

# ECONOMIC-ENVIRONMENTAL ASPECTS OF THE INDUSTRIAL BROWNFIELDS REVITALIZATION AND REUSE

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Presented article is devoted to the problem of the industrial brownfields and their economic-environmental aspects of revitalization. The issue of industrial brownfield revitalization is becoming nowadays increasingly topical in the public as well as in the private sector. It is a result of the restructuring, which led to the migration of workers from the primary to the secondary or tertiary sector, as well as to the expansion of the industry companies with the subsequent takeover of the valuable land for their realization. The issue of the revitalization and reuse of the former industrial sites raises a number of aspects: environmental, economic, social, cultural development of this kind a territories. Industrial brownfield revitalization provides on the one hand, the elimination of the environmental threats to the territories under the consideration, thereby contribution to the environmental protection, and on the other hand, additional investments in case of their reuse.

**Key Words:** revitalization, brownfields, environment

## 1 INTRODUCTION

Radical economic and political-economic changes in the 90s of the last century have left the territory of the Slovak Republic with the number of abandoned industrial areas (brownfield sites), which declined to waste during the time and also primarily contaminated the individual components of the environment in the immediate vicinity, this fact led to the secondary spread of the pollution in the major distances what determine the degradation of the quality in the regional, and supraregional range. The industrial production is characterized by emitting of the wide range of the diverse contaminants of the gaseous, liquid and solid character involved in the global environmental quality degradation, and thus dangerous to the health of the population in the considered area.

On the base of the upper mentioned reasons, the main priority of the brown industrial parks (brownfields) revitalization is the elimination of such the environmental burdens in the areas that were in the past occupied by the fully functional industrial facilities.

## 2 INDUSTRIAL BROWNFIELDS CHARACTERISTICS

The term "brownfield" means literally "industrial brown fields", which arise as a secondary consequence of the industrial restructuring of the territories used in any country and in any time. Typical sources of the industrial brownfields are mining industry, chemical

industry, petroleum industry, iron industry and steel industry, shipbuilding and port docks and dumps. Such types of brownfields are located in the inhabited as well as in the rural areas of the settlements and have a great development potential. Normally, however, the market has only the little natural ability (perhaps with the exception of the big strong cities) to give them a new and significantly more efficient use - recycle them. The brownfield new application, which is not conditioned by its prior usage, requires considerable financial resources principally from the side of the public sector and the time of the environmentally endangered sites retrieval may take decades.

Secondary use of the industrial brownfields is nowadays associated with the issue of sustainable development of the cities, municipalities and regions. Industrial brownfields reuse strengthens not only their effective development within the boundaries of the inhabited area, but also reduces the pressure for the change of using the agricultural land ("greenfields") in the rural area of the settlements. Efficient, economical and sustainable land use also directly supports the competitiveness of the regional and the national economy. Industrial brownfields are basically the special kind of the real estate, which economical existence is specified by the market laws and realty life cycle. Reuse of the industrial brownfields is primarily blocked by the additional costs for the removal of environmental burdens from the previous usage.

## 2.1 Environmental impacts of the industrial brownfields

The presence of the industrial brownfields causes the reduction of the qualitative indicators of the environmental individual components. They are the evidence of the prior industrial activity in the given territory, which is usually clearly reflected in its overall current state, as well as on the state of the surrounding properties. In some specific cases, such an environmental burden may represent the contaminant material that threatens the human health also.

The impact and the quantification of the immission air state degradation are determined by the origin progress and the existence of the industrial brownfield that can be evaluated only for the certain area. Their existence in some cases does not exclude even constant negative impact on the immission air state of all the surrounding area. The overall impacts of the industrial brownfields are given by the climatic conditions (geographical location of the considered area, its geomorphologic situation, altitude, and etc.). [1,2]

Industrial brownfields impact to the surface and ground water resources depends not only on their origin progress and time of existence, but also from the hydrogeological conditions of the site. During the assessment of the impact to the water resources, there should be taken into the consideration also secondary indicators of the soil quality and thus possible influence to the fauna and flora, accepting a variety of exposure routes of contaminants to the consumers themselves (including the man) and threats to their health.

Frequent negative signs of the industrial brownfields are the poor drainage conditions in the area. Construction of the drainage systems had its reasons, and was a result to the certain social and natural conditions. In case of any change in these conditions, it is necessary to evaluate these changes and put the results on to the future solutions. Further structural development may lead to the change of the groundwater level and thus affect the groundwater amount in the affected zone of attraction, what will ultimately reflect in their balance capacity decrease as well. [1,3]

With respect to the previous industrial brownfield land use and nowadays problematic control of the management at these sites, it is clear

for this territory to be considered as potentially contaminated with the risk of the soil contamination. Possibilities of using the revitalized and decontaminated industrial brownfield land are also determined by the hygienic condition of the soil. At the present time, the range of hygienic soil status indicators include the contents of the so-called hazardous substances, which are divided into inorganic nature substances- a potentially risky elements and organic nature substances - persistent organic pollutants (BTEX group, polycyclic aromatic hydrocarbons, chlorinated hydrocarbons, DDT, C 20-40 hydrocarbons indicators of the oil pollution). [1,4]

The largest number of industrial brownfield is associated with the extraction and treatment of the mineral deposits regarding its depletion, mining interruption, or leaving the site of interest. In the terms of the subsequent mining brownfield regeneration not only the form of the certain area destruction is essential, but its areal extension as well. This result in the different ways of recultivation such the areas, for example in cases of the large-scale coal mining the recultivations are different from the recultivations of the small devastations incurred by for example stone quarry or gravel, limestone and other industrial minerals mining. [1, 5]

The origin and existence of the industrial brownfields often disturbs the certain area original habitat composition due to the territorial system of the ecological stability functional elements interruption. Change of the individual environment components interactive relationships causes a change in the fauna and flora species composition. [1, 6]

Categories of the potential seriousness of the environmental selected components contamination by the industrial and other activities type are shown in Table 1. [7, 8,9]

Table 1: Typical soil and groundwater contaminants by industrial and other activities in the various locations

Industrial activity type	Typical soil and ground water contaminants	Seriousness category	Note
Car pools, garages	Petroleum substances	2-3	Oil leak
Machine maintenance workshops	Petroleum substances, Chlorinated solvents	2-3	Oil from machines and equipment, chlorinated cleaners usage
Stores and petrol stations	Petroleum substances, aromatics	3	Almost all industrial and agricultural enterprises in the past have their own stores and petrol stations
Substations, heavy-current distribution plants	Petroleum substances, Polychlorinated biphenyls	2	Serious contamination arising from accidents (polychlorinated biphenyls in recent years are no longer used as the equipments medium)
Furnace oil heating and energy sources	Petroleum substances	2-3	Contamination caused mainly by the tanks and heating oil distribution pipes
Large stationary machines and technological equipment of the mechanical, mining, metallurgical industry, power industry and so on.	Chlorinated solvents	2	Contaminations by chlorinated solvents, which were used for machinery and equipment maintenance and repairs
Generator gas from coal production	Polyaromatics, Cyanides, Heavy metals, Nitrogen compounds, Phenols	3-4	Widespread in the past for e.g. in the glass and ceramic industry

## 2.2 Explanation to the categories of the potential contamination seriousness:

1 - low risk of the significant contamination – do not limit the functional use of the area. Such

contamination is not necessary to be examined in depth.

2 - moderate risk of significant contamination – local, areal limited focus of the contamination, which is essential to be verified by the survey. In this case the reorganization intervention is not necessary and such contamination does not usually limit the possibilities of the affected area further use.

3 - high risk of significant contamination – locally areal limited focus of the contamination, which is essential to be examined by the survey. In such cases relatively demanding local reorganization is necessary. Such contamination may pose some limitations to the possibilities of the territory further use.

4 - high risk of the serious contamination - wide range of the contamination, which must be examined by the serious research. In such cases extensive reorganization intervention is necessary. Existing risk determines the limits for some options of the further territory exploitation. [8]

## 2.3 Economical aspects of the industrial brownfields revitalization

Potential investors during their decision process about the future investments follow the detailed economic analysis. Entry of the new investors into the manufacturing sector of the SR market is stimulated mainly by the attractive discounts to the taxes of the corporate profit or support from the Office of Labor, Social Affairs and Family for the job creation, especially in case of the disadvantaged job seekers. These incentives from the state lead to the extensive building of the new manufacturing companies and other complexes of the commercial use, which significantly affects the three interdependent pillars of the certain region sustainable development - economic, socio-cultural and environmental.

Unused, abandoned and devastated areas of the former industrial companies reduce the attractiveness of the territory in which they are located, the value of the land, as well as other properties in the area, which is negatively reflected in the decisions of the potential investors, existing business sector and communities living around the

industrial brownfields. In such the areas, there are various economic, social, and not last to be mentioned environmental problems that generate significant contrast to the stable and prosperous businesses of the new or developing areas in the mentioned sites. In case of the several brownfields cumulating in the administrative territory of the municipality, problems tend to increase. Solution of these problems is primarily affected by the overall size of the affected area, number and overall condition of all the buildings in the territory, the infrastructure state and of course the environmental burden extension. Effective measures and their implementation are primarily determined by the budget level of the local municipality, in which inhabited or rural area an industrial brownfield is localized, and by the ability of the local self- government to obtain the funds from the other sources . [9]

In case of the former industrial sites reuse the decisions of the potential investors are in most of the cases negatively affected by the existence of the old environmental burdens and their removal requires the additional costs and thereby increases the financial budget of the business plan. Another negative aspect affecting investors decisions are often unclear proprietary and legal relationships to the land or property in the locations that do not allow the competent state and government authority to respond to the situations that happen in a reasonable time horizon. If there are community activities not in accordance with the in advance clearly defined specific objectives of the strategic municipality development plan, developers or individual investors are not able to provide large scale revitalization process. Strategically important investors are not willing to take the risks associated with the new investment in the municipality, which is located in an unstable and problematic region, especially if it is conditioned by the complicated and costly rehabilitation of the old environmental burdens. In such cases, investors usually choose to turn their business ideas into Greenfield investments (green meadows). For investors the investment into the greenfields are more convenient, relatively fast and in case of the general prepared new industrial zones also cheap, since a significant part of the costs in this case are expended by the

municipalities. Despite these negatives, it is undisputed that potential investors, in the process of industrial brownfields revitalization, can use for their investment plans:

- existing transport and technical infrastructure,
- existing production and other objects,
- connection to the regional but also worldwide bulk cargo transport system,
- connections to the functioning public transport system,
- contact with the existing background of the services and subcontractors,
- sufficient number of workers in the residential areas nearby, or within the reach of the public transport.

Another positive impulse for the investors to decide to realize their business plans at the former industrial sites is also the possibility of a financial assistance from the state through the non-repayable grant from the EU structural funds realized through the challenges of the Ministry of Economy of the Slovak Republic and SARIO agency.

### 3 CONCLUSION

Industrial Brownfield revitalization is a difficult and often long process that requires additional funding from the side of the potential investors. To stimulate their regeneration it is therefore necessary to use previously identified specific legislative instruments for e.g. the form of tax motivation or public funding, which would ultimately contribute to the socio-economic development of the municipality territories in the regional as well as supraregional scale. Moreover, the decontamination of the former industrial sites accompanied by the old environmental burdens hereby contributes to the sustainable development of the certain region and to the environment protection, what is closely connected with the restoration of the area functional use without environmental harm to the individual environmental components.

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