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ASSESSMENT OF BROWNFIELD LOCATIONS IN TEN CITIES IN SERBIA: A COMPARATIVE STUDY AND NEW IDEAS FOR IMPROVEMENT

Sanja Simonović Alfirević¹⁵³; Marina Nenković-Riznić¹⁵⁴

Abstract

Brownfield sites, characterized by abandoned or underutilized industrial or commercial properties, pose significant environmental, economic, and social challenges to urban areas. This paper aims to assess the prevalence and characteristics of brownfield locations in ten cities in Serbia and provide a comparative analysis of their potential for redevelopment. The undertaken research was developed for the World Bank Group and SECO project "Technical assistance: Strengthening capacities of local self-governments in Serbia towards low-carbon and resilient urban development investments", and the ten cities were chosen based on the initial survey as cities of interest to the project. Using a combination of qualitative and quantitative research methods, as well as questionnaires developed for the purpose of research data was collected on brownfield sites in Niš, Novi Sad, Kragujevac, Kraljevo, Šabac, Zrenjanin, Novi Pazar, Sombor, Užice and Leskovac. Some of the cities provided the data of brownfield sites within various databases which encompassed basic (geographical) data about the location, site histories, environmental conditions, land use restrictions, ownership status, original and potential purpose, existing infrastructure and accessibility. Future studies can build upon these findings by exploring specific redevelopment strategies tailored to the distinct challenges and opportunities presented by each city's brownfield diversity.

Key words: *Brownfield locations, redevelopment strategy, cities in Serbia.*

Introduction

Urban areas worldwide face the challenges of redeveloping abandoned or underutilized industrial and commercial properties, commonly referred to as brownfield sites. These sites not only present environmental concerns but also carry economic and social implications that demand innovative solutions. In Serbia, as in

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many countries, the issue of brownfield redevelopment has gained prominence due to its potential to drive sustainable urban development, alleviate the pressures on greenfield expansion, and contribute to low-carbon and resilient cities.

Brownfield sites, characterized by their history of industrial activity, often become neglected parcels of land, leaving them vulnerable to various forms of degradation. The revitalization of brownfield sites holds the promise of transforming blighted landscapes into vibrant hubs of economic activity, community engagement, and environmental restoration. This paper focuses on the assessment of brownfield locations in ten cities in Serbia and presents a comparative analysis of their potential for redevelopment.

The research presented here emerges from a study carried out under the project "Technical assistance: Strengthening capacities of local self-governments in Serbia towards low-carbon and resilient urban development investments," within the collaborative effort between the World Bank Group and the SECO SURGE Trust Fund. The selection of ten cities for this study was based on their significance to the World Bank Group and SECO program objectives.

The primary objective of this paper is to reference research conducted within the above-mentioned project and, in a general sense, draw conclusions regarding the key factors for the improvement of brownfield locations in Serbia. Detailed research within the project was conducted to examine the prevalence and characteristics of brownfield sites in selected ten cities in Serbia and to provide insights into their potential for redevelopment. The study employs a combination of qualitative and quantitative research methods, including the collection of data through questionnaires tailored for this research, as well as the exploration of various databases and catalogues containing information about these sites. The findings reveal distinct patterns of brownfield presence across the selected cities, with Novi Sad and Niš showing the highest concentrations.

Through the analysis of geographical data, site histories, environmental conditions, land use restrictions, ownership status, and other critical factors, this research uncovers the complexities associated with brownfield sites in Serbia. Moreover, by recognizing the significance of proximity to urban centres, transportation infrastructure, and utility availability, this study highlights key determinants that influence the potential for brownfield revitalization. Additionally, legal frameworks, financial incentives, and ownership status emerge as pivotal factors shaping the redevelopment landscape. Understanding these dynamics becomes essential for devising effective policies and strategies that encourage brownfield revitalization while addressing potential obstacles. Engaging stakeholders, ranging from local communities to government agencies and developers, emerges as a critical aspect of successful brownfield redevelopment. In the following sections, this paper delves into the methodology employed, the findings extracted from the data analysis, and the implications of these findings for brownfield redevelopment strategies.



Overview of the theoretical background

Brownfield sites are characterized by their history of industrial or commercial activities that have left behind contaminated or underutilized land. These sites, often situated within urban areas, present a unique set of challenges and opportunities for sustainable development. The environmental consequences of brownfields are well-documented, including issues of soil and groundwater contamination, which pose risks to both human health and the surrounding ecosystem [1]. Economic challenges arise due to the blighting effects of abandoned industrial sites on property values and local economies [2]. Additionally, social implications, such as reduced quality of life and community disintegration, underscore the urgent need for brownfield revitalization [3]. Numerous global examples have demonstrated successful brownfield redevelopment strategies [4]. These strategies often involve public-private partnerships, innovative financing mechanisms, and a holistic approach to environmental remediation. While international research on brownfield redevelopment has generated valuable insights into best practices and challenges associated with these sites, in the Serbia, brownfield research is gaining traction as the country strives to balance urban growth with sustainable development goals [5]. Several notable studies and authors have contributed to this emerging field considering history of military or industrial activities, and accordingly, complex challenges and opportunities for urban development [6], [7], [8], [9]. Researchers in this field, suggest a conceptual framework for integrating brownfield regeneration with green infrastructure development, aligning with sustainability objectives. They offer number of case studies exploring brownfield identification and analysis in the Serbian context, offering insights into site-specific challenges and emphasizing the need for tailored strategies [10], [11], [12]. A comprehensive understanding of brownfield characteristics and their redevelopment potential is crucial for formulating effective strategies and policies. The previously presented studies underscores several key themes:

- The importance of context-specific strategies in brownfield redevelopment;
- The need for comprehensive frameworks that consider environmental, economic, and social dimensions;
- The significance of stakeholder engagement and collaboration in successful revitalization efforts;
- The potential for brownfield sites to contribute to sustainable urban development and resilience;
- These themes serve as a foundation for the subsequent analysis and discussion of brownfield locations in ten cities in Serbia, as outlined in this study.

These themes indicate importance of brownfield redevelopment as a multidisciplinary field, drawing on global experiences and localized strategies to address the challenges and opportunities presented by selected sites in Serbia. The insights gained from international and domestic research provide a valuable context for the assessment and comparative analysis undertaken in this study.



Research design for brownfield potential and characteristics

The selection of ten cities (Niš, Novi Sad, Kragujevac, Kraljevo, Šabac, Zrenjanin, Novi Pazar, Sombor, Užice and Leskovac) was guided by the objectives of the World Bank Group and SECO program "Technical assistance: Strengthening capacities of local self-governments in Serbia towards low-carbon and resilient urban development investments." These cities were identified as critical to the project's goals, reflecting their significance within Serbia's urban development landscape. The chosen cities represent a diverse range of geographical, economic, and developmental contexts, ensuring that the findings can be extrapolated to other cities across the country. This selection was aimed at generating insights that can inform policy decisions and strategies at both the local and national levels.

The methodology employed in the previous study within the framework of the World Bank project, encompasses a mixed-methods approach that combines research techniques to comprehensively assess brownfield sites in the selected cities of Serbia. A comparative analysis of the selected cities' brownfield potential and characteristics was carried out, contributing to a broader understanding of the challenges and opportunities associated with brownfield revitalization in the region. A mixed-methods approach was chosen to ensure a holistic exploration of the subject matter. Qualitative methods were used to gather rich contextual information about each brownfield site, including its history, environmental conditions, and legal constraints. Quantitative methods were employed to gather numerical data on factors such as proximity to urban centres and transportation infrastructure.

Data collection involved a multi-pronged approach to ensure comprehensive coverage of brownfield sites' characteristics and potential for redevelopment. Data collection was primarily achieved through structured questionnaires sent to local authorities. These questionnaires were designed to collect standardized information about each brownfield site, including geographical data, site history, environmental conditions, land use restrictions, ownership status, and potential for redevelopment. The quantitative data collected through these questionnaires were subjected to statistical analysis to identify correlations and trends within and between the cities. The questionnaires used in this study were specifically developed for the purpose of assessing brownfield sites in Serbia's ten selected cities. The questions were crafted to elicit detailed information about each site's characteristics, challenges, and potential for redevelopment. The data collected were analysed in order to provide a more comprehensive understanding of each brownfield site's characteristics and potential. Data analysis techniques ensured a robust and holistic interpretation of the research findings, facilitating a deeper understanding of the complex landscape of brownfield redevelopment in the selected cities of Serbia.

The examination of the gathered data has provided us with valuable insights into the occurrence, attributes, and prospects for the rejuvenation of brownfield sites in the ten chosen Serbian cities. These results illuminate the diverse aspects of brownfield sites and form a foundation for comprehending the obstacles and potentials linked to their



revival. Notably, the findings have uncovered differing levels of brownfield prevalence and conditions among the studied cities, with Novi Sad and Niš standing out with the highest concentration.

Factors Influencing Brownfield Redevelopment Potential

The analysis of the distribution of brownfield sites across the selected cities revealed varying degrees of prevalence. Novi Sad and Niš emerged as cities with the highest concentration of brownfield sites, reflecting their historical significance as centres of industrial activity. The prevalence of brownfield sites in these cities underscores the need for targeted strategies to address the environmental, economic, and social challenges posed by abandoned or underutilized industrial properties. Detailed analysis of brownfield characteristics provided insights into various aspects of these sites, including their geographical attributes, site histories, environmental conditions, land use restrictions, ownership status, and potential for redevelopment:

- **Geographical data and location:** The geographical distribution of brownfield sites exhibited variation, with some cities having clusters of sites in close proximity, while others had dispersed locations [13]. This spatial pattern underscores the importance of understanding the local context when formulating redevelopment strategies.
- **Site histories and environmental conditions:** Many brownfield sites were once thriving industrial facilities, ranging from factories and warehouses to manufacturing plants. These industrial legacies often left behind environmental challenges, such as soil and groundwater pollution. The presence of such contamination necessitates rigorous environmental remediation efforts to ensure the safety and sustainability of future redevelopment [14].
- **Land use restrictions and ownership status:** Land use restrictions, often resulting from legal designations and past land use, play a critical role in shaping the potential for brownfield redevelopment [3]. Ownership status emerged as a significant factor, influencing the feasibility of redevelopment projects and the collaboration among stakeholders.
- **Potential and existing infrastructure:** Understanding the potential use of brownfield sites is essential for aligning redevelopment goals with local needs [15]. Existing infrastructure, including utilities and transportation networks, also influences the suitability of sites for various types of redevelopment projects.

The findings of this study emphasize the role of various factors in determining the potential for successful brownfield redevelopment:

- **Proximity to urban centers and transportation infrastructure:** Brownfield sites located in proximity to urban centers and well-connected transportation networks have a higher potential for successful revitalization. Such sites can contribute to urban regeneration efforts and support sustainable growth.
- **Availability of utilities:** The presence of essential utilities, such as water and electricity, significantly influences the feasibility of redevelopment projects. Sites



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with existing utility connections are more likely to attract developers and investors.

- Ownership status, legal frameworks, and financial incentives: Ownership status and legal frameworks can either facilitate or hinder brownfield redevelopment. Clear ownership and supportive legal structures can expedite the redevelopment process, while financial incentives can encourage investment in these sites.

Environmental contamination emerged as a common challenge across many brownfield sites, particularly related to soil and groundwater pollution. Remediation efforts are critical for addressing these contamination issues and enabling safe and sustainable redevelopment [16]. Implementing effective remediation techniques is essential to unlock the potential of these sites and mitigate the associated environmental risks.

The understanding of brownfield characteristics and potential gained from this study provides a foundation for formulating effective brownfield redevelopment strategies that consider the unique attributes and challenges of each site and city. The insights garnered from the conducted analysis within the World Bank Project are crucial for devising strategies that harness the economic, environmental, and social potential of brownfield sites while addressing the obstacles that impede their transformation into productive urban spaces.

Discussion

The identification of Novi Sad and Niš as cities with the highest concentration of brownfield sites highlights the urgency of addressing these areas. As these sites are often located in proximity to urban centres, their redevelopment offers the potential to revitalize underutilized land and promote more efficient land use within urban boundaries. The aforementioned findings underscore the need for targeted interventions that address the unique challenges faced by these cities in the revitalization of their brownfield sites. The diverse nature of brownfield sites, as revealed by the analysis, emphasizes the need for a holistic and comprehensive approach to redevelopment. Each site presents a unique set of challenges and opportunities that demand tailored strategies. A comprehensive strategy encompasses not only environmental remediation but also considerations of land use, infrastructure, ownership, and financial incentives.

Developing such a strategy requires collaboration among various stakeholders, including local governments, developers, community organizations, and environmental agencies. Local communities play a vital role in shaping the vision for the redevelopment of these sites. Their input ensures that projects align with the needs and aspirations of the community, fostering a sense of ownership and pride in the transformed spaces. Government agencies and policymakers also play a significant role in creating an enabling environment for brownfield redevelopment. This involves streamlining regulatory processes, providing financial incentives, and establishing legal frameworks that facilitate the transfer of ownership and the implementation of remediation efforts. A unified approach ensures that the goals of sustainable urban



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development, environmental protection, and economic growth are balanced effectively.

In addition, brownfield redevelopment offers a pathway to achieving low-carbon and resilient urban development objectives. By repurposing existing infrastructure and utilizing underutilized land, brownfield sites can contribute to reducing urban sprawl and the associated carbon emissions. Redevelopment projects can also incorporate sustainable design practices, green spaces, and energy-efficient infrastructure, enhancing the overall resilience of the urban landscape.

The findings of this study provide a basis for formulating policy recommendations aimed at promoting effective brownfield revitalization in Serbia. These recommendations include:

National brownfield strategy	Developing a national brownfield strategy that outlines guidelines for identifying, assessing, and redeveloping brownfield sites. This strategy should incorporate best practices from global examples while tailoring approaches to Serbia's unique context
Stakeholder collaboration	Encouraging collaboration among local communities, developers, government agencies, and environmental organizations. Establishing platforms for dialogue and participation can ensure that redevelopment efforts are aligned with community needs and broader sustainability goals.
Financial incentives	Introducing financial incentives, such as tax breaks and grants, to encourage private investment in brownfield redevelopment. These incentives can help offset the costs associated with remediation and infrastructure development.
Capacity building	Enhancing the capacity of local governments and development agencies to manage brownfield redevelopment projects effectively. Providing training and resources can empower stakeholders to navigate the complexities of the redevelopment process.

The insights gained from this study serve as a stepping stone for future research endeavours. Further studies can delve into specific aspects of brownfield redevelopment, such as innovative financing mechanisms, community engagement strategies, and the integration of brownfield projects into broader urban development plans. Moreover, as cities evolve and adapt to changing urban dynamics, ongoing monitoring and assessment of brownfield sites will be crucial. This will allow for a



dynamic approach to redevelopment that takes into account shifting trends, emerging challenges, and evolving stakeholder needs.

Conclusion

The assessment of brownfield locations in ten cities in Serbia has yielded a comprehensive understanding of these sites' prevalence, characteristics, and potential for redevelopment. The insights gained from this study, conducted in collaboration with the World Bank Group and the SECO program, serve as a valuable resource for urban planners, policymakers, developers, and other stakeholders engaged in brownfield redevelopment. The findings of this study provide a foundation for future research endeavours. Subsequent studies can build upon these insights by exploring specific aspects of brownfield revitalization, such as community engagement strategies, innovative financing mechanisms, and the integration of brownfield projects into broader urban development plans. In conclusion, this study paves the way for a comprehensive understanding of brownfield redevelopment, providing a blueprint for unlocking the economic, environmental, and social potential that lies within Serbia's urban landscapes. Brownfield revitalization offers a viable solution to the challenges posed by greenfield development. By transforming abandoned industrial sites into productive and vibrant spaces, cities can preserve valuable greenfield land, maintain ecological balance, and reduce urban sprawl.

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INVITATION LETTER

Dear Dr. Simonović Alfirević,

Scientific Committee is inviting you and co-author Marina Nenković-Riznić to be the **invited lecturers** with the manuscript titled "**ASSESSMENT OF BROWNFIELD LOCATIONS IN TEN CITIES IN SERBIA: A COMPARATIVE STUDY AND NEW IDEAS FOR IMPROVEMENT**" at the Fifth International Scientific Conference "Science, Education, Technology and Innovation - SETI V 2023" for the thematic field: "D. Sustainable territorial development".

The SETI V 2023 Conference is organized by the International Research Academy of Science and Art - IRASA. It will be held 13 - 14 October 2023 in Belgrade, Republic of Serbia.

We are hoping that you will accept this invitation.

Yours sincerely,



President of the IRASA Academy

Academician Prof. Dr. Vladica Ristić



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