passive use (Koželj et al., 2016).

Table 1: Outline of the most frequently identified types of derelict areas.

Derelict area type	Characteristic examples
Industrial	Disused factories
Commercial	Closed-down commercial buildings
Mining	Disused mining sites and areas affected by the mining industry
Agricultural	Remains of collective farming
Military	Military barracks, border posts, military grounds
Housing	Suburban areas
Transport	Areas of disused railways, ports, storage areas, border crossing points
Public services	Disused schools, prisons, hospitals
Culture	Deteriorating cultural heritage, disused cinema theatres
Tourist, sports, and leisure	Abandoned areas of cableway installations
Greyfields	Unutilised areas
City centres	Abandonment of service activities in city centres

Data source: Gauchon, 1997; Koželj, 1998; Lange, McNeil, 2004; Bergatt Jackson, 2006; Martinec, 2006, in: Vojvodiková, Potužnik, Bürgermeisterová, 2011; *Encyclopedic Dictionary of Landscape and Urban Planning*, 2010; Vojvodiková, Potužnik, Bürgermeisterová, 2011; *Brownfield Action*, 2015; Lampič et al., 2015; *Landscapes2 ...*, 2015; *COBRAMAN Brownfield Types*, 2016; Koželj et al., 2016.

Most typologies of brownfields are thus based on former uses in these sites. Experiences with addressing brownfields show a high diversity of land use as it is continuously changing and adjusting to social changes. For the needs of a detailed studying of brownfields and comparative temporal analysis, the individual types of brownfields can be further divided into subtypes that specify the onset of degradation in more detail (Vojvodiková, Potužnik, Bürgermeisterová, 2011). Such an approach was considered and used in the studies about functionally derelict areas in the Gorenjska statistical region (Lampič et al., 2015).

### 3 METHOD FOR RECORDING AND MONITORING OF FUNCTIONALLY DERELICT AREAS IN SLOVENIA

When defining brownfields for the needs of this study we mostly considered the functional dereliction of a site, which often carries potential for further spatial development. The definition of derelict areas was therefore somewhat narrowed down and we were only concerned with functionally derelict areas. The proposed definition of the term includes brownfields both in urban and open space, which is of key importance for the later use in the proposed comprehensive system of monitoring (functionally) derelict areas in Slovenia.

FDA's were defined as not fully utilized or disused areas with a visible impact of its former uses and of lower utility value. This can present development potential; FDA's can be regenerated by sectorally consistent regulations and revitalisation measures.

For functioning of the entire system, which would allow (provide) FDA rehabilitation or regeneration, Adams, De Sousa, and Tiesdell (2010) identified the following activities as essential: FDA identification (their definition – typology, definition of capture criteria, establishment of a database as records or register), identification of FDA potentials and risks (analysis of conditions), (environmental) remediation, vision of a comprehensive recovery, planning FDA rehabilitation, implementation plan production, plan implementation, plan implementation monitoring, and pursuit of goals.

The first step, i.e. FDA recording, is generally a systematically established activity at the state level as part of systematic monitoring of the condition and processes in space. This does not apply to Slovenia, however, as no comprehensive records at the national level existed until the study presented. Under this comprehensive approach to addressing FDAs, we thus designed and set up the basic system for recording and monitoring FDAs in Slovenia, which includes:

- **Creation of a FDA typology**, describing the basic features of the individual FDA according to the former activity, allowing for further systematic dealing with FDAs.
- **Definition of FDA criteria**, allowing for identification of relevant areas (in space).
- **FDA identification and recording**, allowing for acquisition of data using field visits, inventory, and interviews with stakeholders at the local (municipal) level.
- **Establishment and maintenance of FDA records**, including the entry of identification, substantive, and spatial data into a web application, together with photographs, while the application allows for an overview and basic analyses of a FDA, and the possibility of upgrading the records (changing the data on an individual FDA, adding new FDAs, etc.).

### 3.1 Definition of types of functionally derelict areas

In defining FDA types, we stemmed from former activities (the latest activity before its suspension) and the Rules on the Content, Format and Drawing-up of Municipal Detailed Spatial Plan (Pravilnik ..., 2004), based on which we harmonised the terminology, i.e. the naming of the individual types of FDAs. We identified nine basic FDA types (Table 2). Five types were further classified into various subtypes, to further detail the relevant FDA type (15 FDA sub-types in total). FDA subtypes were differentiated into FDAs of service activities (3 subtypes), FDAs of mineral extraction (4 subtypes), FDAs of infrastructures (4 subtypes), FDAs of transitional use (2 subtypes), and FDAs for housing (2 subtypes).

FDA type or subtype does not indicate a discrepancy between actual land use and zoned use in the municipal spatial plan (OPN), but rather it relates to the last activity before its suspension or the currently prevailing activity at the site. Field visits are necessary to identify the appropriate FDA type and subtype or to delineate between the individual activities.

This typology is an open system, which means that new types or subtypes of functional dereliction (of areas) can be included, as well as other types of degradation (e.g. environmental, social, visual, “spatial planning” – in terms of urban design guidelines and norms, etc.), which must be based on the same methodological framework as FDA treatment (objectively quantifiable criteria for their determination, a system of types and subtypes of brownfields).



Table 2: Typology of functionally derelict areas.

Id	FDA type	FDA subtype
1	FDA of agricultural activities	
2	FDA of service activities	2.1 FDA of public services 2.2 FDA of business, commercial and other service activities 2.3 FDA of a historical city or village centre
3	FDA of tourist and sports activities	
4	FDA of industrial activities	
5	FDA of defence, protection and rescue services	
6	FDA of mineral extraction	6.1 FDA of a mine 6.2 FDA of a quarry, a sandpit 6.3 FDA of a gravel extraction pit 6.4 FDA of other areas of mineral extraction
7	FDA of infrastructures	7.1 FDA of transport infrastructure 7.2 FDA of environmental infrastructure 7.3 FDA of other public infrastructure works 7.4 FDA of green infrastructure
8	FDA of transitional use	8.1 FDA of a disused construction site 8.2 FDA of characteristic transitional use
9	FDA for housing	9.1 FDA for housing – unfinished residential areas 9.2 FDA for housing – old deteriorated areas

Figure 1: The Novoles furniture factory in Brežice, 3.2 ha in size, has been a completely disused industrial site since 2011 (photo: T. Dokler).



In the course of its operation, the emissions to air from Novoles became a major environmental problem. Abroad, brownfields are often defined as abandoned, idle, or underutilized sites where past actions have caused environmental contamination.

*Figure 2: Business zone Na vrtači in the Municipality of Divača (photo: L. Verlič).*



*Business zone Na vrtači, constructed and fully developed with public infrastructure in 2005, remains almost completely vacant, despite its direct proximity to the motorway. Not far from here there is another business zone Risnik that has suffered a similar fate. Divača is an important transport hub, which, however, does not provide a sufficiently strong locational factor for a more intensive development of economic activities. Underutilisation of space is one of the biggest challenges of spatial planning and spatial management. In the most recent period, Slovenia has seen a rather sporadic establishment and development of business zones, particularly at exits from newly built motorways, which remain vacant or poorly occupied in many places.*

*Figure 3: The unfinished residential neighbourhood on the outskirts of Divača includes 19 residential buildings, built in 2008 to the third construction phase (photo: L. Verlič).*



*All residential buildings and appertaining land are abandoned, with visible signs of deterioration. As in many similar cases, the investor is the subject of bankruptcy proceedings, while the fate of the new neighbourhood, which never came to life, remains uncertain. A total of 28 unfinished residential neighbourhoods, out of 95 inventoried FDAs for housing in Slovenia, were recorded, which are either still completely uninhabited or few dwellings or buildings are occupied.*

Figure 4: The envisaged commercial zone Dolsko, whose public infrastructure was developed back in 2011, remains completely unutilised (photo: M. Sevšek).



Various economic activities are planned in former agricultural land outside Dolsko, a new Municipal Spatial Plan and the change in the zoned land use into a residential area are being prepared. Out of 112 FDAs of transitional use, planned investments were suspended in 70 sites (FDA of an abandoned construction site). FDAs of transitional use are often faced with the problem of illegal waste dumping.

### 3.2 Criteria for identifying functionally derelict areas

The system for monitoring FDAs underlines areas that are not in function or a certain function (use) in the area is taking place in a limited scope. Therefore the main criterion for their definition is disuse or the lack of activity. In order to classify a site in question as a FDA, it had to be at least partially abandoned (i.e. at least 10%).

The only exception applies to the FDA subtype for housing – old deteriorated areas, which is despite the preservation of its residential function characterised by distinct physical degradation and deteriorated living conditions.

FDAs must have a minimum size. The minimum area of 0.2 ha was set as the capture criterion in towns, cities, and urban settlements (according to the definition of the Statistical Office of the Republic of Slovenia from 2003 – *Mestna naselja...*, 2004), while other areas (open space) were required to cover at least 0.5 ha. The system for inventorying the relevant areas is not rigid, but rather it adjusts to the diverse conditions in space within the allowed 20 % deviation in size. In the case of some small, mostly rural municipalities (particularly in NE Slovenia), we did not include some of the identified FDAs recorded in the field (e.g. areas of disused affiliated schools, small areas of service activities), as they did not meet the minimum size criterion.

Additional criteria were added to the basic criteria, intended to outline the conditions in FDA, which are significant also for their later evaluation and decision-making regarding their reactivation. We also provided an estimate of physical degradation (maintenance of the site) and suspected social (presence of vandalism, above-average crime rate,

ghettoization) and environmental degradation (water, soil, air, vegetation, surface, etc.). The FDA of transitional use also considers the criterion of the period of abandonment, where e.g. an abandoned construction site is classified as a FDA only when the construction has been suspended for at least a year.

### 3.3 Identifying and recording functionally derelict areas

Regardless of the many available spatial and data layers available (e.g. the Ministry of Agriculture, Forestry and Food's actual land use, Environmental Atlas, applications for showing various statistical data by spatial units by the Statistical Office of the Republic of Slovenia), which in recent years made the treatment and assessment of spatial phenomena easier and of better quality, there is still no available groundwork in place, which would replace the checking of the situation in the field. "In situ" visits are usually not enough, as a mere visual assessment usually fails to reflect the actual spatial characteristics. Field work thus also included interviews with municipal representatives responsible for the environment and spatial planning, who provided valuable additional information (year of abandonment of activity, chronology of development of activities, site development plans, obstacles to development, ownership information, etc.) about the relevant sites recorded (Table 3).

Table 3: Information collected on functionally derelict areas in Slovenia.

Information on FDA	Data acquisition method
Type	Expert assessment (based on previous activities and field conditions)
Boundaries	Field delineation, plotting ( <i>shp</i> polygons)
Area	Calculation from the FDA spatial layer ( <i>shp</i> polygons)
Degree of abandonment	Expert assessment in the field, verified by interviewing a municipality representative
Presence of structures	Expert assessment in the field
Maintenance level	Expert assessment in the field
Ownership (public, private, mixed)	Verified by interviewing a municipality representative, information from the land registry
Suspicion of social and environmental degradation	Expert assessment in the field, verified by interviewing a municipality representative
Development plans, obstacles, and timeframe of the envisaged reactivation activities	Verified by interviewing a municipality representative

### 3.4 Setting-up and maintenance of records of functionally derelict areas

A standalone web application was produced with the purpose of setting-up a national register of FDAs in Slovenia. It was created as an independently developed *Drupal* platform module. The application enables the digitisation of the inventory, while its

functionalities allow for data input for the individual FDA, data editing of the individual FDA, FDA mapping, data transfer/upload of the recorded FDA, and the FDA's basic analytic illustration.

*Google Maps* were taken as the mapping basis, allowing for showing FDAs by statistical region and municipality. Either all or only specific types of FDAs can be shown, or FDAs can be shown by the degree of abandonment (Lampič et al., 2017a); nevertheless, the practical application of the application and the collected information will be revealed only upon actual use and by keeping the data up-to-date.

To ensure that the FDA database is kept up-to-date it is necessary to maintain the existing data and spatial layer. The proposed updating system is based on a periodic review of the changes in the individual FDA locations. Annually, it makes sense to monitor selected information about FDA, such as the degree of occupancy/abandonment of the area, physical condition, and changes in surface area. The newly emerging FDA or the erasing of a FDA due to its regeneration is noted in the records.

*Figure 5: Stročja Vas Primary School building in the Municipality of Ljutomer is an example of FDA of public services, which has been completely vacant since 2009 (photo: T. Kikec).*



*We inventoried 44 FDAs of public services (out of 162 FDAs of service activities), including many disused school buildings. Many of them were not included in the inventory in the areas outside urban settlements due to the minimum size criterion (0.5 ha).*

Figure 6: Šport Hotel Areh on Pohorje is one of the many FDAs of tourist and sports activities in Slovenia (photo: T. Kikec).



*In the territory of the whole nation state we registered 60 FDAs of tourist and sports activities. Among them we registered a large number of derelict hotel buildings which have mostly started to decay and are in a rather poor state. At the end of 2017, the Hotel Areh changed its owner. According to rough estimates its renovation (roof, heating, rooms, restaurant, etc.) would cost at least 2 million EUR.*

Based on continuous, albeit non-systematic, monitoring of development of the already inventoried FDAs in Slovenia (particularly of the sites recorded in 2016), we see that, annually, we can expect changes in 15–20 % of the recorded sites (by also considering the newly established FDAs or regenerated FDAs).

## 4 RESULTS OF THE INVENTORY AND ANALYSIS OF FUNCTIONALLY DERELICT AREAS IN SLOVENIA

The proposed method for a comprehensive inventory and monitoring of the FDA was used and checked, for the first recording of FDAs, in 2016 and 2017. Field work was underway in two periods. The first part was carried out from April to September 2016 (area of seven statistical regions: Pomurska, Podravska, Posavska, Zasavska, Jugovzhodna Slovenija, Goriška, and Gorenjska), and the second one from April to September 2017 (area of the rest five statistical regions: Osrednjeslovenska, Primorsko-notranjska, Obalno-kraška, Savinjska, and Koroška). In the recording we identified and registered a total of 1081 FDAs with a total area of 3422.7 ha. Of 212 Slovenian municipalities, FDAs were recorded in 170 municipalities, while in a total of 35 municipalities more than 10 FDAs were identified.

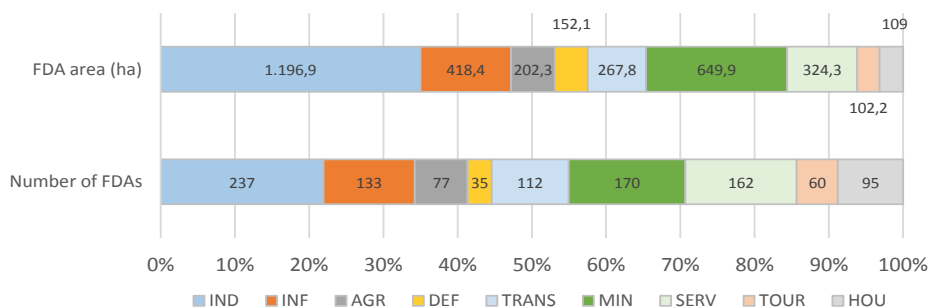
By number (Figure 7), FDAs of industrial activities prevailed (237 sites in total), followed by FDAs of mineral extraction (170 sites in total, of which 128 quarries), and

FDA of service activities (under this type FDAs of business, commercial and other service activities prevailed (84)). According to surface area, there was a prevalence of FDAs of industrial activities (1196.9 ha), FDAs of mineral extraction (649.9 ha), and FDAs of infrastructures (418.4 ha). The average FDA size is 3.2 ha; on average, FDAs of industrial activities (5.1 ha) are the largest, while FDAs for housing are the smallest with only 1.1 ha (Table 4).

Table 4: Number, total area, and average size by type of functionally derelict areas in Slovenia.

FDA type	Number of FDAs	FDA area (ha)	Average FDA size (ha)
FDA of agricultural activities	77	202.3	2.6
FDA of service activities	162	324.3	2.0
FDA of tourist and sports activities	60	102.2	1.7
FDA of industrial activities	237	1196.9	5.1
FDA of defence, protection and rescue services	35	152.1	4.3
FDA of mineral extraction	170	649.9	3.8
FDA of infrastructures	133	418.4	3.1
FDA of transitional use	112	267.8	2.4
FDA for housing	95	108.8	1.1
<b>Total FDAs</b>	<b>1081</b>	<b>3422.7</b>	<b>3.2</b>

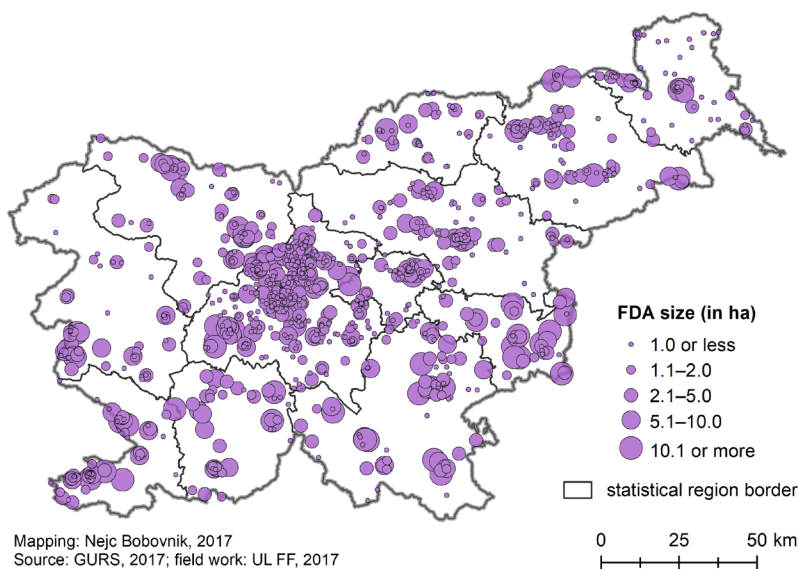
Figure 7: Number and area of functionally derelict areas in Slovenia by type.



Notes: IND – FDA of industrial activities; INF – FDA of infrastructures; AGR – FDA of agricultural activities; DEF – FDA of defence, protection and rescue services; TRANS – FDA of transitional use; MIN – FDA of mineral extraction; SERV – FDA of service activities; TOUR – FDA of tourist and sports activities; HOU – FDA for housing.

The spatial distribution of FDAs demonstrates the actual dimension of the phenomenon of functionally derelict areas in Slovenia (Figure 8). If not so long ago degraded areas were mostly linked to distinctly urban areas, today, seeing that FDAs are represented all over the country, we have learnt that this phenomenon is an important spatial element in rural areas as well.

Figure 8: Spatial distribution and size of all recorded functionally derelict areas.



Even though FDAs are present throughout Slovenia, their density is greatest in Osrednjeslovenska region, as expected, while other large regional FDA concentrations are in the wider areas of Celje, Maribor, Jesenice, and in the eastern Posavska region.

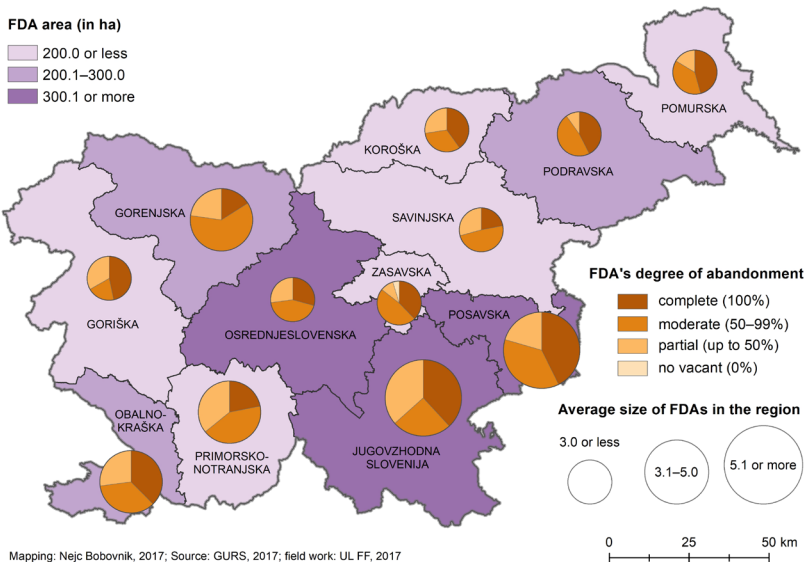
The FDA analysis by regions indicates various regional development specifics of the activities, which are reflected in the representation of FDAs in individual statistical regions. We recorded the most instances in Osrednjeslovenska statistical region (384) and the least in Posavska statistical region (40). According to the maximum total areas of FDAs, Osrednjeslovenska (1103.2 ha), Jugovzhodna Slovenija (500.6 ha), and Posavska (350.8 ha) regions stand out (Figure 9).

Abandonment of activities is the basic criterion for FDA identification, while there are significant differences in the degree of abandoned land among the individual areas (and structures). The data suggest the prevalence of completely abandoned areas (535 of a total of 1081), followed by moderately abandoned (347), and partially abandoned areas (192). Seven areas were defined as non-abandoned – under the FDA type for housing, which includes old, distinctly deteriorated residential areas, with visible signs of physical degradation and often poorly organised common appertaining land. A half of all FDAs in Slovenia is completely abandoned, but their total surface area is somewhat smaller. Thus, completely abandoned land makes up 1149 ha, i.e. more than one third (Figure 9).

The regional illustration of the FDA structure, by surface area according to the degree of abandonment, shows that the degree of completely abandoned FDAs is the highest in Goriška, Pomurska, Podravska, Koroška, and Jugovzhodna Slovenija regions, while,



Figure 9: Functionally derelict areas by surface area and degree of abandonment per statistical region.



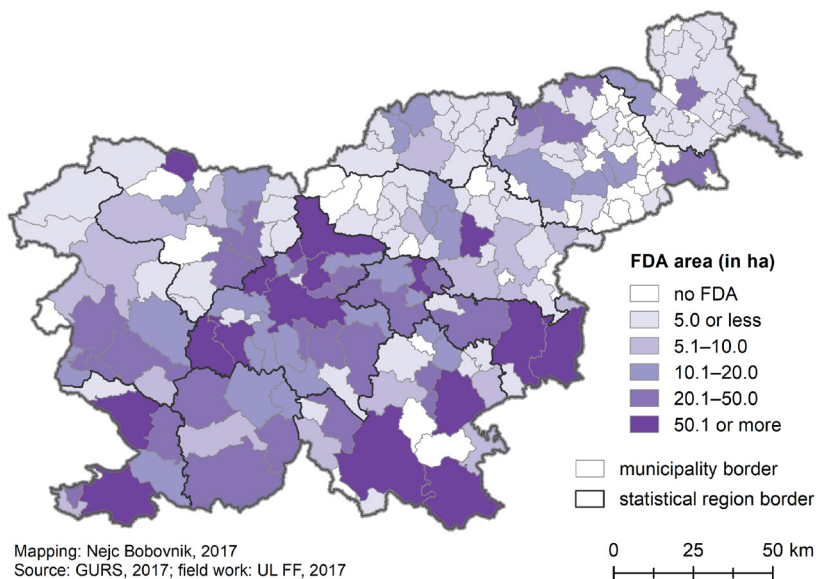
in absolute terms, completely abandoned areas prevail in Osrednjeslovenska (323 ha), Jugovzhodna Slovenija (191 ha), and Posavska (150 ha) regions. Notably, there are also regional differences in the average size of FDAs, where the largest are found in Posavska (8.8 ha) and Jugovzhodna Slovenija (6.6 ha), and the smallest in Koroška (1.3 ha) and Pomurska (1.5 ha) regions. The rather large differences are to a certain degree the result of the FDA structure, as in regions with, on average, larger areas, there is a prevalence of industrial or infrastructural FDAs, while with regions where small FDAs prevail, there is an above-average occurrence of FDAs of service activities.

The size of the areas recorded (Table 5) is significant particularly in terms of site selection and placement of new development projects. Larger investment incentives regarding new production and other activities generally look for larger geographically coherent areas. The FDA inventory showed that there are relatively few large, homogeneous, and available FDAs in Slovenia. Only 16 FDAs larger than 30 ha were identified (mostly FDAs of industrial and craft activities), while a total of 65 FDAs was larger than 10 ha. Almost a half of FDAs (i.e. 504 or 46.6%) is smaller than 1 ha. The existing FDA capacity thus does not allow for introducing ambitious investments, however by technological development and economic conversion into intensive activities in terms of development and innovation, creative activities and by the increasing role by small and medium-sized enterprises in the economic structure, their inclusion in smaller economic zones within the existing settlement structures is possible as well.

Table 5: Functionally derelict areas by size class and type.

FDA type	Less than 1 ha	1–2 ha	2–5 ha	5–10 ha	10–30 ha	More than 30 ha
FDA of agricultural activities	31	20	14	8	4	0
FDA of service activities	109	27	18	3	2	3
FDA of tourist and sports activities	39	7	12	1	1	0
FDA of industrial and craft activities	77	48	62	22	20	8
FDA of defence, protection and rescue services	9	10	9	3	3	1
FDA of mineral extraction	67	38	26	23	13	3
FDA of infrastructures	57	35	23	15	2	1
FDA of transitional use	53	22	25	9	3	0
FDA for housing	62	18	14	0	1	0
<b>Total FDAs</b>	<b>504</b>	<b>225</b>	<b>203</b>	<b>84</b>	<b>49</b>	<b>16</b>

Figure 10: Total functionally derelict area (in ha) by Slovenian municipalities.

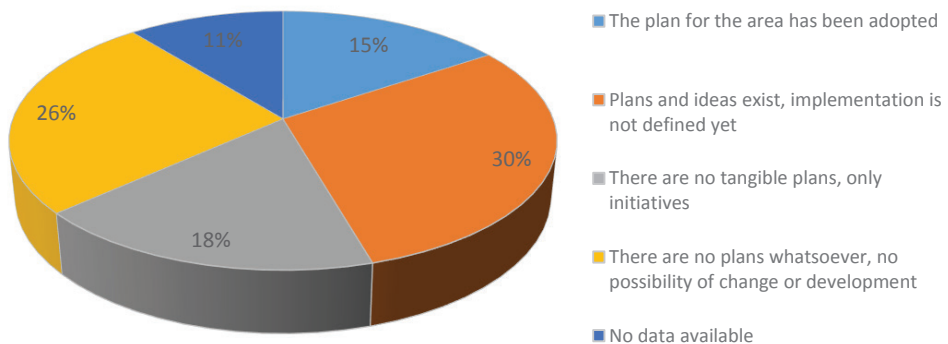


Analysis of conditions at the lowest spatial level, by municipality, shows an even more interesting spatial picture. FDAs were recorded in 170 municipalities across Slovenia. In many other small municipalities, the phenomenon of non-functional, derelict areas was detected as well (e.g. disused affiliated schools with appertaining land, vacant areas of other service activities), which, however, were not included in the records because of their size (smaller than 0.5 ha). In eight municipalities (Ljubljana, Domžale, Kamnik, Vrhnika, Celje, Medvode, Novo mesto, Ivančna Gorica) we identified more

than 20 FDAs, and in 35 municipalities 10 FDAs or more. 17 municipalities have a total surface area of over 50 ha of FDAs, while 44 municipalities have over 30 ha of FDAs. With an extremely large total area of FDAs (more than 100 ha), the municipalities Ljubljana (276.4 ha), Kočevje (185.5 ha), Brežice (168.8 ha), Krško (145.7 ha), Črnomelj (121.2 ha), Kamnik (119 ha), and Vrhnika (105 ha) stand out. The total FDA area in as many as 95 Slovenian municipalities is smaller than 10 ha, among which small municipalities in north-eastern Slovenia prevail (Figure 10).

In the FDA recording, through discussions with municipality representatives responsible for spatial development, we checked rehabilitation and regeneration plans for individual FDAs by municipalities, owners, or potential investors. The answers were provided descriptively, while the interviewees classified them also based on (their assessment of) the time needed for the regeneration (Figure 11).

Figure 11: Envisaged rehabilitation, regeneration plans for the site (by the municipality).



At the level of the entire country, a development plan is in place for a mere 15% of all FDAs – in which case the municipalities mostly stated that the Municipal Detailed Spatial Plan (OPPN) is adopted, or, in some cases, a building permit for the new investment/construction has been issued, or the investor and the design project are known, etc. Nevertheless, there are no plans in place for most FDAs (44%) in Slovenia, i.e. there are no development possibilities or information about development plans. Planners of land use are often not familiar with the potential plans (they underline the power of landowners) or they are unable to influence the rehabilitation or reactivation.

For almost a third of the FDAs, the municipalities stated that, in fact, concrete plans and ideas existed (both by the municipality and the owners), while the manner and time of their implementation was unknown. They frequently provided examples where the solution had already been proposed, or even financially supported, but then right before, or during the implementation, changes or problems occurred.

The demonstrated timeframe of the planned reactivation points out that, at the declarative level, plans have been adopted for many sites, i.e. at least realistic implementation

plans (45% FDAs, Figure 11), but when we inquired about the envisaged time of implementation of these plans and initiatives, it became evident that the implementation is planned to take place within the following five years in only 21% of the sites, while for 67% of all FDAs recorded the municipalities had no schedule for their rehabilitation or reactivation, or there was no information available (Figure 12).

The overview of development plans by FDA type suggests that the most plans relate to areas of transitional use (areas of vacant construction sites) and FDA for housing, while the solution for FDA of agricultural activities and FDA of infrastructures is the most insecure.

Figure 12: Timeframe of the planned area revitalisation (municipality assessment).

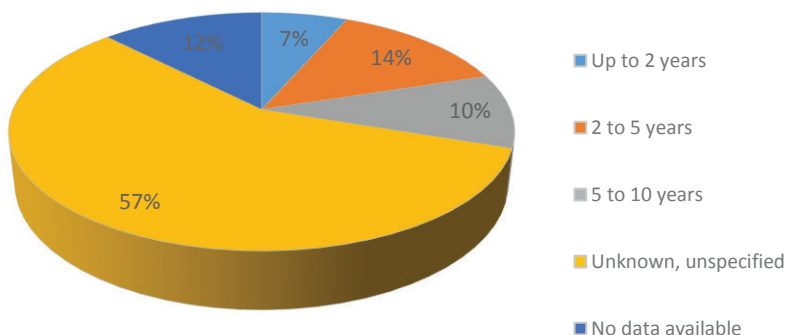
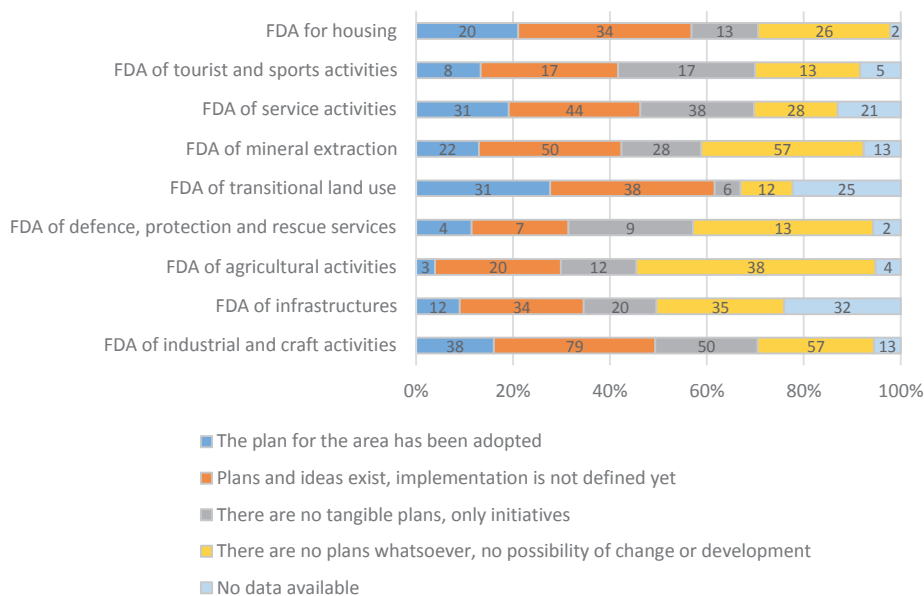
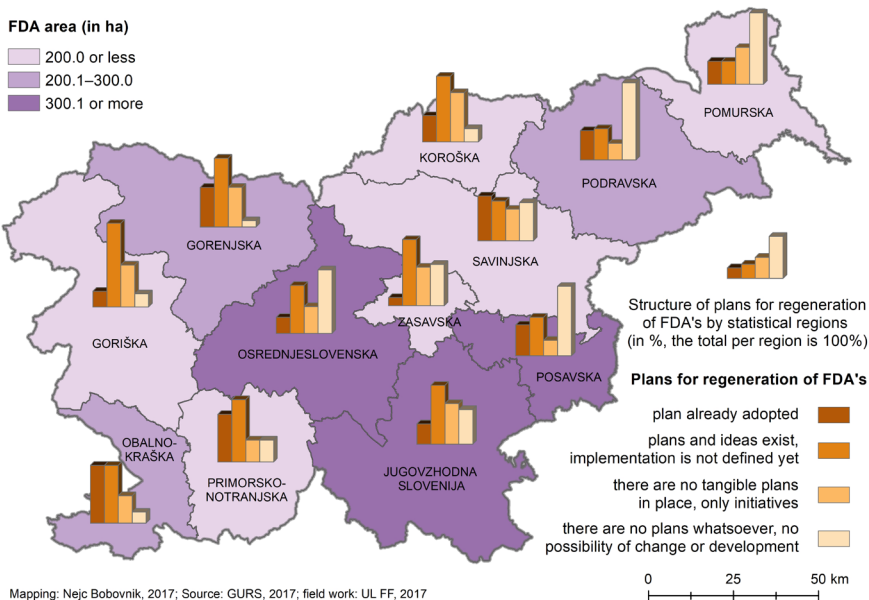


Figure 13: Plans of regeneration by type of functionally derelict area.



The overall results for the statistical regions show that many regions in the Vzhodna Slovenija Cohesion Region (Podravska, Pomurska, and Posavska statistical regions) have more difficulties planning the reactivation of brownfields than those in the Zahodna Slovenija Cohesion Region (particularly Gorenjska and Goriška statistical regions). In the Vzhodna Slovenija Cohesion Region, Jugovzhodna Slovenija and Savinjska statistical regions have more brownfield regeneration activities in place, as seen in Figure 14.

Figure 14: The envisaged revitalisation plans of functionally derelict areas per statistical region.



The analysis by size, type, degree of abandonment, and other information about the recorded FDAs at least to some extent also reflects the structural problems present in the statistical regions addressed: the large number of FDAs of industrial activities is an indicator that suggests, or at least correlates, the high degree of change in the economic structure. In some areas, this is certainly connected with the abandonment of service activities. FDA of tourist and sports activities are less represented and they mostly occur (12) in the Gorenjska statistical region. The least FDAs are intended for housing, which, however, due to other criteria that were not used in this inventory, they do not reflect the real situation in the field.

## 5 DISCUSSION AND CONCLUSIONS

As stated in the introduction, the FDA phenomenon in Slovenia is characterised by great dynamics, which is the result of many factors and social processes: the abandonment

of activities or their changed (spatial) needs is spurring the continuous introduction of new FDAs. At the same time, new activities are included in existing FDAs, leading to their partial, gradual, or even total regeneration. Given the large number of recorded FDAs in Slovenia in 2016 and 2017 (a total of 1081 FDAs), their total surface area (3422.7 ha), and their characteristics (size, degree of abandonment, ownership heterogeneity, infrastructure, presence of various forms of deterioration, etc.), fast responsiveness and systematic actions of various sectors at the state, but also regional and local, levels are necessary, which will allow for a targeted and systematic problem solving.

This study, but also some previous studies (e.g. CABERNET, 2006; Environmental liability ..., 2011), confirmed that due to better understanding, easier handling of the brownfields problem, and more targeted proposals for their regeneration, their treatment should be directed into the relevant types of deterioration (physical, visual, environmental, functional, social, incongruence between land use and applicable spatial planning documents, etc.). As part of the proposed approach to treating FDAs, we thus systematically focused on the areas where human activities do not take place, or they take place to a limited extent, while in the model enough room was left for inclusion of other forms (e.g. social, environmental) and types (e.g. agricultural) of degradation, which could be included in the brownfield records created. We assess that in the future particularly the detailed typology (subtypes) of the currently nine main FDA types will be amended.

The goal of the records established at the national level, allowing for insight into the current situation of functionally derelict areas, is, first and foremost, linked to their regeneration or development activation.

We find that a particularly complex task is to integrate activities (by type and scope) into those areas that are partially already (still) operational, which we identified in the field in many places. In practice, the sale of vacant land inside the formerly coherent functional areas is subjected to uncontrollable development, finally leading to fragmented ownership and breakdown of large homogeneous units. This prevents the planning of activities for major investors. The fragmentation of functionally coherent FDAs thus disables a comprehensive approach to managing or activating an area (e.g. with municipal detailed spatial plan), so the regeneration often occurs partially only, which is reflected in space as disorganisation, i.e. physical (visual) spatial degradation.

Field experiences demonstrate that the prospects for regenerating the individual FDA depend mostly on the ownership structure (type, number, and ownership heterogeneity), owner's financial capacity, location, adopted (municipal) documents, etc.

The reasons for (un)successful FDA regeneration are typically found in:

- Major financial investment required as one of the main reasons inhibiting FDA rehabilitation and regeneration. FDA owners and/or municipalities try to solve the limited financial resources by applying to various domestic or international competitions or by searching for investors willing to invest in FDA rehabilitation.
- FDA ownership structure, which is often manifested in the form of unsolved or unknown ownership, larger number of co-owners who have various interests, mixed public-private ownership, disinterested owners whose only goal is to sell the FDA for

a very high price, long procedures of ownership transfer from the state to the municipality, long bankruptcy proceedings of the companies who own FDAs, etc.

- Municipal and national spatial documents as frequently recognised reasons for reducing the possibility of FDA regeneration, as landowners and investors are faced with discrepancies regarding zoned land use. In the adopted municipal spatial documents the applicable zoned land use frequently does not fit the actual situation in space. The procedures of adopting the relevant municipal spatial documents and municipal detailed spatial plans significantly affect the timeframe of the FDA regeneration process.
- Insufficient public infrastructure facilities, as inhibitors of regeneration and development, as potential investors are not willing to invest in FDAs that lack appropriate access, have poor traffic organisation, or lack public infrastructure facilities.
- (Too) frequent changes of legislation in various areas, when a FDA is located in areas under public-law protection regimes (water protection zones, Natura 2000, protected area, cultural heritage sites, etc.). The procedures concerned with environmental permit acquisition are long, too.

Since October 2017, Slovenia has had a new spatial and data layer on functionally derelict areas, while the data are compiled and edited in a format, which allows for access via a publicly available application (link: <http://crp.gis.si/>) as well as transfer of the recorded data, shapefile polygons, and photographs to other software environments.

This record allowed for identification of types, quantity (number, area), and causes of FDA occurrence in Slovenia. Its design is based on a combination of knowledge in geography, spatial planning, and governance. For the first time, this wide-ranging design, which allows for addition of new types of derelict areas, also enables up-to-date quantitative monitoring of derelict areas in Slovenia. Notably, the records will only achieve their purpose when a system for their (annual) updating at the national level is set up, which should be approached by cross-sectoral consistency of work. The applicability of the records could be improved by simultaneous access to data on relevant locational factors for various activities (industry, services, housing, etc.), particularly comprehensive data on transport, environmental, and other economic infrastructure (see e.g. Jurinčič, 1993; Jeršič, 1999).

When tackling the fast changes that are often reflected as unforeseen possibilities and investors' land requirements for planning (mostly) economic activities, up-to-date data on the condition and processes in space and monitoring of rapid changes are all the more important. There is a declining number of operating mechanisms for monitoring, directing, and controlling the changes in space, which practically further reduces the possibility of a timely response of the relevant sectors and professions. Furthermore it is also necessary to identify the appropriate institution managing the spatial policy as this makes it possible for the records to eventually, in the mid- to long-term, evolve into a registry.

Promotion, public access, insight into actual spatial conditions, and appropriate methodological and technical development of this new spatial layer can considerably contribute to reducing areas of unsustainable land use in Slovenia. At the same time, the newly

established FDA records have provided an excellent basis to finally systematically and comprehensively address the preparation of efficient measures (legislative, spatial planning, financial, and supporting) to contribute to their regeneration in Slovenia.

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*(Translated into English by Mojca Vilfan)*

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