

Determining the standard requirements for sustainable conservation of Iran's industrial architectural heritage with an emphasis on controlling the mutual effects of architecture and the environment on each other

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Abstract:

This article examines the standard requirements for the conservation of Iran's industrial architectural heritage and emphasizes the importance of controlling the interactions between architecture and the environment. Industrial heritage, which includes buildings and facilities related to the industrial era, is a valuable part of the country's cultural history. However, the lack of specific principles and regulations for the conservation of these sites has led to serious damage and destruction of both the heritage and the surrounding environment. The research method of this study is applied in purpose and descriptive-analytical in nature. A questionnaire was designed and distributed among 384 architects who are members of the Tehran Engineering System Organization, followed by statistical analysis. Additionally, existing data and documents regarding industrial heritage and global experiences in this field were reviewed and analyzed. Furthermore, the challenges and obstacles in conserving this heritage have been thoroughly examined. The main innovation of this research lies in identifying the need to formulate new principles and regulations for the revitalization of industrial architectural heritage. Based on the results obtained, it is suggested that a legal and standard framework for managing and conserving these sites be established. This framework could include strategies for coordination between architecture and the environment to prevent the destruction and damage to industrial buildings and the environment. The findings of this research could assist policymakers, architects, and urban managers in taking effective actions for the preservation and maintenance of industrial heritage by better understanding the interactions between architecture and the environment. Ultimately, this article emphasizes the importance of creating a comprehensive and integrated approach to protect industrial architectural heritage and their environments, aiming to raise public awareness in this area.

Keywords: Industrial architectural heritage; Standardization; Sustainable architecture and environment; Khosravi leather factory of Tabriz; Conservation and revitalization of Iran's industrial heritage

1. Introduction

The industrial revolution, which began in the late 19th century, transformed societies and introduced the concept of "industrial heritage" (Jacob, 1997). The destruction of these structures in England highlighted the necessity of preserving and addressing environmental issues. With its rich background, Iran needs to pay attention to this heritage (Pahlevanzadeh and Pahlavanzadeh, 2013). Iranian industrial architecture modernized during the first Pahlavi era, yet

its value recognition remained limited (Khani and Hanachi, 2021). Protecting this heritage goes beyond identity; it opens a window to understanding development, social, cultural, and environmental values. After the revolution, the evolution of industrial architecture in Iran slowed (Pahlevanzadeh and Pahlavanzadeh, 2013). Standard requirements for sustainable protection must include environmental impact assessments. The absence of specific standards in Iran (Fataei and Sheikh Jabbari, 2005) and neglect of environmental issues can have disastrous effects. Revitalizing

these structures for cultural and social uses can contribute to identity preservation and sustainable urban development (Abbaszadeh and Parvin, 2024). The lack of clearly defined standards harms both the environment and heritage. Industrial heritage is an interdisciplinary field (Sardari et al., 2023). Activating restoration workshops promotes social participation (Sharifzadegan and Nouraei, 2015). The revitalization of this heritage with contemporary uses and the establishment of a national standard is essential. Industrialization is part of collective memory (Mosallanejad and Moztarzadeh, 2018). The revitalization of industrial buildings can create prominent historical-cultural and environmental spaces.

The first movements for the protection of these treasures began after World War II (Jacob, 1997). Michael Rix's coining of the term "industrial archaeology" in 1955 highlighted the necessity of addressing these structures (Esmaili Jaloudar et al., 2015). The establishment of the Society for Industrial Archaeology in Britain and the International Congress for the Protection of Industrial Heritage (FICIM) were significant steps. The establishment of the "International Committee for the Protection of Industrial Heritage" (TICCIH) in 1978 was a major advancement (Abbaszadeh and Mirzaei, 2013). Projects like the Lowell National Historical Park in the USA and the design competition for the Parc de La Villette in Paris are notable examples (Farahmand, 2011). Collaboration between ICOMOS and TICCIH and the presentation of the "Nizhny Tagil Charter" in Russia in 2003 was a turning point (Habibi and Maqsudi, 2007).

The establishment of the ARIH Council and South Korea's protective policies in 2007 demonstrated the commitment of Asian countries (Jacob, 1997).

The "Madrid Document" (2011), "Dublin Principles" (2011), and "Taipei Statement" (2012) also emphasized the importance of industrial heritage (Abbaszadeh and Parvin, 2024). The revitalization of the Tabriz leather factory and Zanjan match factory as Iran's first industrial museum took place (Aynechi and Ghasemi, 2015).

The holding of the Bam Congress (2006) and the formation of the Iranian Industrial Heritage Committee at the University of Tehran under TICCIH, along with the International Conference on the Protection of 20th Century Heritage (2019), indicates a growing attention to these areas in Iran.

2. Materials and methods

2.1 Study area

Iran is a country located in Southwest Asia, in the Middle East region. With an area of about 1,648,195 square kilometers, it ranks as the eighteenth largest country in the world. A significant portion of Iran consists of arid and semi-arid regions, although there is considerable climatic diversity throughout the country.

The average annual rainfall in Iran is approximately 250 millimeters, with a highly uneven distribution, ranging from less than 50 millimeters in desert areas to over 2000 millimeters along the Caspian Sea coast. The average elevation of Iran above sea level is about 1200 meters.

The country is surrounded by numerous mountain ranges, the most significant of which are the Alborz Mountains in

the north (with Mount Damavand, at 5,610 meters, as the highest point in the country) and the Zagros Mountains in the west and southwest (Rahimi and Ahmadi, 2014).

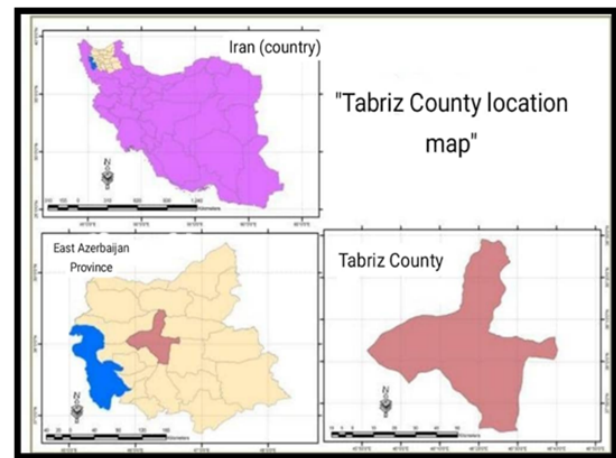


Figure 1. Location of the study area Tabriz country, Iran, Source: (Rahimi and Ahmadi, 2014).

This mountainous structure has a significant impact on the country's climatic patterns and water resources. The Azerbaijan region of Iran is located in the northwest of the country and includes three provinces: East Azerbaijan, West Azerbaijan, and Ardabil. This research focuses primarily on Iran as a whole, and specifically on East Azerbaijan Province and its capital, Tabriz (Fig. 1). With an area of approximately 45,650 square kilometers, this province is one of the important and populous regions in northwest Iran. Due to its geographical location and mountainous terrain, the province experiences a predominantly cold mountainous and temperate mountainous climate (Fig. 2).

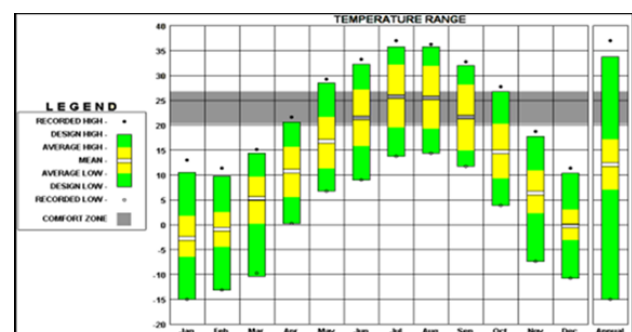


Figure 2. Monthly and annual temperature fluctuation range of Tabriz city. Source: (Rahimi and Ahmadi, 2014).

The average annual rainfall in this province varies between 250 and 400 millimeters, with most precipitation occurring in the cold seasons and spring. Tabriz, as the capital of East Azerbaijan Province and one of the historical, cultural, and industrial hubs of Iran, is the location of the Khosravi Leather Factory, which serves as the case study for this research. Its average annual temperature is approximately 12.5 degrees Celsius, and the average annual rainfall is about 285 millimeters (Fig. 3, Fig. 4).

The geographical and climatic position of Tabriz, along with its rich industrial background, makes the city a suitable

context for studying the challenges and opportunities of preserving industrial heritage with an environmental approach. The Khosravi Leather Factory, as one of the symbols of the leather industry in Iran and Tabriz, is a notable example of this heritage that requires careful attention and planning for sustainable preservation and revitalization (Rahimi and Ahmadi, 2014).

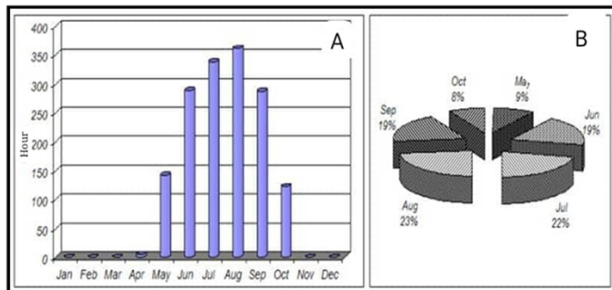


Figure 3. Graph A: Seasonal distribution of hours, Graph B: Seasonal ratio of hourly distribution of the climatic comfort of Tabriz city. Source: (Rahimi and Ahmadi, 2014).

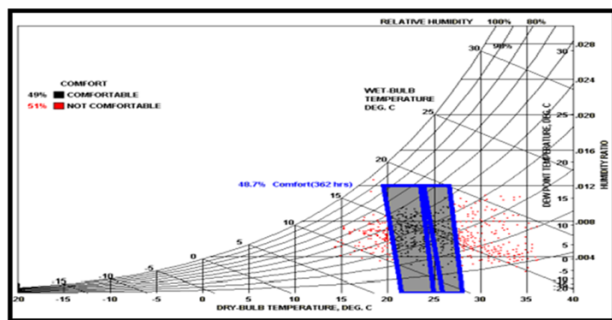


Figure 4. Psychrometric chart of long-term average climatic comfort hours of Tabriz in the summer quarter. Source: (Rahimi and Ahmadi, 2014).

2.2 Definition of industrial heritage

Industrial heritage includes buildings, facilities, and equipment associated with industrial processes that have been created throughout history, reflecting the various stages of a community's industrial development. This heritage comprises factories, mills, mines, and other industrial structures that hold historical and cultural value and can be utilized as resources for sustainable development and environmental protection.

2.2.1 Importance of preserving industrial heritage and its surrounding environment

The preservation of industrial heritage and its surrounding environment holds multiple significances, which are outlined below:

1. **Resource Reuse:** The restoration and reconstruction of old industrial buildings signify the reuse of existing resources, leading to reduced needs for new construction and decreased consumption of materials and energy.
2. **Air Pollution Reduction:** Restoring and repurposing old industrial buildings for new uses, along with employing modern technologies and renewable energies, can help

reduce pollutant emissions and improve air quality.

3. **Sustainable Tourism Development:** Industrial heritage can serve as tourist attractions, boosting the economic prosperity of regions, leading to job creation and increased local income (Hassanpour Kourandeh and Fataei, 2013).

4. **Education and Awareness:** Protecting industrial heritage can enhance public awareness about the importance of environmental protection and cultural history, changing social behaviors and increasing participation in environmental activities (Hanafi Komaleh and Motamed Chabaki, 2021).

5. **Economic Sustainable Development:** By preserving and restoring industrial buildings, optimal use of existing resources can be achieved, preventing new constructions that are often costly and environmentally damaging.

6. **Strengthening Local Governance and Sense of Place:** The protection and utilization of industrial heritage reveal the history and achievements of communities, transforming them into public spaces that enhance citizens' sense of ownership.

7. **Preventing Environmental Pollution and Creating Industrial Parks:** Converting polluted areas into green and recreational spaces improves the quality of life and environmental conditions in the city, providing models for sustainable industrial development.

8. **Economic Impacts:** Creating new tourist attractions, increasing revenue from tourist entries, boosting local businesses, supporting handicrafts and construction jobs, and fostering investment and creative economies are some of the positive economic impacts of preserving and utilizing industrial heritage (Kharrat Sadeghi, 2021).

2.3 Importance of developing standards for the protection of industrial heritage and the environment

Standards for industrial heritage and the environment refer to a set of principles and guidelines established to protect, preserve, and manage industrial artifacts in alignment with environmental conservation. These standards aid in identifying and assessing the values of industrial heritage and preserving the surrounding environment, serving as a basis for protective, restorative, and environmental actions (Rezaei Ghahroodii and M., 2019).

2.3.1 Features and objectives of these standards

1. **Definition and Identification:** Assisting in the precise definition of industrial heritage and identifying its characteristics and the surrounding environment.
2. **Protection and Maintenance:** Establishing appropriate methods for the protection and maintenance of industrial artifacts and their surrounding habitats.
3. **Assessment and Documentation Aiding** in the assessment and documentation of industrial artifacts while considering environmental risks.
4. **Education and Awareness:** Contributing to education and raising awareness about the importance of industrial heritage and methods for protecting them and their surrounding environment.
5. **Sustainable Development:** Supporting the realization of sustainable development in projects related to industrial heritage and the environment (Rezaei Ghahroodii and M., 2019).

2.3.2 Industrial heritage

Standardization in the field of industrial heritage can be examined from four perspectives:

1. Protection and Maintenance*: Standards help define effective methods for protecting industrial artifacts.
2. Quality and Safety*: Standardization ensures quality and safety in restoration operations.
3. Sustainable Development*: Standards contribute to achieving sustainable development in restoration projects.
4. Facilitating Collaboration*: The existence of standards facilitates collaboration among various entities (Habibi and Maqсуди, 2007).

2.4 Khosravi leather factory in Tabriz

The Khosravi Leather Factory is one of the most renowned leather factories in Tabriz, established in 1931 and operational from 1932. During World War II, it produced not only leather and shoes but also military boots and riding shoes, with some products exported to other countries (Fig. 5 (a)). After years of operation, it was shut down due to financial difficulties and subsequently relocated to Shahid Salimi Industrial Town. Currently, this factory is registered as one of the national heritage sites of the country (Khani and Hanachi, 2021).

2.4.1 Restoration and revitalization plan for Khosravi leather factory in Tabriz

After the relocation of the factory's equipment outside Tabriz, the site was designated for the establishment of the Islamic Art University (Fig. 5 (b)). Since 1997, restoration and reconstruction of the campus have been underway, with dilapidated buildings being repurposed. The remaining turbines and generators in the factory's facilities have been restored and will be used as an industrial museum (Khani and Hanachi, 2021).

The absence of a comprehensive and sustainable standard that controls and guides all aspects of restoration and revitalization has left restorers, architects, and researchers confused, highlighting a strong need for the country to establish a sustainable preservation standard for industrial heritage and its surrounding environment.

2.5 Sustainable Conservation of industrial heritage with environmental requirements

The preservation of industrial heritage requires sustainable approaches that aid in the maintenance of this heritage alongside the protection of its surrounding environment. The use of green and environmental technologies, community education and awareness, the development of supportive policies, sustainable tourism development, and collaboration among governmental, private, and civil society entities are key aspects of this issue (Yazdi et al., 2019).

2.6 Requirements related to managing the interactions between architecture and the environment

Sustainable design, the use of compatible building materials, water management, and waste reduction are among the requirements related to managing the interactions between architecture and the environment (Dashtbali, 2019).



Figure 5. (a) Image of Khosravi Leather Factory in Tabriz. Source: (Khani and Hanachi, 2021); (b) Image of Khosravi Leather Factory in Tabriz. Source: (Khani and Hanachi, 2021)

2.7 Management of past pollution in industrial heritage

Identifying pollution sources, assessing damage, utilizing modern technologies, restoration and preservation, education and awareness-raising, and developing supportive policies are key aspects of managing past pollution in industrial heritage (Hanachi and Farahani, 2023).

2.8 Use of sustainable materials in industrial heritage

Selecting local materials, reusing materials, and employing green technologies are key aspects of using sustainable materials in industrial heritage (Yazdi et al., 2019).

2.9 Destructive effects of industrial heritage on the environment

Air pollution, water pollution, soil contamination, habitat destruction, and impacts on human health are among the destructive effects of industrial heritage on the environment (Masnavi et al., 2012).

3. Results and discussion

Sustainable preservation of Iran's industrial architectural heritage, particularly in controlling the interactions between architecture and the environment, requires the formulation of standard requirements that pay attention to specific principles in the restoration of industrial buildings. The restoration and revitalization plan for the Khusro Leather Factory in Tabriz, as a prominent example, can serve as a successful model in this regard.

This plan should be designed based on the principles of preserving and restoring industrial buildings in Iran,

respecting cultural and environmental needs. Preserving industrial heritage not only helps maintain cultural identity but can also play a significant role in sustainable development and environmental protection. To this end, a questionnaire was designed and distributed among 384 architect members of the Tehran Engineering System Organization.

This questionnaire included a question regarding the importance of using sustainable and environmentally friendly materials in the protection and revitalization of industrial heritage. According to Fig. 6, out of 384 architects, 192 (50%) voted for the “very high” option, and 137 (35.7%) voted for the “high” option, indicating the high importance of this issue (Fig. 6).

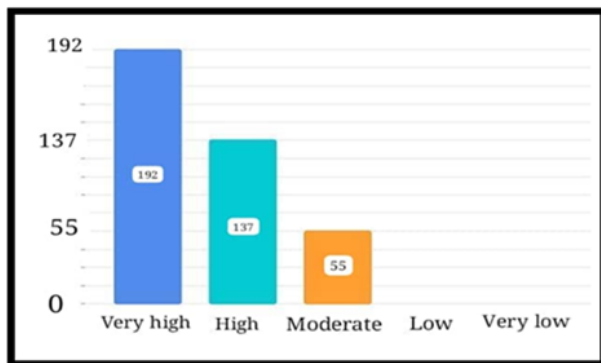


Figure 6. Frequency distribution of respondents regarding the question of the importance of using sustainable and environmentally friendly materials in the protection and revitalization of industrial heritage.

Furthermore, another noteworthy point is the clear misalignment of Iran’s national guidelines and standards for the restoration and revitalization of industrial buildings with globally accepted criteria. This issue, as also reflected in Table 7, is considered a fundamental weakness from the perspective of all research participants. By assigning low scores to this section, they have confirmed the non-conformity of Iran’s standards and principles for the protection and revitalization of industrial heritage with global models. More precisely, 33.58% of respondents chose “very low,” 36.98% chose “low,” and 18.49% chose “medium.” These results clearly indicate the necessity of designing and developing regulations, principles, and standards in Iran that, while aligning with international measures, also address the country’s domestic needs in this field (Table 1).

Undoubtedly, the utilization of modern technologies and their adaptation to local conditions, especially in non-invasive and sustainable restoration approaches, plays a key role in preserving historical buildings and minimizing adverse environmental consequences.

In this regard, implementing industrial heritage restoration projects by relying on synergy and the participation of experts from various fields such as architecture, engineering, environmental sciences, and art can lead to the formation of constructive and effective collaborations.

Table 1. Table of frequency distribution and percentage of respondents regarding the question of the extent to which Iran’s national guidelines and standards for the restoration and revitalization of industrial buildings align with global standards.

Frequency percentage	Response frequency	Option
7.3%	28	Very High
3.65%	14	High
18.49%	71	Moderate
36.98%	142	Low
33.58%	129	Very Low
100%	384	Total

To assess and evaluate the effectiveness of existing regulations in this area, a question was posed in the present study. The findings from this question, depicted in Fig. 7, reflect the respondents’ views. Accordingly, only 28 participants selected the “very low” option and 43 chose the “low” option regarding the inefficiency of current regulations.

In contrast, the other 313 individuals, by selecting “medium,” “high,” and “very high,” confirmed the inefficiency of these rules and standards. These results clearly reveal the necessity of revision, prioritizing collaborative and multifaceted projects, as well as developing new and effective laws, standards, and guidelines in this field (Fig. 7).

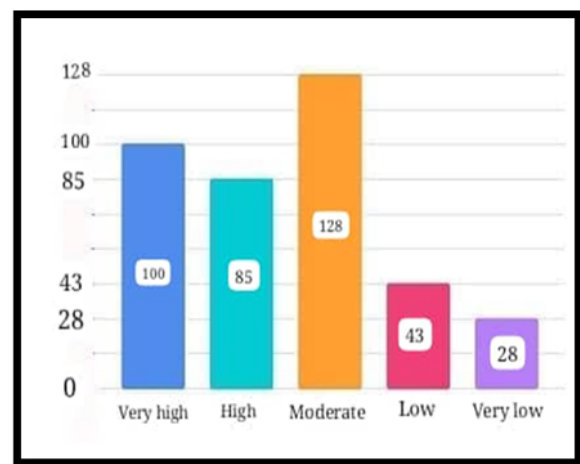


Figure 7. Frequency distribution of respondents regarding the question measuring the extent of inefficiency of Iranian regulations, laws, and standards for utilizing participatory and multi-faceted projects.

Additionally, planning and monitoring international collaboration projects contribute to the exchange of global knowledge and experiences in the field of industrial heritage restoration, leading to sustainable development in this area. In the statistical analysis conducted on the importance of such planning, monitoring, and exchange of global knowledge and experiences, the results presented in Table 2 show that 32.55% voted for the “very high” option, 53.4% for the “high” option, and 9.37% for the “medium” option. Only 4.68%

of the respondents chose the “low” and “very low” options, indicating our need for this type of planning, monitoring, and international exchanges (Table 2).

Table 2. Frequency and percentage distribution table of respondents regarding the question about the importance of planning and monitoring international projects and the exchange of global knowledge and experiences in the field of industrial heritage.

Frequency percentage	Response frequency	Option
32.55%	125	Very High
53.4%	205	High
9.37%	36	Moderate
4.68%	18	Low
0%	0	Very Low
100%	384	Total

Transforming this heritage into cultural and innovation centers, creating specialized institutions, and conducting sociological and economic analyses of these industrial artifacts are among the effective strategies in this area. These efforts can significantly contribute to the preservation of these buildings.

Therefore, a question was raised in this domain where 206 people voted for the “very high” option, 110 for the “high” option, and 41 for the “medium” option. Only 27 people voted for the “low” and “very low” options, which meaningfully emphasizes the importance of revitalizing industrial heritage and transforming it into cultural and innovation centers (Fig. 8).

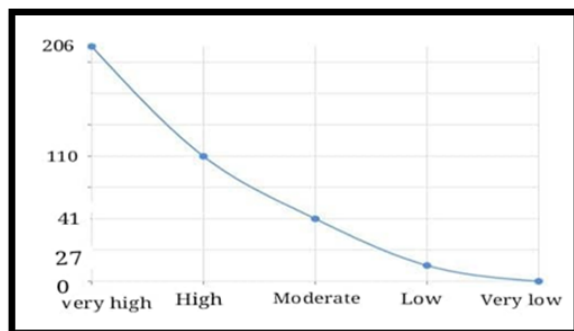


Figure 8. Frequency distribution chart of respondents to the question about the importance of revitalizing industrial heritage and transforming them into cultural and innovation centers.

It is worth mentioning that modeling environmental impacts and using advanced and digital technologies in the restoration of industrial heritage can help improve the quality of their protection and revitalization.

In a question designed and distributed concerning this matter, the results shown in Fig. 9 indicate that 57% voted for the “very high” option, 29% for the “high” option, and 14% for the “medium” option, highlighting the importance of modeling environmental impacts and utilizing advanced technologies.

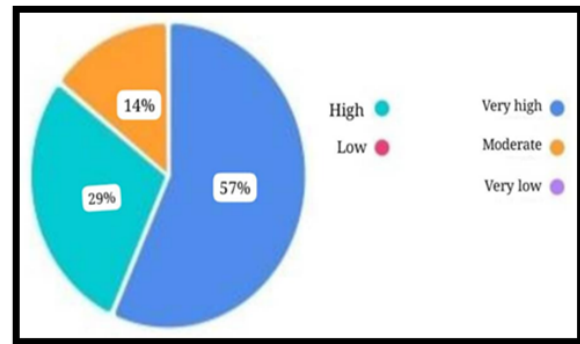


Figure 9. percentage frequency chart of respondents to the question about the importance of modeling environmental impacts and using advanced and digital technologies in industrial heritage restoration.

3.1 Restoration of industrial buildings in Iran and their surrounding environment

3.1.1 General principles of restoration and revitalization of industrial heritage with environmental requirements

1. Authenticity and Integrity:

- Historical Authenticity: Restoration should focus on preserving the structural, aesthetic, and decorative characteristics of buildings.
- Cultural Integrity: Cultural and social values must be considered in the restoration process.
- Preservation of Place and Social Identity: Changes should not erase the historical identity of the buildings.
- Environmental Preservation: Changes should not harm the environment, and if there are previous damages, special attention should be given to their improvement and organization.

2. Respect for Cultural and Environmental Context:

- Restoration must align with the cultural and environmental context, preserving the cultural fabric.

3. Use of Modern Technologies:

- Employing digital technologies and 3D scanning for documentation and simulation of buildings and their environments.

4. Localization of Technologies and Restoration Methods:

- Adapting modern technologies to local materials and training the local workforce.

5. Non-Invasive Survey and Assessment Techniques:

- Utilizing non-invasive methods to assess the condition of buildings and prevent damage.

6. Sustainable Restoration:

- Using sustainable and recycled materials to reduce environmental impacts and enhance durability.

7. Development of Multiple Uses:

- Transforming buildings into cultural and commercial spaces, creating multifunctional areas, and increasing economic productivity. These principles aid in the effective preservation and restoration of industrial buildings, enhancing public awareness and creating new economic opportunities.

8. Collaborative and Interdisciplinary Projects in the Restoration of Industrial Heritage and Its Surrounding Environment:

- Partnership with international organizations to share experiences and expertise.
- Forming interdisciplinary teams comprising architects, engineers, and the local community.

9. Research and Documentation:

- Conducting comparative research in collaboration with universities to localize international experiences.
- Creating digital and physical archives to document restoration projects and their environments.

10. Restoration and Revitalization Criteria:

- Technical and Structural: Accurate assessment of building conditions and use of non-invasive techniques.
- Cultural and Social: Preserving cultural values and engaging the local community.
- Educational and Awareness-raising: Conducting training courses for specialists and the local community.
- Participation: Engaging the local community and organizations in the restoration process.
- Economic and Managerial: Developing management plans and securing financial support.

11. Practical Suggestions for Implementing Principles and Criteria:

- Forming specialized committees and multidisciplinary teams for projects.
- Developing educational programs and organizing specialized workshops.
- Creating pilot projects to evaluate and improve restoration methods and environmental preservation.
- Continuous monitoring of restoration projects and collecting feedback.

These approaches help in preserving and revitalizing industrial buildings and environmental conditions, leading to enhanced social participation and public awareness.

3.2 Creating guidelines and standards for the restoration of industrial buildings in Iran and their surrounding environment

1. Lack of Standards in Iran:

- The main problems in the restoration of industrial buildings stem from the absence of comprehensive and specific standards.

2. National Guidelines:

- Proposing the creation of national guidelines for the restoration of industrial buildings and their environment in collaboration with specialists and international consultants.
- These guidelines include non-invasive methods, use of local and sustainable materials, and structural assessment.

3. Financial Incentives for Investors:

- Offering financial incentives such as tax exemptions and low-interest loans to encourage investors to participate in restoration projects.
- Proposing the establishment of an industrial heritage support fund to facilitate this process.

4. Cultural and Innovation Centers:

- Transforming industrial buildings into cultural and innovation centers, attracting artists and entrepreneurs, and hosting artistic and cultural events.

5. Specialized Institutions:

- Establishing specialized and research institutions to provide technical and scientific consultations and conduct applied research.

6. Sociological and Economic Analysis:

- Conducting social and economic studies to assess the impact of restoration projects on the local community and economy.

7. Environmental Impact Modeling:

- Analyzing the environmental effects of revitalization projects and waste management, aiming to reduce energy consumption and use recycled materials, and preserve the environment of the site and surroundings of this valuable heritage.

8. Advanced and Digital Technologies:

- Using augmented and virtual reality technologies, Building Information Modeling (BIM), and 3D scanning to improve the restoration process.

9. Participatory Models for Community Activity:

- Developing models for the active participation of the local community in the revitalization process and related decision-making.

- These measures will help improve the quality of restoration projects, enhance social participation, and preserve industrial heritage and its environment.

10. Planning and Monitoring International Cooperation Projects and Sustainable Development in the Restoration of Industrial and Environmental Heritage

- The level of cooperation in the restoration of industrial buildings in Iran is low.
- Proposing the expansion of cooperation with international organizations such as UNESCO and ICOMOS for the exchange of knowledge and experience.

11. Sustainable Development Models: (Note: Original numbering was 2. 11.)

- Designing and implementing sustainable development models using local materials and green technologies, considering environmental issues such as the use of traditional bricks and installation of solar panels in restorations.

12. Designing Smart Educational and Cultural Programs:

- Organizing workshops and training courses to increase community awareness about the history of industrial buildings, such as setting up various exhibitions, related museums, and holding educational classes at different levels for various interested groups in society.

13. Financial Plans and Investor Attraction:

- Preparing long-term financial plans and attracting investment from the private and public sectors.
- Creating charitable funds and using online platforms for fundraising.

14. Sustainable Income Models:

- Developing new and updated business models to finance restoration projects through space rentals, ticket sales, and leveraging the capacity of virtual space in this path, as well as attracting different brands for sponsoring restoration and environmental projects.

15. Cooperation with Universities and Research Institutions:

- Establishing joint research projects and organizing seminars and conferences to increase awareness and attract support from academic centers.

These actions will contribute to improving the quality of restoration projects and enhancing social and economic participation in preserving industrial heritage.

3.3 Creative and innovative ideas in industrial heritage

Industrial heritage revitalization projects require coherent strategies and innovative ideas to contribute to the preservation and sustainable development of industrial buildings. These ideas can lead to an increase in tourist attractions and the creation of new economic opportunities.

1. Experience-Oriented Centers: One idea is to create

experience-oriented centers where visitors can interactively learn about industrial history and technologies, and at the same time, fully enjoy the dedicated green space. The advantages of these centers include increased interaction and attraction of younger audiences.

The implementation of this idea includes designing interactive spaces with digital simulators and permanent and temporary exhibitions. Also, collaboration with museums and the use of augmented reality and virtual reality technologies are proposed.

2. Development of Environmental Spaces and Industrial Parks:

The development of environmental spaces and industrial parks at the location of revitalized industrial buildings can enhance the quality of life and bring about improvement in environmental conditions.

Advantages:

- Creating relaxing and sustainable spaces and suitable places for public recreation alongside enhancing community knowledge.

How to implement:

- Creating vertical gardens, green roofs, and public green spaces.

Use of Water Management Systems and Renewable Energy Practical Suggestions for Green Space Development:

- Collaboration with NGOs, municipalities, and organizations such as parks and environmental agencies.
- Use of native and drought-resistant plants in the design of green spaces.

Innovation Factories

- Conversion of industrial buildings into innovation centers, including labs, co-working spaces, and educational facilities.

- Benefits: Attracting investors, promoting innovation, and economic development.

- Implementation: Providing co-working spaces with high-speed internet, creating specialized labs, and organizing training courses.

- Suggestions: Collaborating with universities and providing financial incentives to startups.

- Examples: Converting the Tehran Wagon Factory into an innovation center for rail transportation.

Artistic and Cultural Projects

- Utilizing industrial spaces for sculptures and various exhibitions.

- Benefits: Enhancing cultural significance and attractiveness for visitors.

- Implementation: Organizing exhibitions, inviting artists, and creating galleries.

- Suggestions: Collaborating with artists and establishing residency programs.

- Examples: Transforming the Argo Factory into an art gallery.

Social Rehabilitation Center

- Converting industrial buildings into social and educational centers.

- Benefits: Providing educational opportunities and strengthening social connections.

- Implementation: Establishing counseling and vocational

training centers.

- Suggestions: Partnering with social organizations.
 - Examples: Converting the Qaemshahr Textile Factory into a vocational training center.
- Industrial Tourism
- Creating industrial tours to visit renovated buildings.
 - Benefits: Attracting tourists and raising awareness of industrial heritage.
 - Implementation: Designing tourist routes and organizing special events.
 - Suggestions: Collaborating with tourism agencies.
 - Examples: Creating an industrial tourism route in Tehran.

4. Conclusion

Establishing principles and criteria for the sustainable preservation and restoration of industrial heritage (standardization) and the surrounding environment, considering global experiences and the specific conditions of Iran, can enhance the quality and efficiency of restoration projects and their environmental protection. Utilizing modern technologies, developing multi-functional uses, engaging community participation, and creating supportive standards and policies are key components in the restoration and revitalization of industrial heritage with an environmental perspective in Iran. By adapting global innovations to local conditions, industrial heritage and its surrounding environment can be effectively preserved and revitalized, achieving sustainable environmental and cultural development. This framework should align with local needs and the unique characteristics of industrial buildings and environmental conditions in each region of Iran, ensuring not only the preservation of their historical, cultural, and environmental values but also the creation of new economic and social opportunities. This process can transform buildings and sites into cultural, educational centers, while maintaining their original historical and environmental features. The approach to preserving cultural wealth and industrial architectural heritage should integrate cultural, historical, environmental, social, and economic values with contemporary needs, allowing for reuse and dynamism of these buildings. Thus, Iran can effectively protect and restore its industrial heritage, dynamically and sustainably preserving it as part of the national and global cultural wealth.

Acknowledgment

The following article is a research study extracted from a PhD dissertation currently being written by Payvand Amir Borbor entitled Principles and standards preparation for conservation, restoration and revitalization of industrial sites, building and architecture with the approach of preservation and conversation of cultural wealth and Iran industrial architectural heritage from its appearance till Islamic revolution; at Islamic Azad University, Arak Branch, under the supervision and guidance of Dr. Afshin Ghorbani Param.

Future studies

- Emphasizing the link between industrial heritage and sustainable development.
- Focusing on community-centered conservation and revival.
- Aligning standards with Iran's cultural, economic, and environmental needs.
- Utilizing modern technologies in documentation and restoration.

Authors contributions

Payvand Amir Borbor: Analyzed the data, prepared figures and tables, authored or revised drafts of the paper. Afshin Ghorbani Param: Proposed the plan, and approved the final draft and Analyzed the data.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interests

The author declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- Abbaszadeh M., Mirzaei E. (2013) Revising the Regulations for the Protection of Historical Sites, An Effort to Achieve Sustainable Protection and Development in Urban Historical Textures. National Conference on Sustainable Architecture and Urban Development. Tehran, Iran. <https://civilica.com/doc/214164>
- Abbaszadeh M., Parvin R. (2024) Analysis of indices susceptible to the CPTED approach in urban spaces (case study: lands east of the historical Bazaar of Urmia). *Journal of Sustainable Urban & Regional Development Studies (JSURDS)* 5 (3): 98–112.
- Aynechi Sh., Ghasemi (2015) Protection of Iran's Contemporary Industrial Heritage and Explanation of Intervention Strategies with a Special Look at Tehran's Contemporary Factory Complex. *The International Conference on Human, Architecture Civil Engineering and City (ICOHACC 2015)*, Tabriz, <https://civilica.com/doc/410210>
- Dashtbali R. (2019) The Interplay of Architecture and Urbanism and Its Role in Sustainable Development and the Environment. *First National Conference on Healthy Environment and Sustainable Development in Light of Citizen Rights: Challenges and Strategies*, <https://civilica.com/doc/1147255>
- Esmaili Jaloudar M.-I., Pourian Oli A., Mortazai M. (2015) Industrial System Archaeology: An Approach to Explain the Interaction between Humans and Nature in the City (Case Study: Rey Cement Factory in Tehran) *Iranian Anthropological Studies* 5 (2): 330–313. DOI: <https://doi.org/10.22037/ias.v5i2.11469>.
- Farahmand E. (2011) Post-industrial landscape, the new arena of landscape architecture/A review of ideas and approaches. *Landscape* 16:1–4. <https://ensani.ir/file/download/article/20130417134737-9808-301>
- Fataei E., Sheikh Jabbari H. (2005) Study of Environmental Impact of the 2nd Industrial Township in Ardabil. *Advanced Environmental Sciences(in persian)* 2:29–44. <https://envs.sbu.ac.ir/article-96924.html>

- Habibi M., Maqsudi M. (2007) Urban Restoration: Definitions, Theories, Experiences, Charters, and Global Resolutions, Methods and Urban Actions (3rd ed). University of Tehran Press
DOI: <https://doi.org/10.7456/1080MSE/134>.
- Hanachi M. H. P. Khademzadeh, Farahani H. (2023) The relationship between authenticity and integrity in the restoration of architectural heritage *Iranian Architectural Studies* 23:215–229.
DOI: <https://doi.org/10.22052/jias.2023.252972.1207>.
- Hanafi Komaleh M., Motamed Chabaki H. (2021) Studying the concept of industrial heritage, values and the importance of their protection. *8th Scientific Research Conference on Development and Promotion of Architectural and Urban Sciences in Iran, Tehran*, <https://civilica.com/doc/1431022>
- Hassanpour Kourandeh H., Fataei E. (2013) Estimation of tourism carrying capacity of Fandoqloo Forest in Ardebil Province, Iran. *Bulletin of Environment, Pharmacology and Life Sciences* 2:64–70. <http://Users/fatayi/%20dr/Downloads/10>
- Jacob M.C. (1997) Scientific Culture and the Making of the Industrial West. Oxford University Press
- Khani Sh., Hanachi P. (2021) Rereading and analyzing values in industrial heritage protection; Case study of Shahr-e Ray Cement Factory. *Iranian Restoration and Architecture* 28 (11): 32–19. [10.52547/mmi.1553.14000220](https://doi.org/10.52547/mmi.1553.14000220)
- Kharrat Sadeghi M. (2021) A presentation of SWOT strategies for the sustainable tourism development on the Caspian Sea coast of Gilan province Iran. *Anthropogenic Pollution* 5 [10.22034/ap.2021.1934536.1112](https://doi.org/10.22034/ap.2021.1934536.1112)
- Masnavi M. R., Gholampour S., Seyyed N. (2012) Examining the Relationship between Environmental Destruction and Industrial Advancements and the Decline of Humanity's Belief in Nature as the Source of Life. *Second Conference on Environmental Planning and Management*
- Mosallanejad A., Moztarzadeh H. (2018) Determine The Principles of Green Space Design Effective on Improving the Quality of Urban Spaces(Case Study: East Side Walkway of Azadi Boulevard, Intermediate Gas Square and Meshkin Fam Street in Shiraz, Iran). *Research and Urban Planning* 9:175–184. <https://sid.ir/paper/220306/en>
- Pahlevanzadeh A.M., Pahlavanzadeh L. (2013) The Heritage of Iranian Industrial Architecture: Isfahan Province Islamic Azad University, Khorasgan Branch <https://www.gisoom.com/book/11133701/>
- Rahimi Y. Ghavidel, Ahmadi M. (2014) Estimation and Temporal Analysis of Climatic Comfort in the City of Tabriz. *Journal of Geography and Development* 11 (33): 173–182.
DOI: <https://doi.org/10.22111/gdij.2013.1330>.
- Rezaei Ghahroodii S., M. Mahdavinejad (2019) Reviewing and Implementing International Valuation Criteria for Industrial Architectural Heritage. *mmi* 9:21–38. <http://mmi.aui.ac.ir/article-1-526-fa.html>
- Sardari M., Zare L., Talaei A., Ghobadiyan V. (2023) Redefining architectural styles during the imposed war in Iran with the approach of identifying traditional buildings (Case study; body of prominent buildings). *JRIA* 11:137–160.
DOI: <https://doi.org/10.52547/jria.11.1.7>.
- Sharifzadegan M., Nouraei H. (2015) Study of Industrial Development and Development in Iran in order to Pathologize Iran's Industrial Development, Economic History Studies of Iran. *JRIA* 4 <https://civilica.com/doc/1355437>
- Yazdi S. Samadzadeh, Ansari M., Bamaniyan M. (2019) Evaluating Compatible Adaptive Reuse on Environmental Sustainability (Case Study: Industrial Heritage of Iran). *Journal: Role of the World*