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Protection Mechanisms and Revitalization Strategies for Industrial Heritage

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ABSTRACT

Industrial heritage is a product of the Industrial Revolution and an important asset for a country or region. The protection and revitalization of industrial heritage have become pressing tasks in the present era. In the new era, it is essential, on the one hand, to establish a comprehensive and scientific policy system for industrial heritage protection by creating specialized protection agencies and ensuring strong governmental support. On the other hand, revitalization strategies should be developed based on practical needs, such as transforming industrial heritage into cultural and art centers, converting it into creative industry parks, and integrating industrial heritage resources into tourism and leisure industries. These strategies aim to ensure the comprehensive protection and sustainable use of industrial heritage.

KEYWORDS

Industrial Heritage; Revitalization and Utilization; Protection; Creative Industry Parks.

1. INTRODUCTION

As a major component of cultural heritage, industrial heritage vividly illustrates the history and context of a city's industrial development, while also embodying the brilliance of human industrial civilization. However, with the rapid growth of the economy and the continuous advancement of urbanization, a large amount of valuable industrial heritage is facing the potential risks of abandonment, demolition, or even destruction. In light of this, establishing an efficient mechanism for industrial heritage protection and actively exploring strategies for its reuse have become urgent tasks for contemporary society. This paper focuses on the issues surrounding the preservation and transformation of industrial heritage. We aim to explore how to ensure the protection of these invaluable industrial assets while transforming them into functional spaces for modern use. Additionally, we propose a series of specific and targeted suggestions and strategies, offering guidance for the protection and revitalization of industrial heritage.

2. BASIC DISCUSSION ON INDUSTRIAL HERITAGE

2.1. Definition of Industrial Heritage

Industrial heritage refers to buildings, facilities, sites, relics, as well as related items and documentary materials left behind during the course of industrial development that hold historical, cultural, and technical value [1]. These primarily include mines, factories, docks, railways, transportation facilities, and related social activities, trade, and technological inventions. Industrial heritage can take the form of both tangible buildings and intangible technologies or knowledge. Therefore, industrial heritage

encompasses both tangible cultural heritage and intangible cultural heritage. While showcasing the industrial development process, industrial heritage also reflects the social systems, production methods, technological advancements, and architectural styles of the time [2]. It carries the memory of the Industrial Revolution, embodies human wisdom and creativity, and holds significant historical, cultural, and economic value.

2.2. Characteristics of Industrial Heritage

As a historical witness to industrial civilization, industrial heritage holds profound significance. It not only reflects technological achievements and production methods but also serves as a true record of social development and evolution. In general, the characteristics of industrial heritage can be summarized as follows:First, industrial heritage has significant historical value and cultural connotations. It bears witness to the progress and transformations of human society, providing valuable information on the economic, social, and cultural aspects of the industrial era. It serves as an essential resource for studying and understanding industrial history and culture [3].Second, industrial heritage is a vital component of industrial culture, fully demonstrating humanity's pursuit of technology and spirit of innovation. It encompasses rich cultural elements, including worker culture, corporate culture, and community culture, all of which contribute to the distinct cultural identity of industrial heritage [4].Moreover, industrial heritage is an important carrier of technological development. It contains a wealth of technical information, including past technological achievements and experiences, as well as humanity’s exploration and innovation in the field of technology. Therefore, the protection and study of industrial heritage help us better understand the trajectory of technological development.At the same time, industrial heritage possesses significant social value. It records people's lifestyles, work habits, and community relationships, offering a unique perspective on observing social development and evolution. Industrial heritage not only serves as a testament to historical culture but also to social development [5].Lastly, industrial heritage holds undeniable economic value. Today, many industrial heritage sites have been developed into tourist attractions, generating substantial tourism revenue for local areas. Additionally, through renovation and reuse, industrial heritage can provide new spaces and opportunities for businesses to grow [6].Therefore, it is essential to fully recognize and appreciate the value of industrial heritage, taking effective measures to protect and utilize it rationally, thus ensuring its sustainable development in terms of historical, cultural, social, and economic aspects.

3. CHALLENGES IN THE REVITALIZATION PLANNING OF URBAN INDUSTRIAL HERITAGE

3.1. Limitations of Traditional Preservation Concepts

Unlike general historical relics, the traditional “freeze-frame” preservation concept and the common practice of "restoration to the original" are not entirely suitable for the transformation of industrial heritage in urban centers. First, in terms of architectural form, special types of industrial buildings (such as water towers, flour mills, hemp factories, shipyards, etc.) tend to be large in scale and have distinctive, often clunky, and unwieldy shapes. Strictly restoring these buildings can hinder their potential for reuse, making it difficult to align or integrate them with the envisioned modern urban functions. Second, in terms of the production nature of industrial heritage, the rapid industrialization period involved extensive production models that caused numerous environmental issues, such as air pollution, wastewater discharge, and soil contamination. The low environmental quality and dilapidated conditions of these buildings make it challenging to meet modern environmental standards if they are renovated according to the "restoration to the original" approach. Third, in terms of protection methods, individual industrial buildings with a long history and unique spatial features are often the primary focus of preservation, while the surrounding industrial building clusters and

environments are frequently neglected. These overlooked areas are sometimes demolished and rebuilt, damaging the original urban fabric and form, as well as erasing the production and living memories they carry. Clearly, protection based on traditional concepts often fails to meet the preservation goals for industrial heritage in urban centers, leading to "preservation through destruction."

3.2. Imbalance in Functional Configuration and Location Value

In traditional planning, the positioning of industrial zones primarily focuses on production functions, resulting in a weak connection to the functions of urban centers. As urbanization rapidly progresses, industrial areas located in the suburbs have gradually been surrounded by other development lands due to urban expansion, effectively merging into urban centers. According to the theory of differential land rent in the land market [7], land rents are higher the closer one gets to the urban center, which generally leads to the concentration of tertiary industries and high-value-added emerging industries in urban centers. However, while industrial heritage located in urban centers enjoys clear locational advantages, it tends to have lower land rents and lower output efficiency. The prolonged abandonment or idling of these areas, or their renovation that maintains old functional characteristics, contradicts the principles of differential land rent theory, resulting in a disconnection between functional structure and land value, as well as significant waste of their utilization potential [8].

3.3. Difficulty in Coordinating Renovation and Reuse Models

Current practices in the renovation and reuse of industrial heritage feature various models, including cultural and creative industry parks, integrated commercial developments, industrial landscape parks, and museums. Simply applying these renovation models to industrial heritage in urban centers often fails to achieve the desired outcomes. The cultural and creative industry park model focuses on economic and social value, emphasizing innovation and the modernization of industrial buildings. However, this approach often neglects the material preservation of important memory carriers such as old factories and equipment, leading to a loss of historical and cultural value in industrial heritage. This model is more suitable for cities with high economic development and favorable industrial conditions. In traditional industrial cities with underdeveloped creative industry conditions and lagging economic development, blindly imitating this model can lead to operational difficulties for the parks [9].

The integrated commercial development model can address the issue of poor economic performance, but it typically transforms original industrial heritage into comprehensive shopping centers, supplemented by entertainment and leisure functions, effectively replacing the original purposes. Additionally, due to the large scale of renovations and complex updates, significant funding is required, often necessitating government involvement and the introduction of multiple market players. These market participants tend to prioritize short-term economic benefits, exhibiting a weak awareness of holistic preservation. They may favor demolishing and rebuilding original factory sites or, due to high demolition costs, opt to renovate only single-use industrial lands with better land forms, neglecting surrounding residential and support areas. These factors often compromise the integrity and authenticity of industrial heritage.

In contrast, industrial landscape parks and museum models place greater emphasis on social benefits [10]. The industrial landscape park model utilizes industrial remnants as material carriers and incorporates natural elements to create unique industrial landscapes, thereby focusing more on the aesthetics and social value of industrial heritage while overlooking its underlying cultural and technical significance. From an economic standpoint, such renovations are often government-led, emphasizing public welfare, resulting in a mismatch between investment and returns. The museum model exhibits the development history of industrial civilization and important handicrafts through museums and exhibition halls, serving to promote industrial culture and preserve industrial skills. However, from the perspective of urban development, the singular function of museums conflicts

with the diverse functional development of urban centers and the complexity of social needs. This disconnect between exhibition functions and the needs of urban centers can hinder the revitalization of these areas.

Considering these issues, traditional renovation models for industrial heritage struggle to coordinate various contradictions. Even when industrial heritage renovations are initiated in urban centers, they often become stalled in the later stages, highlighting the urgent need for new planning strategies.

4. STRATEGIES FOR URBAN INDUSTRIAL HERITAGE PLANNING

This study takes a problem-oriented approach and proposes planning strategies for industrial heritage in urban centers from three perspectives: renewal, activation, and stitching.

Renewal: Guided by the concept of dynamic and organic urban renewal, this strategy advocates for reasonable models of internal and external space renewal. The aim is to allow industrial heritage to maintain its historical characteristics while awakening the collective memory of the local community, fostering a sense of belonging, and reducing the disconnect between industrial site updates and surrounding residents. This approach seeks to reinvigorate the area within the city.

Activation: This involves a rational analysis, replacement, and reorganization of the functions of urban decline. By considering spatial, functional, and developmental aspects, this strategy aims to address the unreasonable issues of development and renovation encountered in practice.

Stitching:This strategy focuses on reconstructing connections in fractured or damaged areas. Through planning transportation and landscape systems, principles proposed by Jia Yong da and Guo Qian [11] emphasize holistic, precise, small-scale, incremental, catalytic approaches that encourage public participation. The goal is to achieve the integration of industrial heritage with the urban natural environment and the reorganization of cultural spaces.

Through these three major planning strategies, the objective is to stimulate vitality, attract foot traffic, enhance land utilization value, and shape the cultural connotation of the city.

4.1. Renewal-Updating Internal Spaces and Improving External Spaces

The reuse and renewal of industrial heritage must be based on a clear understanding of its value. First, it is essential to distinguish between objects that carry value and those that do not, and based on this distinction, categorize buildings into those that need to be preserved, repaired, maintained, or transformed. Second, the functional directions for various types of buildings should be clarified, dividing them into three categories: functional restoration, continued use, and replacement use.

For each category of building, while introducing new uses and meeting functional requirements, it is crucial to respect the original patterns and technical characteristics of the industrial buildings [12]. A strategy that minimizes or allows for reversible changes to the main structures and significant internal components should be adopted to maximize the preservation of authenticity.

It is important to note that for industrial heritage in urban centers, the renovation of unique buildings is particularly significant. An outward spatial expansion model can be chosen, utilizing methods such as vertical expansion of rooftop spaces, extension of surrounding volumes, and external "wrapping" renovations. This approach aims to create distinctive nodes in the area, adding new points of memory to the city.

4.2. Activation-Rational Analysis to Activate Urban Centers with Modern Functions

The renewal of industrial heritage should focus on its integration with urban spaces and its connection to urban life, taking on the responsibility of meeting residents' daily, spiritual, and social needs. The

various districts within a city have a mutually stimulating and driving relationship, where certain functional areas can exert pull effects on others, becoming catalytic points in urban development [13].

Industrial heritage in urban centers, due to its unique locational value, relatively favorable transportation conditions, and comprehensive supporting facilities, must accommodate a diverse range of modern functions, evolving into new catalytic points and catalysts. During the process of functional replacement, it is essential to consider integration with surrounding land uses. This involves transforming industrial areas, which were primarily production-oriented, into zones for lifestyle and leisure services within the urban center. This transition aims to attract a diverse range of functions, such as culture, commerce, leisure, tourism, residential, business, and creative industries, thereby establishing a new connection between industrial heritage and urban life.

4.3. Stitching-Organically Connecting Fragmented Systems to Build a Network of Urban Public Recreation Spaces

The transportation system serves not only as a linking passage within industrial heritage but also as a connector to the external environment, allowing for the stitching together of fragmented road networks. In terms of pedestrian access, the original linear elements within the industrial area can be preserved and transformed into walking routes. For vehicular access, connections can be established between the industrial area and major urban roads, or road classifications can be appropriately upgraded. This phase completes the first step toward network integration—creating an organic flow of the transportation system. This flow is not just meant to link various districts or address the issues within the transportation system itself; it should also be considered alongside public spaces as an element of the urban public recreation space, contributing to the second level—the construction of a network system.

As an important node, industrial heritage can enhance the city's public recreation space [14] by using landscape corridors and pedestrian routes as guides, combined with the development of nodes to achieve a network effect. This approach not only integrates urban public recreation spaces but also provides catalytic conditions for the industrial heritage itself, transforming it from a fragmented and isolated entity into one that can genuinely blend into the urban spatial environment.

Notably, from the perspective of cultural heritage, exploring and systematically planning the industrial sites within the city, along with their organic connections, will create a more three-dimensional cultural image of the city.

5. CONCLUSION

In the context of stock planning and urban renewal, how to protect and reuse industrial heritage in urban centers has become an urgent challenge that needs to be addressed. This study first outlines three major difficulties facing the planning of industrial heritage in urban centers: 1) traditional protection concepts are difficult to align with actual protection needs; 2) there is a mismatch between existing functional configurations and land value; and 3) models for renovation and reuse struggle to achieve coordination.

To address these three challenges, this paper proposes a planning strategy of renewal, activation, and stitching, emphasizing the updating of internal spaces and external fabric of buildings, conducting rational analysis and replacement of functions, and integrating urban networks through landscape and transportation planning. However, this study has limitations in that it primarily focuses on spatial research while lacking exploration from the perspective of administrative management. Additionally, there is insufficient research on the interest game involved in the renovation of industrial heritage in urban centers, which needs to be strengthened in future studies.

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