

Mendel University in Brno
Faculty of Regional Development and International Studies

Brownfields and Regional Development in the Czech Republic and the Netherlands

Bachelor Thesis

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Acknowledgment

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Abstract

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This bachelor thesis focuses on the issue of brownfields in the Czech Republic and the Netherlands. In this work the concept of brownfield in the context of the regional development is analysed and also approaches to brownfields revitalization in both countries are described and compared on the basis of a set of indicators. One of the proposed indicators compares prices of agricultural land in both countries. Furthermore, a policy for revitalization of brownfields in the Czech Republic is recommended, which is applied for redevelopment of brownfields in the Netherlands.

Key words

Brownfields, regional development, Czech Republic, Netherlands, land use, revitalization of brownfields

Abstrakt

ŠRÁMKOVÁ, K. *Brownfieldy a Regionální rozvoj v České republice a Nizozemí*. Bakalářská práce. Brno: FRRMS v Brně, 2015.

Tato bakalářská práce se soustředí na problematiku brownfieldů v České republice a v Nizozemí. V této práci je analyzován pojem brownfield v kontextu regionálního rozvoje a následně jsou na základě souboru indikátorů popsány a porovnány přístupy obou zemí k revitalizaci brownfieldů. Jeden z navržených indikátorů porovnává ceny zemědělské půdy v obou zemích. Dále je doporučena politika pro revitalizaci brownfieldů v České republice, kterou Nizozemí aplikuje při obnově brownfieldů.

Klíčová slova

Brownfieldy, regionální rozvoj, Česká republika, Nizozemí, využití půdy, revitalizace brownfieldů

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1 INTRODUCTION

The issue of brownfields and their revitalization has been a very important topic in all developed countries since the late 1960s of the 20th century which is related with changes in the socio-economic structures of various regions, strategic, territorial and landscape planning. Brownfields can be considered as unused, devastated or degraded sites and buildings in urban areas or in open countryside. They represent a major problem and an obstacle for sustainable development of regions, cities and municipalities. Solution of this issue is expressed as a priority in many policies and strategies of public authorities at local, national and regional levels.

The reason of choosing this topic is that the Czech Republic started to deal with problems related to brownfields in the end of the 1990s of the 20th century, when abandoned areas appeared as a consequence of the changes in a political regime and consequent transformation of the economy. Comparing to the Netherlands, which have a longer industrial tradition and also with regard to the highest population density in Europe, the Dutch had to begin solving a problem with revitalization of brownfields much earlier than the Czech Republic. Therefore, it is a certain assumption that the Netherlands might be in some respects ahead of the Czech Republic in the context of solving brownfields, and might be an inspiration for the Czech Republic.

This thesis deals with a theoretical background, providing the most important information related to the issue of brownfields. In the next part is defined the research itself, including a description of individual indicators connected to the matter of brownfields and their revitalization in the Czech Republic and the Netherlands. In the end of the thesis are presented results where are compared indicators and policy used in both countries with the aim of suggesting a policy for revitalization of brownfields in the Czech Republic.

2 GOALS AND OBJECTIVES

The aim of this bachelor thesis is to define approaches related to the issue of brownfields in both the Czech Republic and the Netherlands. The main goal of this work is to compare approaches of reusing brownfields on the basis of concretely defined indicators which are described for the Czech Republic and the Netherlands. The main purpose is to suggest a policy for revitalization of brownfields which would be applicable for the Czech Republic, and which is successfully used in the Netherlands. The partial goal is to describe and analyse the current situation of brownfields regarded to the regional development in both countries.

3 THEORETICAL BACKGROUND

Following chapter is focused on the sustainable development which is defined from the global point of view, describing land use and its European and American viewpoints. The most important part of the theoretical background is about brownfields and their definitions and types, defining terms of greenfields and blackfields, approaches and examples of good practices from the Western European countries.

3.1. Sustainable development

The approach of sustainability in its modern way appeared in the early seventies of the 20th century. It was a reaction to rising understanding that modern development practices were resulting to worldwide environmental and social crises. The term of sustainable development rapidly became a catchy word for alternative development methods which could be foreseen as lasting into the future [1].

The definition of sustainable development according to the Organization of Economic Co-operation and Development is *“a dynamic balance between the economic, social, and environmental aspects of development in globalization, or as economically efficient, socially tolerable, and environmentally friendly development in all fields of human activity.”* [2]

The most common way how to make a concept of sustainable development is to have a Venn diagram with three dimensions: environmental, economic and social. These dimensions are often indicated as overlapping circles, and are characterized by business as the “triple bottom line” (Figure 1). [3]

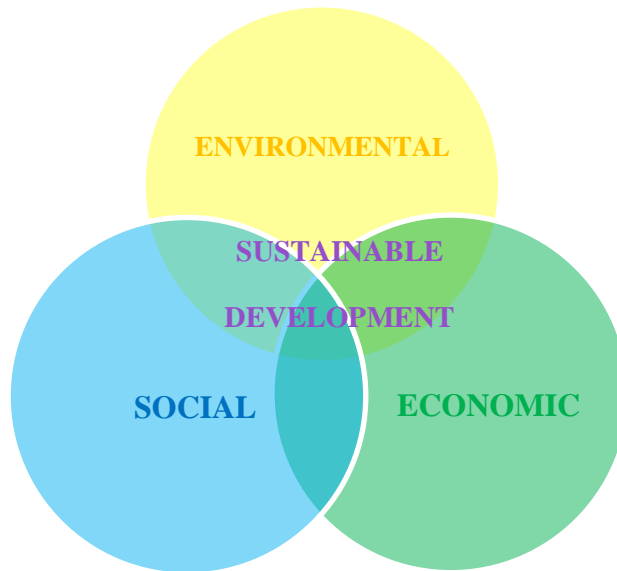


Figure 1: Sustainable development: Venn diagram (Own creation)

Source: Modified from PARKIN S., 2003

3.2. Land use

Human population has continuously impacted on the surface of the Earth for thousands of years. Landscape construction is a part of the historic process of territorial transformation which has had its origins in the interaction between people and nature [4].

Land use expresses functional use of land for what is used. Official definition of FAO characterises land use as [5] *“the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it.”*

Increase in human population, economic development and emerging global markets have caused remarkable land use change during the last 20 years. The consequences of unsuitable land use are land contamination and pollution, soil erosion and nutrient depletion [6].

3.2.1. Urban planning and building's land use

According to Hall [7] who defines urban planning that *“it refers to planning with a spatial, or geographical, component, in which the general objective is to provide for a spatial structure of activities (or of land uses) which in some way is better than the pattern that would exist without planning.”*

Important indicators within urban planning are land use and land use change which have a huge impact on urban sustainability. The Smart Communities Network¹ emphasizes on the importance of competent land use practices to avoid the unsustainable urban sprawl that has been characterized by the growth of cities in the USA as well as in Europe over the past decades.

Owing to buildings and their associated infrastructure force to the loss of ecosystems and biodiversity, decrease of land potential for amusement and also decline of storm water infiltration areas due to soil sealing.

A type of land use is generally given as a qualitative description, ordered from the best to the worst case (where the lower ecological value of a building plot is, the better assessment result is), are as follows [8]:

- *“use of contaminated land*
- *use after decontamination*
- *use of an existing building or recycling of a building plot / brownfield site*
- *building on already developed sites inside of an existing housing settlement*
- *building on plots defined as building areas in addition to an existing housing settlement*
- *development of new building areas (provision of services necessary), and*
- *building on re-designated, ecologically valuable areas.”*

3.2.2. Land use in Europe

The European continent is one of the most intensively used mainlands on the Earth, which has the highest share of land (up to 80%) utilized for settlement, production systems and infrastructure. There are numerous significant drivers in the European land use, such as the increase in demand of living space per inhabitant and the relation between economic activities, the increase in mobility and the growth of transport infrastructure which result in land take [9].

¹ The Smart Communities Network: creating energy smart communities. They offer information and services on how one’s community can adopt sustainable development as a strategy for well-being.

European cities have been facing major challenges. More than 60% of the European population is living in the urban areas. By 2020, about 80% and even more will be living in urban zones, such as in the Netherlands or Belgium. Other new challenges are technological progress and market globalization [10].

One of the main problems within land use is urban sprawl, which is currently affecting Europe. Urban sprawl is defined as extension development into the countryside and is characterized by uncontrolled and thoughtless placement of residential or commercial areas into the landscape. Urban sprawl has mostly visible in the countries or regions with a high population density, such as southern and western Germany, northern Italy, the Netherlands or Paris region, and with a fast economic growth like in Portugal, Madrid region or Ireland. Drivers of urban sprawl are especially price of land and availability of cheap agricultural land. Price of agricultural land is extremely low in comparison to price of previously urbanized land or industrial sites. Due to relative low acquisition costs of agricultural land, it enables to make higher profits compared to those from previous industrial land [11].

3.2.3. Land use in the USA

The United States has experienced the most intense changes of land use which contain of decreases in pastures, increases in forests and their cover due to logging development and also driven expansion of urban areas resulted over the past few decades.

Regarding to land area, the USA continues to be mostly rural country, as its population progressively tends to urban areas. By 2010, population living in urban areas had risen to more than 81%. In comparison with 1910, it was only 46% of the USA population. Over the last 60 years low-density housing developments have very quickly spread throughout the USA. According to the Census data, densities of suburban and exurban areas cover more than 15 times urban land area. Furthermore, it covered five times more land area in 2000 than in 1950. Projections show that land use and its changes will be dependent on rates of population and economic growth. Land use schemes forecast that suburban and exurban areas will enlarge nationwide by 15% to 20% by 2050. [12]

3.3. Brownfields

The existence of brownfields and problems of their regeneration is one of the major challenges for many cities and regions. The issue of brownfields is very broad. Because there is any single definition of the term to refer to brownfields, it is very difficult to define it. This represents one of the barriers of their re-use. From a global point of view, one of the factors is that their definitions differ in Europe and North America.

3.3.1. Definitions of brownfields

European definition

The presence of abandoned area is a subject of concern in many European countries where they have recognized this subject as a problem. However, the concept of brownfields has been used in different ways to have slightly different meanings [13].

The definition is created by the European Expert Network which is called CABERNET². The original definition has been designed by CLARINET³ as a working group in the project “Brownfields in Europe“. Brownfields are defined as sites that [14]:

- *“have been affected by the former uses of the site and surrounding area*
- *are derelict or underused*
- *are mainly in fully or partly developed urban areas*
- *require intervention to bring them back to beneficial use; and*
- *may have real or perceived contamination problem.”*

Although there does not exist any common European definition, a number of the EU member states⁴ have their own definitions of brownfields.

American definition

On the other side of the Atlantic, in North America, the subject of brownfields has also gained an interest in urban policy during the past 20 years. The evolvement of brownfield issue in the United States of America and Canada has caused that these two countries have their own definitions.

² CABERNET – Concerted Action on Brownfield and Economic Regeneration Network

³ CLARINET – Contaminated Land Rehabilitation Network for Environmental Technologies

⁴ This interactive map of Europe shows each country’s definition of brownfield. Available at: <http://www.cabernet.org.uk/resourcefs/328.swf>

The definition of brownfield site in the USA is stated in Public Law, specifically in “Small Business Liability Relief and Brownfields Revitalization Act” which was made into law in 2002. Brownfield site is defined as [15] *“property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.”*

While Canada does not have a single and legal definition of a brownfield, it is similar to the US definition. It is generally defined to be [16] *“an abandoned, vacant, derelict, or underutilized commercial or industrial property where past actions have resulted in actual or perceived contamination and where there is an active potential for redevelopment.”*

3.3.2. Greenfields

Regarding to the subject of brownfields and to understand this matter appropriately, there should be defined another term, which is a kind of antithesis of brownfields, it is called greenfields.

Greenfields are defined as lands and open areas outside of the compact urban areas. They were originally intended for agricultural, forestry and recreational use. After such a change in the planning documentation, they have been redefined as residential, commercial or industrial development sites. Land is being prepared with transportation and technical infrastructure, using private or public financial sources and to be later gradually overbuilt [17].

The problem of greenfields is an intervention into untouched territory. Due to this reason, it is preferred to reuse of brownfields sites which have been already located in the urban landscapes.

The reason, why investors are rather willing to build on greenfields than revitalize brownfields projects, is especially due to higher risks during brownfields development. The comparison between common project risks in greenfields development and risks connected with brownfields development can be seen in the table 1. All these risks cause that investors focus much rather on greenfields than investments to brownfields [18].

Table 1 Summary of common project risks in greenfields development and additional project risks in brownfields development

COMMON PROJECT RISKS IN GREENFIELDS DEVELOPMENT	ADDITIONAL PROJECT RISKS IN BROWNFIELDS DEVELOPMENT
Risk of real estate market	Risk of overall deprivation of an area
Risk of project concept	Technical risk of ecological damage
Risk of time factor	Risk of complicated property-legal relations
Risk of financial market	Risk of increased time demand of a project
Legal risks	Risk of higher costs of a project
Supply risks	Risk of increased coordination complexity of a project and its implementation
Income risks	Time risk associated with possible changes in priorities of real estate market

Source: Modified and translated from JACKSON,J., 2004

3.3.3. Blackfields

With concerning the matter of an expanded land contamination, the term of blackfields is generally related. Blackfields are characterized as localities with extremely high levels of soil, groundwater and surface water contamination, and also other environmental components, which are major obstructions for their future use. The cause of pollutants, usually toxic, were the activities of mining and mineral transformation, industrial production, storage and landfilling of hazardous waste, transportation and activities connected with the military use areas. The expenses on the redevelopment of these old environmental burdens are very high, however, delaying their implementation and solution only multiply their costs [19].

3.3.4. Types of brownfields

Brownfields might be divided into separate categories according to different evaluation criteria. Evaluation criteria might be, for instance, degree of contamination, suitability for their future use or location of brownfields [20].

Brownfields categorization is very important for possibilities of future use of brownfields. According to the methodology of CABERNET, these sites are divided as follows [21]:

- “A” – areas which are attractive for potential investors, do not need any support for their new use, or intervention from public funds. They are attractive localities, mostly in the center of big cities. A problem of contamination is not dominant and does not discourage investors.
- “B” – localities which have average potential of new use for investors. They are areas with a medium ecological burden or located in less attractive locations. It is supposed that lower intervention of public funds will be needed.
- “C” – territories which are not re-usable without significant intervention of public funds. Those are areas with a strong ecological burden that are situated in non-attractive locations. It should be focused on these sites with the greatest attention in the future.

3.3.5. Revitalization of brownfields

The subject of brownfields has becoming increasingly current. Its solution should be included among the priorities of the local, regional and national policies because of a significant importance for sustainable development and maintenance of national competitiveness.

Regeneration of brownfields involves a reconstruction of an unused and neglected building for new use. However, a technical condition of buildings (associated with environmental problems) sometimes does not allow a reconstruction. In this case, a process of brownfield regeneration consists of two basic phases. The first step is a reclamation phase. At this phase occurs cleaning of the area and returning of a status similar to greenfields. The second step is a recovery phase, thus putting the site back to the effective usage. In practice, areas are usually of a great size, and therefore, is used a combination of both types of regeneration [22].

Revitalization represents a complicated process whose success is dependent on a scale of many factors, which are follows [20]:

- location
- environmental aspects (existence of burdens)
- potential of future use
- property relations
- existence of infrastructure
- expected return on investments
- funding sources
- coverage of costs
- regulation
- ability to manage risks
- relationship between municipalities and citizens.

Function use of brownfields

According to the target type of recovered property, brownfields sites can be categorized into six basic segments [23]:

- industrial areas – including logistic and stock activities
- commercial zones – offices and retail trade
- housing
- mixed activities – retail trade, commerce and housing
- leisure and recreational activities – amusing and sport centers, golf courses, activities on open areas
- extremely contaminated areas – are intended to minimize the threat for use, such as park adjustments, where are prohibited other development activities.

3.3.6. Approaches to the practice of brownfields development in the Western European countries

Brownfields sites are usually located in the areas as a consequence of previously used for industrial and agricultural purposes, mining activities, military service and other activities. These abandoned and contaminated sites are mostly situated in highly industrial regions which deal with negative aspects, such as a high rate of unemployment and a decline in the economic potential of a neighborhood.

In the industrialized countries of the Western Europe, a problem of restructuralization with a transition to more efficient technology and reducing of production volume in some industries began to appear already between the two world wars. Most obviously in the most industrialized countries, such as the Great Britain, the Netherlands, France and Germany [24].

England

Due to a strong industrialization in the English history, it is one of the countries with the highest range of brownfields. A specific problem is differences in the intensity of a territorial development which concentrates primarily on the southeast of the country. The strengths of the English approach might be considered as follows: the existence of a detailed database of *Previously developed land*, functioning of state agency *English Partnership*, traditional partnership between local government and private developers, and increasing interest of civil initiatives about direct involvement in regeneration projects [25].

A priority of the Great Britain is to ensure that 60% of all new developments will be built on brownfield land. This national approach has been implied by the Government in 1998. Local authorities tend to develop brownfields to help in regeneration of urban areas degeneration. This is considered to be preferable to developing on greenfields [26].

France

France began to face a change in the structure of the economy from the early 1970s. There was a decline in the industry which resulted in the formation of numerous abandoned industrial sites or *friches industrielles* representing a risk for a population and the environment. The issue does not affect brownfields in France equally but

concentrates on the north of the country and in port cities. Although in France operate state development agencies, they primarily focus on a recovery of problematic urban areas. Rather different roles have land banks which became a regional tool. They make a pre-preparation of lands for municipalities, in term of a purchase, putting land into a “*state 0*” (demolition, remediation of soil, permanent or temporary greening) and their management. Lands are given to municipalities when projects for new uses are created and investors found [25].

Germany

Brownfield sites in Germany are considered to be a big issue which is frequently discussed as a fundamental factor of contaminated land management. There have been made efforts how to solve the environmental problems which arising from contaminated sites. However, the issue of brownfields revitalization and of redeveloping contaminated sites bringing them back into economic use is still a major task for the future. Even if brownfields cause risks related to the environmental threats, at the same time land consumption used for building purposes is rapidly increasing at a rate of 129 ha per day. In Germany is registered about 362,000 contaminated sites and 128,000 ha across the country. Germany does not have any specific brownfield regulation. The Federal Planning Building Act defines approaches of land saving planning which are linked to greenfields policies as a difficulty to get building permissions on greenfields. Also, there exist recent methods at the Federal level to develop a brownfield network [27].

3.3.7. Examples of good practices

Regarding to the approaches from the Western European countries it is reasonable to seek for guidance on the solution for revitalization of the brownfields sites in those countries, which have already existing experiences.

Tabakfabrik in Linz (Austria)

Tabakfabrik Linz became a factory of tobacco switching from previous used mill in 1850. It turned into a monopoly in the tobacco industry (Annex 1, photo 1). During its biggest fame the factory was reconstructed to its nowadays form based on aesthetics of bauhaus and functionalism. Tabakfabrik had been the first Austrian building with steel construction. The main building is under culture heritage since 1981 and is considered

as a milestone of Austrian interwar architecture. The city of Linz created an organization *Tabakfabrik Linz Entwicklungs-und Betriebsgesellschaft mbH* for reuse of this factory. The change of Tabakfabrik for culture purposes was based on four basic pillars: creativity, social care, employment and education. The transformation came hand in hand with cultural and territorial planning and strategic development of the city on the use of industrial space for cultural purposes. The current use of Tabakfabrik Linz is artistic, cultural and social living lab and a platform for innovative and progressive projects (Annex 1, photo 2) [28].

Museum of the art and industry in Roubaix (France)

In the rich city of Roubaix in the interwar period was built luxurious urban spas in the art deco style with Moorish and Byzantine influences (Annex 1, photo 3). In that time they were considered as the most beautiful spas in France. However, moisture and other environmental factors caused that they had to be closed for safety reasons in 1985. They were declared as a monument. It was decided to be rebuilt on a regional museum in 1990. The locality of previous spas was reconstructed into a representative gallery (Annex 1, photo 4). Successfully renovated old spas consist of one of the main dominant of the city [24].

Gallery of modern art in Liverpool (England)

The complex of old docks comes from the 19th century and is one of the most famous industrial sites in the United Kingdom (Annex 1, photo 5). The prosperity of port and industrial city of Liverpool was largely associated with British expansion into the New World. However, Liverpool started to lose its dominance after the Second World War when the main initiative gained other main port cities in Europe, such as Rotterdam and Manchester in England. A large area of Liverpool's docks began to be used less. Docks ended completely abandoned and in ruins. Realization of project started in 1988. With a respect to the existing building architects were led only to necessary changes of the interior, where were required solutions of a main lobby. Nowadays the exhibition premises are enriched by artists' studios, meeting places and a restaurant (Annex 1, photo 6). [24]

4 METHODOLOGY

The bachelor thesis is divided into two parts – theoretical and practical part. The theoretical part consists of a chapter 3 and its sub-chapters which were processed in the form of a literature review giving an outline of the given issue. This part of work was created on the basis of searching and studying primary sources of information (in particular, books dealing with the topic of brownfields, journal articles and internet sources). From all sources were obtained the most important facts which were categorized and subsequently processed into the literature review. In the last sub-chapter – examples of good practices were used photographs from official internet websites of revitalized brownfields.

The practical part is based as well on studying primary sources of information at the national levels of both the Czech Republic and the Netherlands. In this part of thesis was used a comparative method. First of all, indicators were chosen regarding to the literature review. Both countries were compared in the context of approach to brownfields revitalization on the basis of a set of indicators which can be seen in the figure 2.

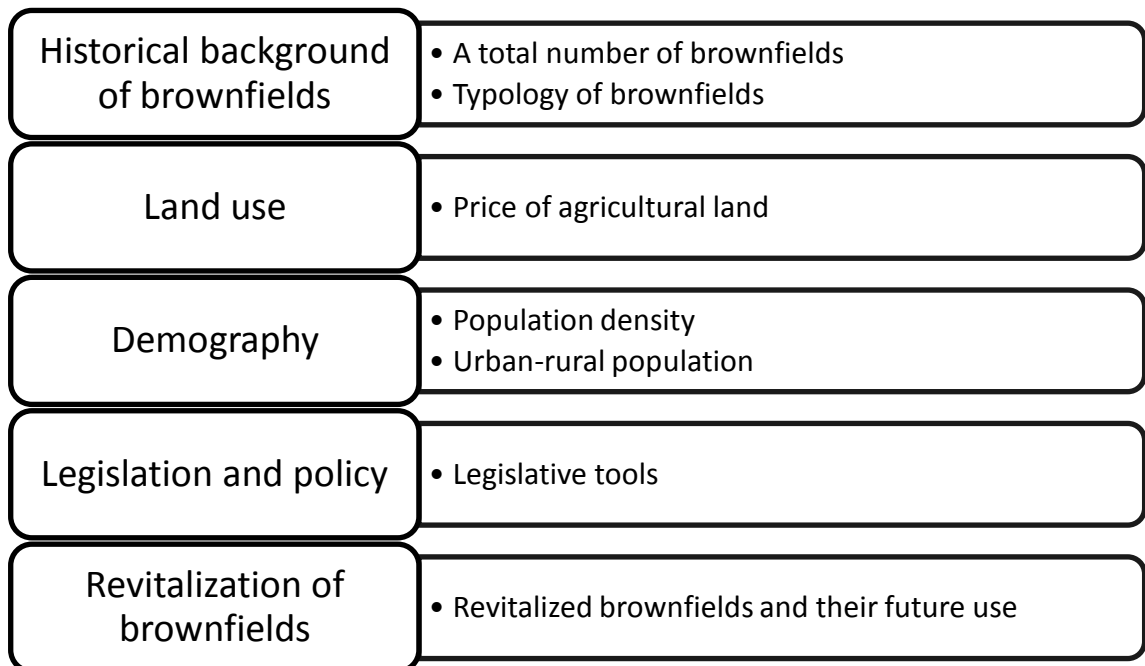


Figure 2 Scheme of a set of selected indicators

Source: Own creation

In the chapter about the Czech Republic were used journal articles connected to the history and land use. For the parts about typology and revitalization of brownfields was used the Prospecting study for locating brownfields made by CzechInvest Agency. Defining of the prices of agriculture land was analysed on the basis of the Situation and Outlook Report of the Ministry of Agriculture. The demographical part was made with the data used from the Czech Statistical Office. Legislation and policy was based on the legislative acts of the Czech Republic.

In the chapter about the Netherlands were obtained data from the brochures of the Government of the Netherlands and its Ministries related to the land use and brownfields revitalization. Demographical data were gained from the official website of the Statistics Netherlands and its web magazines, as well from the journal articles. Legislation and policy was based on the legislative acts of the Netherlands used from the OECD – Territorial Outlook and dissertation study.

In this thesis were defined two hypotheses, and in the end of this work were transformed to the conclusions.

The first hypothesis is: *In the Czech Republic is more agricultural brownfields than in the Netherlands due to the remnant of agricultural activities.*

The second hypothesis is: *The Netherlands are more dependent on re-using of brownfields than the Czech Republic because there is a scarcity of land which is as well more expensive.*

The comparison of indicators resulted in which aspects these two countries differ or not in the process of brownfields revitalization. To conclude, the method of analogy was used to make suggestions what could be improved in the case of brownfields re-use in the Czech Republic according to the policy which is used in the Netherlands.

5 PRACTICAL PART

5.1. Brownfields in the Czech Republic

The following chapter is focused on the approach of brownfields in the Czech Republic. First of all, it is defined a historical overview how was influenced brownfields development in the Czech Republic. Furthermore, it is described a character of land use and prices of agricultural land which is followed by a demographical part concentrated on the population density and urban-rural population. Moreover, it is explained legislation and policy connected to the regeneration. The last part is focused on brownfields revitalization.

5.1.1. Historical background of brownfields

Focusing on the history of brownfields is not only important for further understanding of the subject, but also for its future development. From the analysis of the past conditions of brownfields, can be seen causes of a decline and preliminary status of examined sites.

The development of railways and the use of steam at a constantly increasing production led to a concentration of factories in the areas where coal was mined. Industrial sectors were linked and formed large factory complexes with several hundreds or thousands of workers. This trend is called urbanization which caused that people moved for a work from rural areas to big cities, and influenced development and size of cities in the modern times. Lately, the use of electricity in the transportation, the invention of combustion engine and the emergence of the automobile had the greatest impact on the movement of inhabitants and production from industrial centres to the suburbs, where new job opportunities were created. Until then, the entire industrial districts were emerged and focused on factory production together with residential houses for workers. However, the development of transportation allows a process of suburbanization which means moving from urban industrial centres to adjacent neighbourhoods [29].

After the Industrial Revolution the process of migration to big cities stopped and the situation reversed after the World War 2. Small towns and municipalities began to grow because living in there was not so isolated anymore. The standard way of living of inhabitants in the cities slowly started to rise as well. With the growth of population in

rural areas was associated the increase in the agriculture. The 1950s were noted as the sign of collectivization in the Czech Republic.

Agricultural cooperatives were established and large agricultural areas were built up at the expense of the surrounding landscape. After 1989 there was a large restitution and forcefully collected and land property had been returned to the original owners. Agricultural cooperatives were dissolved, leaving them unused areas.

Transformation and restructuralization of the modern domestic economy in the 1990s influenced the formation of brownfields. A radical change of social-economic structure, as a consequence of restructuralization, was represented by a shift of workforces from secondary to tertiary sector of the economy. By this time, foreign investors began to invest to the projects of developing commercial centres and residential areas on the greenfields. It is called urban sprawl when the capital is moved which could be used on reconstruction of already built areas. This had caused the abandonment of obsolete factory buildings and industrial areas, which began to degrade. Its effect is undesirable in the context of economic, environmental and social aspects. [30]

Indicator 1: *A total number of brownfields*

CzechInvest Agency conducted in cooperation with individual regions so called “*Prospecting study for locating brownfields*” in years 2005-2007. The aim of this study was not to outline all localities but to gain an overview of brownfields characteristics in the Czech Republic. On the basis of this study was reviewed a sample of brownfields in each region, especially in the areas where is expected their early revitalization. The purpose of regeneration is to increase attractiveness of existing areas at such a level that will be able to compete with the construction on greenfields.

According to the results in the Prospecting study for locating brownfields was localized of 2 355 brownfields with a total area of 10 326 ha and a total built-up area of approximately 421 ha. The data synthesis was made from all regions except of Prague, registering brownfields from a size of about 1 hectare but not including of mining brownfields. However, a total number of brownfields is significantly higher, as was mentioned in 2004, the estimation was 8 500 – 11 700 brownfields sites with a total area of 27 000 – 38 000 ha. [22]

Indicator 2: Typology of brownfields

Brownfields can be evaluated according to numerous criteria and divided into various categories. However, the typology of brownfields as the second indicator is based on the historical development of brownfields in the Czech Republic which was described in the chapter 5.1.1., and in regard to the final results of statistics from Prospecting study for locating brownfields made by CzechInvest Agency in 2007. The division of brownfields according to their previous use is shown in the figure 3.

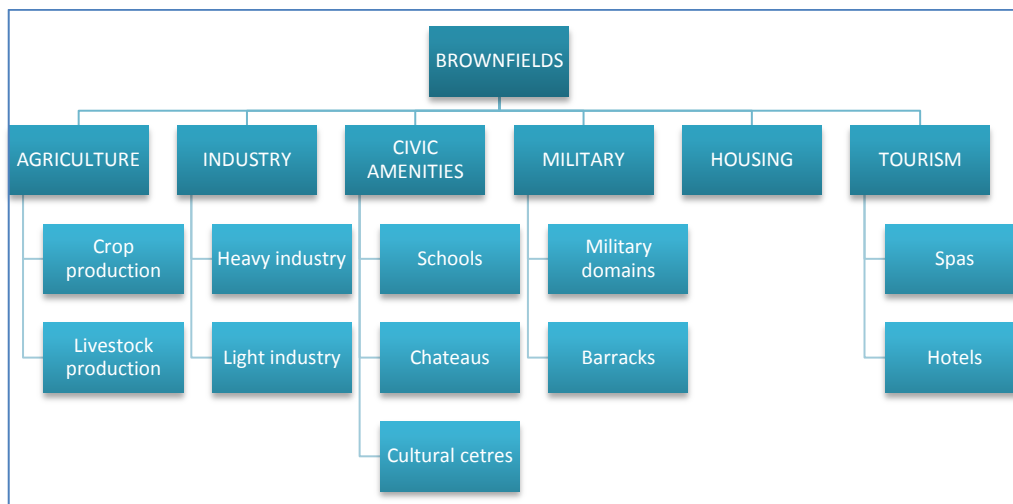


Figure 3 Division of brownfields according to their previous use (Own creation)

Source: Modified and translated from CzechInvest: Prospecting study for locating brownfields (2007)

The final results of statistics from the study can be seen in the table 2 whose data represent the structure of brownfields according to the previous use. Although once was said about brownfields that were used to be a consequence of transformational changes in the industry, the study showed, the most brownfield localities were previously used for the agriculture. Industrial brownfields consist of the second third of the total number of brownfields; on the other hand, occupy the largest area of a total size of brownfields in the Czech Republic. Remaining brownfields are as a result of unused areas of civic amenities (such as schools, chateaus, cultural centres, etc.), military areas, housing, localities of the tourism and others. After the largest occupation of industrial brownfields it is followed by military and agricultural areas. However, military sites showed by far the largest average area of 15,9% ha per a single brownfield unit [31].

Table 2 Structure of brownfields according to the previous use in the Czech Republic

Previous prevailing use of the locality	Absolute frequency	Relative frequency (%)	Total area of locality (ha)	Total area of locality (%)	Average size of a single unit (ha)
Agriculture	821	34,9	1 840,4	17,8	2,2
Industry	785	33,3	4 423,2	42,8	5,6
Civic amenities	304	12,9	413,3	4,0	1,4
Military	151	6,4	2 394,1	23,2	15,9
Housing	95	4,0	88,3	0,9	0,9
Tourism	22	0,9	22,4	0,2	1,0
Others	177	7,5	1 144,3	11,1	6,5
In total	2 355	100	10 326,3	100	4,4

Source: Modified and translated from CzechInvest: Prospecting study for locating brownfields (2007)

Regarding to the historical overview of the Czech Republic were defined two indicators: *a total number of brownfields* and *typology of brownfields* which show significant outcomes of how many and what kind of brownfield sites have been left in the Czech Republic from the past. Thereafter, the same kind of indicators is used for the Netherlands and then is compared with each other.

5.1.2. Land use

The Czech Republic has a high proportion of arable land in the total area of the country. Most of the soil cover⁵ consists of agricultural land which is about 53,5% (4 220 thousands of ha) of the total land fund. Trends of changes in land use after 2000 are characterized by a continuous loss of arable land and increase in permanent grasslands within the Agricultural Land Fund. However, the total area of the land fund is constantly decreasing, especially due to the expansion of built-up and other areas. For the main agricultural areas and urban centres is typical anthropogenic pressure on land use, resulting in a particular increase in the scale of built-up areas, or even of arable land at the expense of other environmentally more valuable land use. The size of built-up areas increased by 290 ha (0,2%) in 2013, which is more than double compared to 2012. [32]

All in all, there is a decline of the agricultural land at the amount of 15 ha per day, which is a land mostly with the highest quality. In this context, it should be emphasized that land beneath of buildings is permanently lost. At the same time, are still built storage facilities within of large cities (so called future brownfields). The construction is often done under intense pressure from investors, developers and land speculators. Unfortunately, our environment has to suffer from these circumstances. On one hand, there is still being insufficiently withdrawn agricultural land; on the other hand, are not used brownfields [21].

Indicator 3: Prices of agricultural land

Setting a price of land is not a simple matter. Land prices are influenced by many factors and current legal arrangements in a given year. Market prices of agricultural land in the Czech Republic belong to the lowest in the EU, compared to Germany, Denmark, Belgium or the Netherlands where prices much higher are. These significant differences have many causes. A fragmentation of ownership is one of the most powerful reasons for holding a market price at such a low level in the Czech Republic. This is applied particularly on land for agricultural activities, but partly also on land used for non-agricultural use, mostly for development [33]. A low price of agricultural land and still

⁵ Issued by the Czech Office of Land Surveying and Cadastre in 2013, data for the indicator Land Use are withdrawn from the publication Summary overview of the land fund used from the Cadastre of the Czech Republic.

relatively easy process of its transformation through changes in a spatial plan for building lands do not make revitalization of brownfields such a common issue, thus construction on greenfields is easier and faster.

Table 3 shows average prices development of agricultural land in 2000 and in the period from 2005 to 2011. However, the quality of agricultural land is decreasing in the Czech Republic; the price of land had increased since 2000. Furthermore, it has been growing rapidly since 2007. A general trend is a price of land is progressively increasing, and getting nearer to the other European countries. Even though prices of land are growing, there still belong to the lowest in Europe, which is attractive for foreign investors as a vision of a good profit. To conclude, the predictions indicate that prices will significantly arise.

Table 3 Average prices of agricultural land in the Czech Republic

	Year	2000	2005	2006	2007	2008	2009	2010	2011
Czech Republic	Price (EUR/ha)	1 556	1 621	1 625	1 867	2 375	2 250	2 230	2 373

Source: Modified and translated from the Situation and Outlook Report: Land (Ministry of Agriculture, 2012)

In relation to the land use was defined an indicator – *prices of agricultural land*, representing an overview on the price development during a period of time. This indicator means an important aspect for comparing prices in both countries.

5.1.3. Demography

The Czech Republic is located on the area of 78 866 km² which consists approximately of 2% of total area of the EU. By September 2014 there were registered 10 528 477 inhabitants⁶.

Indicator 4: Population density

Placement of the Czech population is uneven. The population density reaches 133 inhabitants⁷ per km². From the economic point of view, the most concentrated

⁶ Obtained data were taken from the Czech Statistical Office, in the section of the Population.

⁷ It was based on the data which were observed in the last Census from 2011.

population is where job opportunities are, especially in large cities (such as Prague, Brno, Ostrava or Plzeň) and industrial areas (North Bohemia, Ostrava and Central Moravia). It can be said that more populated is north and east of the Czech Republic and less west and south of the territory.

Indicator 5: Urban-rural population

All Czech, Moravian and Silesian cities are located on the territory of 20,9 thousands km² (27% of the total area). The Czech Republic contains in total of 601 cities. While some of these cities are large, densely populated metropolises which are important centres of regional and supra-regional importance, others are small municipalities of rural character. Currently 7,3 millions of inhabitants (70% of the Czech population) live in towns. It means that the density is relatively high (350 inhabitants per km²). In other words, it indicates a high concentration of inhabitants on relatively small area [34].

There are 4925 rural municipalities (78,8% of the total) in the Czech Republic with a population density of 100 inhabitants per km². The largest part of the country is occupied by municipalities with a population density of 25 to 50 inhabitants per km² (26,9% of the Czech Republic). However, only 7,6% of the total country's population lives in these municipalities. Rural communities occupy nearly 80% of the territory of the country but only 30% of the Czech population lives there [35].

In the context of demography were described two indicators: *population density* and *urban-rural population*, showing the concentration of population and its division among Czech cities and rural areas. Furthermore, these two indicators are used for the comparison with the Netherlands.

5.1.4. Legislation and policy

The major issue connected with legislation on brownfields is that its definition is not legally defined in the Czech Republic. Therefore, it is challenging to be included in the legislation. It is highly required, that the law relates to brownfields, should be precisely defined what does the term mean.

Indicator 6: Legislative tools

The most effective tools for brownfields regeneration process are influenced by several areas of legislation. They are promoted by following conceptual and legislative instruments; it is primarily legislation of regional policy, spatial planning and construction law and legislation of the environment.

Regional policy

The legislative framework to support of regional development generates *Act No. 248/2000 Coll. on the support of regional development*. The law helps to the application of all main principles of sustainable development, providing a subject of the support in the frame of the regional program which will be in addition to the development of economic activities, improvement of infrastructure facilities, restoration of landmarks, measures for protection of the environment and reducing the influence of the landscape disturbing. [36]

Construction law and spatial planning

The new version of *Building Act No. 183/2006 Coll.* has been valid since January 2007. The main target is a better efficiency of the actions in spatial planning and authorization of buildings. This law is partially contributed to a solution of brownfields revitalization. Specifically, it focuses on a simplification and acceleration of changes in spatial plans for regeneration projects, setting methods of cooperation between the public and private sectors in the field of construction or restoration of infrastructure, common project preparation and application of tools in expropriation.

This new legislation has come up with a fundamental change in the fact that in the spatial plans will be able to indicate a brownfield site as the area of regeneration. The legislation brought an indirect support of redevelopment which has made stricter conditions for defining new built-up areas. Moreover, new Building Act directs to the authorities of spatial planning to observe the occurrence of brownfields, also contains new tools for clarifying property relations. Other importance is legislation in buildings removal. Building Authority might order the removal of building due to its harmfulness to the environment and has greater power in initiating of the owners regarding to the maintenance of the building.

Environment

The main obstacle is that the Czech legal system needs a comprehensive regulation of liability for environmental damage, pollution and removal of these burdens. The *Act No. 167/2008 Coll.* deals with prevention of environmental damages and its remedy, however, it refers to the “new” environmental damages but not to those who have become damaged in the past. This means that contaminated sites are not governed by law at all, or only slightly.

The ambiguity in the Czech environmental legislation also needs to deal with a soil protection including limits of acceptable pollution which causes problems and uncertainties among investors who are interested in these sites.

Other laws dealing with the environment are the *Act No. 334/1992 Coll.* about protection of agricultural land fund which defines agricultural land. The *Act No. 114/1992 Coll.* about protection of nature and landscape which specifies the “previously built-up areas of municipalities”.

According to the contaminated site are distinguished numerous schemes of legislation and ecological burdens. The *Act No. 92/1991 Coll.* about the removal of ecological burdens in the frame of privatization process that adjusts a property which was privatized and passed to the transferee with all rights and duties. The compulsory part was the environmental audit which was either a discount on the purchase price or the state concluded the environmental agreement which undertook the burden to be disposed. The site should be cleaned according to the previous uses, which has brought complications.

The *Act No. 254/2001 Coll.* about the removal of defective condition, Water act (in the later regulations) that regulates the issue of bad conditions and corrective measures which removed the damage. In the most cases are used measures by the Water act when brownfields are regenerated and contamination is removed. The responsible person is who has caused the damage, or his legal successor. However, it is mostly difficult to identify a responsible person and force him to remove burdens. [37]

Regarding to the legislation was defined an indicator of *legislative tools*, defining the most relevant legislative instruments connected with a process of brownfield revitalization. This indicator is used for comparison with the Dutch legislation and policy.

5.1.5. Revitalization of brownfields

The major assumption for successfully regenerated brownfields is primarily a feasible, sustainable and sufficiently courageous vision for their future use. This vision is even more important than the best prepared investment project aimed at only cleaning up of devastated sites. The practice shows that this is a weak point of many projects in the Czech conditions.

Indicator 7: Revitalized brownfields and their future use

The project *Brownfields 3000* was created within the framework of the National Brownfield Regeneration Strategy in the Czech Republic. The vision of the CzechInvest representatives in 2006 was that out of 3000 mapped brownfields should be revitalized 1/3 of them until 2013. By 2025, should be revitalized maximum of brownfields.

On the basis data from the Prospecting study for locating brownfields was not mentioned information according to which criteria are going to be used brownfields sites in the future. It was studied that it might be used more areas in the future than existing ones. For example, it is not necessary to promote industrial production again but there are new possibilities of using such as tourism, spas and public greenery. On the contrary, there should not be used sites for military purposes. Currently, the largest sector of the economy-services might be applied in mixed industrial function together with light industry (20,8%), following by mixed urban function together with housing (20,7%). By 16,5% cases is expected with the use for civic amenities.

Figure 4 shows a comparison of previous use with expected future use of brownfield sites. Perhaps the biggest change is seen in the character of previously used agricultural objects. Compared to 786 sites formerly used in the agriculture is expected future use in the agriculture at only 191 sites. At 249 localities seems to be the best use for mixed agriculture. [31]

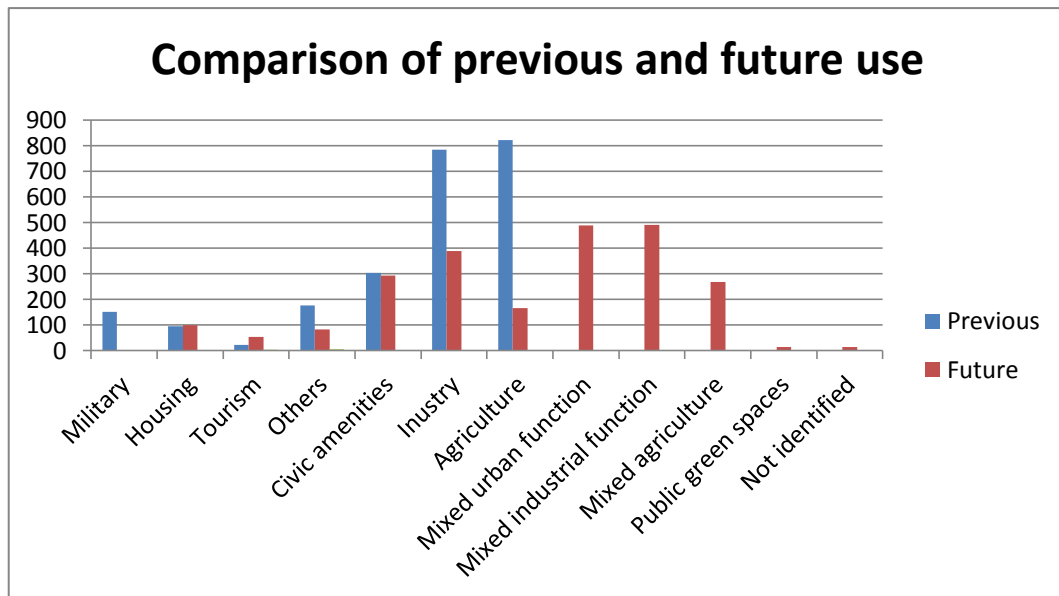


Figure 4 Comparison of previous and future use of brownfields

Source: Based on the data from CzechInvest: Prospecting study for locating brownfields, 2007 (Own creation)

Examples of successfully revitalized brownfields in the Czech Republic

Agrocentrum Ohrada Visky (South Moravian Region)

Agrocentrum emerged by the reconstruction of the original cowshed which was built in the 1960's. After the revolution the cowshed was functioned only until 1991 when a cow husbandry was finished. In 2001 it was completely abandoned. Firstly, it was considered to use a project for agricultural production again; however, it was discontinued because of the bad situation in the agriculture [30]. After a long consideration, the choice fell on the rebuilding of the facility which will combine activities of agro-tourism and relaxation (Annex 2, photo 7).

Overall the whole action can be considered as successful as it managed to accomplish the objective of this revitalization. The proof is that it was awarded in 2006 by the Prize of Czech consumers of the South Moravian Region.

Palladium (City of Prague)

Former barracks of George of Poděbrady on the Republic's square in Prague is currently known as the Palladium shopping centre. Originally it was object of Capuchin monastery and the hospital, built in 1653. It has served many famous personalities of the Czech nation, such as Josef Kajetán Tyl. Barracks were owned by the army from 80's of the 18th century until 1996. In the second half of the 20th century the site was almost unused and failing into disrepair.

The Ministry of Defence decided to reuse it in the early 1990. The reconstruction began in 2005 and Palladium was opened to the public in 2007. Since then, the building is a major shopping centre which is a highlight of Prague centre (Annex 2, photo 8).

New Vítkovice (Moravian-Silesian region)

The entire land of approximately 150 ha of previous industrial production which started in 1828 and finished in 1998, is divided into three parts. In the northern part is a mine Hlubina, blast furnaces, coke plant and its chemical plant. The central part focused on engineering production. In the southern parts is a group of industrial and administrative buildings. On the territory of the Lower Vítkovice is growing the area for the leisure time, housings, shopping, museums, galleries, research establishments, or facilities for university students (Annex 2, photo 9). [22]

At last, it was defined an indicator – *revitalized brownfields and their future use*, focusing on the brownfields which have been already revitalized, and identifying their future use. Moreover, there are mentioned three examples of successfully revitalized brownfields in the Czech Republic. This indicator is also used for comparing the revitalization of brownfields with the Netherlands.

5.2. Brownfields in the Netherlands

The following chapter is focused on the approach of brownfields in the Netherlands. In this part of the thesis are described the same indicators, as were chosen for the Czech Republic, however, dealing with the Dutch approach.

5.2.1. Historical background of brownfields

The process of industrialization in the Netherlands did not emerge into smoking chimneys as it was in Belgium or the Great Britain. The capital city of Amsterdam was still a wealthy trade and finance centre, where farmers lived from potatoes, flowers and cheese. Whereas trades like shipbuilding and fishing were still in decline. Specifically, the old textile region around Delft, Haarlem and Leiden suffered a big crisis. Only highly specialized fields, such as silk-weaving were able to survive against a big competition from British machinery-driven textile mills.

British new technologies spread very slowly to the Netherlands. However, there had already developed a sophisticated technology of hydraulic engineering to avoid dykes and canals from flooding and to gain back land from the sea. The pumps had been traditionally driven by windmills, mostly numerous windmills in itself. By the mid-19th century the Dutch started to use steam power. Industrialization began to occur after 1860 when new textile factories were built in the North Brabant. Those new built factories and industrial sites were situated at easy accessible urban location near harbour, railroads or highways. Harbour in Amsterdam was linked directly to the North Sea through the new channel. The city of Rotterdam received so-called “New Waterway” which had allowed establishing a profitable business route with the ironworks and mines in the Ruhr. Due to the extensive network of waterways in Holland, building railways was less profitable form of business, therefore people rather preferred to continue transporting their goods by water. Since it was more usual to live close to work and as well because of the population growth, large neighbourhoods were built next to urban areas. Due to this trend industrial sites located near urban areas summed up to mostly built-up areas. By the end of the 20th century industrial sites were no more needed because of the development of a knowledge based economy. Many industrial sites were no longer in use and were left abandoned, underused, and were mostly contaminated due to previous industrial activities [38].

Indicator 1: A total number of brownfields

In the study made by the Ministry of Economic Affairs of the Netherlands in 1990 was estimated between 9 000 and 11 000 hectares of industrial sites throughout the Netherlands. However, the exact figures for the total size of the brownfield issue are not easy to define as this mostly depends on the definition of brownfield. According to the Environmental Ministry, there are estimated about 110 000 – 120 000 suspected or potential contaminated sites in the Netherlands, where one third of this number are located in the cities Amsterdam, Rotterdam and Zaanstad. The issue of brownfield land is very important in an urban context because every large city with previous industrial activities has problems with brownfields [13].

Table 4 shows an increase in recorded cases of contamination sites in the Netherlands throughout the historical development over twenty years of research. In 2004, the approximate total size of contaminated soil was about 400 000 square kilometres. According to the last summation and existing surveys relating to soil show that there are already about 700 000 contaminated localities. The main reasons for such a high number of brownfields can be explained by the high density population and a very long history of using soil.

Table 4 *Increase in recorded cases of Dutch contamination sites*

<i>Year</i>	<i>Number of contamination sites</i>	<i>Type of site</i>
1982	2 000	Waste deposit sites
1987	10 000	+ Industrial locations
1995	200 000	+ Historical industrial locations
2003	400 000	Comprehensive survey
2005	700 000	

Source: Modified from Brownfields Handbook, 2006

Indicator 2: Typology of brownfields

The historical development of brownfields in the Netherlands described in the chapter 5.2.1. indicates that the most dominant aspect for the formation of brownfields was the period of the nineteenth and twentieth century, since when barracks complexes, port areas, new industrial and railway yards were blossomed. The sites were often located on the edge of cities, easily accessible by rail and waterway. A century later, these areas were no longer suitable for the functions they once served. [39] However, there cannot be identified exact types of brownfields located in the Netherlands because it is not existed a database of brownfields due to a short time remaining space in unused condition.

According to a preliminary report on the estimated number of potentially contaminated sites which was presented by the Parliament, was concluded that between 110 000 – 120 000 sites were potentially to be contaminated. Table 5 indicates a number of Dutch contaminated sites which were allocated to the corresponding polluting activities. There was estimated a number of 80 000 sites as abandoned industrial sites and 25 000 sites as operating industrial sites.

Table 5 *Number of potentially contaminated sites in the Netherlands according to polluting activities*

Activity/Type of site	No. of sites
Abandoned gasworks	234
Municipal waste disposal	2 300
Abandoned industrial sites	80 000
Operating industrial sites	25 000
Out-of-service petrol stations	6 200
Military sites	2 500
Others (waste disposals, diffuse sources, leakage in sewing systems and underground tanks)	Not defined
Total (estimated)	110 000 – 120 000

Source: Modified from Management of contaminated sites in Western Europe (European Environment Agency, 2002)

5.2.2. Land use

The Netherlands is a country with a long history of land appreciation. Concerns which have arisen from contaminated sites were caused mainly due to the accident of several soil related to a very densely populated areas, shallow ground-water tables, high range use of groundwater, intensive agricultural and industrial use. As such a pressure on land is very high with regard to these concerns. The access to land and land registration are well-organized by a clear legislation in combination with a functional land registration and cadastral system.

If land use is taken into account, the Netherlands is still considered as a green country with more than four fifths of its surface area is used for recreation, agriculture, woodland and nature. Agricultural and horticultural purposes consist of more than half of the total area of the country; however, this area is progressively being reduced due to an expansion of built-up areas.

During the period 2006 and 2008, there was a growth of the total built-up area by nearly 7 000 ha, which can be compared to the size of Maastricht city. The share of built-up area has risen up from 8,1% to 8,3% between 2006 and 2008. The greatest development has been in the province of the South Holland within large cities, in Rotterdam and the Hague, and as well on the outskirts of big cities such as Utrecht. Although built-up areas are noticeable, they cover only 8% of the total land area of the country. Altogether the agricultural sector remains the main land user in the Netherlands. [40]

Indicator 3: Prices of agricultural land

The Netherlands in comparison with other EU member states has the highest prices of land which have increased during the last period, mainly around cities. In the rural areas close to cities, the price of agricultural land is determined by the distance to built-up areas. Such high prices of land could reduce land mobility, and as a result land productivity could increase in the agriculture.

Table 6 shows a development of average prices of agricultural land in 2000 and in the period from 2005 to 2011. In 2007, the average market price of agricultural land increased to 34 969 EUR/ha which is 27 times more compared to the Czech Republic. In 2011, the national average of land price rose up to 48 328 EUR/ha. After a period of such a strong increase of land prices between 2005 and 2009, the market has stabilized

since 2009. The increase in the price flattened. The general economic situation has not lead to a decline in land prices. Two explanations can be considered. The agricultural sector has had good years in the past. Land-based agriculture has a specific financing culture when relatively small companies with a high equity have largely invested in land and buildings. In these cases, banks are more willing to provide credits. [41]

Table 6 Average prices of agricultural land in the Netherlands

	Year	2000	2005	2006	2007	2008	2009	2011
Netherlands	Price (EUR/ha)	35 713	30 235	31 276	34 969	40 916	47 051	48 328

Source: Modified and translated from Land Price Monitoring Report 2011 (Ministry of economic affairs, agriculture and innovation, 2012)

5.2.3. Demography

Demographically, the Netherlands is different from the Czech Republic. The total area of the Netherlands is 41 543 km², out of this area is 18,41% water land. This Western European country has about 16,9 million inhabitants.

Indicator 4: Population density

The Netherlands is the most densely populated country of the European Union and also the twenty-seventh most densely populated country in the world. According to the last Census in 2011, the density was amounted to about 496 inhabitants per km², if it was only considered the land area.

Indicator 5: Urban-rural population

The Netherlands is very urbanized country with 85% of the Dutch population living in urban areas. There are not cities with more than 1 million population in the Netherlands. The Randstad consists of four big cities, namely Amsterdam, Rotterdam, The Hague and Utrecht, which can be regarded as a single metropolitan area with about 7 million inhabitants, and where 46% of the total population live on the land area of 26%. There have been living more inhabitants in urban areas than in rural areas since 2002. It was a growth of Dutch population living in urban areas from 40,7% in 1999 to 41,6% in 2004. Urbanization is mostly occurring in the central and southern part of the Netherlands.

As such, the majority of the rural areas are situated within a short range of the urban areas. Despite of this fact, it makes identifying rural areas challenging in the Netherlands. The level of rurality is limited, there cannot be found rural regions at provincial levels, however, at the local level large areas of the country can be considered to have a certain level of rurality. Rural population had decreased in the same period from 41,9% to 40,6%. Population living neither in urban areas nor in rural areas (so called transitional areas) had grown slightly from 17,4% to 17,8% during the same period. [42]

5.2.4. Legislation and policy

The development of soil protection and remediation policy has been fast and has resulted in various Acts connected with rules and regulations over the last period. Dutch policy-makers began to work with brownfield sites since the late seventies. Nowadays, integrated approach is characterized involving diversity over the range of policy-actors and their interests from different administrative levels. [43]

Indicator 6: Legislative tools

As such a scarcity of space in the Netherlands, there is on the other side a significant pressure to reuse the land. To build on greenfields is not likely in many cases, not only because of a lack of space but also due to the Dutch spatial planning system and policies. [13]

Urban and Rural Regeneration Act

Urban approach was formally introduced within the *Urban and Rural Regeneration Act (1985)* aiming at urban renewal and creating the physical improvement of the built environment. The main purpose of this act was to reduce the quality defaults of the residential, working, production and living environments in the built-up areas since 1970. By 1990s, this legislative policy was extended into one of urban regeneration involving infrastructure, green spaces, economic activities and other neighbourhood amenities. [43]

The Soil Protection Act

The remediation of contaminated soil is primarily dealt under the *Soil Protection Act (1987)*. This Act tries to solve concerns of the old policy, mostly related to the high costs which required for the soil remediation. This legislation consists of preventive and remedial measurements regarding to the contaminated sites. The remedial measurements perform the most significant role in regard to brownfields redevelopment as they are determined to revitalize the remediation level of the soil.

It is focused on the prevention of new contamination as well the historical contamination. Historical contaminated sites are considered as the brownfield sites appeared during the history, and before this Act was in place. However, with the historical contamination is dealt differently than with recent contamination which is caused by carelessness. This approach is based on the polluter pays principle. From this principle arises that newly appeared contamination should be remediated to such an acceptable level within this Act. Historical contamination which appeared before January 1, 1987 has to be bringing back to its previous state. In the case the polluter does not take his responsibility, administrative forces can be used to maintain regulations. The Soil Protection Act was amended in 1994 which regulates soil pollution deriving from the following sources: use of fertilisers, disposal of solid and liquid waste, storage of petrochemicals in underground containers, outflow of surface waters and the reuse of cleaned soil as building material.

Other important Acts regarding to the brownfields revitalization in the Netherlands are related to the environment, spatial planning, and financing. In regards to the environment are relevant these following acts: *Environmental Protection Act*, *Building Material Decree* *Soil and Surface Water Protection Act* and *Groundwater Act*. *Spatial Planning Act* and *Housing Act* are related to the spatial planning part of the legislation on brownfields. *Urban Renewal Act* is important connected to the financing of brownfield revitalization. [44]

5.2.5. Revitalization of brownfields

Transformation of brownfields fits perfectly with the purpose of the National Spatial Strategy to build 40% of all new homes, shops and offices within already built cities and villages. Successful approaches mean a boost for the cities, rural areas and the economy itself. The Ministry of the Infrastructure and the Environment supports this form of urbanism with the instruments like the new Spatial Planning Act. [39]

Indicator 7: Revitalized brownfields and their future use

In the study, which was based on the National Survey of Soil Contamination, was found to identify locations which are situated within urban areas and had industrial past. Out of 407 121 locations under the Soil Protection Act are situated 224 184 in urban areas with an estimated total size of approximately 250 000 ha. On the basis of model calculations are expected in 2030, after the implementation of the soil remediation, there are 36 000 remediation processes realizing in the current built-up areas. In the end about 41 000 have been cleaned up.

Table 7 *Expected number of remediation for 5 different categories in urban areas*

	No. of areas in workload	Current surface	Expected no. of remediation	Expected sanative area (ha)
Urban area, no brownfields	144 553	140 000	21 290	22 000
Major activities	23 750	33 000	4 600	6 400
Gasworks	435	800	180	320
Recent operation locations	17 850	14 000	3 290	2 500
Current industrial sites	37 596	56 000	6 760	10 000
In total	224 184	243 800	36 120	41 220

Source: Modified from Brownfields better used, Notes to Final Report (2007)

Table 7 indicates an analysis of the expected number of remediation for 5 different locations in urban areas. The analysis seems to be rather the contrary, precisely the locations where soil contamination have been found, were more likely to have recovery plans or restructuring in progress. However, it is plausible where an obsolete or old business locations occurred, there was also soil contamination. Therefore, it is assumed that brownfields within the old or obsolete locations will be found within the respective categories. [45]

Examples of successfully revitalized brownfields in the Netherlands

The Westergasfabriek (Amsterdam)

The Amsterdam Westergasfabriek was built in 1885, which was once one of the largest coal and gas factories in the Netherlands. Gas was used for street lighting in Amsterdam. The 14-acre area was like a city within a city. Gas production of the former gasworks stopped in 1967, since then it was mainly used for storage. The site was highly polluted which made difficult to find a new purpose for it. Since 1992, the sites were used for creative and cultural activities in the short term. After that, it was redeveloped and started to be used as the creative centre for adventurous entrepreneurs and artists, and became a spot for various events and festivals (Annex 3, photo 10). The Westergasfabriek is one of the first transformation projects in the Netherlands which received several creative and cultural functions. It can also be seen as the most successful project within the redevelopment of industrial heritage, both in nationally and internationally. [39]

Van Nelle Fabriek (Rotterdam)

Van Nelle Fabriek in Rotterdam was built between 1925 and 1931 as an example of the modern architecture in the Netherlands. It was used to be a former factory which processed coffee, tea and tobacco and afterward chewing gum, cigarettes and rice. The process was over in 1996. Since then, it was discussed a new use for the complex. In 2000, it started the overall renovation and the redevelopment was carried between 1999 and 2006. Nowadays, it is a place for meetings, conventions, tour guides and events [39]. UNESCO appreciated the fact that the redevelopment has sustained the reality of the complex in all aspects which can be seen and felt by new business users and visitors of the Van Nelle Fabriek. As a result of this, it became a designated World Heritage Site

since 2014. Moreover, in 2015 it was awarded on the list of the 25 Most Beautiful Factories in the World (Annex 3, photo 11).

De Hallen (Amsterdam)

De Hallen in Amsterdam, located on the West side of the city, is a former tram depot dating from 1902. It was built between 1901 and 1928, holding very characteristic features such as long halls structure. This is only tram depot which remained its original state in the Netherlands, and which is a traditional and functionalist complex needed for the maintenance of the first electric trams. It was historically been closed in the late 19th century characterizing by long closed brick blocks. The entire complex is about 2 700 square meters which is currently used as a hotel, a cinema, a library, shops and newly food market (Annex 3, photo 12). [39]

5.3. Comparison of the Czech Republic and the Netherlands

Following chapter is comparing indicators which were described above for the Czech Republic and the Netherlands. It also suggests a policy and tools which might be used as an inspiration for the Czech Republic and thus would be applicable for the Czech Republic regarding to the revitalization of brownfields.

The Czech Republic occupies a *centralized approach* for solving brownfields due to a preparation of the *National Strategy for Revitalization of Brownfields* and the establishment of the *National Database of Brownfields*. Despite the efforts of the central holding of brownfields there is missing a single national policy and controlling organization for overarching a given topic. Despite there is no single controlling organization for overarching of brownfields and their revitalization at the state level; there are seen efforts for holding of the area by CzechInvest.

The approach of the Netherlands is considered as *decentralized*. Traditional governmental approach to urban policies has been left. The state currently encourages local governments to motivate investments of the private sector by their activities and financing of projects. Since 2000, it has been introduced an integrated subsidy program *Investment Budget for Urban renewal*. This program includes subsidy programmes of

four ministries (VROM⁸, Agriculture, Management of Nature and Fisheries, and the Economy).

5.3.1. Czech and Dutch approach to brownfield revitalization

Comparison of databases and a number of brownfields

In the Czech Republic are reflected efforts for monitoring a total number of brownfields which can be seen in the Prospecting study for locating brownfields. By far, there are not mapped all abandoned sites. Even though, Prospecting study talks about 2 355 locations, however, National Strategy of Brownfields Regeneration estimates that their amount is much higher, providing estimation of 8,5 – 11,7 thousands. The most common type of brownfields according to their previous prevailing use is from the agricultural activities.

The Netherlands does not have any single type of quality database that would allow municipalities comparing among themselves and offering a comprehensive overview of unused areas. This absence of a database is due to the fact that there is a short remaining time in unused conditions. The estimation made by Ministry of the Environment expects about 110 000 – 120 000 brownfield sites, out of this number there is the highest portion of industrial sites according to their previous activities.

Comparison of prices of agricultural land

The prices of the agricultural land in the Czech Republic belong to the lowest ones in the EU. However, the trend of average prices is that they are significantly increasing in the last decade. One of the reasons for holding prices at such a low level might be a fragmentation of ownership. Generally, there is a big interest of the Czech land among foreign investors. For example, the Dutch buy up Czech land and continue on it with the agriculture because it is very cheap for them. Comparing to the Dutch prices which belong to the highest in the EU, and which are still increasing. The reason could be that land reduces land mobility which results in the land productivity in the agriculture.

⁸ VROM - Het ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (Ministry of housing, spatial planning and the environment of the Netherlands)

Comparison of population density and urban-rural population

Czech population density reaches 133 inhabitants per km². The highest density is in Czech cities where it reaches 350 inhabitants per km², comparing to the density in the villages where it is 100 inhabitants per km². About 70% of the Czech population live in towns and the rest of 30% live in the rural areas. Dutch population belongs to the most densely populated country of the EU, where the density is about 496 inhabitants per km². Out of the total population, 85% of the Dutch live in the urban areas.

Comparison of legislative tools

The key problem is that brownfields are not legally defined in the Czech legislative system which represents a major obstacle for the future revitalization of brownfields. The new version of Building Act has brought many improvements but it did not define anything particular to the issue of brownfields. In the part of the environment is missing a legislation dealing with responsibility for ecological damages which are contaminated from the past. The main legislation dealing with contamination in the Netherlands is Soil Protection Act which defines a fundamental approach of polluter pays principle. This legislation divides approach to accountability to pollution existing before 1987 and after 1987. For new contamination is not an option of work delay.

Czech urban planning has yet not fully comprehended an urgent need to support the reuse of brownfields. Still, there exists a lack of consistency in the theory and practice of urban planning with the principles of land use economy and the reality of real estate market. Comparing to the Dutch way of spatial planning which has a sophisticated system for planning public space.

Comparison of brownfield revitalization

On the basis of CzechInvest and its project called Brownfields 3000 which has already mapped the situation of brownfields. From the results is clear that out of 3000 mapped brownfields should have been revitalized 1/3 of them by 2013. The rest should be revitalized by 2025. Out of this number is 70% in the private ownership and around 40% is ecologically bounded. The estimation for revitalization of all 3000 brownfields is 100 billion of Czech crowns. According to the National Survey of Soil Contamination in the Netherlands is expected that by 2030 will be realized 36 000 remediation

processes. In the end will be cleaned up about 41 000 sites. There is expected a sum of about 8 billion of Euro.

5.3.2. Recommendations for revitalization of brownfields in the Czech Republic

The main purpose was to make a suggestion for a policy and tools which could be applicable for revitalization of brownfields in the Czech Republic, and which is based on already used policies and tools from the Netherlands. Following proposed solutions might be an inspiration for the Czech Republic how to re-use of brownfields.

Soil functions

Dutch approach to the land use can be seen as very specific due to the high density of population, territorial built-up area and relationship to the land, which are the historical assumption that has a lead prior to the Czech Republic. Lack of construction land reinforced by the limitations of urbanization in non-urban areas has contributed to a rapid start-up of new land use. In the Netherlands are distinguished seven soil functions (see table 8) corresponding to the risk connected with these types of soils. These soil functions concern to a type of soil and allowed level of contamination on that kind of soil. Following seven soil functions are distinguished into three categories: clean soil, residential and industrial areas. Clean soil corresponds to soil where no contamination is found and which meets remediation criteria. Soil approved for living shows that it could be used for residential and recreational green areas with an ecological value. Industrial areas are the most permissive category out of those three.

Table 8 *Soil functions and their categories*

Soil functions	Soil function categories
Kitchen gardens Nature Agricultural	Clean soil → meets (multifunctional) remediation criteria
Residential with garden Playgrounds Green with ecological value	Residential and recreational green areas
Other green, gardening, infrastructure, and industrial areas	Industrial areas

Source: VROM (2008)

Urban and spatial planning policy

Dutch experience in urban and spatial planning has become a doctrine for spatial development of other cities and regions, and which can be an inspiration for the Czech experts. As result of the advanced methods of approaching Dutch spatial planning, soil functions are clearly established. Spatial planning is controlled by policy VINEX⁹ focusing on urban recovery. The policy is based on strategy of compact cities. In the priority focused on sustainable development occur targets connected to the contaminated land.

The Dutch have a sophisticated system for planning public space. The Dutch work with a *specific zoning registry* which is constituted in the Spatial Planning Act. By this law is required from municipalities to make a spatial plan for their competence every ten years. Each site in this spatial plan has its intended purpose. Such a mechanism allows requiring sites to be redeveloped according to the functions they are set for.

Legislation dealing with contamination

A useful tool from the Netherlands would be how to deal with contaminated sites; the Czech Republic could be inspired by this method. As it was described in the chapter 5.2.4, the Soil Protection Act focuses on historical and new contamination, which is better distinguished in the table 9. In the theory and practice is defined contamination that had occurred before January 1, 1975 as “*legacy cases*”. In these cases owners can expect higher financial subsidy than the owners of historically contaminated sites which had occurred between January 1, 1975 and January 1, 1987. However, new contamination which has occurred later than January 1, 1987, has to be restored into its original state and the owners are fully liable for a financial subsidy.

⁹ VINEX – Vierde Nota Ruimtelijke Ordening Extra (Fourth Policy on Spatial Planning)

Table 9 *Distinction between historical and new contamination in the Netherlands*

Type of contamination	Time	Subsidy
Historical contamination: <i>“legacy cases”</i>	< January 1, 1975	Highly funded
Historical contamination	> January 1, 1975 - January 1, 1987 <	Funded
New contamination	> January 1, 1987	None, owner’s full liability

Source: Modified from Van der Broek, Soil Protection Act (2006)

In general, there is a potential to find these recommended tools applicable to the Czech Republic. First of all, it should be legally defined what does a term of brownfield mean and how to deal with brownfields in the practice. This is very important step regarding to the upcoming stages.

Secondly, there should be established a tool for dividing soil into its functions which would make a guideline how to work with a concrete function of soil.

Thirdly, the Czech Republic should be inspired by the Dutch approach to spatial planning how to deal with changes in the spatial plan. It is known that the Spatial Plan of the Czech Republic works with areas and corridors, instead of a Dutch way of using parcels. The disadvantage of the Czech division is that it is less detailed than the Dutch approach. The main problem is a quite easy process in changes of spatial plan which easily change agricultural areas to areas of another category, and then it allows building on these types of areas. It should be required to make a specific zoning registry where each site will have its own purpose and it will not be possible to make simply change in the spatial plan. Therefore, it will allow that a site is revitalized only according to the purpose it was determined for.

Finally, it should be focused on the contamination which had occurred in the past. In this case, the Dutch approach would be a good example how to deal with those contaminated sites from the past. In some way, The Czech Republic could follow the distinction which is described in the table 9; however, it should be modified according to the Czech historical milestones when the contaminated sites had occurred.

6 DISCUSSION

This bachelor thesis helped to further understanding of the approaches to brownfield revitalization in the Czech Republic and the Netherlands. The issue of brownfields has become a well-known term in these two countries, however, both countries accessed to solving this problem differently. Explanations might be in the historical influences which had determined both countries during their historical development and ways how is dealt with land use. The first brownfields in the Czech Republic were formed with the change of political and economic conditions after 1989. In comparison with the Netherlands where they started to solve contamination after a big scandal in the town of Lekkerkerk in the early 1980's, where several contaminated soil was discovered in the recent built neighbourhood. Shortly after this big issue, the Dutch legislation regarding to contaminated soil was established. The Dutch way of dealing with land use might be another explanation how to look at the revitalization of brownfields. It is important to be mentioned, land is considered as a scarcity for the Netherlands, due to a high population density and the pressure on the growth of land prices, which belong to the highest in the EU.

From my point of view, above mentioned recommendations of a policy and tools could be a good solution regarding to the revitalization of brownfields in the Czech Republic. Of course, there are significant differences comparing these two countries, arising from the population density, a scarcity of land or approach to spatial planning. However, the Netherlands still might be an example of a good practice for the Czech Republic, if we look at the matter of brownfields in the long run. We can see that urban sprawl is becoming significantly dominant nowadays and what is going to happen in the future. This is a reason why we should prevent of disappearance of agricultural land and support revitalization of brownfields.

From the practical part was concluded that in the Czech Republic are located 821 agricultural brownfield sites which arose from the agricultural activities in the past. These agricultural brownfields are usually located in commercially less attractive locations which represent one of the most significant reasons of statistically slow regeneration of brownfields in the Czech Republic. To be compared to the Netherlands, from the analysed data was not obvious that there are agricultural sites as a remnant of the agricultural activities in the Netherlands.

There had never been a collectivistic agriculture which would be formed into smaller private communities and cooperatives as it was used to be in the Czech Republic. The most brownfield sites in the Netherlands were arisen from the industrialization period. View of these facts, the first hypothesis is confirmed in this work.

As it was mentioned in the analysis, the Netherlands is a country which has a significant problem with a scarcity of land which is caused by the highest population density in Europe. Despite of the fact, the country uses tools how to give priority to reuse brownfields rather than build on greenfields, comparing to the Czech Republic where building on greenfields is still easier and faster. The other reason is due to such high prices of agricultural land which causes that revitalization of brownfield is better option for the Dutch. View of these facts, the second hypothesis is confirmed in this work.

7 CONCLUSION

The aim of this thesis was to analyse a policy and tools regarding to the revitalization of brownfields in the Netherlands, with a purpose to suggest this policy for regeneration of brownfields in the Czech Republic. For elaboration of the practical part was necessary to choose indicators according to those were able to make a comparison of approaches of both countries. Individual indicators were chosen in regard to the brownfield revitalization. Described indicators showed that the Netherlands approaches to revitalization of brownfields using a different way than the Czech Republic does. The main reasons are such a high population density, territorial built-up areas and long historical relationship to the land, which make Dutch a big lead prior to the Czech Republic. As well, the Dutch has a big lead in the soil cleaning including legislative tools. Despite of such a high demand for land, the contamination is not an obstacle for new land use in the Netherlands.

Unfortunately, the Czech Republic is lagging behind in some aspects of the approach to brownfield revitalization compared to the Netherlands. However, this matter could be advanced by the suggested tools for improvement of the Czech approach to regeneration of brownfields. The Czech Republic could use a system of soil functions and their categories according to which would be considered how to deal with a contamination according to the allowed levels. Furthermore, the legislation on the environment could be enhanced by the Soil Protection Act defining not only current contaminated sites but also dealing with contaminated sites from the past.

To conclude, hopefully, the approach to brownfield regeneration in the Czech Republic will be improved regarding to the proposals of already used policy and tools from the Netherlands. Revitalization of brownfields is one of the modern and proven ways how to significantly support regional development. It means major opportunities for individual regions and to strengthen their stability and prosperity.

8 SOUHRN

Cílem této bakalářské práce bylo přiblížit problematiku brownfieldů, jejich revitalizaci a znovu využití a zároveň definovat jejich význam v regionálním rozvoji České republiky a Nizozemí. Všechny cíle byly v této práci dosaženy a náležitě popsány. Porovnání přístupů obou zemí bylo provedeno na základě souboru indikátorů, ze kterých vyplynulo, že rozdíly mezi Českou republikou a Nizozemí jsou patrné, a to především vzhledem k hustotě zalidnění, k nedostatku a cenám půdy, ale také vzhledem k rozdílnému přístupu územního plánování. Z dosažených výsledků bylo zjištěno, že by se Česká republika měla zaměřit především na řešení problému kontaminovaných oblastí z minulých let, na které by měl být kladen důraz a které by měly být ošetřeny v české legislativě, stejně jako je tomu v Nizozemí. Na základě zjištěných poznatků lze konstatovat, že má Nizozemí v problematice řešení brownfieldů značný náskok, tudíž by mohlo být dobrým příkladem pro Českou republiku.

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Photo 11 Van Nelle Fabriek in Rotterdam

Photo 12 De Hallen in Amsterdam

13 ANNEXES

Annex 1 - Photos of examples of good practices in the Western European countries



Photo 1 View of the workers in the Tabakfabrik, 1935

Source: www.linz.at



Photo 2 Panorama of the Tabakfabrik at present

Source: www.tabakfabrik-linz.at



Photo 3 Old use as spas (La Piscine) in Roubaix

Source: <http://www.roubaix-lapiscine.com/>



Photo 4 New use as a Museum of the art and industry

Source: <http://www.musenor.com/>



Photo 5 Liverpool docks in the past

Source: <http://www.liverpoolecho.co.uk/>



Photo 6 Tate Gallery Liverpool, presence

Source: www.tate.org.uk

Annex 2 - Photos of successfully revitalized brownfields in the Czech Republic



Photo 7 Agrocentrum Ohrada Vísky in its current state

Source: <http://www.ohrada.cz/>



Photo 8 Palladium shopping centre after revitalization

Source: www.praguecityline.cz



Photo 9 Night view of New Vítkovice during its current state

Source: www.dolnivitkovice.cz

Annex 3 - Photos of successfully revitalized brownfields in the Netherlands



Photo 10 The Westergasfabriek as the creative centre

Source: www.holland.com



Photo 11 Van Nelle Fabriek in Rotterdam

Source: www.derotterdamert.nl



Photo 12 De Hallen in Amsterdam

Source: www.dehallen-amsterdam.nl