Green Adaptive Re-use in Industrial Heritage Sites Based on Integrity (Case Study: Rey Cement Factory)

Shilan Amirashayeri[1]
[1] Master of Landscape Architecture, Faculty of Art and Architecture
Tarbiat Modares University
Tehran, Iran

Mojtaba Ansari[2]
[2] Professor of Department of Architecture
Faculty of Art and Architecture
Tarbiat Modares University
Tehran, Iran

Mohammad Javad Mahdavinejad[3]
[3] Professor of Department of Architecture
Faculty of Art and Architecture
Tarbiat Modares University
Tehran, Iran.

Abstract

Aims*: Industrial buildings, as cultural heritage, are facing destruction due to changes in their framework, economic, social, environmental, and cultural aspects. Each industrial complex requires a unique approach to renewable and redesign, based on local aesthetic and architectural characteristics. The Leipzig Charter, which promotes integrated urban development and green adaptive reuse, can be used in revitalization projects to protect integrity and address issues. The Ray Cement Factory, a valuable architectural symbol, has become an abandoned site due to its closure. Reviving these industrial complexes can be achieved through redesigning their landscape with an emphasis on integrity and industrial heritage values. This article aims to provide solutions for revitalizing Iran's industrial heritage using sustainability indicators, based on the Leipzig Charter.*
Methods: *In this article, the research methodology is a case study and combined strategies.*
Findings*: The results of this study have revealed that activity is the most critical factor for maintaining space's alive and gives meaning to them. The combination of structure and meaning will be revitalized along activities which absorb the population, but on the contrary, it will be considered a threat to the place.*
Conclusion*: The results and solutions presented in this study can be an instructor to green adaptive reuse which can contribute to the development of social, economic, cultural and environmental sustainability in interact with contemporary architecture heritage and industrial architecture heritage sites.*

Keywords: Industrial Heritage, Post-industrial landscape, Re-design, Green Adaptive Reuse, Rey Cement Factory, Leipzig Charter

Introduction

Industrial heritage sites, once vibrant symbols of progress and innovation, now stand on the precipice of destruction due to changing trends and neglect [1]. This shift has transformed these sites from potential thriving living spaces into realms of disorder. The essence of an industrial building goes beyond its physical structure; it encompasses a holistic integrity intertwined with economic, social, environmental, and cultural dimensions [2, 3]. Any alteration to these sites presents intricate challenges, demanding unique approaches that respect local aesthetics and architectural attributes for successful renewal and redesign [4-6]. The Leipzig Charter, a cornerstone for integrated urban development, introduces the concept of green adaptive reuse as a means to safeguard the integrity of such spaces and address their multifaceted challenges [7-10]. Embodied within this context is the Rey Cement Factory, an architectural gem laden with historical significance. Once a bustling hub, the factory has now succumbed to abandonment following its closure. The revival of such industrial complexes hinges on a comprehensive redesign of their industrial landscapes that meticulously preserves their integrity and inherent heritage values.

In this vein, this article embarks on a mission to propose viable solutions for the revitalization of Iran's industrial heritage, all while adhering to the principles outlined in the Leipzig Charter. Sustainability indicators serve as the guiding framework, illuminating the path towards a harmonious marriage of contemporary architectural heritage and industrial legacy.

Literature Review

The preservation and adaptive reuse of industrial heritage sites have gained prominence in recent years as societies grapple with the transformation of these historically significant structures into spaces of disorder and neglect. This literature review delves into the multifaceted dimensions of green adaptive re-use in industrial heritage sites, drawing insights from existing research and theoretical frameworks.

Industrial heritage sites have transcended their utilitarian roles to become potent cultural symbols reflecting the evolution of societies and technological progress. Research by Smith and Waterton (2009) underscores the importance of recognizing the holistic integrity of these sites beyond their architectural frameworks [11]. This aligns with the notion highlighted in the abstract that these sites encompass economic, social, environmental, and cultural facets, rendering any interventions a complex endeavor. The challenges of revitalizing industrial heritage sites are manifold and deeply entwined with issues of sustainability, aesthetics, and socio-economic dynamics. Dell'Ovo et al., (2021) [12] stress the need for adaptive reuse strategies that consider the local context and aesthetic values. The Leipzig Charter emerges as a pivotal touchstone for integrated urban development, offering a comprehensive framework to guide the revitalization process while respecting the integrity of these sites [13].

The concept of green adaptive reuse has gained traction as a sustainable approach to reinvigorate industrial heritage sites. Sustainable indicators, as highlighted in the abstract, serve as essential tools to guide the transformation while safeguarding cultural heritage. Throsby (2003) asserts that sustainability should encompass economic viability, social cohesion, and environmental responsibility to ensure a comprehensive revival that nurtures heritage values [14]. Belhassen et al., (2008) emphasize the role of activities in imbuing these spaces with meaning, drawing parallels with the article's exploration of activity as a critical factor in maintaining the vibrancy of industrial heritage sites [15]. Preserving the identity and historical essence of industrial heritage sites while infusing contemporary innovations poses a delicate balance. Architectural historian Rapoport (2020) emphasizes the importance of continuity in adaptive reuse, where historical layers coexist with modern interventions [16].

The literature highlights the importance of economic, social, environmental, and cultural aspects in preserving and adaptively reusing industrial heritage sites. The Leipzig Charter and sustainable indicators guide this process, while the relationship between activities, identity, and innovation is crucial for holistic revival. Green adaptive reuse in industrial heritage sites offers a promising path towards sustainable urban development.

Methodology

This study uses a qualitative approach to investigate the Shahr Ray cement factory, focusing on its historical and current state. The research employs various methodologies, including contextual theories, ethnography, and interpretivism, to uncover natural environmental conditions and formulate theories. The study employs historical interpretation, survey, and logical reasoning strategies to gather information. The library method examines two categories of sources: books about the city's evolution and factories during Tehran's industrial period, while the field method involves interviews with knowledgeable individuals and the compilation of essential maps and photographic documentation.

The research explores successful global precedents and draws targeted conclusions. The spatial quality of the research field is assessed through thorough examination and analysis. The study concludes with strategic recommendations to enhance the semantic quality of abandoned industrial landscapes, which take the form of design options. This comprehensive approach lays the foundation for a robust assessment of the research subject and the formulation of well-informed suggestions.

Case Study / Case Studies

The cement factory complex is located in the 20th district of Tehran, in Ray City. This region consists of seven districts; the desired site is located in the first district and on a land area of 87,358 m^2. As it was said, Shahr Ray Cement Factory is the best cement factory in Iran.

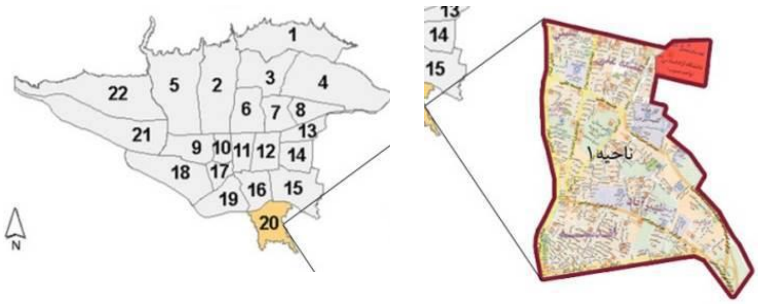

Fig 1. Study location

Building complexes are designed to perform specific static tasks in dimensions, shape, and connection. Disrup tive factors, which work together to damage the building, cause changes in the stability and balance system. These changes, if they cross borders, cause imbalances in the building mass and cause damage or complicatio ns. To investigate and conduct pathology studies, it is necessary to categorize and separate the diverse types o f damage. At the beginning, a general classification of damages is done, followed by a specific classification based on the type of damage in the collection. This helps to ensure the building's longevity.

Figure 2 depicts the current state of various components within the cement factory, impacting the complex in terms of execution technique and architectural form. Furthermore, Figure 3 illustrates the condition of the silo s located on the north side of the factory, while Figure 4 provides the plan detailing the current state of the e ntire factory.

Fig 2. Current state of various components within the cement factory

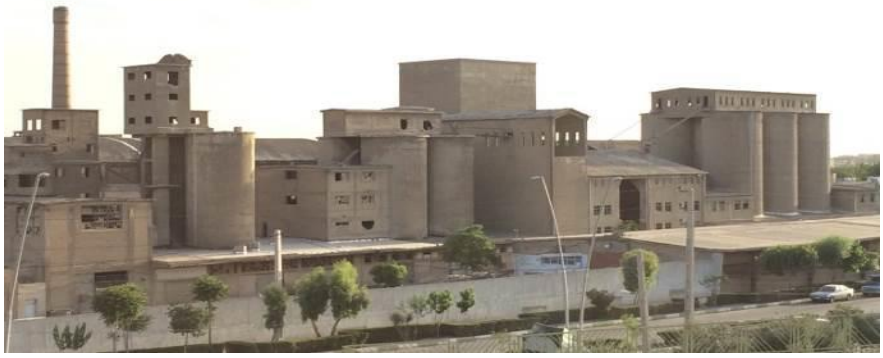

Fig 3. Silos located on the north side of the factory

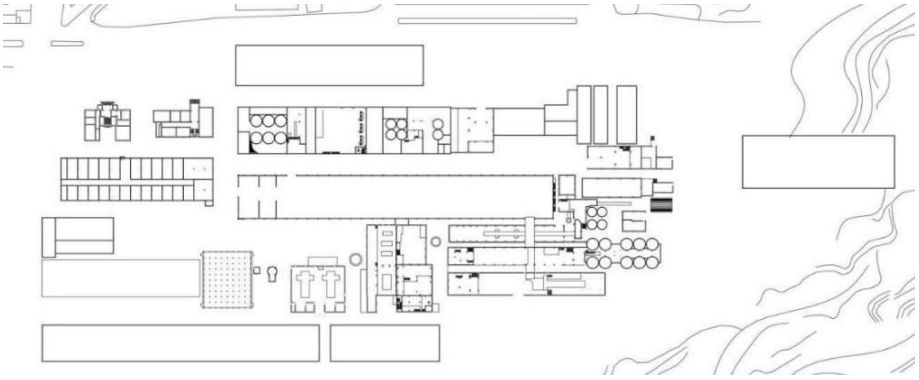

Fig 4. Plan detailing the current state of the entire factory

Results

The pathology of the desired building can be attributed to two major damages: improper management and inherent erosion of materials. The lack of proper maintenance and abandonment of the building is the biggest disturbing factor, as it has valuable and exquisite equipment that rusts over time. The building's disappearance over time is due to the lack of proper insulation and attention to underground conditions. The rehabilitation department is the most important treatment plan for the building's damage, as leaving it abandoned will worsen the damage. A design program aimed at returning the building to life and regaining its soul is one of the design programs that will help restore the damaged parts of the building. Table 1 shows design strategies and solutions. Also, Figures 5 and 6 show the complex from a bird's eye view, respectively, and Figures 7 and 8 show the eastern and northern views of the complex, respectively.

Table 1. Design strategies and solutions.

System	Strategy	Solutions
Physical and Spatial Structure	1. Preserving the inherent authenticity and reinforcing the sense of place 2. Restoring the identity of the complex as the first cement factory in Iran 3. Preserving the existing values in the factory and emphasizing unique and distinctive values 4. Providing cultural, recreational, and tourist functions for the structure 5. Transforming the factory into a cultural space (e.g., museum,	1. Organizing the entrances of the complex to attract audiences 2. Engaging audiences in protection, conservation, and project management 3. Organizing the northern and southern facades of the factory 4. Utilizing the potential of the location on the historical axis of Rey city 5. Considering appropriate protection for equipment within the factory

	gallery) 6. Increasing the permeability of the complex and establishing a deep connection with the audience	
Management	1. Developing a management plan for the preservation and revitalization of the complex 2. Involving local residents in protection, conservation, and project management 3. Organizing Street facades 4. Refining and organizing the factory spaces according to the project's usage	1. Utilizing relevant experts in the field of conservation and restoration of the factory 2. Involving public participation and engaging student groups
Performance	1. Considering cultural uses such as museums, exhibitions, and galleries for the complex 2. Reviving some industrial functions of the complex, like cement production 3. Creating vibrancy and dynamism in the cement factory and the affected areas 4. Treating the factory as an urban space and enhancing its functional scale beyond a single building	1. Considering usages aligned with the production process of the factory's products 2. Designing service and welfare facilities for tourists
Economic	1. Achieving economic and social returns from the complex 2. Encouraging and attracting investors to leverage the potentials of the cement complex 3. Involving the local community in participating in the complex's exhibitions 4. Utilizing the complex for business activities throughout day and night 5. Strengthening the presence of tourists and allocating suitable functions based on their economic needs	1. Creating employment opportunities in the factory for local residents to improve the economic level and cultural ties 2. Involving the community in enhancing the economic position of the complex through participation in activities 3. Encouraging and attracting investors to seize economic opportunities within the complex 4. Diverse and appropriate nighttime activities
Social and Cultural	1. Organizing art festivals and creating a space for creative industries 2. Reviving historical memories 3. Attracting both general and specific audiences to the complex 4. Reviving collective memories 5. Increasing public participation 30. Establishing a sense of belonging 6. Catering to the leisure time	1. Providing education and increasing public awareness for establishing connections with the industrial complex 2. Familiarizing the audience with the industrial era and Iran's industrial history through showcasing the production process and an industrial museum 3. Maximizing participation of public institutions in protection and project utilization 4. Designing the factory entrance space as a place for

	of people	leisure
Form and Landscape	1. Organizing the visual appearance of the site based on the planned functions 2. Organizing the northern and southern facades 3. Creating suitable landscaping within the complex 4. Providing and designing protective elements for the equipment in the factory	1. Collecting inappropriate attachments in different periods 2. Designing landscapes between buildings
Tourism	1. Introducing the rightful authenticity and identity of the first cement factory 2. Attracting tourists and visitors 3. Elevating the economic level of the complex 4. Creating continuous cultural programs to enhance the quality of visits	1. Creating suitable conditions to attract tourists 2. Encouraging private sector investment at various levels of tourism, including modern tourism technologies 3. Considering service and welfare facilities for tourists 4. Defining the entrance of the complex and designing tourist routes for the historical axis of Rey city
Accessibility	1. Defining suitable entrances for the complex 2. Implementing approved detailed plans, including the proposal for a 16-meter-wide street on the eastern side of the site	1. Prohibiting vehicle traffic within the complex 2. Designing tourist routes considering the extensive site area
Utilities, Facilities, and Urban Services	1. Encouraging private sector investment to supply equipment and services within the site 2. Ensuring the security of the complex 3. Organizing equipment within the premises 4. Facilitating traffic on the eastern side of the site	1. Organizing lighting in the premises 2. Organizing equipment and furniture 3. Ensuring appropriate protection for equipment within the site 4. Considering parking facilities for the complex

Fig 5. Complex from a bird's eye view

Fig 6. Complex from a bird's eye view

Fig 7. eastern views of the complex

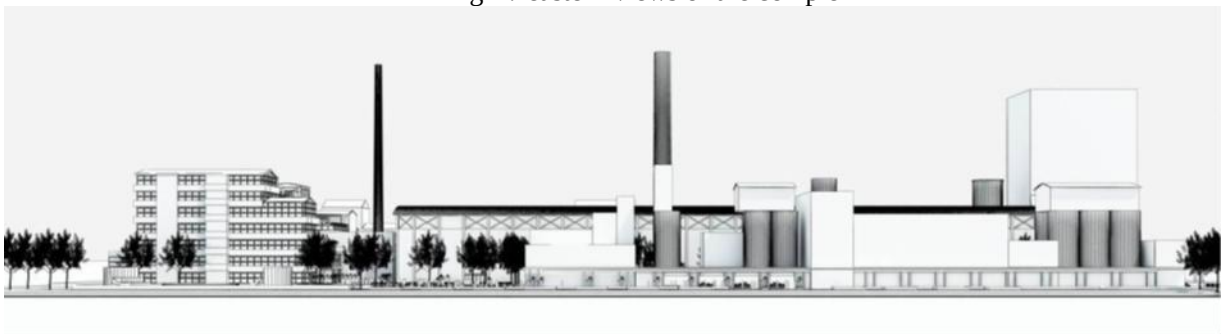

Fig 8. northern views of the complex

Conclusion

The findings of this study have underscored the pivotal role of activity in infusing spaces with vibrancy and significance. The dynamic interplay between the physical structure and the narratives they house becomes truly revitalized through engaging activities that draw in the community. Conversely, neglecting this aspect can pose a potential threat to the very essence of a place. In light of these insights, the results and proposed solutions unveiled in this study emerge as a guiding light towards fostering green adaptive reuse practices. These approaches not only hold the promise of breathing new life into spaces but also stand as catalysts for fostering comprehensive sustainability. By harmonizing the tenets of green design with the intricate tapestry of contemporary and industrial architectural heritage, a symbiotic relationship is nurtured one that nurtures both the past and the present.

References

Gül K, Gül M. The role of industry museums in promoting industrial heritage tourism. InHeritage Tourism Beyond Borders and Civilizations: Proceedings of the Tourism Outlook Conference 2018 2020 (pp. 139-146). Springer Singapore.

Nikolić M, Drobnjak B, Kuletin Ćulafić I. The possibilities of preservation, regeneration and presentation of industrial heritage: The case of Old Mint "AD" on Belgrade Riverfront. Sustainability. 2020 Jun 29;12(13):5264.

Talampas SI, Shrestha S, Mohanasundaram S, Loc HH. Development of a watershed health assessment framework integrating ecological, social, cultural, economic and policy attributes. International Journal of River Basin Management. 2023 Aug 8:1-5.

Tsai Y, Dewancker BJ, Ardhyanto A. Urban-Rural Revitalization Space for Sustainable Social Value: An Evaluation in Redesigning Built Environment in Taiwan. Land. 2023 Mar 7;12(3):634.

Gahura O, Hierro-Yap C, Zíková A. Redesigned and reversed: Architectural and functional oddities of the trypanosomal ATP synthase. Parasitology. 2021 Sep;148(10):1151-60.

Gospodini A, Manika S. Conceptualising'Smart'and'Green'Public Open Spaces; Investigating Redesign Patterns for Greek Cities. Civil Engineering and Architecture. 2020;8(3):371-8.

Fatima Z, Pollmer U, Santala SS, Kontu K, Ticklen M. Citizens and positive energy districts: are Espoo and Leipzig ready for PEDs?. Buildings. 2021 Mar 6;11(3):102.

Wong L. Adaptive Reuse in Architecture: A Typological Index. Birkhäuser; 2023 May 8.

Trovato MR. An axiology of residual green urban areas. Environments. 2021 Jun 4;8(6):53.

Foster G, Saleh R. The adaptive reuse of cultural heritage in European circular city plans: A systematic review. Sustainability. 2021 Mar 7;13(5):2889.

Waterton E, Smith L. There is no such thing as heritage. Taking archaeology out of heritage. 2009:10-27.

Dell'Ovo M, Dell'Anna F, Simonelli R, Sdino L. Enhancing the cultural heritage through adaptive reuse. A multicriteria approach to evaluate the Castello Visconteo in Cusago (Italy). Sustainability. 2021 Apr 15;13(8):4440.

Thornton G, Franz M, Edwards D, Pahlen G, Nathanail P. The challenge of sustainability: incentives for brownfield regeneration in Europe. Environmental science & policy. 2007 Apr 1;10(2):116-34.

Throsby D. Sustainability in the conservation of the built environment: an economist's perspective. Managing Change: Sustainable Approaches to the Conservation of the Built Environment; Teutonico, JM, Matero, FF, Eds. 2003:3-10.

Belhassen Y, Caton K, Stewart WP. The search for authenticity in the pilgrim experience. Annals of tourism research. 2008 Jul 1;35(3):668-89.

Varisco DM. Lost Maps of the Caliphs: Drawing the World in Eleventh-Century Cairo by Yossef Rapoport and Emilie Savage-Smith. Peregrinations: Journal of Medieval Art and Architecture. 2020;7(2):162-6.