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Sustainable Development of Industrial Heritage in China: Examples of Beijing and Jingdezhen

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Abstract. Sustainable development is a hot issue in modern society. People have different opinions on whether sustainable development can be achieved. We may be in a phase of overshoot as one of the main features of the human socio-economic system since the Industrial Revolution has emerged, namely exponential growth. So, changes should be made. To make industrial heritages develop sustainably, Chinese society has made a lot of efforts and the methods are worth learning from. This paper focuses on the sustainable development of industrial heritage in China. Through reviewing related literature, the author analyzed and summarized the solution to the sustainable development of industrial heritage in Beijing and Jingdezhen, which can be standard examples. They have been sprung back to life subtly by the architects and become the focal point of the city with a new identity. In conclusion, the cultural value of industrial heritage needs to be excavated, and there is also a need to attach great importance to the environment and realize its sustainable development.

Keywords: Sustainable development of industrial heritage, Cultural sustainability, Environmental sustainability, Vibrant urban spaces.

1. Introduction

As economic changes and urban environmental problems are receiving increasing attention, the old factories in China have ceased production. The industrial complexes occupy a big area in the city center. Traditionally, industrialized spaces have been considered polluted and unappealing zones that must be tucked away from people's life. Most of them were demolished, which caused huge waste. However, industrial heritages of different historical and architectural value witness the history of a city. They are an important part of the city's heritage. At the same time, their location along the axis of the city is an opportunity that makes interesting regeneration investments possible. Restoring their social value and leading a revitalization will activate urban spaces and provide opportunities for economic growth.

Approaches to the sustainable development of industrial heritages in Chinese Cities are as follows. First, create sustainable urban spaces in industrial heritages by utilizing their cultural sustainability and environmental sustainability. Second, create vibrant urban spaces in industrial heritages. Two revitalization cases in China are studied, including Shougang No.3 Blast-Furnace Museum in Beijing and "Taoxi Greek" industrial heritage in Jingdezhen, which are success stories and inspirations for the renewal of industrial sites.

Thus, precious experiences can be studied and the protection and excitation of industrial heritage can be emphasized. To make industrial heritages develop sustainably and promote the harmonious

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development of humans and nature, valid approaches should be studied. And this paper is supposed to make a modest contribution to the sustainable development of industrial heritage.

2. Theoretical background

2.1. Sustainable urban spaces

Sustainable urban spaces relating to industrial heritage should be culturally sustainable and environmentally sustainable.

2.1.1. Cultural sustainability of industrial heritage. Cultural sustainability relates to sustainable development, which has to do with the maintainance of cultural beliefs, cultural practices, and heritage conservation. Cultural sustainability can arouse people's sense of identity with the city. Industrial heritage, as an industrial cultural relic with historical, technological, social, architectural, or scientific value and a witness of industrialization, is a milestone of human industrial civilization and an important part of world heritage [1]. According to the paper published by a Chinese researcher Du Leilei at the 11th Chinese Industrial Heritage Conservation Annual Academic Conference in 2021, by the end of 2020, there were 81 industrial heritages out of World Heritage [2].

2.1.2. Environmental sustainability of industrial heritage. Environmental protection measures would have a lasting impact, which includes the reduction of pollution, the reduction of energy consumption, the improvement of waste management, etc. The environmental restoration of the industrial sites, such as increasing vegetation coverage and ecological diversity, will provide recreational uses and environmental sustainability.

Since the beginning of the 20th century, people's demand for raw materials has exploded. This has not only led to a resource shortage, but also climate degradation, environmental pollution, and other problems, which have had a negative impact on global sustainable development. According to the research of China Building Energy Efficiency Association, in 2018, the total carbon emissions of the whole life cycle of China's buildings (including the production and transportation of building materials, building construction, building operation and use, building demolition, and waste disposal) reached 4.93 billion t CO2, accounting for 51.2% of the national energy carbon emissions. Among them, the carbon emission in the production stage of building materials is 2.72 billion t CO2, accounting for 28.3% of the total energy carbon emission in China, much higher than the carbon emission in the operation stage, which accounts for 21.9% [3].

Cradle to Cradle, a concept of sustainable development, emphasizes the conservation and recycling of resources. Through process upgrading, materials that were previously discarded can enter new construction cycles, just as biological cycles occur in nature.

Most of the existing buildings in China have a convertible and exploitable physical foundation. Although the existing industrial buildings are different in construction time and structure type, they are generally characterized by strong structure, spatial openness and plasticity, superior location and facility conditions, and suitable for reuse. Among them, industrial buildings built before the 1980s should be protected and revitalized because of their high historical, cultural, and scientific value [4].

2.2. Vibrant urban spaces

There are some abandoned industrial buildings generating nothing but rust. Turning these buildings into a new attraction is a definite advantage, which provides the surrounding communities with new cultural and entertainment hubs, as well as new economic opportunities.

Transforming industrial heritages into vibrant urban spaces requires the reinvention of their functions. Adaptation of the building to new functions should be done with respect for the historic matter and the new space should encourage users' creativity. They could be turned into multifunctional museum-educational-scientific facilities to create more activity and communication opportunities.

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3. Case study

3.1. Revitalization of Shougang No.3 Blast-Furnace Museum in Beijing

No.3 Blast-Furnace is a part of the Shougang Steel-Making Plant which was built in 1919. It is located in the west of Beijing and covers an area of 25000 square meters. It ceased production in 2005 for the Urban Environmental Promotion Programme. Cities are running out of available land, while the revitalization of this industrial heritage would increase urban activity space. This industrial site carries the profound memory of the city. Its appearance and outdated mechanical equipment are the signature of an era. Efforts were made to preserve the original structure to the greatest possible extent, and, at the same time, to introduce new elements that redefine the functions of the structure. The core strategy is "keeping the old, removing the unnecessary, and establishing the new", namely keeping the most profound historical memory of the industrial heritage, properly removing unnecessary industrial buildings and building efficient dialogue between blast-furnace and nature, and injecting into the project with brand-new urban function and dream [5].

The blast-furnace is changed to a theme exhibition hall, the top of which is an urban interactive platform. The academic report, temporary exhibition, and catering are in the building attached to an underwater exhibition hall. To be a new vibrant city center, the heritage holds various events, such as AI technology shows, light shows, and new car announcements.

Cultural sustainability was achieved in this project. By using advanced technologies, the giant iron structures of the blast-furnace are preserved to highlight the characteristics of the industrial heritage. Having been cleaned, painted, and polished, the iron machines and precise joints are exposed in order to restore their original appearance.

The blast-furnace was the heart of a machine, gathering a large number of technology heritages. An exhibition inside the blast-furnace is the theme of "industrial archaeology", which shows the most important process platform in the production cycle, such as the original iron runner, slag runner, and dust extraction shields.

Environmental Sustainability was achieved through the restoration of the natural environment. In the west of the blast-furnace, there is a lake which was used to store the cooling water. Through the removal and treatment of contaminated soil and water purifying, the ecological environment of the lake is restored now. The vegetation on the site becomes abundant and animals return gradually, which transform the site into a public place for outdoor activities.

Giant iron structures combined with modern technology and contemporary arts provide a new park for the crowded city, commemorating the century glorious history of Shougang, which was once China's largest steel maker. The transformation of this huge industrial complex into a positive urban space, which continues its industrial culture and renews its environment to make itself sustainable, provides an innovative way to revitalize industrial sites. It has created a sustainable development system of cultural revival, industrial revival, ecological revival, and vitality revival [6].

3.2. Revitalization of "Taoxi Greek" industrial heritage in Jingdezhen

Jingdezhen became the porcelain capital of China 1000 years ago and has inherited the ceramic culture of China.

It is famous for blue and white porcelain. "Taoxi Greek" in Jingdezhen has more than 20 ceramic factories, most of which were dilapidated and abandoned in the 1990s due to technological advances. As a result, fewer and fewer people work and live in "Taoxi Greek".

Efforts have been made to pass down the traditional ceramic culture in a fashionable way. In 2013, the old factories were preserved and given new functions, such as cultural exchange, artistic creation, and ceramic live broadcasts. The old buildings have been transformed into art galleries, pottery experience spaces, studios for art designers, shops, etc. Attracting many artists, designers, and tourists, "Taoxi Greek" is vibrant and becomes an international ceramic art exchange center.

The ceramic industry of Jingdezhen "Taoxi Greek" museum belonged to brick material is given priority to the bent frame structure of the industrial workshop. The once nearly abandoned clinkering

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workshop was transformed into a set of cultural exhibitions with retail and recreational functions in the integration of the museum of the ceramic industry. It has become an important city landmark, greatly promoting the ceramic industrial upgrade to create more employment opportunities and improve people's livelihood [4]. The structure and materials of the old workshop were retained and moderately transformed to achieve environmental sustainability. Only the old bricks reused were as high as 500T [4]. The wooden structures, which have been damaged over time, were replaced by the steel structure with high strength and light dead weight. The authentic production equipment of different periods, such as the round kiln, long kiln, and truck track, is preserved as exhibits [7].

The implementation strategy of "preserve and transform" has created cultural and tourism facilities with historical and cultural charm and modern functions for Jingdezhen old town. At the same time, the carbon emission level to achieve the goal has been greatly reduced.

The 2017 UNESCO Award for the Preservation of Cultural Heritage in the Asia-Pacific Region announced that Jingdezhen Ceramic Industry Museum, Jingdezhen, China, got the award of New Design in Heritage Contexts [8].

Only innovative ways can revitalize the thousand-year culture, and “Taoxi Greek” is a good example. During the renovation process, the value of industrial heritage was given priority, and the combination of ancient and modern design has turned the area into an Internet celebrity spot and recreated the bustling scene. The recycling of materials can save energy and maintain the appearance, which is a model to promote the sustainable use of resources. This is a successful case of industrial site revival.

4. Conclusion

With the development of the economy, the renovation of industrial heritage is inevitable. In order to meet the needs of social development, industrial heritage must be sustainable. The analyzed cases of the revitalization of industrial heritage in this paper show that cultural and environmental sustainability should be concerned about, which is the key to creating sustainable urban spaces. The cultural value which comes from the history and technique of the past industrial complexes should be excavated and investigated. In addition, attention must also be paid to the environment on the site. Environmental restoration projects, energy-saving measures, and recycling of resources are all good ways to realize the harmonious development of man and nature. Cultural and environmental sustainability can promote industrial heritage to become a sustainable urban space.

Space and function of the industrial heritage must respond to the advancement of the changing times. After investigating the heritage, the functional transformation and the introduction of new concepts will bring vitality to it and seek a direction suitable for the development of contemporary society. As a result of the combination of the past and the future, vibrant urban spaces will reactivate the site, achieving sustainable development of Industrial Heritage.

Approaches for sustainable development of industrial heritage are closely related to the level of socio-economic development of a country as a whole and the individual city, and will remain a matter of debate for a long time. Therefore, the sustainable development of industrial heritage is a worthy direction to study and more cases in diverse regions should be studied [9].

References

[1] Liu, B. Y. New Opportunities and Tasks for the Conservation and Utilization of Chinese Industrial Heritage [J]. Architectural Pratice 36(11), 16-25 (2021). https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7iJTKGjg9uTdeTsOI_ra5_XYGfib0Cd59e1OC7zlPVeuFsSsdbyuiNUbEfRkWw9qbC&uniplatform=NZKPT.

[2] Du, L. L. Review and Prospect of the Research on “Application for World Heritage” of Modern Industrial Heritage in China [C]. Investigation, Research and Protection of Chinese Industrial Heritage, Proceedings of the 11th Chinese Symposium on Industrial Heritage, 2020. Guangzhou: South China University of Technology Press, 11–23 (2021).

[3] China Building Energy Consumption Annual Report 2020 [J]. Journal of BEE 49(02), 1-6 (2021).

DOI: 10.54254/2755-2721/3/20230559

[4] Zhang, J., Zhang, G., Li, M. H. Exploring a Low-Carbon Oriented Strategy for Urban Renewal: From "Demolition, Redevelopment and Preservation" to "Preservation, Transformation and Demolition". World Architecture (8), 4-9 (2022). DOI:10.3969/j.issn.1002-4832.2022.08.001.

[5] Bo, H. T., Liu, P. F., Jiang, K. Revitalization of Shougang No.3 Blast-furnace [J]. Architectural Pratice 20(06), 30-41 (2020). https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7i8oRR1PAr7RxjuAJk4dHXoiupudXEOaUvoE7dMMjqHzW0J9NuqYXm57PzRgTRvz__&uniplatform=NZKPT.

[6] Wu, C., Ju, P. Y., Wang, S. Z., Bo, H. T. Theory, Method and Key Technology of Urban Revitalization in Shougang Industrial Heritage area (2021). https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=SNAD&filename=SNAD000001883770.

[7] Zhang, J., Hu, J. X., Liu, Y. Museum and Art Gallery in the Exhibition Area of “Taoxi Greek” Industrial Heritage in Jingdezhen. Architectural Journal 596(05), 20-25 (2018). https://kns.cnki.net/kcms2/article/abstract?v=3uoqIhG8C44YLTlOAiTRKibYlV5Vjs7i0-kJR0HYBJ80QN9L51zrP7UfQmPv8vXTr9oSaOST_-gnPAlngBOKVNRouEEubI_a&uniplatform=NZKPT.

[8] 2017 UNESCO Asia-Pacific Awards for Cultural Heritage Conservation [J]. World Architecture (12), 6 (2017). https://d.wanfangdata.com.cn/periodical/ChlQZXJpb2RpY2FsQ0hJTmV3UzIwMjMwMTEyEhdRS0MyMDE3MjAxODAxMTgwMDA2ODQ2NRoIaGFwOGllYmE%3D.

[9] Stefanski, K., Gryglewski, P., Ivashko, Y., Dmytrenko, A., Ivashko, O. Revitalization Specifics of Industrial Enterprises Made of Brick and Concrete. Examples of Lodz, Kyiv and Poltava. International Journal of Conservation Science 11(3), 715-730 (2020).