

Original Paper

Research on Protection and Redevelopment Strategies of Industrial Heritage from the Perspective of Urban Innovation

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Abstract

Since the 18th century, industrial production has promoted the transformation of social productive forces and the progress of human civilization, formed a unique factory model and industrial civilization, and became a manifestation of the interaction between human and environment. With the industrial transformation in the middle of the 20th century, many large factories have stopped production and closed down, and their abandoned sites have formed a huge industrial heritage because they retain a large number of industrial buildings and machinery and equipment, which has become the focus of attention in urban environmental management and context protection. Industrial heritage has profound historical accumulation and cultural value. For the protection and redevelopment of industrial heritage, reasonable reconstruction plans should be formulated according to the preservation state and cultural value of the local industrial architectural landscape and the innovative needs of the city in terms of economy, people's livelihood and environment. Under the current background of sustainable urban development and self-innovation, proper protection and development of industrial heritage is not only the functional transformation of abandoned industrial parks but also the functional repair of old urban areas. It is of positive significance for urban tourism development, economic revitalization, livelihood improvement, cultural protection and resilience design.

Keywords

urban innovation, industrial heritage, value analysis, conservation and redevelopment, countermeasure Research

1. Introduction

The industrial revolution promoted the transformation of modern urban structure. In order to meet the needs of industrial production for land, materials, population, transportation and other resources, the city built factories, workshops, warehouses, stations, access railway and supporting facilities such as market, housing, schools, hospitals, churches and other facilities. With the development of new energy, the innovation of computer technology and the sustainable development of globalization in the middle of the 20th century, the traditional industrial zones of many countries have been closed, leaving huge industrial parks as an industrial heritage that is difficult to deal with. With the improvement of the innovation demand under the sustainable development of the city, how to transform and develop the industrial heritage to radiate the city vitality, restore the regional landscape, improve the people's livelihood environment and revitalize the local economy has also become an important subject for the government and academic circles.

2. Analysis of the Status of Industrial Heritage

In recent years, the protection and redevelopment of industrial heritage has attracted wide attention under the constant appeal of academic circles and conservation organizations. The Chinese government published two lists of industrial heritage protection in January 2018 and April 2019 (Figure 1), which clearly defined the supporting attitude for the protection and rejuvenation of China's industrial heritage. In view of this, many industrial heritage parks, such as China and Germany, have established urban landscape corridors, industrial cultural and creative industrial parks and historical characteristic blocks through the transformation of "functional transformation and environmental regeneration, combined with the new era landscape design concepts such as "urban landscape", and integrated industrial heritage protection, redevelopment and urban innovation in order to seek new ways of cooperation and share opportunities.

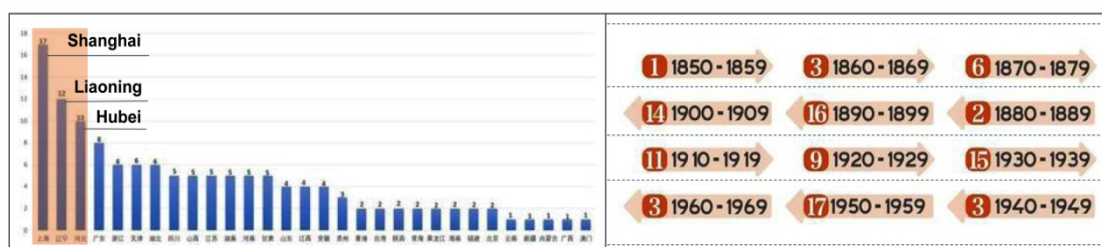


Figure 1. Regional Distribution and Age Statistics of China's Industrial Heritage

http://ph.fjsen.com/wap/2019-04/15/content_22180855.htm

3. Value Analysis of Industrial Heritage

3.1 Historical and Cultural Values

From the historical and cultural point of view, industrial heritage is the witness and cultural wealth of the development of human society, plays a role in the long historical evolution—not only continues the material core of manual production of human society, but also opens a new chapter in the era of science and technology and information, which is an important witness of the development of industrial history; At the same time, affected by the historical culture, social livelihood, political system and other factors, its industrial architecture and park construction form and development model are also different, forming the German Bauhaus style, Soviet Stalin style, American mechanicalism style, Chinese classical style and other different types of industrial architecture (Figure 2), while recording the vertical industrial history, it also produces a horizontal design that integrates national characteristics and national customs, and has research significance for the cultural exploration of industrial heritage.



Figure 2. Industrial Heritage Styles in Different Countries

<http://www.cafa.edu.cn/st/2015/9017981.htm>

3.2 Human Emotional Value

From the point of view of humanistic emotion, the architectural community formed with industrial production as the core has become one of the functional areas of the city. People who work and live here have deep spiritual sustenance and impression of the years. It is a spiritual comfort and value recognition people who have worked and lived in it. It is an inspiration and demonstration for inheriting the spirit of the times and protecting urban culture. At the same time, it can make people understand the relevant industrial history and behind-the-scenes stories, and has positive significance to supplement and perfect the history of urban development. (Figure 3)



Figure 3. Age of Industrial Heritage

https://www.sohu.com/a/278727161_120029359

3.3 Socio-Economic Values

From the point of view of social and economic development, the development of industrial heritage can make secondary use of barren industrial parks, in order to reduce land development, increase urban outdoor venues, while promoting the optimization of urban functions, environmental renewal while improving people's understanding and understanding of industrial heritage; At the same time, under the influence of historical factors, most industrial heritage sites are in depressed areas of national development (such as industrial cities in Northeast China). It is of practical significance to promote local economy and improve urban people's livelihood by means of industrial heritage protection and market development. (Figure 4)



Figure 4. Industrial Heritage Tourism Development

Authors organize and draw according to Internet data.

4. Industrial Heritage Development Model

4.1 Shaping Urban Landscape Garden—Ruhr Industrial Zone, Germany

As an important industrial park in Germany, Ruhr Industrial Zone fell into a downturn after the adjustment of international energy industry structure in the late 20th century. To this end, the government issued a series of countermeasures to guide the revitalization of the park, help urban innovation. (Figure 5)

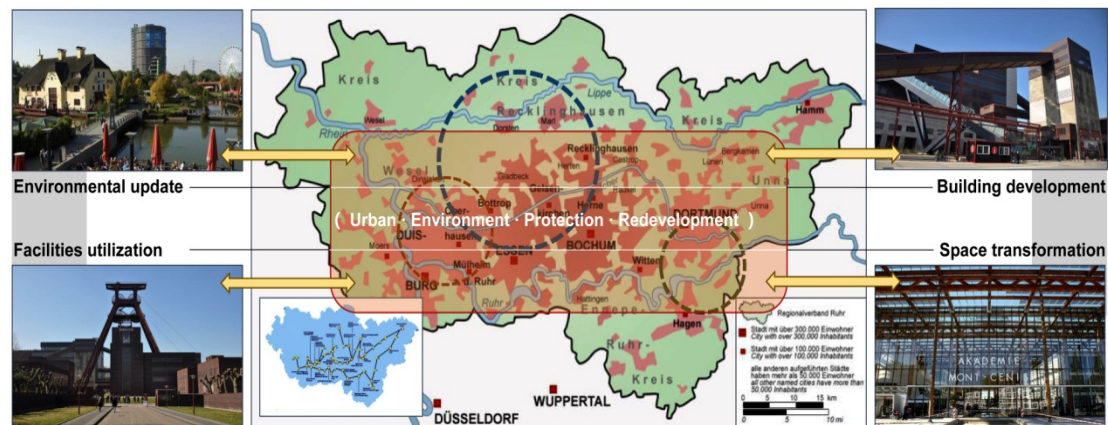


Figure 5. Landscape Transformation of Ruhr Industrial Zone

Authors organize and draw according to Internet data.

4.1.1 The Market Level—Cater to the Market Demand, Renovate the Enterprise Structure

On the one hand, by shrinking the size of the park, reduce the economic impact of the decline of small and medium-sized enterprises, in order to ease the financial burden of the government. On the other hand, we should actively introduce scientific and technological production technologies that meet the needs of the current market, concentrate on promoting them in most large profitable enterprises, introduce necessary foreign funds and technical support, and ensure the stable operation of large enterprises. Avoid serious social unrest caused by bankruptcy of large enterprises.

4.1.2 Traffic Level—Improve Traffic Network, Strengthen Regional Links

The developed transportation network is a necessary guarantee for modern urban operation and industrial production. It is helpful for enterprises to carry out cross-regional cooperation and commodity transportation. By optimizing the transportation network of West Germany, including Ruhr Industrial Zone, and guiding enterprises to complete the operation layout of “point-by-point, line-by-line and surface” by combining “waterway railway, road and aviation”, thus strengthening the economic and trade ties between Ruhr and the world, it has become an important measure to improve the market competitiveness of enterprises and promote the transformation of urban industries.

4.1.3 Environmental Level—Optimize the Park Environment and Improve Infrastructure

As the “garden factory” concept of scheme design, adopt green ecological landscape planning, repair the environmental damage caused by the industrial production, ease of foreign city area, such as water and soil pollution damage, in order to improve the infrastructure construction of the enterprise, give people the old image of traditional industrial park; At the same time, the development of abandoned industrial sites (such as railway yard and access railway factory), the natural elements and public skills is blended in among them, the construction of urban public garden and the green corridor, and industrial facilities of disused railway shall be reasonable protection and restoration, respond the needs of the urban industrial heritage protection and the environment update; (Figure 6) In addition, comprehensive consideration and park to improve the demand of enterprise management, guide the

industrial production and a simultaneous landscape construction, and the integration of city streets and rural landscapes, the industrial production becomes the important of innovation in modern cities swimmer.



Figure 6. Landscape Development of Special Railway and Station in Ruhr Industrial Zone

Authors organize and draw according to Internet data.

4.2 Building Urban Art Centre—Beijing 798 Art Industry Park

As a city cultural landmark of Beijing, the 798 Art Industry Park, built in the state-owned electronics factory area, has become a famous art industry park and tourist attractions at home and abroad. The park is a part of the “North China Radio Joint Equipment Factory” designed by the former Soviet Union and the Democratic Germany. Its internal planning is rigorous and its function distribution is clear. The production workshop, processing equipment, forging furnace, material warehouse, office building, office building and railway facilities have strong post-industrial characteristics, showing the mechanical aesthetics of industrial design and the simplicity of modern architecture. It is a relatively well-preserved industrial building community in China and has become a historical portrayal and epochal imprint of the development of socialist industrialization.

Due to the unique rigorous layout and unique architectural design of the factory area and the low rent, many art creators have been attracted to participate in the design and reconstruction of the factory area and create their own art studio. And formed the famous 798 art industry park, become the art scene of modern Beijing. (Figure 7) 798 Art Industrial Park is a model of urban industrial heritage redevelopment, which has positive significance in the transformation and construction of urban functional areas, the integration of urban environment, the expansion of urban employment, and the enhancement of urban vitality, which provides constructive ideas for the redevelopment of domestic industrial heritage.



Figure 7. Renovation of Industrial Facilities in 798 Art Industrial Park

Author photo and drawing.

4.3 Creation of Urban Life Corridor—Jianxi Industrial Park, Luoyang

Construction of Jianxi Industrial Park in Luoyang City, Henan Province during the “15th Five-Year Plan” was conducted by Balajin, a former Soviet urban planning designer. The project drew on the experience and lessons learned from urban design planning such as Shenyang and Changchun, and avoided the inconvenience caused by excessive urban agglomeration. The first tractor factory, glass factory and other projects were lined up in line on the north side by special railway, while the supporting facilities such as residential area, auditorium, cultural palace, cinema, school, post office, hotel, supply and marketing agency were built on the south side of the factory, making Jianxi Industrial Park one of the representative industrial bases in Henan Province. It not only laid the foundation for the transformation of Luoyang as a national industrial city, but also changed the form of industrial development and layout in Henan Province after the founding of the people’s Republic of China, that is, the parallel development of northwest industrial zone and southeast agricultural area.

In the reconstruction of Jianxi Industrial Park, the government protects and redevelops by declaring industrial remains and transforming historical and cultural streets. With the theme of “implementing protection and exploring tourism value”, the project revolves around the planning of “one axis, one area, three districts and four nodes”, covering the historical landscape protection axis, water system and public green space, well-preserved Soviet-style building blocks, industrial parks and special railways, etc., forming a landscape belt of Jianxi industrial heritage blocks, which is dominated by industrial heritage expo, urban landscape corridors, cultural and creative industries and leisure tourism. (Figure 8)

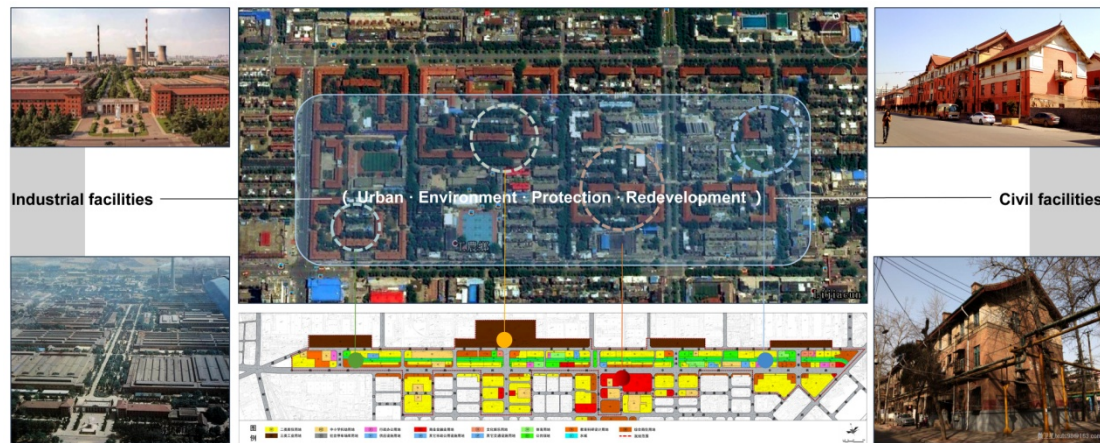


Figure 8. Reconstruction Plan of Jianxi Industrial Park in Luoyang

Author photo and drawing.

5. Related Issues in Industrial Heritage Development

Before the historical and cultural value of industrial heritage itself is not paid attention to by the society, the relevant departments pay less attention to the protection of urban industrial relics and their representative building sites, while the cultural excavation of industrial heritage supporting facilities (such as access railways, living areas, schools, parks, etc.) is less understood and recognized, and its inherent humanistic value has not been widely recognized in academic circles. At present, industrial heritage around the world is facing the threat of enterprise reform and urbanization development, and with the increasing calls for the protection of industrial heritage, countries have also carried out cultural excavation and protection of industrial heritage, at the same time, has also exposed a number of problems to be solved:

5.1 Secondary Destruction during Development

Driven by economic interests, some cities have carried out secondary damage to buildings, landscapes, railways, machinery and equipment in the industrial heritage on the grounds of the commercial transformation of the project, and on this basis have made artificial adjustments, resulting in some architectural appearance and structural deformation, landscape green space damage, excessive development of park sites, railway track landfill and other problems, which have broken the sense of spatial harmony of the industrial park itself and reduced the artistic appreciation and historical and cultural value of the industrial heritage. In addition, some areas also use the “Industrial Park” as the brand to develop the park as a commercial and residential integrated property for sale, causing irreparable trauma to the local industrial heritage.

5.2 Management Confusion during Operations

Due to the large number of units involved in the commercial development and operation of industrial heritage, complex management and heavy workload, some cities have adopted a multi-party approach to industrial and cultural historical streets, creative industrial parks and industrial railway parks. Due to

the lack of unified leadership and coordinated management of relevant departments, many departments make profit and intervene in the operation of the park in order to obtain the best economic benefits.

5.3 Loss of Features during Transformation

In recent years, with the rise of commercial development of industrial heritage and the value of tourism economy and surrounding industries behind it, many cities are scrambling to emulate it in order to maximize the economic benefits brought by the redevelopment of industrial heritage. However, many projects do not start from the protection needs of local industrial heritage, the design scheme lacks basic protection measures, and fails to integrate with local industrial characteristics, resulting in the same development content. It reduces the industrial cultural value and educational significance of the project itself. As in zhengzhou coal mine machinery factory creative industrial park development, taken from the industrial heritage business development mode, to a large number of plant development for commercial stores, for the factory original industrial facilities and access railway did not do too much, resulting in the loss of the park industrial elements at the same time also does not favor the neighborhood around the transportation linkage, such as considering disused railway reconstruction for urban greenway or walk corridor, helps the neighborhood traffic linkage and personnel exchanges and improve the overall environment of the region. (Figure 9)



Figure 9. Creative Industrial Park and Access Railway of Zhengzhou Coal Mine Machinery Factory

Author photo and drawing.

6. Related Strategies for Industrial Heritage Development

According to the actual situation of local industrial heritage and the demand of urban innovation, a variety of protection measures and redevelopment models can be adopted around the existing problems of industrial heritage protection and redevelopment. (Figure 10)

Be Extant	Value Analysis	List of Entries	Joint Management	Characteristic	— ? —
Countrywide	Historical Characteristics and Cultural Values	Development and transformation	Comprehensive Cooperation Mechanism	Programme development and design reservations	
Past	Early 1960s	Late 1970s	Late 1990s	21st Century	Future
Awareness formation	Practice Attempts	Social and Legal	Ecologism	Innovative Development	

Figure 10. Research and Development Strategy of Urban Renewal-Oriented Industrial Heritage
Author drawing.

6.1 Accurately Grasp the Value Connotation of Industrial Heritage

Taking protection and restoration as the primary goal, we should correctly recognize the historical characteristics and cultural value of industrial heritage, face up to the spiritual and material influence of the connotation of industrial heritage, and attach importance to its own social effect and urban innovation. Through the necessary protection and restoration measures, the industrial heritage as a part of the history of urban industrial development for time and space inheritance, for the spiritual and material aspects of the promotion of urban innovation laid the foundation. (Figure 11)



Figure 11. List of Protection of Industrial Heritage

Authors organize and draw according to Internet data.

6.2 Parallel Development and Rational Transformation

For the industrial heritage that enters the protection list and carries out the repair work, it is necessary to achieve moderate development and reasonable transformation. In the process of repair, we should try our best to carry out the work around the value connotation contained in the industrial heritage, so as to restore the original characteristics of the industrial heritage and meet the innovation needs of modern cities. (Figure 12)

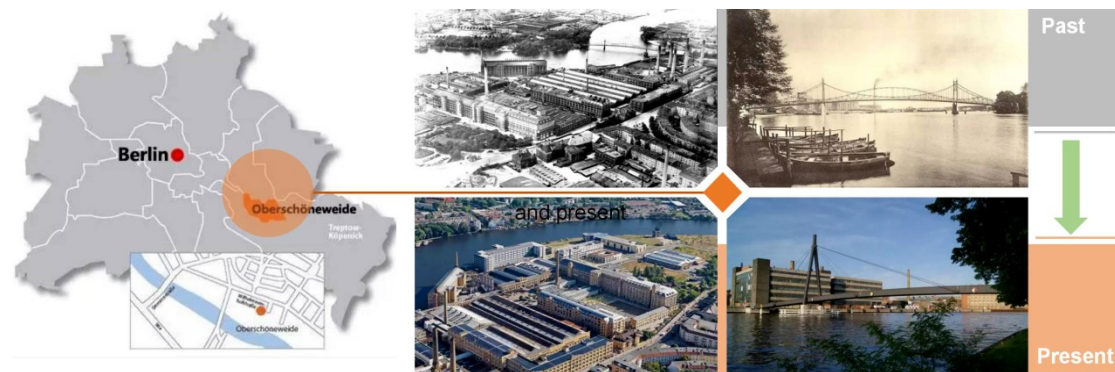


Figure 12. Berlin's Upper Ranch Factory City

Authors organize and draw according to Internet data.

6.3 Establishment of a Comprehensive Cooperative Management Mechanism

For the operation and management of industrial heritage, we can try to establish a comprehensive cooperation mechanism, which can be planned by the government as a whole, and managed jointly by the street community and the tenant of the park. The commercial development and operation management of the project park can be jointly formulated by the three parties, combined with the requirements of public opinion, to reach an agreement before it can be carried out, in order to avoid the disorderly management caused by the separate and disconnected management in the cooperative management, and cause unnecessary confusion. (Figure 13)



Figure 13. Hangzhou Industrial Heritage Cooperative Management Mechanism

Authors organize and draw according to Internet data.

6.4 Development of Design Plans in Combination with Urban Characteristics

For the protection and development of industrial heritage based on the actual situation of the city, must not blindly follow the trend, simple imitation. Before formulating the design plan, we should first conduct in-depth investigation, visit and understand the industrial heritage of the region and the elements associated with the industrial heritage. After obtaining the actual survey results and statistical data, we should integrate and analyze the successful cases of other cities, and then formulate reasonable design plans to create a cultural and creative industrial heritage park with urban characteristics and innovative times. (Figure 14)



Figure 14. Turin Industrial Park, Italy

<http://www.chinabuildingcentre.com/show-11-2489-1.html>

6.5 Design retention Based on Urban Resilience Requirements

The industrial heritage is mainly urban industrial park, which has the characteristics of wide space, large building volume and strong traffic flow. It is suitable for the expansion of public space in urban innovation. In the face of all kinds of sudden public safety events, it is difficult to provide sufficient public space for personnel placement, material allocation and traffic diversion, such as Wenchuan earthquake relief in 2008, Wuhan new crown pneumonia epidemic prevention and control in 2019, etc. All of them expose the problem that compact modern cities are difficult to provide sufficient public space in a short time.

The resilience demand of modern cities requires urban planning and management to take full account of all kinds of safety risks and provide effective measures to make full use of the existing resources of cities to meet all kinds of emergency needs. For the multi-party cooperative management of industrial heritage and other urban resources, can retain part of the building, site and regular maintenance, usually used for the park cultural landscape display, special period emergency requisition for urban material reserve points, personnel resettlement areas (including temporary hospitals), vehicle dispatching stations, so as to improve the modern city to face all kinds of risks of flexible response, improve the urban self-protection mechanism. (Figure 15)



Figure 15. Shougang Advanced Industry Integrated Service Park

Authors organize and draw according to Internet data.

7. Discussion

Industrial heritage is the material wealth left by social development. It is not only in line with the innovation demand of urban sustainable development for internal environment, but also the retention and continuation of urban industrial culture. Become the fulcrum of improving urban environment and revitalizing tourism economy. In this regard, the relevant work should take “protection, transformation and upgrading” as the main purpose, give full play to innovative thinking, make effective use of existing resources, carry out scientific management planning, adopt green ecological landscape design scheme, integrate industrial heritage into social life as part of urban function, and provide necessary assistance for urban protection in the event of various emergencies.

Under the influence of history, economic and political factors, the current urban industrial heritage in China as its industrial historical material record, has the rich cultural value and the era characteristics, and researches for the protection, development of industrial heritage in China still has a long quest that need to be in between countries, between region and region to carry out exchanges and cooperation, combined with the actual situation of domestic cities, the comprehensive implementation “the protection, transformation and upgrade” development concept, the industrial heritage self innovation in promoting the city retained in the world at the same time as the excellent cultural achievements.

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