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Sustainable Brownfield Redevelopment: A Solution to Control Urban Sprawl

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Abstract

With the expansion of cities, meeting the requirement of increase in population has always been a concern for the environment. As a consequence of urbanization, surge in tenancy, need for recreational spaces and increased congestion within the cities, its boundaries are expanding rapidly, occupying the outskirts of the same for new infrastructural development. This causes problems such as uncontrolled urban sprawl.

This paper intends to highlight the impact of urban sprawl on a city and how it can be mitigated by implementing strategies like brownfield redevelopment, retrofitting and revitalization of existing structures for mixed use developments which will not only allow us to retain the natural habitats surrounding the city but will also prove to be a suitable sustainable approach towards urban development.

Keywords: Urbanization, Urban Sprawl, Brownfield Redevelopment, Sustainable.

1. Introduction

Aim

To explore the potential of sustainable brownfield redevelopment as a solution to control urban sprawl.



Figure 1. Brownfield redevelopment projects

Objectives

• To explore the causes and effects of urban sprawl and the challenges it poses to sustainable urban development.

- To understand the concept of sustainable brownfield redevelopment, its history, and its current implementation in various cities worldwide.
- To analyze the benefits and challenges of sustainable brownfield redevelopment as a strategy for controlling urban sprawl.
- To identify best practices and key success factors for sustainable brownfield redevelopment, based on case studies of successful projects.

Scope

The research will focus on the benefits and challenges of brownfield redevelopment, and the various possibilities of its implementation with sustainability as the key element.

Limitations

- The paper includes the lack of empirical data on the effectiveness of brownfield redevelopment in controlling urban sprawl.
- The study is limited to a qualitative analysis of case studies and literature review.

Need of the study

- Urban sprawl as result of rapid urbanization has become major concern in many parts of the world, leading to the depletion of natural resources, loss of agricultural land, and environmental degradation.
- Brownfield redevelopment can be a sustainable solution that will provide an alternative to developing previously untouched land inside the cities and thus, controlling urban sprawl.

2. Urban Sprawl

The spread of development in the fringes of cities on undevelopable land is termed as Urban sprawl. It is described as an unlimited expansion of a number of cities where housing, commercial development and roads are developed on large stretches of land with limited concern for planning in urban areas.



Causes

- Rapid population growth drives the demand for housing and infrastructure, leading to urban expansion.
- The desire for larger homes and a suburban lifestyle promotes low-density residential development on the outskirts of cities.
- Inadequate land use planning and zoning policies prioritize low-density development and hinder compact, mixed-use development.

- Economic incentives and market forces drive developers to seek cheaper land on the urban fringe, leading to urban expansion.
- Consumer preferences for larger lots, privacy, and distance from urban centers contribute to the demand for suburban development.

Effects

- Conversion of natural habitats and farmland into urbanized land reduces biodiversity and ecosystem services.
- Urban sprawl fragments natural habitats, affecting wildlife populations and ecological connectivity.
- Longer commutes and higher energy demands in sprawling areas lead to increased greenhouse gas emissions and air pollution.
- Dispersion of development contributes to traffic congestion, longer travel times, and infrastructure costs.
- Urban sprawl requires extensive infrastructure networks, resulting in higher costs for governments and taxpayers.
- Spatial divisions between urban and suburban areas can lead to unequal access to services and amenities, exacerbating social inequalities.
- Sprawl limits physical activity, access to green spaces, and increases exposure to pollution, impacting public health.
- Inefficient land use, increased infrastructure costs, and dispersed economic activity can hinder economic growth and productivity.

3. Material and Methods

3.1 Methodology

- To establish the aim of the study, objectives, scope, and limitations.
- To study the existing literature on urban sprawl and brownfield redevelopment.
- To study similar cases and extract inferences from them.
- To analyze the location and the current state of the study area.
- To formulate strategies and reviewing possible options of brownfield redevelopment.



Figure 3. Structure of the Study (Developed by Author).

The study is designed to provide valuable insight and suggestions on sustainable brownfield regeneration as a solution for urban sprawl using these research methods. The findings of this study will help stakeholders, policy makers and urban designers to make sound decisions for achieving the Sustainable Development Goals by contributing to an existing knowledge base.

3.2 Similar Cases across the world:

The first stage of the Shanghai Binjiang Avenue Public Space Development Project is the **Demonstration Section of the Yangpu Riverside Public Space**. It is also a benchmark for the entire 45 km stretch of river restoration, and not just in that area. The architects decided that the structures and textures of the site reflect its history in a genuine, vivid yet sensitive way. In an active effort at spatial reuse, 80,000-ton silos on the Minsheng Wharf, have been renovated. The 420,000 square metres masterplan, which was designed as a point of connection between the old city and the new Financial District, is highly accessible to pedestrians.

An island near Pittsburgh that had once been demolished has been transformed by the **Washington's Landing** brownfield project into a top-notch multi-purpose development that includes a marina, affordable housing, office spaces and light industrial uses, as well as a rowing centre with a public park. Originally used for cattle stockyards, meatpacking, and other manufacturing units, the island started to decay and getting neglected around the 1960s. Herrs Island has been a brownfield site as a result of industrial activity. The Urban Redevelopment Authority of the City of Pittsburgh took advantage of this singular land resource in 1983 to finance redevelopment planning and site preparation.



Figure 4. 1- Yangpu Riverside Public Space, 2- Washington's Landing, 3- Phoenix Mall, 4- South City Mall

3.3 Similar Cases in India:

One of the most popular shopping malls in India, **Lower Parel's High Street Phoenix** is known as one of Mumbai's favourite shopping destinations. The surrounding compound is also home to a five-star hotel, a multiplex, commercial spaces, and a residential tower with a gross floor area of approximately 365,000 square meters. However, the history of Phoenix dates back to 1905, when Phoenix Mills was established in Mumbai to manufacture cotton textiles. Except for a few industrial features such as Chimney, almost all of the buildings that existed on these mill lands were entirely destroyed in order to make way for reconstruction.

Since February 2004, the **South City Project** had been initiated in south Kolkata, where the former Usha Industries factories and offices were located. Founded in the 1950s, Jay Engineering was a large sewing machine and fan manufacturing facility for the Usha Group of Industries. In 2003, the factory was closed down and the land was given to a corporation of five major developers. However, for the construction of the South City project, which currently include four towers of 35 floors and one tower of 15 floors, a shopping mall, a school, and a social club with many recreational facilities, the factory buildings were demolished earlier.

4. Results

From the above case studies, we can conclude that the major drawback of these projects is the complete demolition of the previous structures and thus destruction of the original fabric of the site. The study intends at defining the main factors and strategies for successfully executing sustainable brownfield revitalisation projects. Thus, eventually providing policy makers, city planning and stakeholders with insight and recommendations that can be used in their effort to combat urbanization and promote sustainable growth.

Brownfield Redevelopment

The term "brownfield development" refers to the construction of buildings on sites that have already been used for industrial or business purposes. In some cases, there may be already existing infrastructure on these sites in other they might not.



Figure 5. Brownfield redevelopment projects

History

- Brownfield development gained momentum in the 1990s as a response to urban blight and the need for sustainable land use.
- The concept originated in the United States, where the government recognized the potential of redeveloping abandoned industrial sites.
- Brownfield redevelopment was initially driven by environmental concerns and the desire to remediate contaminated sites.
- Over time, the focus shifted towards promoting economic revitalization, community development, and sustainable urban growth.
- Brownfield redevelopment has since spread globally, with numerous successful projects transforming underutilized sites into thriving and sustainable urban areas.

Advantages

- Reduces urban sprawl and creates more liveable and sustainable urban environments.
- Efficient land use by reusing existing urban land, thus, reducing the need for greenfield development.
- Utilization of existing infrastructure, thus, saving costs and resources needed to build new infrastructure in undeveloped areas.
- Preservation of natural habitats, agricultural land, and open spaces on the urban fringe.
- Revitalization of blighted areas, results in improving aesthetics and economic viability.
- Preservation of cultural heritage and architectural character. Repurposing historic buildings can contribute to the preservation of local history and identity.
- Improves the visual appearance of neighbourhoods, raises property values and stimulates economic growth by revitalising unused areas into lively and interesting spaces, while at the same time affecting its inhabitants positively both in terms of social and mental health.
- Environmental remediation which improves site quality and mitigates pollution risks.
- Promotes community engagement and inclusion. Involves local residents and stakeholders in the planning and decision-making process, ensuring that the redevelopment meets their needs and expectations.
- Mixed-use development, where residential, commercial, and recreational spaces are integrated, reduces the need for long-distance commuting, thus, promoting compact and walkable communities.

Implementation

- To identify potential brownfield sites that are suitable for redevelopment.
- To assess the site's condition, including ecological contamination and structural stability and create a comprehensive redevelopment plan after reviewing the same.
- To address any contamination issues on the site through remediation techniques.
- Funding from government, private investors, or specialized redevelopment funds should be considered to support the project.
- To involve the community and relevant stakeholders and ensure the project aligns with community needs and expectations.
- To establish a plan for ongoing site maintenance and tracking economic growth, ecological impact, community satisfaction and public benefits.

5. Discussion

5.1 Location Study for Potential Site



Figure 6. 1- Map of India showing Telangana, 2- Map showing Hyderabad in Telangana, 3- Map showing Hyderabad city, 4,5 - Map showing potential site, 6,7,8 - Pictures showing current state of the site

The purpose of this study is to present the results of the possibilities of brownfield development in Hyderabad, India. The study assessed whether it is feasible to transform an abandoned manufacturing site into new uses and identified potential challenges and opportunities for the project.

Over the past few decades, a major industrial expansion has taken place in Hyderabad, the capital city of Telangana. This has resulted in the availability of several brownfield sites for development which provide an opportunity for regeneration, economic growth and sustainable development. An appropriate site has been chosen for this study, near Zamistanpur, a prime location in the city which is easily accessible to transport networks and also has close proximity to residential areas.

The selected site mostly consists of automobile manufacturing companies and bus depots. The structures are almost 130 years old with most of them abandoned and only few still functioning. The current state of the site can be deduced from the site photos above.

The site study has proven to be helpful in understanding the feasibility and possible challenges associated with redevelopment of the selected site. The area's potential for market value and the aspirations of the community makes it an attractive choice for development, despite the necessary infrastructure improvements. This project could help in the revitalization and in sustainable growth of the city with proper planning, remediation and involvement of the current stakeholders.

5.2 Sustainable Approach

Sustainable methods must be adopted in order to guarantee the success of brownfield redevelopment projects. The United Nations Sustainable Development Goal 11 has been incorporated as a possible solution to the study. The recommendations for every target that can be achieved with a sustainable solution are as follows:

GOAL 11: Sustainable cities and communities

It focusses on making cities and human settlements inclusive, safe, resilient and sustainable.

The sustainable solutions to be implemented are:

- To achieve a balance between economic growth, social inclusion, and environmental protection.
- To incorporate sustainable building design principles that improve energy efficiency, reduce waste, and conserve water.
- To adopt a multi-stakeholder approach, prioritizing green infrastructure, conducting thorough site assessments, focused investment, and creating a long-term monitoring and management plan must be considered for successful sustainable brownfield redevelopment.

11-1 - Safe and affordable housing

Targets to ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums. The sustainable solution to be implemented is:

• Converting existing buildings, such as former factories, warehouses, and schools, into affordable housing units along with commercial spaces, such as restaurants and grocery stores creates a more vibrant community.

11-4 - Reduce environmental impact of cities

Targets to reduce the adverse environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

The sustainable solutions to be implemented are:

- Efficient use of land, reduces urban sprawl, and aids in the preservation of green spaces.
- Implementation of remediation technologies that target specific types of contaminants.

11-6 - Inclusive and sustainable urbanization

Targets to enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

The sustainable solution to be implemented is:

• Engaging with local stakeholders and community members to create a shared vision for the redevelopment of the site aligned with community values.

11-7 - Provide access to safe and inclusive green and public spaces

Targets to provide universal access to safe, inclusive and accessible, green and public spaces, for women and children, older persons and persons with disabilities.

The sustainable solution to be implemented is:

• By revitalizing derelict spaces in the city for community gardens, public parks, and shared spaces, abandoned structures can become centers for community-building activities.

6. Conclusions

- Urban sprawl is a major environmental issue that can be addressed through the sustainable redevelopment of brownfield sites.
- Brownfield redevelopment offers multiple benefits, including environmental remediation, economic development, and the reduction of urban sprawl.
- However, brownfield redevelopment can be complex and costly, and it requires a coordinated effort from all stakeholders.
- To promote sustainable brownfield redevelopment, governments should develop financial incentives, streamline the regulatory process, and engage with the local community.
- Sustainable design should also be incorporated into every stage of the brownfield redevelopment process to ensure the environmental impact is minimized.
- Urban areas are required to be revitalized thus, reducing the need for new land development, protecting natural resources, and promoting alternative transportation modes.
- By taking a holistic approach to brownfield redevelopment, we can address urban sprawl and create more sustainable communities for future generations.



Figure 5. Possible sustainable solutions for Brownfield redevelopment projects

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Conflict of Interests

The authors declare no conflict of interest.

References

- Aziz Amen, M., & Nia, H. A. (2018). The dichotomy of society and urban space configuration in producing the semiotic structure of the modernism urban fabric. Semiotica, 2018(222), 203–223. https://doi.org/10.1515/sem-2016-0141
- Amen, M. A., & Kuzovic, D. (2018). The effect of the binary space and social interaction in creating an actual context of understanding the traditional urban space. Journal of Contemporary Urban Affairs, 2(2), 71–77. https://doi.org/10.25034/ijcua.2018.3672
- Amen, M. A., & Nia, H. A. (2021). The Effect of Cognitive Semiotics on The Interpretation of Urban Space Configuration. https://doi.org/doi:10.38027/iccaua2021227n9
- Aziz Amen, M. (2017). The inspiration of Bauhaus principles on the modern housing in Cyprus. Journal of Contemporary Urban Affairs, 1(2), 21–32. https://doi.org/10.25034/ijcua.2017.3645
- Amen, M. A. (2021). The Assessment of Cities Physical Complexity through Urban Energy Consumption. Civil Engineering and Architecture, 9(7), 2517–2527. https://doi.org/10.13189/cea.2021.090735
- Aziz Amen, M. (2022). The effects of buildings' physical characteristics on urban network centrality. Ain Shams Engineering Journal, 13(6), 101765. https://doi.org/10.1016/j.asej.2022.101765
- Amen, M. A., Afara, A., & Nia, H. A. (2023). Exploring the Link between Street Layout Centrality and Walkability for Sustainable Tourism in Historical Urban Areas. Urban Science, 7(2), 67. https://doi.org/10.3390/urbansci7020067
- Amen, M. A., & Nia, H. A. (2020). The Effect of Centrality Values in Urban Gentrification Development: A Case Study of Erbil City. Civil Engineering and Architecture, 8(5), 916–928. https://doi.org/10.13189/cea.2020.080519

Beatley, T. (2016). Biophilic cities: Integrating nature into urban design and planning. Washington, DC: Island Press.

Bolund, P., & Hunhammar, S. (1999). Ecosystem services in urban areas. Ecological Economics, 29(2), 293-301.

- Haider, J., & Molin, E. (2018). Redevelopment of brownfield sites for sustainable urban growth: A review. Land Use Policy.
- Newman, P., & Kenworthy, J. R. (1999). Sustainability and cities: Overcoming automobile dependence. Washington, DC: Island Press.
- Plevoets, Bie and Van Cleempoel, Koenraad, Adaptive Reuse of the Built Heritage Concepts and Cases of an Emerging Discipline, Routledge (2019), New York.
- Fuladlu, K. (2019). Urban Sprawl Negative Impact: Enkomi Return Phase. Journal of Contemporary Urban Affairs, 3(1), 44–51. https://doi.org/10.25034/ijcua.2018.4709
- Seto, K. C., Fragkias, M., & Güneralp, B. (2013). Urban land use change: Challenges for sustainability. Annual Review of Environment and Resources.
- Thomas, M. R. (2003). Brownfield redevelopment: information issues and the affected public. Environmental Practice.
- UN-Habitat (2003). Sustainable urban development: Guidelines for policy makers and planners. Nairobi, Kenya: UN-Habitat.
- United Nations Sustainable Development Goal 11 KnowSDGs (Knowledge base for the Sustainable Development Goals), European Commission.
- Wheeler, S. M. (2004). Planning for sustainability: Creating livable, equitable, and ecological communities. New York, NY: Routledge.
- Images Alamy, iStock, Arch Daily features on brownfield redevelopment.

Maps – Google Street map.