

CHALLENGES AND OPPORTUNITIES OF REVITALIZING INDUSTRIAL HERITAGE IN SERBIA

Abstract

The focus of this research is the revitalization of Serbia's industrial heritage. The study examines the factors that influence the success or failure of revitalization projects. The aim of the research is to identify which factors are crucial for the successful implementation and sustainability of a revitalization project. The study employs the method of comparative analysis of case studies. Three case studies were analyzed, representing, respectively, a successful revitalization project abroad, an unsuccessful example in Serbia, and a successful example in Serbia. The results indicate that the key factors for the successful implementation of a revitalization project are the institutional factor, the sustainability factor, and the involvement of the local population in the project.

Keywords: industrial heritage, revitalization, adaptive reuse, sustainability

ИЗАЗОВИ И МОГУЋНОСТИ РЕВИТАЛИЗАЦИЈЕ ИНДУСТРИЈСКОГ НАСЛЕЂА У СРБИЈИ

Сажетак:

Област овог истраживања јесте ревитализација индустријског наслеђа Србије. Истраживање испитује факторе који утичу на успех то јест неуспех пројекта ревитализације. Циљ истраживања је да дефинише који фактори су кључни за успешну реализацију и опстанак пројекта ревитализације. Истраживање користи методу компаративне анализе студија случаја. Анализиране су три студије случаја, које представљају редом успешан пројекат ревитализације у иностранству, неуспешан пример у Србији и успешан пример у Србији. Резултати указују да су најкритичнији фактори за успех пројекта ревитализације институционална подршка, одрживост и активна укљученост локалне заједнице.

Кључне речи: индустријско наслеђе, ревитализација, адаптивна пренамена, одрживост

1. INTRODUCTION

Although Serbia has never been a leading industrial power, it is undeniable that numerous industrial heritage buildings exist throughout the country, possessing significant potential for revitalization. These structures are particularly prevalent in urban areas that are undergoing active development. Therefore, it is essential to consider industrial architectural heritage within the framework of urban planning, specifically regarding its integration with newly constructed buildings and the surrounding environment. At the global level, urban renewal and heritage revitalization are taken very seriously, as evidenced by European Union initiatives such as the New European Bauhaus.

The challenges of revitalization practice in Serbia are multifaceted and must be examined from various perspectives and disciplines to be properly understood. Firstly, from a legislative standpoint, Serbia lacks legally integrated guidelines to direct such practices. At the time of writing this study, Serbia does not have a law on revitalization. A second challenge concerns legal protection. Industrial buildings may be particularly vulnerable when they are not officially registered as cultural monuments or do not enjoy prior protection, which leads to a related problem of an economic nature. Economic feasibility is crucial for any project, as it is the primary factor influencing the sustainability of a building. If a building is not protected, an investor faces no administrative barriers to demolishing it in order to implement a project with proven economic viability.

Based on the above, this study will examine three case studies of industrial heritage revitalization. Two of the case studies are from Serbia, while the third is from abroad. The objective is to compare an example of poor practice in Serbia, an example of good practice abroad, and an example of good practice in Serbia. The example of poor practice is the failed revitalization project of the “Snaga i Svetlost” Thermal Power Plant in Belgrade, which illustrates the worst-case scenario for revitalization projects in Serbia, where a lack of institutional support leads to decay. The example of good practice in Serbia is the Coal Mining Museum in Senjski Rudnik, which serves as an excellent example of the economic sustainability of a local-level revitalization project. The successful international example is the Zollverein Industrial Complex in Essen, which is internationally recognized as an exemplary model of industrial heritage revitalization that subsequent projects often emulate.

The aim of the research is to identify the key factors that ensure the successful implementation and sustainability of a revitalization project. Based on the identified factors, the proposed guidelines should be designed so that they can be integrated into the legal framework of the Republic of Serbia. For this reason, the literature review also examines certain legislative frameworks, charters, and acts in Europe that have provided effective guidance for revitalization practices, as evidenced by the successful outcomes of industrial heritage revitalization projects across Europe.

The research questions of this study are as follows:

- What are the key factors influencing the success or failure of a revitalization project?
- Why might revitalization initiatives in Serbia fail to be implemented?

The research is structured according to the general standard for scientific research papers. It includes an introduction, a literature review, an explanation of the methodology, the presentation of case studies, a comparative analysis of the case studies, a discussion, and a conclusion.

In this research, the observed technique used for implementing revitalization projects is the method of adaptive reuse, defined by ICOMOS as the conversion of obsolete or unused structures, such as buildings of historical significance, into new uses or functions, while preserving and respecting their historical and cultural value [1].

2. THEORETICAL FOUNDATIONS AND CONCEPTUAL FRAMEWORK

In order to address industrial architectural heritage, it is first necessary to define it. The Nizhny Tagil Charter for the Industrial Heritage Conservation from 2003 provides the following definition [2]:

“Industrial heritage consists of the remains of industrial culture that possess historical, technological, social, architectural, or scientific value. These remains include buildings and machinery, workshops, mills and factories, mines and processing and refining facilities, warehouses and storage spaces, sites where energy is produced, transmitted, and utilized, transportation and all related infrastructure, as well as spaces used for social activities connected to industry, such as housing, religious practices, or education.” The Charter also specifies that its primary focus is on heritage that emerged during the Industrial Revolution.

Within the Nizhny Tagil Charter, and particularly relevant to this study, there are also guidelines for adaptive reuse. These guidelines are defined under Article 5, "Maintenance and Conservation." Adaptation of an industrial site is acceptable unless the site is of exceptional historical significance. Emphasis is placed on the compatibility of the new use with the old, and it is desirable that the new use interprets the old in some way. Adaptive reuse of industrial heritage, especially when located in neglected urban areas, can be crucial for economic regeneration and sustainability. Interventions should be reversible and have minimal impact on the site. All changes must be documented, and in cases where elements are removed, they should not be discarded but preserved and maintained. Reconstruction, or returning a site to a previously known state, should be considered an exceptional intervention and is appropriate only if it contributes to the integrity of the entire site or in the event of the destruction of a significant site due to violence [2].

It can be stated that adaptive reuse is acceptable in cases where its implementation does not compromise the uniqueness of the site, promotes the economic regeneration of the wider area, and where the new use retains traces of the old. In this way, industrial architectural heritage can be activated without losing its significance. At the 2008 conference in Essen, the Pan-European Industrial Heritage Network (ERIH, European Route of Industrial Heritage) proclaimed its objectives:

- Utilizing cultural heritage for sustainable local and regional development in former industrial areas;
- Enhancing the economic potential and attractiveness of ERIH anchor points and other sites;
- Establishing industrial heritage as a brand, including the marketing potential of anchor points and other industrial heritage sites;
- Raising awareness, identity, and knowledge regarding the protection of industrial heritage sites;
- Emphasizing the transnational aspect of Europe's industrial heritage;
- Expanding industrial heritage cultural routes across all regions of Europe [3];

The objectives of ERIH are fully aligned with adaptive reuse. Adaptive reuse is even necessary to achieve the first two objectives, and it significantly increases the likelihood of achieving the third and fourth. It can be said that ERIH promotes a form of modernization of industrial heritage, in the sense of adapting it to a contemporary context and enhancing its positive impact on that context. In this regard, successful adaptive reuse represents a project that functions in a dual manner: it enhances the economic potential of the surrounding area while simultaneously improving its own economic viability. Adequate adaptive reuse can also serve as a catalyst for raising local residents' awareness of a specific industrial heritage site. Broad implementation of good adaptive reuse practices across Europe can directly contribute to the fulfillment of ERIH's final objective.

The functionality and significance of adaptive reuse are supported by the concept of integrative conservation [4]. Integrative conservation is based on recognizing the utilitarian value of cultural heritage and ensuring its appropriate use, while taking into account its specific characteristics and qualities. This approach to conservation also includes a social dimension, namely the influence of local communities on project success. It represents a synthesis of conservation and planning practices, encompassing urban renewal as well [5]. It has been proven that the success of reactivation projects depends on the alignment of the economic viability of the adaptive reuse, the inspirational qualities of the building, and the benefits to the local community [6].

The factors that most strongly influence the success of adaptive reuse are sometimes difficult to define, as project success is relative and can be measured in various ways. In one study that focused on systematizing the literature on this topic, ten success factors were identified, which can be summarized into three key categories: conceptual, operational, and hybrid factors. The most frequently cited factors in the literature are conceptual, including socio-cultural factors and authenticity. Within the operational category, the architectural-physical and economic factors are most commonly mentioned [7]. Over the past decade, European initiatives have placed special emphasis on the sustainability of adaptive reuse projects. The context of the current global climate crisis has led to the creation and signing of the New Green Deal, which will significantly influence European initiatives, including the New European Bauhaus (NEB). It is important to note that an adaptive reuse project framed within sustainability has a higher chance of success, although this does not guarantee it. In a study conducted by professors and collaborators at the Faculty of Architecture in Belgrade, which examined student projects for the adaptive reuse of Belgrade's industrial heritage, projects were evaluated based on criteria encompassing authenticity and sustainability. These criteria form an essential part of the support for defining the methodology [8]. The Nizhny Tagil Charter and the objectives of ERIH provide a foundation for the evaluation of

revitalization projects. By synthesizing them with other research, a framework for key criteria is established, the fulfillment of which constitutes a successful project.

3. METHODOLOGY

Within this research, the method of evaluation and comparative case study analysis will be employed. For the purposes of the study, three case studies were selected: the Zollverein Industrial Complex in Essen, the “Snaga i Svetlost” Thermal Power Plant in Belgrade, and the Coal Mining Museum in Senjski Rudnik. The defined factors for comparison were developed based on a review of literature relevant to adaptive reuse and the revitalization of industrial heritage. For each factor, specific criteria have been established by which the projects will be evaluated and compared. The aim of applying this methodology is to gain a better understanding of the challenges involved in implementing revitalization projects, how the defined factors influence these projects, which factors distinguish successful projects from unsuccessful ones, and which factors are not necessarily required to be fully met for a project to function effectively. The comparison will be carried out according to the following factors: institutional factor, authenticity factor, adaptive reuse factor, local community involvement, and sustainability factor.

The institutional factor focuses on the existence of institutional support for a revitalization project. The comparison is carried out according to three criteria, or indicators. The first criterion is the presence of interest and support from government bodies and organizations for the revitalization project. Such interest and support are reflected in the existence of legal protection and organized working groups dedicated to the project. The second criterion is the existence of strategic plans for phased project development. The third criterion is the presence of investors, or financial support, for the revitalization project. The institutional factor was chosen for analysis in order to accurately examine the differences between Serbian and international case studies. It is possible that different institutional frameworks will influence quality of revitalization projects. The chosen criteria reflect different ways in which institutions are expected to support a project.

The authenticity factor relates to architectural and conservation criteria. Projects are compared according to the following criteria: preservation of spatial organization, preservation of stylistic characteristics, and preservation of the original structural system. The authenticity factor and its chosen criteria are mentioned as significant for a successful revitalization in previous research and theory. Keeping authenticity in adaptive reuse projects ensures readability of heritage history, which serves to improve general awareness of it amongst the wider public. The three authenticity criteria are borrowed from a previous research paper titled *Examined in Theory—Applicable in Practice: Potentials of Sustainable Industrial Heritage Conservation in a Contemporary Context—The Case of Belgrade* [8].

The factor of envisioned adaptive reuse of space is named as such because, in one of the cases, it concerns a conceptual design for reuse. Within this factor, the cases are compared based on the following criteria; clarity of the new use, the presentation of the old use, and the spirit of the place. This factor is chosen to examine the compatibility of old and new. It is possible for this compatibility to create a stylistic and spiritual coherence in the urban environment, which might influence project success. The factor of adaptive reuse also examines if the repurpose of the old, through careful consideration and respect for authenticity, answers contemporary problems in the built environment. Regarding **local community involvement factor**, the cases are compared according to the following criteria: the involvement of local residents in the implementation of the project and the involvement of local associations in the project's realization. Local community involvement is an important factor to consider in regards to revitalization project success, seeing as it is mentioned to be relevant for the concept of integrative conservation. Previous research points out the importance of local communities being initiators of adaptive reuse projects [6], [5]. Also, local community involvement in project maintenance, such as locals being museum curators for example, shows that the adaptation of heritage has been socially integrated.

The sustainability factor relates to the ecological and economic sustainability of the projects. It considers the materials used, the potential for reusing new materials, and the use of original authentic materials on the site. The greening of spaces is also evaluated to improve ecological outcomes. Finally, project profitability is assessed, taking into account the annual number of visitors, the number of employees, and the financial revenue generated by the revitalized complex. With the rising of new European initiatives that put an emphasis on sustainability, it is important to assess it in these case studies and determine its influence on their success.

It is expected that through the comparative analysis of the case studies according to the criteria outlined above, the research will be able to identify the key factors influencing the success or failure

of a revitalization project. By including the institutional factor and the criteria defined within it, the study also addresses the specific challenges of revitalization in Serbia.

4. CASE STUDIES

4.1. THERMAL POWER PLANT „SNAGA I SVETLOST“

The industrial facility, the “Snaga i Svetlost” Thermal Power Plant, is located on the right bank of the Danube River in the Marina “Dorćol” area of Belgrade. Historically, “Snaga i Svetlost” represents a significant milestone in the development of the city. Following population migrations to Belgrade in the 1920s, it became necessary to construct a thermal power plant capable of meeting the energy demands of the growing population. The construction of the plant was entrusted to a Swiss group for electrification and transport based in Basel. Construction took place from 1930 to 1932. For many years, the power plant supplied Belgrade with electricity until its closure in 1969. [9], [10]. The architecture of the “Snaga i Svetlost” Thermal Power Plant reflects the spirit of modernism and the Bauhaus school. The building itself is three-nave in design. The predominant materials used are glass, brick, and concrete, while the main structural framework is steel, with certain reinforced concrete components. From a structural and technological perspective, the power plant consists of three main sections: the machine hall, the boiler hall, and the control-counter hall. The current physical remains of the plant include the three-nave building with its three halls, a crane with an arm, a pumping station, and a filtration facility. The plant’s equipment has not been preserved, but archival documentation about it exists. Ideas for the revitalization of this facility first emerged in 2007, when a theoretical proposal for its adaptive reuse was published in the journal *Nasleđe* in an article titled “Revitalization of the ‘Snaga i Svetlost’ Thermal Power Plant in Belgrade” by the author Neda Knežević. The proposed new use for the “Snaga i Svetlost” Thermal Power Plant was an energy museum, which would include three research centers:

- Center for energy and ecology (ENEKO centar)
- Center for Cultural Heritage Rehabilitation
- Design center

This proposal emphasizes the integration of the proposed energy museum with the planned cultural and commercial facilities within Marina “Dorćol” (art workshops, exhibition spaces, areas for multimedia theater performances, and events) [11].



Figure 1. Thermal Power Plant “Power and Light” [12].

In the context of the year when this theoretical adaptive reuse proposal was made, 2007, there was interest in granting the thermal power plant the status of a cultural monument. It officially received this status in 2013 [13]. In 2015, a proposal for the revitalization of the “Snaga i Svetlost” Thermal Power Plant emerged, suggesting that the Nikola Tesla Museum, currently located on Krunska Street, be relocated there. The proposal was a conceptual design and a master’s thesis by architect Andreja Mišić, defended in 2015 at the Italian University Politecnico di Milano. The project was presented to the city authorities the same year, and in 2017, a working group was established with the task of implementing the proposed project [14]. The conceptual project covers an area of approximately 70,000 square meters. It includes the main building of the power plant, a portal crane with an arm, the administrative building, the pumping station, the filtration facility, and green

spaces, which in the redesigned plan become a park oasis with an open-air amphitheater, hospitality facilities, and a new promenade [15]. The administrative building retains its administrative function, with the addition of gallery space and a rooftop terrace. The pumping station and filtration facility are transformed into hospitality venues [15]. The large green area becomes a park oasis with walking and cycling paths, an open-air amphitheater, a pavilion dedicated to the development of young talent, and accompanying hospitality facilities. The square at the riverfront is dedicated to the renowned Serbian physicist Đorđe Stanojević [15]. However, over the past ten years, the project has not been initiated. The candidates for the new home of the Nikola Tesla Museum have changed. At one point, relocating the museum to the former railway station building was announced [16]. In 2024, the company Belgrade Waterfront commissioned a competition, conducted with the assistance of the Urban Planning Institute of the City of Belgrade, for the adaptive reuse of the former Milan Vapa paper factory in Belgrade. The competition was carried out, and first place was awarded to the design team of Zaha Hadid Architects and Bureau Cube Partners [17]. When considering the failure of the revitalization project for the “Snaga i Svetlost” Thermal Power Plant, it is necessary to also examine the Marina “Dorćol” commercial-residential complex project. This project essentially exists in two versions: one from the period between 2005 and 2012, and another from the period between 2019 and 2025 [18]. Although the projects differ in terms of architecture, they occupy the same space, the surroundings of Marina “Dorćol” itself. The latest version of the Marina “Dorćol” project has a total surface area of 195.853m² and encroaches on the parcel where the thermal power plant is located [19]. This parcel is protected by law, which granted the thermal power plant and its associated structures the status of a cultural monument. The law specifies that parcels containing industrial heritage buildings belonging to the power plant must remain undisturbed. It also stipulates that any new developments in the surrounding area must be compatible with the cultural monument [13]. Despite the negative opinion of the Institute for the Protection of Cultural Monuments, which pointed out that no construction is permitted on the parcel where the “Snaga i Svetlost” Thermal Power Plant that was declared a cultural monument in 2013, is located, the City Administration of Belgrade illegally adopted a plan. Furthermore, the strategic environmental assessment did not analyze or determine the potential impacts on the environment and cultural assets [19].



Figure 2. Concept for the revitalization of the Thermal Power Plant by Architect Andrej Mišić, Up left: 3D view from Dunavski kej, Up right: 3D view from the back, Down left: Side view, Down right: aerial view [20].

4.2. INDUSTRIAL COMPLEX ZOLLVEREIN

The Zollverein Industrial Complex is located in Essen, Germany, and represents the city's most significant landmark. The complex comprises the complete infrastructure of a historic coal mine, including some 20th-century buildings of exceptional architectural value. Due to its outstanding architectural qualities (reflecting Bauhaus modernism) and its testimony to Europe's heavy industry tradition, the Zollverein Industrial Complex was added to the UNESCO World Heritage List in 2001. Most of the complex was built in 1932, while the mine and factory were closed in 1986 [21]. The complex serves as one of the anchor points of ERIH (European Route of Industrial Heritage) [22].



Figure 3. Winding Tower of Shaft XII, Symbol of Zollverein [23].

The preservation and revitalization of Zollverein were considered even before the complex received World Heritage status. As early as the 1980s, a professional assessment was conducted, during which it was first argued that Shaft XII should be preserved as a museum. After the factory's closure, efforts to save the complex began. The city of Essen and the then-owners of the mine considered demolishing most of the buildings, as there were no indications that the entire complex could be economically viable. In this context, the city of Essen proposed protecting only the main shaft and surrounding buildings of key significance, which was opposed by the Rhine State Office for the Preservation of Monuments. The Rhine State Office took the opportunity to file an appeal with the Ministry for Urban Development, Housing, and Transport. As a result, on December 16, 1986, Shaft XII of Zollverein, along with the entire building complex and equipment, was declared a cultural monument. From the following year, revitalization concepts began to be developed, envisioning Zollverein as a cultural institution [24]. Art exhibitions and workshops are held, and the complex was renovated during the 1990s. A key role in promoting and restoring the complex was played by the Internationale Bauausstellung Emscher Park (International Building Exhibition Emscher Park). Industrial heritage throughout the Ruhr region was restored and transformed into cultural and service facilities. As part of this process, measures were primarily aimed at ensuring that the essence of the buildings was preserved. This conservative approach to working with the site through careful use and extensive preservation of existing structures was fully in line with heritage protection principles [25].

After the complex was granted UNESCO World Heritage status in 2001, interest in further revitalization emerged from around the world. Between 2001 and 2010, a strategic revitalization master plan was developed. Architect Rem Koolhaas created the master plan, and the European Union invested €165 million in its development. The renovation focused on sustainable economic use. In 2010, Essen was designated the European Capital of Culture. At that time, the site was presented for the first time with new tourist infrastructure: the new Ruhr Museum housed in the refurbished coal wash factory, the redesigned Zollverein Monument Trail with a variety of guided tours available in multiple languages, and an international visitor center. In the period following 2010, thanks to the high number of visitors during the Capital of Culture year, the Zollverein Industrial Complex became extremely popular and, as a result, economically self-sustainable.

The Zollverein Industrial Complex covers a total area of 100 hectares. The complex consists of several sections: Shaft XII, Shafts I/II/VIII, the coking plant, and the railway tracks. Surrounding the boundaries of the complex is a buffer zone that contains complementary facilities for the site.

Today, the complex houses the Ruhr Museum, the Red Dot Design Museum, and the Museum of Industrial Heritage, all within Shaft XII. The complex also includes four restaurants, artist studios and workshops, as well as various types of shops. For sports and recreational purposes, the complex features gardens, a seasonal swimming pool, an ice rink, and cycling paths [26], [27].

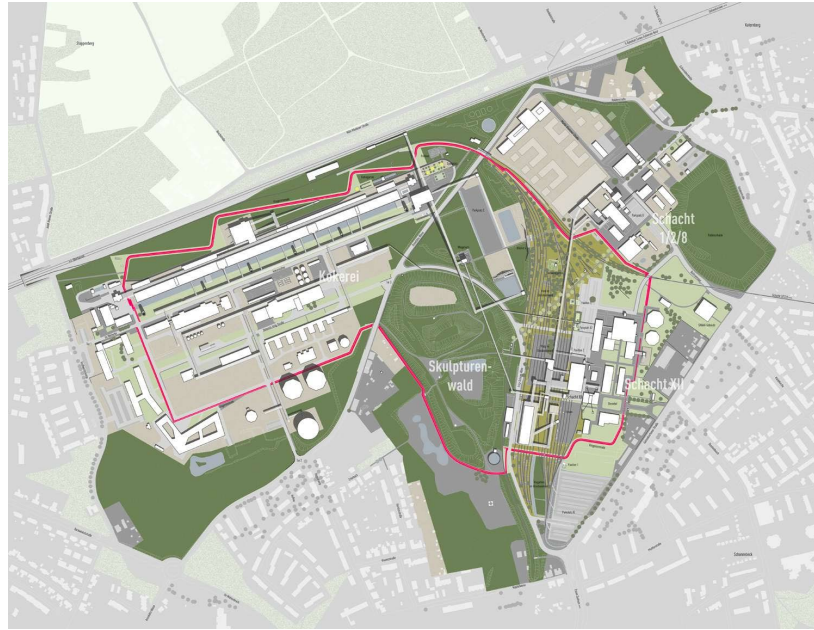


Figure 4. Map of the Zollverein Industrial complex [28].



Figure 5. Up left: Zollverein aerial view [29], Up right: Zollverein complex [30]
Down left: Zollverein park [31], Down right: Pool area in Zollverein [32].

4.3. COAL MINING MUSEUM, SENJSKI RUDNIK

Senjski Rudnik was established in 1853 and represents the oldest brown coal mine in Serbia, as well as the oldest preserved industrial area. It is located in the municipality of Despotovac in the Pomoravlje District. By a decision of the Institute for the Protection of Cultural Monuments in Kragujevac in 1975, three structures within the Senjski Rudnik complex were placed on the list of cultural monuments. These structures are Aleksandar's Shaft, the Coal Mining Museum, and the Machine Workshop. In 2005, the list was expanded to include the building of the hoisting engine with its tower and steam plant, as well as the steam engine used for transporting people and materials [33].

The museum itself was established in 1980. It is located in the building of a former warehouse, which was adapted for this purpose in the same year. The building exhibits objects dating from antiquity to the present day. The machine workshop building contains four rooms whose exhibition concept presents the story of miners' lives. The museum also includes an outdoor exhibition featuring a steam engine [34].

The initiative for the revitalization of Senjski Rudnik and the elevation of the entire complex to a higher level is part of the project titled “The Ljubljana Process II – Rehabilitation of Our Common Heritage.” The aim of this project was to provide the necessary tools for implementing a high-quality revitalization process. Technical and financial support for the Ljubljana Process was provided by the Council of Europe, while the project was managed by a working group based in Sarajevo.

In 2009, the Council of Europe placed the Senjski Rudnik revitalization project on its priority list. The goal of this revitalization was to transform Senjski Rudnik into an eco-museum similar to those found across Europe. The European Union invested €1.5 million in the restoration of this cultural-historical site, financing restoration works and technical assistance, with additional investments from the Government of the Republic of Serbia, the Municipality of Despotovac, and the brown coal mining company “Rembas.” [35]. The ambition of this project was not only to restore individual buildings but also to revive the spirit of the entire settlement. The adaptive reuse does not involve only industrial structures. It was planned that the abandoned hospital in the settlement would be converted into a hotel with accommodation for around thirty guests, while the former cultural center building would be transformed into an artists’ center. The project also envisaged the restoration of the Church of St. Procopius, as well as the so-called Workers’ Street [36].

The project was implemented in two phases. The initial works began in 2012. During the first phase, which lasted from 2012 to 2014, the building of the Coal Mining Museum, the machine workshops, and Aleksandar’s Shaft were reconstructed, along with the arrangement of the entire complex. The second phase of the project includes the restoration of the underground entrance to Aleksandar’s Shaft, with the aim of allowing visitors to experience miners’ working conditions. It also involves the creation of an outdoor exhibition of models and the restoration of the steam engine [37].

Special emphasis in this project is placed on the economic sustainability of the revitalization and the economic rehabilitation of the settlement. Within the Management Plan for the Senjski Rudnik Cultural-Historical Spatial Unit, tourism is highlighted as a key solution to the economic degradation of the area. According to the information available at the time the management plan was written, the site receives approximately 2,500 visitors annually. The local population is actively involved in the rehabilitation and maintenance of the complex, working as museum curators and as former miners who maintain the machines that form part of the outdoor exhibition. [33]. Today, various cultural events are held in Senjski Rudnik, such as the Night of Museums and Miners’ Day [38]. The museum includes a space where children’s workshops are held, as well as facilities for organizing scientific conferences. Senjski Rudnik represents one of the anchor points of ERIH (European Route of Industrial Heritage) [39].



Figure 6. Up: Senjski Rudnik Coal Mining Museum [40], Down left: Aleksandar’s Shaft building [40], Down right: Museum interior [41]

5. COMPARATIVE ANALYSIS

The comparison of the presented case studies will be displayed in a tabular format, accompanied by a brief description of the fulfillment of each criterion defined based on the reviewed literature. Criterion fulfillment will be evaluated with a YES/NO response, along with a specification of how the criterion is met in each case. In the case of the “Snaga i Svetlost” Thermal Power Plant, the proposed conceptual design will be assessed, taking into account the immediate surroundings and the Marina “Dorćol” project.

Table 1. Comparative analysis of the criteria

FACTORS	CRITERIA	INDUSTRIAL COMPLEX ZOLLVEREIN	THERMAL POWERPLANT „SNAGA I SVETLOST“	COAL MINING MUSEUM SENJSKI RUDNIK
FACTOR 1 Institutional support	•Support from government authorities •A strategic plan for project development •A defined project financing model	• YES (UNESCO protection, government supported the project) • YES (phased implementation plan, regular progress reports) • YES (project financed by the EU)	• NO (cultural monument status, government does not implement the revitalization plan) • NO (no strategy plan, no progress reports) • NO (no data on the investor)	• YES (cultural monument, government supported the project) • YES (two-phase implementation plan, progress reports available) • YES (project financed by the EU)
FACTOR 2 Authenticity	•Preservation of spatial organization •Preservation of stylistic characteristics •Preservation of the structural system	• YES (authentic machinery preserved, interior-exterior relationship maintained, original building footprint retained) • YES (authentic Bauhaus architecture preserved, original facade openings maintained) • YES (original structural system retained)	• YES (relationship between exterior and interior,) • YES (authentic Bauhaus architecture preserved, crane preserved) • YES (basic structural system retained with minimal interventions)	• YES (preserved relationship between exterior and interior space, original building footprint) • YES (facades restored according to photographic documentation) • YES (original structural system retained)
FACTOR 3 Envisioned adaptive reuse	•Clearly defined character of the new use •Legibility of the former use through the new one •Spirit of place	• YES (museums, workshops, restaurants, recreational and sports facilities) • YES (museum tours present the history of the complex) • YES (authentic materials, restoration of original appearance)	• YES (Nikola Tesla Museum, restaurant, commercial facilities, administrative space) • NO (museum program does not present the history of the complex) • NO (Marina Dorćol project disrupts the site)	• YES (museum exhibition, children's workshops) • YES (museum tours present the history of the complex) • YES (restoration of original facades, new materials compatible with the old)
FACTOR 4 Local community participation	•Involvement of the local population in the project implementation process •Network of local associations	• YES (public consultations and urban workshops, local population employed within the complex) • YES (former mining associations and their families involved)	• NO (project concept does not involve local population) • NO (no involvement of local associations)	• YES (former miners maintain technical equipment, local population works in the museum) • YES (involvement of mining associations)
FACTOR 5 Sustainability	•Promotion of nature •Economically sustainable adaptive reuse • Use of authentic materials and potential recycling of new materials	• YES (parks and gardens promote biodiversity) • YES (1.5 million visitors annually, complex contributes to regional tourism) • YES (sustainability through keeping authentic construction materials)	• NO (green space is disputed) • NO (project not implemented) • NO (not specified by project)	• NO (no explicit increase of green space) • YES (museum contributes to local tourism, 2,500 visitors annually) • YES (sustainability through keeping authentic construction materials)

6. DISCUSSION

Based on the evaluation and comparison of the case studies according to the criteria within the five defined factors, it can be observed that factors 1, 4, and 5 (the institutional factor, local community involvement, and sustainability factor) are completely unmet in the case of the unrealized "Snaga i Svetlost" Thermal Power Plant project, whereas the other two successful cases in Serbia and abroad fully satisfy all criteria within the defined factors. From this observation, it follows that the key factors determining whether a revitalization project will be successfully implemented are precisely those previously mentioned: institutional support, sustainability, and local community involvement. The very concept of adaptive reuse and the fulfillment of the authenticity factor within it are not critical for the success of project implementation. Nevertheless, in the successful cases, factors 2 and 3 are fully met, which contributes to the quality of the revitalizations. It is essential not to overlook factors 2 and 3 simply because factors 1, 4, and 5 form the foundation for the success of a revitalization project. Factors 1, 4, and 5 can be considered "primary" success factors that must be satisfied in any project, not only in revitalization projects, while factors 2 and 3 relate to the overall quality of the revitalization.

It can be assumed that a revitalization project may still be successful even if it hypothetically fails to meet one of the three criteria within the envisioned reuse factor, as long as all institutional factors are met; the opposite scenario, however, does not hold true. These results indicate that the process of industrial heritage revitalization primarily depends not on the architectural concept of adaptive reuse itself, but on broader institutional and social support that enables project implementation.

Furthermore, project success can be considered relative and evaluated from different perspectives. A project may be successful, economically sustainable, and regularly visited, yet still be an imperfect example of revitalization. Globally recognized revitalization projects, such as the Warsaw Power Plant, awarded for their application of the principles and values of the New European Bauhaus, may fall short in certain criteria. For example, the Warsaw Power Plant revitalization project does not clearly present the building's previous function through its new use, yet in all other criteria, its success cannot be disputed [42]. The balance between the criteria of authenticity and envisioned adaptive reuse, alongside the economic sustainability of the project, is crucial for the quality of a revitalization project. This balance can only be achieved through the creation of a detailed project implementation plan, consultation with experts, and institutional support.

7. CONSLUSION

This study examined the factors influencing the success or failure of revitalization projects through a comparative analysis of case studies. The analysis concluded that the key factors are the institutional factor, the sustainability factor, and the involvement of the local community in the project. The reason for the failure of revitalization projects in Serbia, based on the case study of the "Snaga i Svetlost" Thermal Power Plant, is the lack of institutional support in the form of a clear project implementation plan and financial backing, as well as systemic corruption affecting the decision-making process. Factors such as authenticity and the envisioned reuse influence the success and quality of a revitalization project, but they can remain functional even if not every criterion of authenticity and reuse is perfectly met. It is essential to focus on procedural processes and phased planning of revitalization projects to ensure that all factors are addressed. Future research in the field of industrial heritage revitalization, as well as heritage conservation more broadly, must emphasize the economic sustainability of projects and the types of adaptive reuse through which this sustainability can be achieved.

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