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INDUSTRIAL BROWNFIELD SITES AND THEIR URBAN REGENERATION

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Abstract

This paper covers the problems related to the transformation of brownfield locations in the context of modern urban development and strategies of sustainable urbanism and urban regeneration. Specifically, it covers the preservation of the identity of the location and restoration of that industrial, cultural, and architectural heritage, thus contributing to urban regeneration and improving the quality of living and working.

Adaptive regeneration stands out as a sustainable model for brownfield site regeneration. It implies the integration of abandoned industrial sites in an urban environment and their adaptation, repurposing, and reconstruction in the context of modern trends and social and economic needs, meeting environmental criteria, etc. Due to this approach to the regeneration of these locations, which is mainly conditioned by the program for local economic development, the historical, spatial, and cultural values, the urban memory of the inhabitants is neglected, which leads to the destruction of the urban identity of those locations. In addition to the goal of these abandoned, underutilized, often polluted complexes becoming economically profitable and contributing to a better image of the environment, we must not forget that they have a historical and cultural value that can help attract investments.

For this reason, a well sustained analysis of all parameters (economic, urban, ecological, property-legal, aesthetic, and social, etc.) should be done beforehand, and then all the possibilities offered by a brownfield site should be considered, but in the context of local economic development and the real needs of a city. In this way, positive effects can be achieved that would lead to a complete urban regeneration of a brownfield site.

Key words: *adaptive conversion, urban regeneration, identity, cultural heritage*

INTRODUCTION

The process of deindustrialization that has followed the restructuring of the global economy has led to a change in the urban landscape, leaving underutilized and abandoned large areas of construction land and numerous industrial and commercial facilities in urban areas. Deindustrialization can be seen as a process of economic, social, spatial, and environmental changes, related to the reduction of production activities in cities, i.e., part of a transition process. Cities faced with these problems have lost their position in local and regional frameworks. The uncompetitive economic base and disturbed environment, together with other unfavorable facts of the industrial centers, slowed down the overcoming of the structural deficiencies introducing the centers into a stage of stagnation or regression [1].

Abandoned and unused spaces, in international professional jargon, are called brownfields. They arise as a result of various interdependent social and economic changes, which include the development of new technologies, the way of organization of work, traffic, which are integrated into the urban landscape [2]. In other words, brownfields are a tangible and visible result of interconnections, economic and urban changes and the radical restructuring of the global economy, changes in social systems of arrangement, wars, natural disasters, etc.

Brownfield in the literature usually means surfaces and objects in urbanized areas that have lost their original way of use or are used very little for their original purpose. Often, they have environmental loads, or they have deteriorated buildings or simply have been overtaken by time. Also, it is a fact that

a brownfield can occupy a large area of a city. In that way, they tarnish the general image of a city aesthetically, psychologically, and socially [3].

Abandoned and unused industrial spaces often occupy attractive city spaces, and have a high degree of pollution, which leads to many social, cultural, economic, environmental, and other problems. The loss of the economic value of the land, in a disturbed economic system, the loss of the identity of the city, where those locations are, as well as the negative psychological impact on the inhabitants, contribute to the deterioration of the quality of the urban environment.

On the other hand, due to the growth of urban housing, the need for expanding the coverage of cities and vacant construction land is increasing, which further highlights the problem of irrational use of construction land and the need to recycle it. Considering that the construction land is a strategic resource and a factor for the development of the city, it is also an element and a factor for the competitiveness of cities in attracting new developmental activities and investors. For many cities, these locations represent important "reserve spaces", and their reconstruction is an important mechanism for improving the quality of the urban environment and achieving sustainable development [4, 5].

Observed from a cultural point of view, abandoned and unused industrial complexes represent cultural landscapes, that is, part of the industrial heritage of urban environments. According to The Nizhny Tagil-Charter for the Industrial Heritage of 2003, industrial heritage consists of the remains of industrial culture, which consist of historical, technological, social, architectural, and scientific values. This charter recognizes the values of the industrial heritage as material evidence, a witness of certain civilizational flows with lasting and deep, historical consequences.

The social values of the industrial heritage represent an important part of the residents' identity, as they are part of the memories of people's lives, memories of the industrial development and the pride of the local population. The technological and scientific value of brownfield sites is reflected in the history of production, engineering expression, architectural print, urban design, and complex planning. Historical values influence the creation of a community with strong feelings of local identity-belonging (local patriotism) that represent a significant catalyst in the renewal and attraction of investments [6] as well as the very desire of the residents to contribute to the development and improvement of the standard of living.

With the decline of industrial heritage as part of urban memory and material evidence of the industrial past, urban areas are losing a part of their history. In that sense, the revitalization of these spaces is a necessary step in preventing the continuous decay of the remnants of the industrial past. Within these frameworks, revitalization can be explained as a variety of possibilities and options that allow the "old" space to serve modern purposes, while protecting the past in the future [7].

Urban regeneration

The concept of sustainable protection and restoration of cultural settlements belongs to the domain of urban regeneration. In the literature, the term urban regeneration is often vaguely or differently defined. The terms "urban regeneration" are also equated with "urban revitalization" and "urban renewal with urban rehabilitation." However, if we start from the term regeneration, it naturally points to the term degeneration. So that space, part of a city, etc. it was degenerated and needs to be regenerated. The purpose of regeneration is to re-integrate this threatened area into the social and economic flows of urban local development [8].

The general conclusions arising from many studies indicate that revitalization implies a comprehensive vision and activity aimed at solving urban problems and improving the economic, physical, social, and environmental conditions in the degenerated space. That can be achieved with long-term strategic goals. Urban regeneration strategies aim to bring life back to dilapidated urban tissues and improve the city's image, thus ensuring social coherence, economic efficiency, and environmental sustainability. So, urban regeneration tends to establish a balance between people's needs, economic growth, and the character of the settlement [9].

Concept and definition of brownfield sites

In the introduction, the generally accepted definitions of brownfield sites were listed. It seems that the definition of the term is not so simple and does not boil down to a literal translation. The anglicism brownfield literally translated into Macedonian, brown earth, in some way points to the meaning of this term, but for its exact definition it is necessary to refer to the world research on this

topic. Definitions vary by location (geographically by continent), depending on political, economic, cultural, and other characteristics.

There is no single definition.

Depending on the experience, there is a difference between American and European definitions. The definitions of the USA and the EU as well as that of the UK differ. From this, it is clear that the use of this term is broad and not rigid; however, the facts that contain all these definitions should be sublimated, in order to perceive the scale of this urban problem or potential.

In addition, several definitions of brownfield sites will follow, to explain the general meaning of this term.

The term brownfield was first used in 1992 in the documents in the United States. According to the United States Environmental Protection Agency, brownfields are defined as: "abandoned and underutilized industrial and commercial zones and/or facilities and their development is hampered by actual or presumed contamination" [10].

This definition was expanded in 1995 to "and sites, or parts thereof, that have actual or suspected contamination, but also the potential for new development and use." That definition has been further expanded and new criteria have been defined that must be met for a site to be defined as a brownfield.

There is no single definition on the European continent. The first definition is related to the working group CLARINET (Contaminated Land Rehabilitation Network for Environmental Technologies). According to this group, brownfields are sites that are altered by previous use of the site and surrounding space, abandoned and underutilized, and have a real or perceived pollution problem. This definition was later supplemented in 2006 by CABERNET (Concerted Action on Brownfield and Economic Regeneration Network), which, in addition to the above, adds that brownfield sites are mainly located in developed urban areas and require intervention to be reused.

There are also different understandings of this term between countries in Western Europe and Scandinavia, which stems from population density and competitiveness. Countries with higher population density promote efficient land recycling, while those with lower density focus on the problem of decontamination. Considering that in the Scandinavian countries and the countries of North America and other countries that have a low population density, brownfields are defined as contaminated land, land modified by previous industrial activity [11]. While most Western European countries, such as Austria, Belgium, France, Germany, the Netherlands, Great Britain, define brownfield primarily as land that was previously developed and is now abandoned or underutilized, real, or presumed contaminated, but which has the potential for redevelopment if intervened [12].

Redefining industrial estates in the context of sustainable regeneration

During the last 10 years, the protection of cultural heritage, as an irreplaceable and non-renewable strategic resource, has become a central theme in the most significant international documents and modern strategies for urban development. The document "The future we want" [13] contains chapters that promote the importance of culture for the sustainable development of communities. In the section on "Sustainable cities and settlements" the need for conservation of natural and cultural heritage, revitalization of historical districts and rehabilitation of city centers is expressed. The importance of preserving the ecosystem and sustainable use of natural resources is also emphasized. In the same document, respect for the culture and natural diversity of resources, respect for the tradition, habits and mentality of the local population and their use in addition to the modernization of the brownfield, without imposing the modern, because in this way, only the opposite effect can be achieved, and the regeneration of the brownfield becomes only the beginning of its new end.

In a lot of research, the importance of respecting the existing conditions (historical, cultural, traditional, religious, sentimental...) has been emphasized as a condition for reaching sustainable strategies that are applicable to a stable social situation [14-16].

Therefore, it is important to determine exactly what should be preserved, what should be emphasized, and what should be bypassed or neglected, in order to direct planning and program interventions accordingly.

Brownfield sites as cultural landscapes

The concept of a cultural landscape provides a framework for analyzing the values of brownfield sites.

Let us first define what a landscape is. It is an area, visually perceived, whose character is the result of the interaction of natural and human factors. Cultural landscapes represent a reflection of the evolution of society and space under the influence of internal and external constraints, the potential of the environment and society, economic and cultural factors [17].

As a result of the complex layered interactions of society and the environment, cultural landscapes such as brownfield sites arise. Brownfield sites have witnessed the development of modern society and its technological progress over the last two centuries. According to the charter of TICCIH [18], industrial heritage consists of the remains of industrial culture, which are of historical, technological, social, architectural, and scientific significance.

The industrial heritage is a witness to civilizational flows and deep historical consequences. But not all degenerate industrial sites have historical value. Those that are related to the cultural identity of the community are significant, those that are part of the memory of the residents and remind them of the powerful times of that complex. The architectural expression and the construction challenge that has been overcome, the functionality and the artistic dimension are also some of the conditions that an industrial site must meet in order to be included in the group of buildings and sites with industrial historical significance. Historical values influence the community, the creation of a strong sense of identity and belonging and represent a significant catalyst for their renewal.



Figure 1. Initial site analyses, Regeneration with full retention of found structures as sculptures in space, Duisburg-Nord Landscape Park, Duisburg-Dortmund, Germany, Latz + Partner, 1989-2000

Socio-cultural objectives of the regeneration of brownfield sites.

For the regeneration of brownfield sites to be sustainable, research should take into account social, cultural, economic and environmental conditions and objectives. However, empirically, in practice brownfield sites are mainly driven only by economic and environmental objectives. Research shows that regeneration plans are mostly focused on the development of commercial and tourist content, without paying attention to the identity and memory of the place. In this way, the identity of the brownfield is violated, its connection with the historical and contemporary flows of the settlement

where they are located is lost. Such brownfield regeneration can lead to its destruction or gentrification [19].

The objectives that are aimed at the social and cultural needs of people when planning the regeneration of a brownfield are:

- preservation of cultural values that have been assessed as such by the local community and their use in the context of modern social and cultural development;
- education about the process of urban regeneration and improvement of people's skills, in order to respond to the modern currents of economic development;
- promotion of employment opportunities and;
- achieving social equality.

While the goals aimed at creating sustainable places are:

- improving the perception and image of the surrounding field location;
- contribution to the strategic goals of sustainability of the urban settlement;
- ensuring physical accessibility to the locations as infrastructure;
- ensuring a healthy and safe environment suitable for the living and working of local residents.

Both sets of objectives represent the basis for redefining the traditional concept of brownfield regeneration. Achieving those goals requires improving the skills and education of the people who will be involved in that process.

As a basic error that is repeated, and not in favor of regeneration, is the intentional or accidental neglect of the cultural heritage, the memories associated with that location. It leads to a bad and in certain cases catastrophic outcome of a whole genesis of research, creation and finally non-realization of projects related to a brownfield.

Therefore, the first and basic goal is the preservation of cultural identity and industrial heritage. The second goal is to create sustainable places and improve the urban landscape.

On the other hand, it is considered that one of the most important aspects of the development of the new identity and the unique image of the brownfield is identifying the values and resources that make that location valuable. In fact, in this case, the architectural and cultural heritage is recognized as an important element of the new image of the brownfield because it contributes to the creation of unique, easily recognizable values. The main role of the new image of brownfield is to make the location attractive for investments, thereby opening new jobs, increasing the value of land, developing tourism, improving the quality of life of the population [20].

Given that industrial heritage, as an important part of cultural heritage, has many technological, social, and architectural and scientific values, the question arises about the meaning of industrial heritage in the context of brownfield regeneration. According to some authors, industrial heritage has a role in creating the alternative aesthetic and sensual experiences in all post-industrial cities.

The ERIN (European Route of Industrial Heritage) network, through which a large number of experts from different fields exchange experiences and develop projects for the protection and sustainable use of industrial heritage, has made a significant contribution to better understanding the importance of preserving industrial heritage.

Collective memory in the context of industrial heritage conservation

At the beginning of the 21st century, industrial heritage is understood as a complex concept that results from the mutual effect of material and immaterial values. Therefore, the connection with the place becomes more important in the context of urban conservation and regeneration. One of the challenges of brownfield regeneration is defining the meaning that the social community ascribes to that location, that is, the intensity of the content of individual or collective memory. The involvement of the community in urban planning, or the involvement of their individual or collective memory-memories, can contribute to the strengthening of the local identity of the place, otherwise there can be a loss of the significance of the specific places or simply a non-functional planning solution. It does not

mean that the memory associated with a place is always positive. Therefore, care should be taken to emphasize the positive memories and to fade, but not to forget the negative ones, as a lesson.

All this is possible with the regeneration of the brownfield and it can contribute to the creation of good technical documentation and attracting investments, thus reviving the place, only if the industrial heritage and the weight that it carries with it is respected.

The threat of man's relationship with the environment that matters to him, due to globalization, displaced values, mobility, environmental problems, etc., has contributed to an increase in awareness and the activation of many multidisciplinary studies of the value of the connection with the settlement. There are many definitions of this connection in the literature, but it mainly boils down to the connection with the place that is filled with meaning for a certain person, the place that awakens some feelings, and it represents an exciting tension that satisfies the basic human needs of belonging, presence, etc. The closeness a person feels to a place is genuine and evokes a surreal sense of mutuality. The emotional qualities of a place are accompanied by thoughts, knowledge, and belief [21].

Psychologists have done significant research on this connection, instead of mentioning it as an addiction. They believe that the strength of feelings that arise towards a place depends on how long one stayed in that place, at what age the same thing happened, the dynamics of the events that the person attended, as well as the psychological state at the time of the stay. These and many other studies show how important the relationship between the person and the field is. Therefore, the revitalization of a place like this is not so naive. Relinquishing a brownfield site to a new user who would not respect the memoirs of a group of people would mean both a potential revolt and a loss of trust, which in the political world would mean a loss of votes.

Value of brownfield sites

The location of the brownfield site is defined in terms of its position within the boundaries of the urban settlement. Industrial complexes in the 19th and early 20th centuries were located mainly in the central city area, while after the Second World War they began to be built on the outskirts of urban settlements. Because of this, brownfield sites can be located in the settlement, next to the settlement and outside it. Hence the classification of the research network CABERNET, according to which there are three categories of brownfield sites A, B and C, which differ according to the economic status and the potential they have for urban regeneration.

The economic status is determined based on the costs of land recovery and the additional costs of transformation on the site, as well as the value of the land after those interventions [22]. Many studies show that brownfield sites located in the central city area have more potential for development, due to the possibility of being converted into residential, cultural-social, educational, or administrative-commercial facilities, which as types of use are always in demand and can reach higher price, especially when they are in the center of the urban area.

The size of the brownfield refers to the number of objects it consists of and it can be composed of one object, a group of objects connected to each other by functional connections (complex) or an industrial landscape (group and complexes). In terms of size, in some cases, a division is made depending on the literal area under which it is spread: small (up to 5 ha), medium (from 5-10 ha) and large (over 10 ha). The size of the site directly affects the possibility of implementation and the duration; understandably, smaller brownfields would be implemented faster, would cost less and would generally be simpler to design and perform.

The form of the industrial complex depends on its function. Whether it will be compact objects connected to each other or broken, scattered over the entire site or maybe it will be one independent object depends on the production process that took place. The different shape offers different possibilities for regeneration. Congested brownfields offer the possibility of social-societal concepts where proximity is necessary for function. Or a broken type of brownfields, for example for housing where privacy is also important, etc.

The basic principle in the construction of industrial facilities is the achievement of functionality, efficiency, and satisfaction of the needs of the production process, economy, and safety. Those

principles direct the form. Usually, the appearance itself just follows from the function. Industrial architecture is a very young branch, but it has seen a large and rapid development in parallel with the development of the industry itself. Because of that, a large part of industrial buildings and complexes are significant innovative and technological examples in the history of industrial architecture. In addition to the evolution of the shape of the buildings, which changed during the development of industrial production, the building materials also changed. From halls built of solid brick and massive construction, then reinforced concrete skeleton construction using ceramic blocks and glass, to the current light skeleton constructions with walls made of thin thermal insulation panels and thermal insulation glass. Therefore, the architectural expression of the brownfield is a physical property that should be taken into account during regeneration, to fit the traditional building concept into the modern trends, in a way that will obtain an ideal symbiosis.

Accessibility is related to the location of the brownfield. The easy arrival or finding of the location, traffic connection with the surrounding places, but also with the world (closeness to the airport, railway, and bus station, etc.) means greater development potential.

Connectivity means infrastructure traffic connection to the site, but also within the site. The internal traffic in the complex, which once functionally connected the buildings, can be used and upgraded in addition to the new function that will be given to the brownfield.

Cultural values are related to the memory and the cultural-historical value of the object. The intensity of memory is the intangible, cultural value of a place. From previous research, it has been determined that the memory with a high strength must not be neglected in the revitalization process; if we want a successful process with the ultimate goal of a new life for the brownfield and a new landscape, we must take it into account.

The content of the memory, in turn, can help guide planning interventions and perhaps provide an idea for the new function. Usually in Municipalities, Local Economic Development departments should pay attention to this if they want to maintain the connection of the city with the residents and reduce emigration. When a resident loses his/her connection with the settlement, it no longer matters where they live.

Structure of the overall brownfield revitalization action plan

The overall detailed revitalization plan should be divided into individual phases and projects that include activities (groups of activities, investments, and other interventions) needed to achieve the established functional goals, such as:

- Sanitation: clearing and disposal of waste, demolition, waste management
- Phase for economic development: determination of new functions - business, production, science, education, housing, sports, recreation, combined, etc.
- Architectural phase: architectural design, planning, preservation of heritage, construction, etc.
- Infrastructure phase: transport, water, sewage, solid waste, public safety, energy, etc.
- Management, marketing
- Financial planning (price and financing, types of sources of funds)
- Revitalization actors: developers, investors, various partnerships.

All these phases, as well as others that are not specified and are required by a brownfield in the revitalization process, should be explained in detail with analyses by a multidisciplinary expert team, photos, drawings, a financial plan, and detailed calculations.

In the calculations, apart from the cost of construction of the facilities, the ground floor, the infrastructure, the design, the costs for management, communication activities, branding, etc. should also be foreseen.

Then a projection of costs and revenues for the entire life cycle of the facility should be done, i.e., the costs and revenues related to the operation of the site after all planned investments and other projects are closed in order to provide a complete picture of the operation, the plan is the management structure for project implementation, monitoring and issues related to quality, risk management is foreseen.

In the General Plan of the city, and in the Detailed Plan, the legal aspect and ownership are considered first, based on that there are two options, when:

- The legal entity-owner is not known or does not exist
- When the legal entity is included or appointed during planning.

The first option means that the implementation of brownfield revitalization is undertaken by the municipality, exactly from its initial team, which can be determined by the municipality (i.e., a team of experts from different fields is created). This option also includes the so-called "embedded organizational type" (if necessary, the establishment of a new unit within the municipal administration or within a municipal company with a relevant profile, such as property management or economic development).

The management structure should be responsible for the efficient, timely and smooth implementation of the project and the achievement of the planned results.

It is very important that the project is accepted by the general public at the very beginning of its promotion. A positive opinion can contribute to a smoother flow of work and involvement. The marketing plan for the revitalization project should first of all clearly define the target groups. Depending on the newly envisioned features, regeneration can attract companies, residents, consumers, etc. The marketing plan should contain a detailed description of the scope, e.g., its location, its connection to transport networks, the functions to be brought in, the special qualities and benefits associated with the site (e.g., new buildings, clean environment, work opportunities), the environment of the brownfield (such as commercial, residential, educational, cultural, etc. opportunities) and a detailed description of the elements (land, premises, residential units, sports facilities, etc.) intended for sale or rent. The plan should include contact details for project managers or funders, to enable interested parties to obtain further information and advice [23].

CONCLUSION

In order to achieve the regeneration of a brownfield site, it is important to recognize its potential. At the right moment, when a symbiosis of positive conditions occurs, brownfield regeneration could even lead to the revival of an entire city. The moment a location is recognized as an opportunity for development, it must enter the program of the Economic Development Department of a municipality. The municipality, whether it is an owner or not, must be the coordinator for the successful realization of the conceived idea.

The industrial heritage that the brownfield carries with it, and the memory of the place that is largely collective, must be taken into account. Much research has been done showing that the connection of the brownfield site with the inhabitants of the settlement is often inextricable and means identification. Breaking that strong bond can lead to a revolt or simply to the alienation of the inhabitants from their place of residence, which would mean the loss of the desire to contribute to the common good. The interpolation of history, memory and the modern in a smart sustained way can bring flair to the brownfield and from a dead site with many memories, it can grow into a beautiful functional landscape that will bring development and start creating a new history.

Due to the dwindling open space or greenfield available to states, brownfields are an excellent opportunity to bring new development without taking up the open space. Favoring brownfields over Greenfields is especially pronounced in densely populated countries, where every m² is planned. In those countries where there is enough free space, brownfield regeneration means decontaminating the space, so the ecological versus spatial significance is emphasized.

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УРБАНА РЕГЕНЕРАЦИЈА НА ИНДУСТРИСКИ БРАУНФИЛД ЛОКАЦИИ

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Резиме

Се опфаќа проблематиката поврзана со трансформацијата на браунфилд (*brownfield*) локациите во контекст на современиот урбан развој и стратегиите на одржлив урбанизам и урбана регенерација. Поточно, зачувување на идентитетот на локацијата и обнова на тоа индустриско, културно и архитектонско наследство, а со тоа и придонесување кон урбаната регенерација и подобрување на квалитетот на живеење и работа.

Како одржлив модел на регенерација на браундфилд локациите се издвојува адаптивната пренамена. Таа подразбира интегрирање на напуштените индустриски локации во урбана средина и нивно прилагодување, пренаменување и реконструирање во контекст на модерните токови и општествени, економски потреби, задоволување на еколошки критериуми и тн. Поради ваквиот пристап за регенерирање на овие локации, кој што главно е условен од програмата за локален економски развој, се занемаруваат историските, просторните и културните вредности, урбаната меморија на жителите, што води кон уништување на урбаниот идентитет на тие локации. Покрај целта, овие напуштени, недоволно искористени, најчесто загадени комплекси, да бидат економски исплатливи и да придонесат за подобар лик на околината, не смееме да забораваме дека истите имаат историска и културна вредност која може да оди во прилог, за привлекување на инвестиции.

Поради тоа претходно треба да се направат добри издржани анализи на сите параметри (економски, урбанистички, еколошки, имотно-правни, естетски и општествени, социјални и тн), а потоа да се разгледаат и сите можности кои ги нуди една браундфилд локација, но во контекст на локалниот економски развој и реалните потреби на еден град. На тој начин можат да се постигнат позитивни ефекти кои би воделе кон целосна урбана регенерација на една браундфилд локација.

Клучни зборови: *адаптивна пренамена, урбано, регенерација, идентитет, културно наследство*