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URBAN BROWNFIELDS IN ESTONIA: SCOPE, CONSEQUENCES AND REDEVELOPMENT BARRIERS AS PERCEIVED BY LOCAL GOVERNMENTS

Jiří TINTĚRA, Aime RUUS, Epi TOHVRI, Zenia KOTVAL

Abstract

Awareness of brownfields is limited in Estonia. In fact, there is no specific term officially used for brownfields at present. The aim of this study is to examine concerns in the redevelopment of brownfields and to present preliminary findings regarding the scope, consequences and redevelopment barriers of Estonian urban brownfields, as perceived and assessed by local authorities. The perceived importance of the negative impacts of brownfields on urban space is more than the mere number of brownfields and their total area, as it is influenced by the presence of other negative socioeconomic phenomena, such as local unemployment or population decline. According to municipal authorities, major barriers to the redevelopment of Estonian urban brownfields, besides the economic issues, are both the lack of knowledge regarding state and local measures and tools to help the public sector deal with brownfields, and the common perception that brownfields re-development is a private sector issue.

Shrnutí

Urbánní brownfieldy v Estonsku: rozsah, dopady a revitalizační bariéry z pohledu městských samospráv

Povědomí o problematice brownfields je v Estonsku slabé, dodnes pro ně neexistuje žádný konkrétní oficiální termín. Cílem této práce je prozkoumat zájem městských samospráv o regeneraci brownfields a analyzovat rozsah, dopady a bariéry rozvoje urbánních brownfields v Estonsku ve vnímání a hodnocení místních samospráv. Vnímaná důležitost negativních dopadů brownfields je spíše než množstvím a rozlohou brownfields ve městech ovlivněna přítomností dalších negativních socioekonomických jevů jako lokální nezaměstnanost či úbytek populace. Podle samospráv obcí představují kromě ekonomických faktorů hlavní překážky regenerace městských brownfields v Estonsku jednak nedostatek znalostí možných nástrojů k podpoře regenerace brownfields ze strany statní správy a samosprávy a také široce rozšířený názor, že regenerace brownfields má být záležitostí soukromého sektoru.

Keywords: *urban brownfields, sustainability, land management, legal definition, negative impacts, barriers to development, Estonia*

1. Introduction

After the collapse of the Soviet Union in the early 1990s and similarly with other Baltic countries, Estonia went through radical structural changes in its economy and politics. As a result, an increasing number of urban brownfields emerged. Despite this fact, abandoned urban space is only seldom re-used for new development. Due to its economic growth, accession to the European Union and access to the EU structural funds, Estonia is now reaching the point where it would be able to start to deal with brownfields redevelopment. Awareness of brownfields, however, their opportunities and constraints, remains fairly limited in Estonia. Currently, there is no specific term or legal definition for brownfields in the Estonian language. Drawing on the experience of other countries, it is possible to assume that local governments, which are on the frontline when it comes to dealing with negative impacts of the presence of brownfields in their administrative area, will also be the first to show interest in brownfields regeneration (CABERNET, 2006).

Given this background, the aims of this study are to examine local governments' interest in brownfields regeneration in Estonia, to present preliminary data regarding the extent and the perception of Estonian urban brownfields and their redevelopment from the perspective of municipal governments, as well as to understand public sector concerns and issues related to such redevelopment. Drawing on Estonian survey-based research, this research will show the scale and nature of urban brownfield redevelopment problems that municipalities of former Soviet countries are facing, and will highlight the most affected towns. The critical question is: Does the presence of brownfield sites have any impact on the quality of life in Estonian towns?

This paper seeks to answer this main question from four different aspects:

1. How do local governments perceive the extent, cause and nature of brownfields in Estonian towns?
2. What geographical and socioeconomic factors affect the spatial diffusion and extent of brownfield areas in towns?
3. What do local governments perceive as the most important negative impacts of brownfields on local communities' quality of life and how significant are these impacts? and
4. What do local government officials consider to be the main barriers to redevelopment of urban brownfields?

Once answered, these questions can begin to provide a sense of the magnitude and nature of the brownfield redevelopment tasks, and could serve as a starting point for possible future policy of brownfields redevelopment in Estonia. Responses to these questions were collected from survey data and interviews with local government officials. The feedback received also contains implications for future

research and planning, providing an initial empirical basis for assessing the scale of the problem of brownfields in Estonian towns, and the resulting problems that municipal governments face.

2. Urban brownfields redevelopment

Successful redevelopment of urban brownfields requires effective public and private sector cooperation. Redeveloping a brownfield is far more complicated and difficult than building a new structure on a greenfield site. Benefits gained by the local community from such redevelopment, however, could be immense: from financial advantages (tax income from the site) to qualitative factors, such as environmental clean-up and an improved quality of life. The attitudes of the community towards redevelopment are critical (Kotval and Mullin, 2009), and local governments have a key role in shaping these attitudes. For successful brownfield redevelopment, local authorities need to be able to communicate factually and openly with local residents about potential risks of such redevelopment (Eiser et al., 2007). Local authority regulators are one of key stakeholders involved in the redevelopment of brownfield sites (Williams and Dair, 2007).

CABERNET (Concerted Action on Brownfield and Economic Regeneration Network) is a European multi-stakeholder network that focuses on the complex issues that are raised by brownfields regeneration. CABERNET, in its report "Sustainable Brownfields Regeneration", describes key governance and institutional issues in the regeneration of brownfields. This report also highlights the fact that municipal governments are one of the key decision makers with an impact on brownfields regeneration processes. "Municipalities' actions, or indeed inaction, can have impact on the manner and pace at which brownfield land is brought back into use, or the degree to which it might remain under-used or derelict. Therefore, there is a strong need for a brownfield specific strategic approach for regeneration at the local government level" (CABERNET, 2006).

Among a number of issues that need to be considered when reviewing the role of municipalities, this report states that two of the key problems are a low awareness of the issue among municipal governments, and a lack of adequate knowledge about the scale of the problem. The report further underlines the need of policy makers and developers for reliable and up-to-date information in order to facilitate the re-use of land. It highlights the importance of national land use databases, which would incorporate both the extent and the nature of brownfield lands. Such databases would help member states to deal with the problem of brownfield sites and would be useful "in taking advantage of the opportunities for increased competitiveness presented by successful brownfields regeneration and urban land management" (CABERNET, 2006).

Oliver et al. (2006) divide EU countries into three groups – by competitiveness and population density. The first group is represented by the Scandinavian countries and Ireland. These countries, with a high level of competitiveness and relatively low population density, focus on the regeneration of brownfields by resolving the issues of contamination. In the second group, represented by Western European countries such as Germany and France, high population densities and the lack of available greenfield sites has already created a priority for land regeneration through brownfields redevelopment. The third group is represented mostly by the EU member states from the Mediterranean region and Eastern Europe. These countries have medium relative population densities and a relatively low competitiveness. Due to a lack of any contact with the CABERNET network, Estonia is not mentioned among the selected countries in the CABERNET report. Considering its current state of economic development and past economic structural change, however, it can be presumed that Estonia, despite its low density of population, would be classified in the third group: "It is perhaps these countries [from the third group] that have the most to gain from maximizing the potential for creating more competitive cities that are available through the successful regeneration of urban brownfield land" (Oliver et al., 2006).

This paper reacts to the CABERNET network's recommendations and aims to deliver preliminary findings enabling the establishment of an Estonian national land use database in the future. It also shows local governments' perceptions and awareness of the brownfield issue. The first step towards dealing with the 'brownfield issue' in Estonia is to give it a name. Currently, there is no specific term for brownfields in the Estonian language. Mostly, some equivalent to spoiled or polluted area is used. The term 'tühermaa', which could be translated as a bare or empty plot of land, is noticed more frequently. This term has not been clearly defined yet, however, nor is it exclusively used for brownfield sites. Therefore, for the purposes of the present study, the international term 'brownfield' is used.

The second step towards understanding the full dimensions of the 'brownfield issue' is to define the term. Defining the term and evaluating the problems associated with it makes an essential contribution to its solution (Alker et al., 2000; Adams, De Sousa and Tiesdell, 2010). The definition and the approach to deal with brownfields differ by country and are developing over time (Adams, De Sousa and Tiesdell, 2010; Thornton et al., 2007). While in most of the EU member countries the concept of brownfields as previously-developed land is prevalent (Oliver et al., 2006; ODPM, 2005), both in North America and Australia definitions continue to refer to both known and potentially-contaminated sites (Adams, De Sousa and Tiesdell, 2010). Even in these countries, the focus is shifting from mostly 'contaminated areas' towards 'previously developed land' (Hula and Bromley-Trujillo, 2010; Susilawati and Thomas, 2012). Initially, the term brownfield was associated primarily with urban regeneration, which later began to cover rural areas, too (Frantál et al., 2013). At the moment, there is no standard definition for brownfields across the EU, and legal definitions differ from one EU member state to another (CABERNET, 2006; Oliver et al., 2006). CABERNET, as one of the first approaches at a European level to unify the term, defines brownfields as sites that: (i) have been affected by the former uses of the site and surrounding land; (ii) are derelict or under-used and may have real or perceived contamination problems; (iii) are mainly situated in developed urban areas; and (iv) require intervention to bring them back to beneficial use.

In a similar way that an Estonian term for brownfields is lacking, there is still no legal or commonly-used definition for a brownfield site, either. The concept of brownfields as being previously-developed land seemed to be more appropriate for the Estonian context, and hence the definition elaborated by CABERNET has been used in this study. The definition specifies urban brownfields, but in the context of Estonia, referring solely to urban areas could be problematic. Due to various economic transformation processes in its recent past, Estonia has been left to deal with a number of derelict former

agricultural complexes from the socialist era. These are mainly 'Kolkhozes' (collective farms) and 'Sovkhozes' (farms of collective management). These complexes are situated mostly in the countryside, outside of larger settlements. Narrowing down the definition to only sites in the developed urban areas would ignore the reality of Estonian brownfield sites, and could be a limiting factor in finding a successful solution.

The presence of unused, derelict areas and deteriorated buildings within the compact pattern of a town reduces the attractiveness of a site. It also reduces the value of land and properties in the neighbourhood for potential investors, the existing business sector, as well as for residents. Economic and environmental problems may occur and accumulate in the area and it may start to contrast sharply with both stabilized and new development zones. A large number of brownfields on the administrative territory of a town aggravates problems and may make the area, as a whole, unattractive both for investors and residents. This could lead to growing unemployment and decreasing population (Susilawati and Thomas, 2012). Urban sprawl into outlying green spaces, a hollow urban core and redundant infrastructure, are further products of the missing brownfield policy (Brill, 2009). Unattractive environments, especially if marked by derelict buildings and overgrown lots, detract from the beauty of the surroundings, and give the place an air of neglect. This affects residents' pride, their sense of identity and the perception of attachment to the neighbourhood, which are important for possible future improvements in such areas. Letang and Taylor (2012) state that from the perspective of residents, improved environmental aesthetics are one of the most desired outcomes of successful brownfield redevelopment. The main types of problems caused by or negatively influenced by the presence of brownfields can be listed as follows: economic, financial, spatial, environmental and social. For the purposes of this study, the categorization by Kadeřábková and Piecha (2009), of brownfield's negative impacts on the quality of life within towns, was adapted for use in the questionnaire used (see results in Tab. 3, below).

Compared with greenfield sites, brownfields are often not economically competitive for regeneration without public intervention. Various authors discussing brownfields have identified a number of barriers to redevelopment that may be addressed through government policies. Susilawati and Thomas (2012) see the public perception of brownfields sites as contaminated as one of the main barriers to brownfield redevelopment, even when it is not necessarily the case. Whitney (2003) notes two main barriers: the cost of clean-up and legal concerns. De Sousa (2006) conceptualizes the main constraints on brownfields redevelopment as falling under three categories: development barriers, governance issues and neighbourhood-based drawbacks or under planning/regulatory constraints, physical and ownership constraints (Adams, De Sousa and Tiesdell, 2010). Economic, environmental and social barriers are often present at the sites, hindering the return of brownfields to beneficial use. Public incentives could make brownfields regeneration more attractive. Two types of incentives are applicable: financial incentives including direct and indirect funding, and legal incentives including spatial planning and regulatory drivers (Thornton, 2007).

The present study examines local governments' perceptions of the main constraints that need to be addressed in relation to improving overall brownfield policies in Estonia, and in providing public incentives for undertaking brownfields redevelopment. For the purposes of this study, a list of the development barriers and governance issues relating to brownfields redevelopment, based on De Sousa's (2006) categories, has been incorporated into the questionnaire. The importance of each barrier has also been examined (see results in Tab. 4, below).

Frantál et al. (2013) show that brownfields located in municipalities with a higher local development potential are more likely to be redeveloped. There are different geographical and socioeconomic indicators that can characterize the development potential of a municipality. The results of this study are interpreted in relation to these two types of indicators: (a) geographical indicators – town size, population and proximity to Estonia's capital city, Tallinn; and (b) socioeconomic factors, including the relative changes in population and registered unemployment.

3. Geographical context of the study

Estonia is a small country in the Baltic region of Northern Europe. With a population of 1,339,662 (January 1, 2012) and a total area of 45,227 km^2 its population density is 31 inhabitants per km^2. The Estonian territory is divided administratively into fifteen counties and 226 administrative units managed by local governments, including 33 towns, 193 rural municipalities and fourteen towns without municipal status (ES, 2012). The populations of all 47 towns (with or without municipal status) vary from 1,040 to 397,617 inhabitants. Fourteen towns have a population of more than 10,000 inhabitants and six of them more than 20,000 (Fig. 1). Population is distributed unevenly, with a higher density in northern parts of the country. The location and size of Estonian towns mirror the distribution of population. Apart from the capital of Tallinn in Harju County and the towns of Tartu (Tartu County) and Pärnu (Pärnu County), all other larger towns are concentrated in the East-Viru County in the most north-eastern part of Estonia (Fig. 1).

Since the collapse of the Soviet Union, the size of the Estonian population has continually decreased. According to the 2011 Population and Housing Census, 1,294,455 permanent residents lived in Estonia. Compared to the previous census of 2000, the population of Estonia decreased by 75,597 persons, i.e. by 5.5%. The census results also indicate the continuing concentration of the population around major cities. This is mainly occurring around the capital of Tallinn, but also around the towns of Tartu and Pärnu. These shifting population densities have resulted in the general shrinkage of Estonian towns (ES, 2013b). There are only three towns (Saue, Maardu, Keila), where the population has increased between the two censuses. All of them are situated in relative close proximity of the capital and their growth can be explained as an effect of urban sprawl (Roose, Kull, Gauk and Tali, 2013). In the remaining towns, the population has decreased. Compared to 2000, the decrease in population has been the most notable in smaller towns (Fig. 2). Mőisaküla, Kallaste and Püssi were the most affected towns, losing 29.2%, 29.7% and 42.1% of their population, respectively. Tallinn, the capital city, and Tartu, the second largest city, have lost only a moderate 1.8% and 3.5%, respectively (ES, 2013b).

The socioeconomic situation of Estonian regions varies significantly. This can be demonstrated by the distribution of registered unemployment across the country. Looking at other socio-economic parameters, such as median household income or the number of persons living below the poverty line

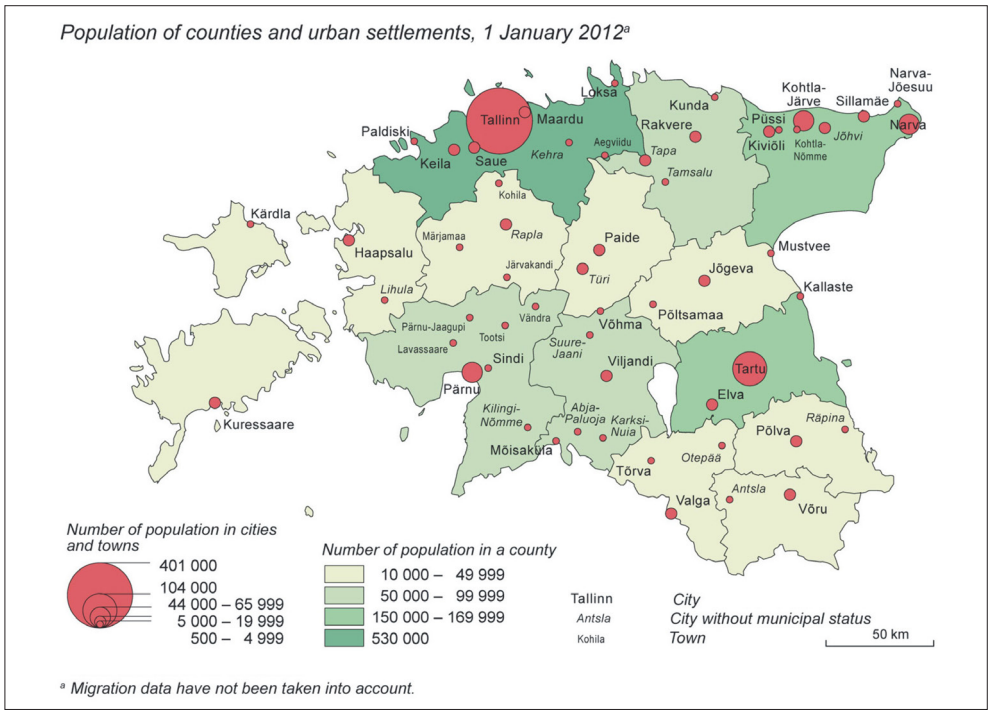

Fig. 1: Population of counties and urban settlements (January 1, 2012)
Source: ES (2012); Graphic courtesy of Statistics Estonia (2012)

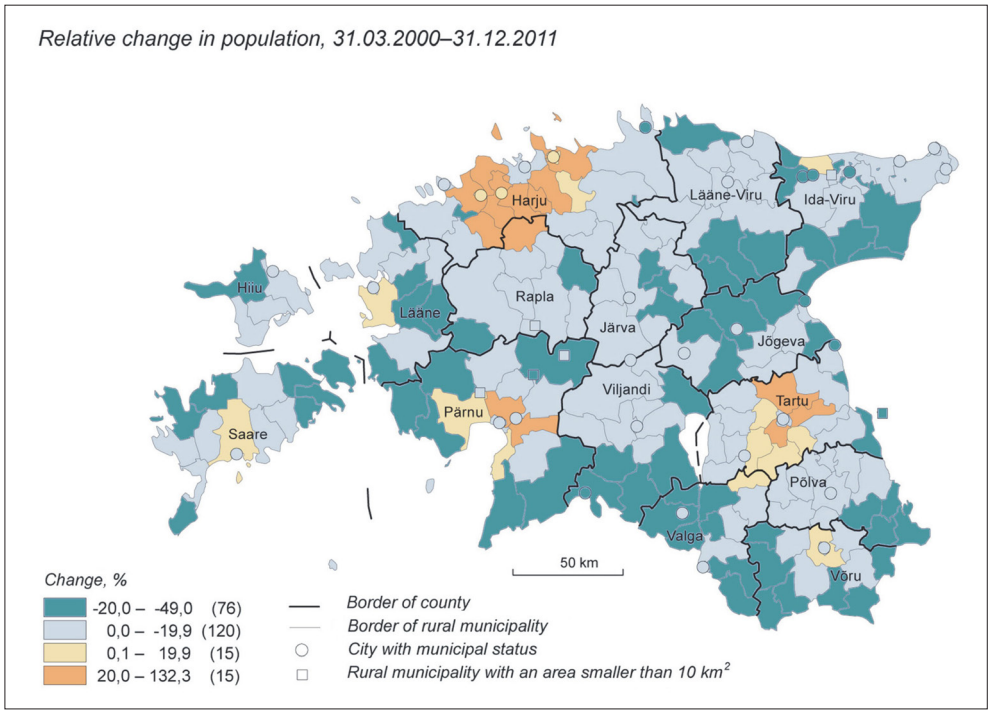

Fig. 2: Relative change in the population of Estonia (31.03.2000–31.12.2011)
Source: ES (2013a); Graphic courtesy of Statistics Estonia

(Letang and Taylor, 2012), would show similar distributions. Areas most affected by unemployment are the regions of the East-Viru County (towns of Narva, Kohtla-Järve, Silamäe, Jõhvi, Kiviõli, Püssi) and the Valga County (town of Valga). The lowest rates are recorded in the Viljandi County and the Jõgeva County (Fig. 3). The East-Viru County is historically a highly industrialized region with large deposits of oil shale and a concentration of heavy industry. The population of the East-Viru County amounts to 166,548, constituting 12.6% of the total Estonian population. Although the Valga County is a rural region on the border between Estonia and Latvia with a population of 34,135 inhabitants, the town of Valga itself has a strong industrial and military past.

Knowledge about brownfields, their opportunities and constraints, is fairly limited in Estonia. The Estonian government has shown a certain interest in the issue and awareness of the problem, however. The National Environmental Action plan of Estonia for 2007–2013, published by the Ministry of the Environment, states that under the planned action 1.8.3.2, there is a need for 'the elaboration of the principles of financing the cultivation, restoration and arrangement of spoilt areas and elimination

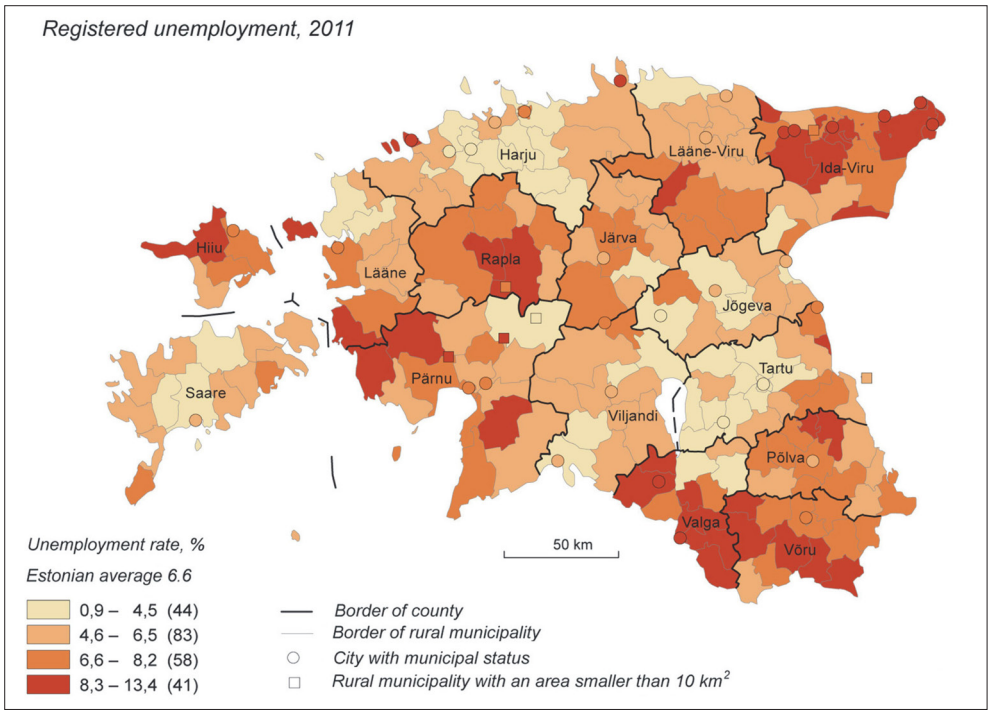

Fig. 3: Registered unemployment in Estonia (2011)
Data sources: ES (2013a); Graphic courtesy of Statistics Estonia

of littering objects', and under action 1.8.3.3 a need for 'the support for arrangement of spoilt and polluted areas (e.g. military areas, quarries, peat production areas, agricultural areas, etc.)' (Ministry of the Environment, 2008). In the national governmental Action Programme for 2012–2015, the need for establishing a national land pollution database, creating measures to reduce ownership constraints and enabling funding from state sources, is mentioned (Eesti Vabariigi Valitsus, 2011).

While these intentions continue to be nothing more than just plans, one already-functioning action can be pointed out. Site owners now have the possibility to apply for a grant from the government agency Environmental Investment Centre (EIC) for the 'demolition of structures damaging the landscape' within their property. This measure corresponds well with Letang and Taylor's (2012) concept of improving environmental aesthetics, as pointed out above. Since this measure is applicable only to old industrial, military and agricultural facilities situated outside of urban areas or in their periphery, however, it can be a tool for remediating only a small part of urban brownfield sites.

4. Data and methods

To gain an overview of how aware the government is of the brownfield problem, certain state institutions were contacted. The Ministry of the Environment, the Ministry of Economy and Communication, the Ministry of the Interior and the Estonian Land Board were asked for written contributions and comments. The Ministry of Economy and Communication and the Ministry of the Interior were responsive, both pointing out a real need to analyse the issue of urban brownfields in Estonia and giving their full support to this study. At the same time, however, they underlined the fact that in Estonia, it is local governments that are primarily responsible for local spatial development planning. As a result of the 'absent' brownfield policy and uncertainty as to who is responsible for it, there is not any clear and united approach among Estonian stakeholders in the propagation of brownfields redevelopment.

Neither the state nor the local governments have an accurate picture of the extent of urban brownfields within their territories. Due to the missing definition for brownfields, a systematic inventory of brownfields is difficult to conduct. Brownfield areas in current local comprehensive plans and master plans are mainly marked according to their last use or – less frequently – according to their intended use. Such plans do not give any information about their actual use, however. Presuming that town government officials responsible for environmental protection or planning are those who are aware of possible brownfield areas in their towns, our survey targetted local governments for information on urban brownfields. Roose, Kull, Gauk and Tali (2013) give a deeper overview of the actual state of land use planning in Estonia, the role of local governments in this process and limits to their activities. Data for this study were gathered between December 2011 and July 2012 from mail-out questionnaires and visits to 47 Estonian towns. These 47 towns included all Estonian towns with or without the municipal status. In order to help local governments become more willing to participate in the research, written support letters from the Ministry of Economy and Communication, the Ministry of the Interior and Estonian Town Association (ELL) were mailed in the autumn of 2011.

A modified and translated CABERNET definition of brownfields was part of a mail-out questionnaire for local government officials. The questionnaire comprised eleven questions designed to identify or determine:

- possible previous brownfield redevelopment policies in town governance;
- local government's perception of the extent and nature of local brownfield sites;
- preferences for the future use of brownfield land;
- relative importance of actual new construction on brownfield land;
- importance of negative impacts of brownfield sites on local life;

- types of negative impacts on local life; and
- barriers inhibiting redevelopment of urban brownfields.

For questions in parts five to seven, respondents were asked to choose three answers from the given list and mark with three (3) points as the most important, two (2) points as the second most important, and with one (1) point as the third most important option. The option "other", requiring further comments was also available.

The questionnaires were first mailed out in December 2011, using the Estonian Town Association's mailing list. They were mainly sent to officials responsible for environmental protection or planning in town government bodies. As not all Estonian towns are members of ELL, an official University e-mail was sent to non-members in January 2012. Follow up e-mails were sent in March and April 2012. The e-mails attempted to target officials at higher positions who were responsible for planning. In the case of small towns, this might have even been the mayor. Throughout the data gathering process, researchers were available to receive questions and provide further information and, where necessary, personal visits to stakeholders were offered. In fact, the e-mail sent out in April proposed only the latter. The need for a personal visit occurred only in larger towns. Three towns were visited: Tallinn (twice), Tartu and Maardu. In all cases, one of the contact persons was an official from the department of town planning. In Tartu, a Town Architect and in Maardu, a Deputy Mayor were also present. Interviews were composed of two parts. During the first part, brownfields were delineated on a printed town development plan. Their previous utilization and actual ownership were added. During the second part, questions similar to those in the e-mailed survey were asked. Sections referring to local government's perception of brownfields' negative impact on their town's quality of life and their view of barriers inhibiting redevelopment of urban brownfields, were the focus of the discussions. After each visit, the Estonian Geoportal (GIS system) was used for gaining more precise data regarding the number and size of brownfields in the areas pointed out by local government officials.

In total, data from twenty towns were gathered, with the response rate being 43%. Eighteen of the returned questionnaires included all data asked for. Respondents from the remaining two towns only stated, without filling out the questionnaire, that there were no brownfields in their territory. Officials of larger towns tended to display more interest in the research. Ten out of fifteen towns with a population larger than 10,000 participated in the survey.

5. Scale and characteristics of urban brownfields in Estonia as perceived by local governments

Respondents were asked whether the redevelopment of brownfields had already been discussed in their town and, if so, with what results. Although ten out of eighteen respondents affirmed that there had been some discussion on this issue, only two of them were able to specify the results. The Paldiski town government official noted that land use was specified for the whole town territory (including brownfields) in the town's master plan. In the case of Sillamäe, removal of contamination from a former large industrial plot and the development of plans for the site were mentioned.

5.1 Estimation of the extent of urban brownfields in Estonia

The study revealed that local governments have a very limited overview of the actual land use in their towns' territory, including the possible presence of brownfields. There are no municipal brownfield inventories. Data about the quantity and areal surface of brownfields presented in this paper are only estimates, the quality of which depends considerably on the accuracy of respondents' survey answers. Although the definition of brownfield was presented in the questionnaires, we cannot presume that all respondents understood the term in the same way. There is a need to improve the depth of knowledge about brownfields among Estonian stakeholders, as this may help to make the term clearer. We assume that large brownfield areas with higher negative impacts on their surroundings were more often detected than smaller ones. And also that the time and effort contributed by the respondents differed significantly. Nevertheless, the results give an idea of the extent of urban brownfields in Estonia.

Local government representatives were asked to estimate the number and size of brownfields in their municipalities. No local governments involved in the research had a formal brownfields inventory from which to derive an estimate. Twenty towns provided an estimated number of brownfield sites; eighteen of them also estimated brownfield area. Responses ranged from zero (Loksa, Suure-Jaani) to 283 (Tallinn), covering from zero to 9.7% (Tamsalu) of their area (Tab. 1).

Although a significant correlation between the relative extent of brownfields in a town (as a % of a total area) and the town size or population was not detected (see Table 2), it is remarkable that the proportion of brownfields in the four largest towns (ranking from 0.5 to 2.2%) is lower than in most of the middle-sized (< 20,000) and smaller towns (see Table 1). Decline in population is strongly associated with the town's location in terms of proximity to the capital city (Pearson's $r = -0.596$), but none of those factors seem to influence the presence of brownfields in a town. Even registered unemployment is not significantly associated with the estimated size of brownfields (Pearson's $r = 0.139$). Because of the potential inaccuracy of respondents' estimations of the quantity and areal surface of urban brownfields, an affirmation that the extent of brownfields is not associated with a town's geographical location and its socioeconomic situation would be premature. There is a need for more precise inventories of Estonian brownfields.

Industrial heritage is another important factor influencing the presence of brownfields in a town (Filip and Cocean, 2012). While towns with a strong industrial past (Tamsalu, Maardu, Rakvere, Võhma, Sillamäe, Valga) declare the proportion of their brownfields to be between 5 and 9.7%, less industrialized towns such as Saue, Loksa and Suure-Jaani state that they have practically no brownfields within their territory (Table 1). In the case of towns such as Valga and Rakvere, the former presence of large Soviet bases has likely played an important role in the extent of brownfield sites within these towns.

On average, brownfields in the participating twenty towns occupy approximately 2.5% of urban land. This is less than estimations in De Sousa's (2006) similar study for Canada (3.3%) and USA (6%), but not unusual, given Estonia's different, less industrial, history. Within the participating towns, 695 potential brownfield sites with a total area of 1,152 ha were detected. Assuming that this average percentage of brownfield area is applicable to all 47 Estonian towns, including those not included in the study, approximately 1,000 brownfields with a total of up to about 1,600 ha may be present in the Estonian towns.

Town name	Population[a]	Total area[b] (ha)	Unemployment rate[d]	Population change[e]	Regional location[g] (km)	Number of brownfields[k]	Area of brownfields[k] (ha)	BF as % of total urban area	Perceived importance[m]
Tallinn	397,617	15,827	3.3	– 1.8	0	283	272.0	1.7	2.0
Tartu	102,414	3,880	3.2	– 3.5	186	34	86.0	2.2	3.0
Narva	66,453	8,454	12.6	– 14.6	213	53	117.8	1.4	5.0
Viljandi	20,117	1,462	4.2	– 15.8	161	3	7.2	0.5	2.0
Rakvere	16,612	1,064	5.0	– 10.7	100	120	74.7	7.0	2.0
Maardu	6,549	2,276	5.8	4.7	20	46	218.3	9.6	4.0
Sillamäe	16,392	1,054	8.0	– 17.1	187	2	65.2	6.2	3.0
Kuressaare	14,965	1,495	4.7	– 11.8	220	33	34.5	2.3	4.0
Valga	13,789	1,654	10.7	– 14.4	240	19	93.4	5.6	4.0
Kiviõli	6,749	1,175	11.4	– 23.9	145	22	43.0	3.7	4.0
Rapla	5,641	472	5.9	– 9.7	53	15	n/a	n/a	3.0
Saue	5,142	349	2.9	11.2	22	1	1.4	0.4	1.0
Paldiski	4,154	6,017	8.9	– 3.8	49	17	66.3	1.1	3.0
Kärdla	3,678	450	6.4	– 19.6	158	12	n/a	n/a	2.0
Loksa	3,437	381	7.8	– 21.0	69	0	0.0	0.0	n/a
Tamsalu	2,544	402	7.4	– 14.5	102	18	39.0	9.7	4.0
Võhma	1,515	193	5.8	– 17.7	132	3	13.1	6.8	3.0
Lihula	1,425	417	7.1	– 10.6	113	11	11.4	2.7	3.0
Suure-Jaani	1,236	223	4.0	– 21.5	145	0	0.0	0.0	n/a
Mõisaküla	1,040	220	4.8	– 29.2	191	3	8.9	4.0	4.0
Total		**47,465**				**695**	**1,152.2**	**2.5**	**3.1**

Tab. 1: Geographical and socioeconomic indicators of participating towns and perceived extent of brownfield problem
Notes:
[a] Statistics Estonia. Data as of 1 January 2012 (ES 2012);
[b] Estonian Land Board. Data as of 1 January 2007; [d] Statistics Estonia based on the data of the Estonian Unemployment Insurance Fund. Data for the year 2012 (ES 2013a);
[e] Statistics Estonia. Relative population change between the two censuses 2000 and 2011;
[g] Estonian Road Administration. The distance of the town from Tallinn. Data as of 30 July 2003 (ES 2013a); [k] Authors' own survey (estimate);
[m] Authors' own survey. Perceived Importance of brownfields negative impact on the quality of life (5 = extremely high importance);
[o] Total area of Paldiski includes two uninhabited islands (1,287 and 1,160 ha).

	Population	Total area	Unemployment	Population change	Regional location	BF as % of total u. area	Perceived importance
Unemployment	– 0.258	0.031	1.000	– 0.347	0.326	0.139	0.652
Population change	0.304	0.337	– 0.347	1.000	– 0.596	0.003	– 0.411
Regional location	– 0.300	– 0.256	0.326	– 0.596	1.000	– 0.007	0.484
% of total urban area	– 0.183	– 0.246	0.139	0.003	– 0.007	1.000	0.322
Perceived importance	– 0.208	– 0.008	0.652	– 0.411	0.484	0.322	1.000

Tab. 2: Inter-correlation matrix of geographical and socioeconomic indicators and extent of brownfield problem

Given the unstructured selection of the towns participating in this survey, however, this assumption is not necessarily correct and would need to be checked by further research. We can assume though that, in reality, these counts and areas are likely to be higher than those estimated here, as the survey results depended on the ability and willingness of respondents to detect brownfields on their municipal lands.

Similar estimations concerning only urban brownfields in other countries are not available. Oliver et al. (2006) lists the available data for a range of brownfield types in some European countries, and Adams, De Sousa and Tiesdell (2010) for USA and Canada. In Filip and Cocean's (2012) analysis of 60 from 320 Romanian cities, 222 industrial urban brownfields were identified taking up from 0.1 to 17.3% of the administrative area of each city. Note, however, that we have to be aware of limitations in comparing all of these presented data due to the use of varying brownfield definitions (Alker et al., 2000), different study focuses, such as only on urban or only on industrial brownfields, and different data collection methods.

5.2 Structure of Estonia's urban brownfields

Respondents were asked to divide their detected brownfields into groups by former use and ownership. Figure 4 shows that most urban brownfields in Estonia consist of former industrial premises (35%), followed by post-military sites (30.8%), and then residential (18.1%) land. By its area, the former industrial land occupies almost a half (47.9%) of all brownfield areas and the post-military sites occupy almost a quarter (24.3%). The relative importance of the former residential land is relatively low (5%). The majority of brownfield sites are owned by the private sector (63.3% by number and 71.4% by area – Fig. 5). Still, more than one-third (25% by area) of the detected brownfields are in public (municipal or state) ownership. For the rest of the sites, local respondents were not able to specify the actual ownership.

Data relating to the former use of urban brownfields reveal that most of the abandoned sites were previously used for industry. This is in accordance with other countries' experiences (Czech Invest, 2008; De Sousa, 2002). Post-military sites, however, constitute an important share of extant brownfields. In the middle of the 1980s, before the collapse of the Soviet Union in 1991, around 122,480 Soviet soldiers were resident in Estonia with their families and service personnel (Pärn, Hergauk and Őun, 2006). When the Soviet troops withdrew in 1994, many military bases were left empty. Most of them were located in rural areas, but some were also in developed urban areas. Typically, those sites remained in the state's possession and when local governments showed any interest, they were transferred to them. This can explain the quite high proportion of public sector ownership of detected brownfields, as compared for example with the situation in the Czech Republic (Czech Invest, 2008).

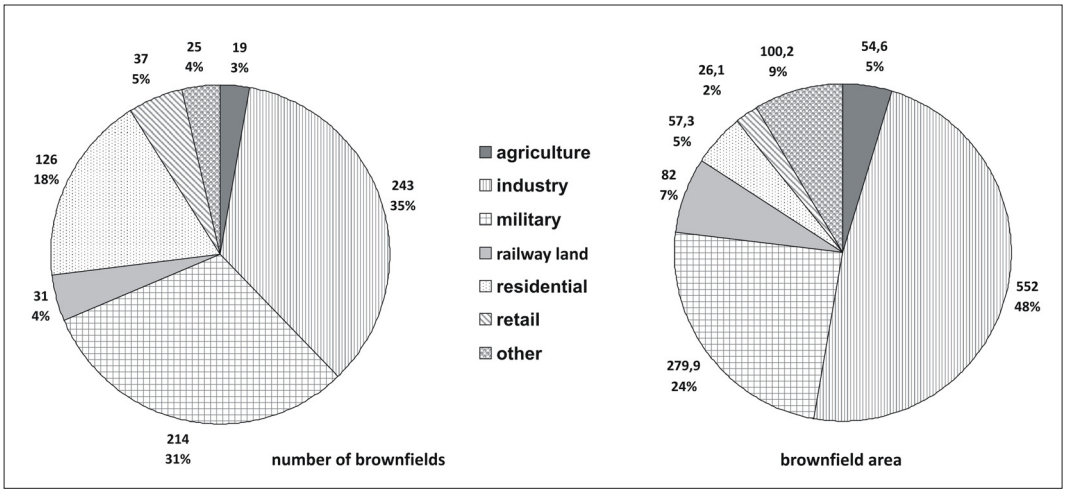

Fig. 4: Distribution by former land use. Source: authors' survey

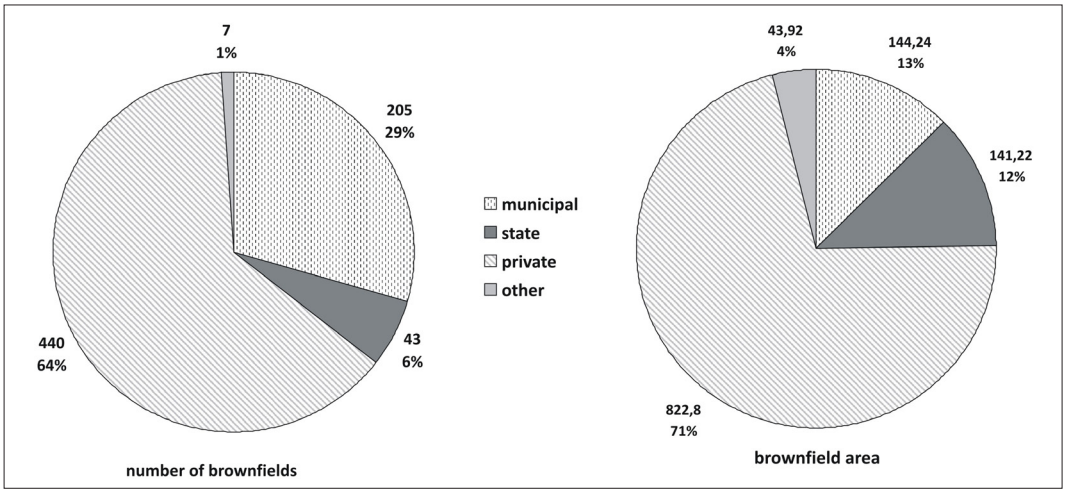

Fig. 5: Distribution by ownership. Source: authors' survey

Public ownership can be an advantage for successful redevelopment of brownfield sites, because ownership constraints represent one of the main barriers to redevelopment (Adams, De Sousa and Tiesdell, 2010). Public ownership simplifies the redevelopment of a brownfield site for non-profit use, turning it into a green space, for example (De Sousa, 2003; Franz, Gules and Prey, 2008). It also makes interim or temporary use easier (Rall and Haase, 2011). And lastly, in Estonia, public ownership provides better access to grant funding. The Estonian Environmental Investment Centre (EIC), provides landowners with the possibility to apply for a grant for "the demolition of structures damaging the landscape" from their property. According to EIC rules, private site owners need to co-finance at least 50% of the removal costs. In the case of sites in public possession, 10% of co-investment is acceptable (EIC, 2012).

The process described above can be illustrated by the case of a former military airport situated in Tartu, the second largest town in Estonia. This formerly important Soviet military airport lies partially within the town's borders, the rest lying within the territory of the neighbouring village. The airport was abandoned by the Soviet army in 1992. Service buildings, including barracks, remained empty. The majority of the airport territory is in the state's possession. Ownership of the land where the barracks are located was transferred to the Tartu government. In November 2012, the town government decided to demolish the remaining barracks with a grant from the EIC. Town co-investment was 10% (Tartu Linnavolikogu, 2012). In Tartu's master plan, this area is marked for future reuse as land for public buildings.

Between 2011 and 2013, EIC supported 45 demolition projects of structures "damaging the landscape". The total amount of grant funding supplied was 1,236,015 EUR. Twenty-one applications were submitted by the public sector. Only three of these demolitions took place on the lands of any of the 47 Estonian towns (EIC, 2013).

5.3 Future land use in local governments' preferences

The relative importance of actual new construction on brownfields was also examined. Town representatives counted the number of all permits for new buildings issued by local government from the year 2005 until now, and estimated how many of them concerned brownfields. The estimated data show a wide variation. Eleven out of nineteen towns replied that there were no building developments on their brownfields at all, while four towns estimated the share of new construction on brownfields to be higher than 10%. Two towns indicated an extremely high percentage. In Kiviõli it was 23.7%, and in Sillamäe, the estimate was up to 54.5%. Both are small former mining and industrial towns with a considerable number of brownfields. These estimates, however, will need to be validated by further research.

Permits issued for brownfield land in all nineteen towns represented on average 5.6% of all permits for new buildings. In England, the proportion of new dwellings built on previously developed land is the main figure used for monitoring the success of planning policy. This figure has risen from 57% in 1996 to 77% in 2007 (Baing, 2010). Compared to this, the proportion (5.6%) for Estonia is very low and shows space for future improvement.

To gather information about town governments' preferences towards the future use of the detected brownfields, a list of common land use options was compiled and respondents were asked to mark all suitable options. Although the questionnaire included the option of 'no preference' for the future use of brownfields, most respondents did indicate their preferences.

In terms of desired future uses, retail (13 points), industry (13 points) and residential (10 points) use were the most popular (Fig. 6). The key issue in reuse, however, needs to be flexibility. As Adams, De Sousa and Tiesdell (2010) state: "… local planning authorities may wish to reserve sites for an apparently useful purpose for which current demand is low (for example, manufacturing industry) by preventing their immediate development for another purpose for which current demand is high (for example, housing)". Local governments should try to make their planning regulations concerning brownfield sites as flexible as possible, so as not to stiffen the constraints to brownfield redevelopment.

5.4 Negative effects of brownfields

As Letang and Taylor (2012) argue, citizens and local authorities have different perspectives concerning the perception of brownfields, their negative impact and the success of their redevelopment. While local authorities tend to put more emphasis on economic aspects, citizens rate neighbourhood quality of life higher. The following results therefore need to be addressed with this perspective in mind. Municipal officials were asked how important they considered the negative impact of brownfields to be on local quality of life. One out of twenty respondents stated it had extremely high importance, six considered it highly important, another six marked the option 'medium importance', four 'low importance' and one respondent did not see it as important at all (Table 1). It can be understood then that most municipalities acknowledge the need for action in this domain. For thirteen out of eighteen local governments, brownfields' negative impacts on the quality of life in their town were of at least medium importance.

The size of a town or its population did not significantly affect the perceived importance of brownfields' presence (see Tab. 2), although a correlation (Pearson's r = 0.322) with the relative extent of brownfields in a city (as % of total area) can be seen. However, even this relationship has a lot of exceptions. For example, the town of Rakvere has one of the largest proportions of brownfields (7.0% of total city area), but it is not perceived as a serious problem there. On the contrary, Narva reported its percentage of brownfields to be only 1.4%, while also noting that the negative presence of brownfields has an extremely high importance (Fig. 7 – see cover p. 2).

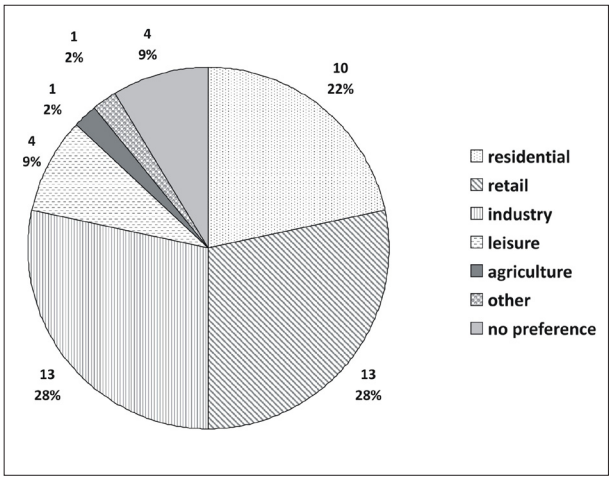

Fig. 6: Preferred land use by municipalities
Source: authors' survey

It is interesting that such differing results were received from respondents. It seems the perceived importance of brownfield sites on town land better expresses the size of the brownfield problem than data relating to the relative extent of brownfield sites in the area. Respondents seem to be more precise in the evaluation of brownfields' negative impacts on a town's life than in the estimation of the real extent of brownfields in their municipalities. A more important correlation though is between the growth or decline of population in the last decade and the perceived importance of negative impacts (Pearson's $r = -0.411$). An example of this correlation can be seen when comparing towns that present completely opposite perceptions of brownfield importance. The town of Saue reported no negative impacts from brownfields. Saue is situated in close proximity of the capital, and is one of three towns where the population has been increasing during the last decade (+ 11.2% between 2000 and 2011 census) as a result of Tallinn's urban sprawl. In contrast, the town official from Narva noted that the negative impact on the quality of life in their town was of extremely high importance. Narva, the most populated town in the East-Viru county, and a large town in the Estonian context with more than 60,000 inhabitants, represents a typical shrinking city (Schetke and Haase, 2008; Rall and Haase, 2011). Due to historical reasons, a former high level of industrialization, the social composition of inhabitants and its current economic decline, Narva is experiencing a massive depopulation trend. Between the years 2000 and 2011, its population declined from 68,680 to 58,663 (– 14.6%).

There are also exceptions to this pattern, however. Contrary to the town of Saue, the town of Maardu, another of three growing towns (+ 4.7%), marked the effect of brownfields as being highly important. Among the group of towns losing more than 15% of population, Mõisaküla (– 29.2%) and Kiviõli (– 23.9%) perceive the negative impact of brownfield sites as highly important, while Kärdla (– 19.2%) and Viljandi (– 15.2%) seem not to be concerned. To understand this contradiction we must look more into the history of these communities. All three towns acknowledging problems with abandoned sites (Maardu, Mõisaküla and Kiviõli) were important industrial towns of the former Soviet Union. Since its collapse in 1991, which resulted in radical structural changes in the Estonian economy, these towns have struggled to deal with their industrial heritage. Even the growth in population as a result of urban sprawl from Tallinn during the last decade, has not helped Maardu deal with its former industrial sites. Kärdla and Viljandi, on the other hand, have always been important tourist towns. Viljandi is a mediaeval town with a well-developed cultural life (folk festival, theatre, cultural academy) and Kärdla is a seaside resort town. As such, the loss of population does not seem to be connected to the presence of brownfields.

The regional location of towns, represented by distance from the capital of Tallinn, also plays an important role in the perceived importance of brownfields (Pearson's $r = 0.484$). Among seven towns that rated the negative impact of brownfields as having a high or extremely high importance, four are situated relatively far away from the capital (Valga, Kuresaare, Narva and Mõisaküla). Only one of them, the above-mentioned industrial town of Maardu, is situated in close proximity to Tallinn. An even stronger correlation can be seen between registered unemployment and the perceived negative impact of brownfields (Pearson's $r = 0.652$). Narva, as a town with the highest unemployment rate in Estonia, perceives the importance of brownfields as extremely high (Fig. 8, see cover p. 2). Among six towns that rated negative impacts as having a high importance, three suffer from unemployment higher than the Estonian average (Valga, Kiviõli and Maardu). Conversely, three towns from four, which perceive the effect of brownfields as either being of low or no importance (Saue, Tallinn and Viljandi), have unemployment rates lower than average.

Towns with an industrial past (Narva, Kiviõli, Maardu, Mõisaküla, Tamsalu, Valga) see the presence of brownfields in their territory as being important. These towns tend to have weaker real estate markets and are struggling with the much stronger negative influence that the presence of brownfield sites pose. Towns with many abandoned industrial or military sites have a hard time attracting private investors, which can in turn cause higher unemployment. Town governments in economically distressed areas also have limited resources to put towards these sites. As a result, these town officials feel a real need for their towns' regeneration. Towns that see the negative impacts of brownfield sites as having a low importance are towns that have historically been attractive for tourists (Viljandi, Rakvere, Kärdla), as well as the capital Tallinn. The latter seems to be able, due to its economic power, to deal with a rather high number of brownfields without any considerable perceived negative impact on its inhabitants' quality of life. The actual socio-economic situation of a town in combination with its historical, industrial or military heritage, are the main factors influencing the perceptions of abandoned or under-used areas in Estonia.

The survey results show that there was consensus on the types of negative impacts that brownfield sites pose on a local community's quality of life. Loss of town attractiveness for investors and citizens was pointed out as the most important one (39 points). Brownfields also tend to generate lower municipal revenues through unpaid taxes (15 points), and cause devaluation of their surroundings (11 points). The loss of town attractiveness for tourists and environmental damage (soil, water and air pollution) were also mentioned (8 points each). Other negative impacts received five points or less (see Tab. 3).

Municipalities are clear about the nature of the main negative impact, which is the loss of attractiveness for citizens and investors. For most of them, the presence of brownfields symbolizes depopulation and declining local economic and social activity, which threatens the town's future. Environmental issues only play a secondary role for them. The town of Valga is a good example of such development. Valga is situated in South–Estonia, on the border between Estonia and Latvia. Valga is a medieval town where the main development occurred at the end of the 19th century; then it became an important railway junction. Before the First World War, its population peaked at 20,000 inhabitants. As a result of the collapse of the Russian Empire, Valga was divided between Estonia and Latvia and lived through economic decline. After the Second World War, during the time of the Soviet occupation, Valga became an important industrial and military centre and its population peaked at 18,500 citizens by the end of the 1980s in the Estonian part of the town. To house the incoming workers and soldiers, large numbers of new pre-fabricated apartment blocks were raised. After the collapse of the Soviet Union, military troops left the town and Valga lost more than 4,000 people in one year. As a result of industry restructuring, Valga's current permanent population is a little higher than 12,000 people (ES, 2013b). Because of a large surplus of apartments after the military withdrew at the beginning of the 1990s, many people moved from the historical, mainly wooden apartment houses with

Rank	Negative impact	Category	Points
1.	Loss of town attractiveness for investors and citizens	Economic	39
2.	Decreasing tax revenue, loss of tax base	Financial	15
3.	Deprivation of brownfields' surrounding	Spatial	11
4.	Loss of town attractiveness for tourists	Economic	8
5.	Environmental damages (soil, water and air pollution)	Environmental	8
6.	Deterioration of market climate	Economic	5
7.	Urban sprawl	Spatial	5
8.	Higher unemployment	Social	5
9.	Rising crime rate	Social	5
10.	Increasing need for social security benefits	Social	1
11.	Reduction of local government's budget (risk of failure in financing actual level of public good)	Financial	0

Tab. 3. Negative impact of brownfields on life in towns as perceived by local governments. Source: authors' survey

poor facilities to relatively new ones made of pre-fabricated panels. Nowadays the town's historical centre, which is under heritage protection, is practically empty. Of eight historical buildings around the main church, only two are occupied: the town hall and a music school. Vacant, unused buildings contribute to a loss in property value. They also have a negative effect on citizens' sense of attachment to the place (Letang and Taylor, 2012) and a trust in the town's future. This results in civil apathy and low citizen involvement in town affairs. Given the above results, it might be safe to say that in Estonia, brownfield perception has less to do with actual environmental contamination and is more a result of the legacy of Soviet heritage and regional development.

5.5 Barriers to redevelopment of brownfields

As to the impediments to redevelopment for potential investors, there was a consensus among municipalities on two responses in terms of both rank and frequency: additional costs associated with the site clean-up and redevelopment (23 points); and low real estate value of the site (20 pts.). Unsuitable site location (15 pts.), investors' fear of risk (13 pts.) and longer project duration (13 pts.), were also often pointed out. Other forms of negative impact received six points or less (Tab. 4).

The main barriers slowing down the process of brownfields revitalization in Estonia, from the municipalities' point of view, were the municipalities' limited financial resources

Rank	Barriers to brownfields redevelopment	Points
	Development barriers	
1.	Additional costs associated with clean-up and redevelopment	23
2.	Low real estate value	20
3.	Site location	15
4.	Fear of risk	13
5.	Project duration	13
6.	Responsibility issues	6
7.	Other	6
8.	Lack of access to funding	5
9.	Ownership constraints	2
	Governance issues	
1.	Municipality's limited financial resources	27
2.	Lack of funding from state or municipal sources	19
3.	Perception that such development is a private sector issue	19
4.	Municipality's limited administrative resources	13
5.	Lack of a proactive brownfields management strategy	8
6.	Lack of political will	5
7.	Competing municipal priorities	4
8.	Lack of government awareness of the problem	3
9.	Restrictive zoning	2
10.	Lack of site inventories	1
11.	Other	1

Tab. 4: Local governments' perception of main barriers to brownfields redevelopment. Source: authors' survey

(27 points), followed by the lack of funding for potential investors from state or municipal sources and the perception that such development is a private sector issue (both 19 points – see Tab. 4).

Finally, respondents were asked to point out any state program or activity that would help to improve the situation. Typically, various subsidies or grants were mentioned: either direct subsidies for investors to improve the economic viability of projects on brownfield sites (three respondents) or grants for municipalities or site owners for site clean-up (three respondents). Also the need for improved municipal measures to help make site owners take responsibility for their properties was stated twice. One respondent suggested a change in legal regulations to simplify site expropriation and re-privatization; to increase land tax differentiation and generally to improve regional politics.

As for the reason why investors are not in general willing to invest in brownfield sites, local government representatives most often suggested additional costs associated with site clean-up and redevelopment, combined with low real estate value of the site. This reveals the need for measures to decrease the gap between the investments in greenfield and brownfield projects. One of the major barriers to the redevelopment of Estonian urban brownfields is the lack of knowledge about possible state incentives to help the public sector deal with brownfield issues.

The main solution for brownfields redevelopment suggested by municipalities was increasing their financial resources and the implementation of funding for potential investors by state or municipal sources. For both of these measures, municipalities seem to expect special funds from the central government. In addition to these resources, municipalities also expect the government to change legal regulation in order to make site owners more responsible for their property and to increase the possibilities of local governments to impose and control this responsibility.

Central and local governments' perceptions that brownfields development is primarily a private sector issue, also plays an important role. And this is not just the governments' point of view, but seems to be the attitude of the stakeholders involved in land use planning and regulation on the whole – regulators, statutory consultants, service providers, councillors, interest groups, and individuals (Williams and Dair, 2007).

Rates of real estate ownership in Estonia went through significant changes with the end of the Soviet Union. At the beginning of the 1990s, land and real estate that was originally in state ownership was by processes of privatization and restitution transferred to private hands. The significance of those changes can be demonstrated by housing statistics, which show that 95.8% of dwellings in 2012 were privately owned, primarily as a result of this reform. Local governments own 3.2% and the state owns 2% of the dwelling stock. Such figures place Estonia at the forefront of residential property ownership rates within Europe as the share of privately-owned residential properties in Western Europe is around 40–55% (ES, 2012). At the same time, the prevailing liberal-conservative market ideology of the Estonian government has led to a modest regulation of land and real estate use (Roose, Kull, Gauk and Tali, 2013). As a result of these factors, the majority of brownfield sites are owned by the private sector (Fig. 5).

In general, prevailing governmental attitudes on both state and local levels do not facilitate the redevelopment of privately-owned brownfield land. A good example here can be found in section 5.2 above: EIC's different co-financing rules for private and public owners. In spite of the fact that municipalities experience the negative impact of brownfields in their towns, from their point of view it is the owner of each site who is mainly responsible for its redevelopment. And if such redevelopment is not economically viable for the owner, the site stays abandoned. This results in latent conflict between local governments and landowners. Municipalities accuse owners of not using their property and owners accuse municipalities for the economic decline of their town. This conflict needs to be resolved through a better cooperation between the public and private sectors. The public sector needs to play an active role with private sector entities to promote brownfields redevelopment. Currently, the governments on both levels have fairly limited knowledge to be able to do so. The present study aims to contribute to changing that.

5.6 Lack of clear responsibility for the redevelopment of brownfields

Currently there is no government policy to simplify urban brownfield redevelopment in Estonia on a state or local level. The present study shows that, on both levels, officials are aware of the problem and are prepared to deal with it but the ideas on how to start are lacking. During the preparatory work for this study, communication with state institutions revealed the problem of responsibility. In general, there is no governmental institution currently responsible for this issue and prepared to coordinate a possible brownfield policy.

State Government, in its Action programme for 2012–2015 (Eesti Vabariigi Valitsus, 2011) and the Ministry of the Environment in the National Environmental Action plan of Estonia for 2007–2013 (Ministry of the Environment, 2008), shows its willingness to participate in any action in this domain. It is however the Environmental Investment Centre (EIC), falling under the Ministry of Finance, which distributes grants to demolish structures damaging the landscape: this is the only specific measure already used to help brownfields redevelopment. The Ministry of the Interior, which exercises in Estonia the competences of the Ministry of Regional Affairs and is therefore responsible for the coordination of spatial planning, also admitted its responsibility in this regard. At the same time, all state officials stressed it is local governments that are primarily responsible for local spatial development planning. As experience from other countries shows, for the successful redevelopment of brownfields to occur, clear and mature policy at both state and local levels needs to be developed (Adams, De Sousa and Tiesdell, 2010).

6. Conclusions

The present study reveals that, while at the local government level a considerable interest towards brownfields redevelopment is apparent, most Estonian towns are struggling with the challenge. During the study, 695 urban brownfield sites with a total area of 1,152 ha were detected. They constituted on average 2.5% of municipal territories. Correlations between the relative extent of brownfield areas in towns and certain geographical factors (town size, population and spatial peripherality), and socioeconomic factors (relative change in population and registered unemployment) were not shown to be significant. This may be a result of limits presented by the chosen data gathering method. Middle-sized and smaller towns with strong industrial pasts showed a higher proportion of brownfields in their territory. Post-military sites in public possession, representing an important part of all

urban brownfields, are easier to reuse for local governments, although only a modest share of new construction is actually carried out on this previously-developed land.

The perception of the importance of brownfields' negative impacts differs among Estonian towns, with such impacts being perceived as more important in historically industrial towns with a weaker real estate market. Rapidly depopulating towns are the most affected. There is a certain correlation between the importance of brownfields as perceived by local governments and the extent of brownfield area in the town. However, the perceived negative impact of brownfields on a town's life is more influenced by its relative change in population, location and local unemployment. The socio-economic circumstances of a town, in combination with its historical, industrial and/or military heritage, are the main factors influencing the negative perception of abandoned or under-used areas in Estonia. The decline of a town's attractiveness for investors and citizens is most often mentioned as the main negative impact of brownfields on local life. Brownfields symbolize depopulation and decreasing local social and economic activity.

The main barriers inhibiting the redevelopment of Estonian urban brownfields are, in the municipalities' point of view, the lack of assistance from the central government and the widespread opinion that brownfields redevelopment is a private sector issue. There is a strong need for a mature brownfields policy with clearly divided responsibilities at the state level. Measures need to be taken that make investments in brownfields more profitable for investors. Municipalities are also calling for changes in legal regulations that would clarify who is responsible for the property regeneration.

This study has taken some first steps by showing that brownfields do present a problem and are recognized by local governments as an issue that needs attention. The next step could be a detailed study of one Estonian town to create a model process for the inventory and assessment of all brownfield areas. Other important work would be the prioritization of sites by their development potential, the documenting of barriers to development and the creation of model regulations and policies to encourage development. In essence, while municipal officials realize that urban brownfields are a problem that needs to be addressed, the full scope and nature of brownfields redevelopment is not yet understood or measured. If Estonia is to protect its open lands and continue to concentrate development in existing built-up areas, the public sector will need to play an active role with private sector entities to make brownfields revitalization a priority.

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Authors' addresses:

Jiří TINTĚRA, e-mail: *jiri.tintera@ttu.ee*
Aime RUUS, Ph.D., e-mail: *aime.ruus@ttu.ee*
Epi TOHVRI, Ph.D., e-mail: *epi.tohvri@ttu.ee*
Tallinn University of Technology (Tartu College)
Puiestee 78, 51008 Tartu, Estonia

Zenia KOTVAL, Ph.D.
AICP, Michigan State University
East Lansing, MI 48824, USA
e-mail: *kotval@msu.edu*

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