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A Study on the Landscape Design Strategies for Regeneration of Post-Industrial Sites of the Beijing-Tianjin-Tangshan Region in China

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국문초록

산업구조의 변화와 함께 도시공간구조가 재편되는 것은 세계적인 현상이고, 중국은 대표적인 국가 가운데 하나이다. 중국의 수도권이라고 할 수 있는 북경-천진-당산으로 이어지는 경진당(京津唐) 지역은 공장과 공업단지들이 이전하고 남겨진 산업 이전적지들의 재생 프로젝트가 활발하게 진행되고 있다. 경진당(京津唐) 지역의 산업 이전적지 재생 사례들을 분석하여 사업의 특징과 목표, 설계 철학과 전략을 정리하고 시사점을 도출하여 향후 유사한 프로젝트를 위한 기초 자료를 제공하고자 하는 것이 본 연구의 목적이다. 연구 방법은 경진당 지역의 산업 이전적지 재생 프로젝트를 현지 답사를 통해 조사, 분석하고 문헌연구를 통해 귀납적으로 결과를 도출하였다. 연구의 결과는 다음과 같다. 첫째, 경진당 지역의 산업 이전적지 재생프로젝트는 산업 유산 보호, 문화적 창의성, 공동체성 증진 같은 다원화된 목표를 추구하고 있다. 둘째, 대상지의 공간적, 장소적 특성과 산업유산을 존중하는 디자인 전략을 통해 새로운 디자인 내용과 대상지의 고유성이 조화되어 장소적 특징과 경관 효과를 최대화하고 있다. 셋째, 산업 이전적지의 생태적 복원에 초점을 두어 오염된 토양에 적응성 있는 식물과 자생식물을 위주로 식재하고 있다. 넷째, 조경 디자인은 조각이나 그래피티 같은 현대예술과 결합하여 대상지를 풍요롭게 하고 활성화를 촉진한다. 다섯째, 재생된 장소의 활성화 측면에서 도시적 이벤트와 대중 활동 프로그램을 적극 도입하고 있다.

주제어: 대상지 특성, 디자인 전략, 생태적 복원, 현대 미술, 공공 활동

ABSTRACT

This study aims to discover the implications through the analysis of the characteristics and design strategies of the regeneration of the post-industrial sites in the metropolitan the Beijing-Tianjin-Tangshan region. This study provides a basis for future research and theoretical strengths for post-industrial site regeneration practices. The results of the study are as follows. First, post-industrial site regeneration projects pursue diverse goals such as industrial heritage preservation, cultural creativity, and neighborhood revitalization in the Beijing-Tianjin-Tangshan region. Second, in the design process, the characteristics and spatial levels of the space are enhanced by utilizing the original industrial space, incorporating transitional space, and using industrial facilities of varying heights. Third, old and new landscape elements are harmoniously integrated through the rational use of industrial relics and the appropriate addition of new elements. Fourth, the design emphasizes ecological soil restoration and the use of native and adaptable plants that have the capacity to remediate polluted soil. Fifth, the design combines modern artistic elements, such as sculpture and graffiti art to enrich the site and promote the revival of the post-industrial site. Sixth, urban events and public activities are actively programmed to vitalize the regenerated site.

Keywords: Site Characteristics, Design Strategies, Ecological Restoration, Contemporary Art, Public Activities

1. Introduction

1.1 Research Background

China's industrialization began late but grew rapidly. Traditional industrial bases lose vitality as industrialization advances. Numerous post-industrial sites have been produced by the process of industrial transformation. New industrialization and urbanization continue to drive an increase in the number of post-industrial sites (Zheng, 2015). Due to environmental, economic, and social issues caused by post-industrial sites, urban construction is extraordinarily challenging. Thus, post-industrial sites must be dealt with urgently in urban construction.

In China, research on the revitalization of post-industrial sites has lagged behind. In the 2000s, post-industrial site revitalization emerged for the first time (Pan and Wu, 2009). Regeneration of post-industrial sites in China has begun to demonstrate results in accordance with the excellent transformation theories and the successful practices of post-industrial site regeneration in western countries (Zheng, 2015). However, the research on post-industrial sites has ignored the different industrial cultures of China and Western countries, as well as the characteristics of post-industrial sites. The theories are not mature enough.

Post-industrial site regeneration is the primary focus of brownfield regeneration in China because of their relatively high regeneration value. Post-industrial site regeneration has shown great environmental, economic, and social benefits. It has become a general consensus that post-industrial site regeneration is one of the most effective ways to provide urban green space and open space. From this perspective, the study of landscape design strategies for post-industrial site regeneration is relevant to urban construction and sustainable development at this stage.

1.2 Related Research Trend and the Purpose of This Research

In terms of policy context, post-industrial site management policies in China lack a systemic and persistent nature, and often consist only of campaign-style management that does not guarantee long-term effectiveness. There are merely regulations governing pollution control in industrial production processes, such as the Water Pollution Prevention and Control Law, the Air Pollution Prevention and Control Law, and the Solid Waste Pollution Prevention and Control Law. Zhuo (2019) introduced the land management policies relating to post-industrial sites in China, specifically 'Land Reclamation Regulations (2011)' and 'Soil Pollution Prevention and Control Law (2018)'. Liu (2021) argues that China's post-industrial site governance laws are scattered among many laws and do not have specific rules or regulations.

In terms of practical work, industrial heritage conservation in architecture and post-industrial landscape practice in landscape architecture have now become major forces in regenerating post-industrial sites. In 2001, the Qijiang Park project, which was built on the former site of the Yuezhong Shipyard, marked the early stages of post-industrial site development in China. Shanghai Houtan Park and Beijing 798 Art district are also relatively successful projects. At present, China's post-industrial site regeneration projects are concentrated in large cities such as Beijing, Shanghai, and Guangzhou. During the period 2017-2021, 194 industrial heritage projects in five batches of the 'National Industrial Heritage List' of the Ministry of Industry and Information Technology have accelerated post-industrial site practices.

In terms of theoretical research, landscape architecture has focused primarily on the design content of post-industrial site regeneration from the post-industrial landscape perspective. Wang and Ren (2003) compile landscape design ideas and design techniques for the transformation of post-industrial sites into parks by studying overseas cases. By analyzing the ecological characteristics of the landscape and the environmental effects of post-industrial sites, Cui (2010) elucidates the methods of ecological restoration and proposes the principles of sustainable landscape transformation. Wang and Zhao (2011) focus on the case of post-industrial site regeneration in the United States and discuss the experience that can be learned from China's urban development by analyzing the methods of site ecological restoration and postindustrial site

landscape regeneration. Liu and Wang (2019) assess the value of reclaiming post-industrial sites by examining the Duisburg-Nord Park in Germany from the point of view of industrial products, wild plants, spatial sequences, and water features. Cheng and Yao (2020) study the theory and principles of urban post-industrial sites' landscape transformation and utilization. In addition, there are also studies concerning the preservation of industrial heritage. Liu (2009) provides a more detailed analysis of urban land renewal and industrial heritage conservation in 'Urban Industrial Land Renewal and Industrial Heritage Conservation'. A primary focus of this book is on the revitalization of urban industrial land and the preservation and utilization of industrial architectural relics.

As stated previously, the study of post-industrial site regeneration began only about twenty years ago. A substantial body of research has not yet been accumulated in this field. Most of the available results are based on post-industrial site regeneration cases in foreign countries. In China, local post-industrial site regeneration research is still lacking. Therefore, it is necessary to examine cases of post-industrial site regeneration in China and summarize their experiences. The Beijing-Tianjin-Tangshan region is an old industrial centre in China and a typical area for post-industrial site regeneration, but it is not included in the current study. Due to this reason, this study focuses on the case of post-industrial site regeneration in the Beijing-Tianjin-Tangshan region. This is the difference and significance between it and previous research.

This paper aims to discover the implications through analysis of the characteristics and design strategies of regeneration in the post-industrial sites at the Beijing-Tianjin-Tangshan region which is the metropolitan area. It provides a basis for future research and theoretical strength for post-industrial site regeneration practices.

1.3 Research Object and Scope

This paper needs to begin with a definition of post-industrial sites in China that distinguishes them from other types of brownfields. Post-industrial sites are sites that were previously used for industrial production or directly supported it, such as old factories, shipyards, abandoned docks, etc. Infrastructures such as transportation facilities, pipeline facilities, and logistic reserve facilities are also included.

This study examines five completed post-industrial regeneration projects in Beijing, Tianjin, and Tangshan. They are Shougang Industrial Heritage Park and 798 Art District in Beijing, Cotton Three Creative District and Vanke Crystal City Community in Tianjin, and Qixin 1889 Cultural Creative Park in Tangshan.

1.4 Research Method

Literature on post-industrial site regeneration has been examined to understand the current research status. Field research was conducted in Beijing (Shougang Industrial Heritage Park and 798 Art district), Tianjin (Cotton Three Creative Park and Vanke Crystal City Community) and Tangshan (Qixin 1889 Cultural Creative Park) between July-August 2018 and January-February 2022 to determine the conditions of the sites. Many photographs were taken in order to complement the content of the paper.

Based on the results of the literature review, Wang and Ren (2003) see the utilization of industrial heritage, pollution treatment, and plant restoration as the key elements of post-industrial site regeneration. Wang and Zhao (2011) analyze the cases based on ecological design, industrial heritage landscape design, and waste reuse. Liu and Wang (2019) present their findings based on industrial products, wild plants, spatial sequences, and water features. Accordingly, this study provides a comprehensive analysis of the project location, scale, year of regeneration and use of the site before regeneration. The design content analysis is based on the design philosophy, basic object, spatial layout, program and plantscapes (Table 1).

Table 1. Frame of the analysis of case

Overview	Project name / address / year of the regeneration / area / original use
Design philosophy	The main design idea of the project
Basic object	New use of the site New use of the industrial relics
Spatial layout	Space zone / road division
Program	New functions Industrial relics utilization program
Plantscape	Restoration of plants The effect of plantscape

On this basis, the general design strategies are summarized and interpreted for different post-industrial site regeneration cases. Landscape design strategies for post-industrial site regeneration are described in terms of six aspects: regeneration goal, space integration, element reorganization, ecological restoration, design and art combination, and public participation.

2. Overview of Post-Industrial Sites in the Beijing-Tianjin-Tangshan Region

2.1 Condition of the Beijing-Tianjin-Tangshan Region

The Beijing-Tianjin-Tangshan region is situated in the northern portion of the North China Plain, along the coast of the Bohai Sea. Three cities are located 110 to 150 kilometers apart, forming a square triangle. There are various types of landforms, mainly plains, mountains and hills. The main rivers are part of the Haihe and Luanhe water systems, respectively.

The Beijing-Tianjin-Tangshan region is one of the four major industrial bases in China, which are home to the famous Kailuan coal mine, the Jingxi coal mine, the Qian'an iron ore mine, etc. Also nearby is the Changlu Salt Farm, one of the four major salt farms in China, as well as the famous Dagang Oil Field and Renqiu Oil Field. It is a fact that railway transportation and shipping are well developed, as well as the original industry, science, and technology in the Beijing-Tianjin-Tangshan region. This provides good conditions for the development of the regional industrial economy. As a result of large-scale economic development since the founding of the country, the Beijing-Tianjin-Tangshan region is now considered one of China's most developed economic regions. Tianjin and Beijing have become more complete industrial categories, comprehensive and strong cities, with Beijing's petrochemical, electronics, culture, education, arts and industries, and Tianjin's marine chemical and daily light textile industries. Tangshan has established itself as an important industrial city in Hebei, and is known for its coal, metallurgy, ceramics and other industries.

2.2 Post-Industrial Site Distribution

2.2.1 Beijing's post-industrial site distribution

Beijing's post-industrial sites are mainly located in large and medium-sized old industrial zones along and around the Fifth Ring Road, such as Beijing Shougang Factory, West Fifth Ring Industrial Zone, Fengtai Industrial Zone, Urban Construction Group Storage and Transportation Corporation, Beijing Chemical Industry Factory No. 3, Beijing Hongshi Paint Factory, Fatou Industrial Zone, Industrial Zone along Tonghui River, Dashanzi Industrial Zone and Huangzhuang Industrial Zone (Figure 1).

2.2.2 Tianjin's post-industrial site distribution

Tianjin's post-industrial sites are located in Nankai district, Hedong district and Hongqiao district, covering large areas such as the Tianjin Heavy Machinery Factory and Tianjin Tractor Factory. Large areas of the

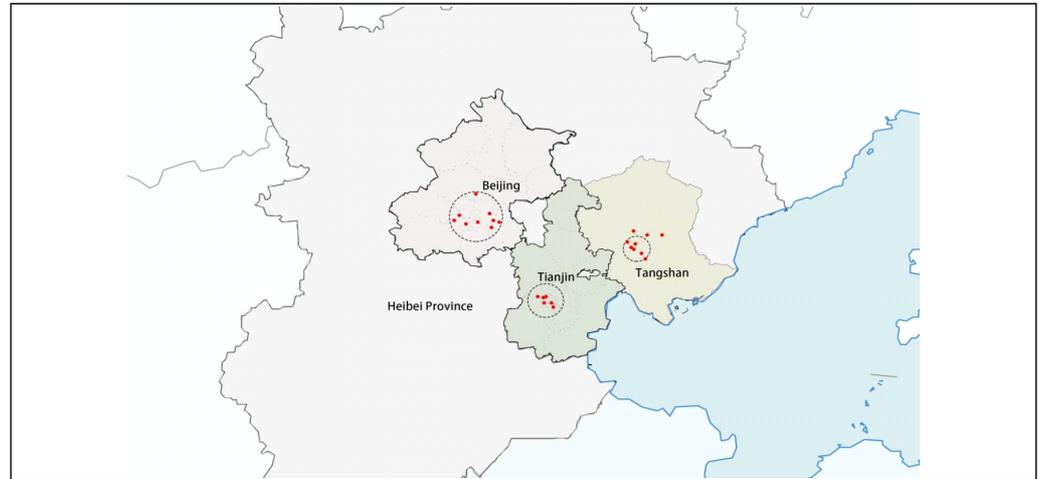


Figure 1. Post-industrial site distribution in the Beijing, Tianjin, Tangshan

factories are vacant and need to be given new functions in order to revitalize them. Tianjin was developed by the Haihe River, and most factories were built here. Therefore, the post-industrial sites in Tianjin are mainly concentrated along the Haihe River (Figure 1).

2.2.3 Tangshan's post-industrial site distribution

Tangshan's post-industrial sites are made up of various industrial types, including coking, electric power, machinery, metallurgy, casting and light industry. Some of the post-industrial sites are closely related to Tangshan's economic development. Mostly in the Lunan district and Lubei district of the city center, with a concentrated spatial distribution. There are fewer and scattered post-industrial sites in Tangshan's surrounding areas (Figure 1).

2.3 Post-Industrial Site Characteristic

2.3.1 Spatial characteristic

The site terrain of the post-industrial site in the Beijing-Tianjin-Tangshan region is flat without significant elevation changes. The majority of industries are heavy industries such as steel, cement, and chemical factories. Thus, the most prominent spatial features on the site are large industrial buildings and facilities (Figure 2a).

2.3.2 Ecological characteristic

Beijing-Tianjin-Tangshan's post-industrial sites have been affected by extensive human intervention resulting in a landscape substrate. There has been some damage to the ecology of the site due to long-term industrial production activities in the past. In addition, the rail transportation system, road system, and industrial facilities built for production on the site have severely damaged the original landscape pattern. The continuity of the landscape has been broken and fragmented (Figure 2b).

2.3.3 Cultural characteristic

The industrial history of the Beijing-Tianjin-Tangshan region is a colorful piece of China's industrialization development process. As relics of the past, post-industrial sites provide witness into the industrial evolution of a region. Numerous historic structures that reflect the aesthetics of industrial technology and innovation can be found in post-industrial sites. This is a significant cultural aspect of these sites. The post-industrial sites are also a testament to the lives and labors of the region's inhabitants. They carry the strong emotional identity and profound sense of belonging of urban residents in the Beijing-Tianjin-Tangshan region (Figure 2c).



Figure 2. Post-industrial sites in the Beijing-Tianjin-Tangshan region

Source: a. Post-industrial site in the Beijing (<http://www.soho.com>)

b. Post-industrial site in the Tianjin (<http://www.douban.com>)

c. Post-industrial site in the Tangshan (<http://www.gov.cn>)

3. Case Study

3.1 Beijing Shougang Industrial Heritage Park

Located in the north area within the Shougang industrial zone in the Shijingshan district of Beijing, Shougang Industrial Heritage Park occupies approximately 2.91km². Shougang Industrial Building Heritage Park is an urban open space with a variety of functions. It emphasizes the concept of conservation by systematically and completely protecting industrial facilities with distinctive features, such as raw material silos, blast furnaces, coke ovens, etc. The theme is industrial civilization, which highlights the characteristics of the industrial landscape and explores the potential value of the repurposing of industrial buildings in excellent and efficient ways. The old functions, industries, and cultures are transformed in order to adapt to the new characteristics of each building. Ecological restoration technologies improve the environment. Shougang Industrial Heritage Park has become a classic landscape project in China's post-industrial site regeneration (Table 2).

3.2 Beijing 798 Art District

The 798 Art district, which encompasses approximately 600,000 m², is located in northeast Beijing's Dashanzi district. It used to be the old factory area of the former state-owned 798 factory and several other electronic industries. The artist initiated the renovation of the factory buildings in Beijing 798 as a personal act. The renovation was based on the philosophy 'the exterior is as old, the interior is renovated' so that the original industrial elements could be preserved following government intervention. The primary purpose of the design is to reuse the old buildings adaptively. The designers focused on the long-term potential development value of the factory site and integrated industrial elements with distinctive Bauhaus-style architecture. With art as the central theme of the district, a wide range of art forms and styles are incorporated to create a vibrant and active community. Gas plants, railroad tracks, and industrial elements are preserved and transformed to create an open space for outdoor performances and tours (Table 2).

3.3 Tianjin Cotton Three Creative District

Cotton Three Creative District is located in Tianjin's Hedong District and covers an area of 10.51hm². It was formerly the Tianjin Cotton Spinning Plant No. 3. The factory's construction began in 1921 and continued until the end of the 20th century. During the interim, construction activities have continued. Thus, the Cotton Three Factory has many industrial buildings from different periods. Many of these have high historical and cultural value. Therefore, the Cotton Three Creative District cannot adopt a total demolition renewal strategy. It is necessary to prioritize the preservation and integration of creative and industrial elements. The Cotton Three Creative District has become the first new creative district integrating innovative design, business consultation, art exhibition, new media service, cultural leisure, and talent training in Tianjin

(Table 2).

3.4 Tianjin Vanke Crystal City Community

Tianjin Vanke Crystal City is the first purely commercial development project in China. It is located in the ecological residential area of the Meijiang River in the south of Tianjin city and the former site of Tianjin Glass Factory. It covers an area of 440,000m², with a planned total construction area of about 400,000m². The plan is based on the philosophy of 'building the future out of history' with due respect for the environment. The original industrial building remains are analyzed for value and selectively retained before being cleverly incorporated into the design. It also considers the architectural style, scale, and charm of the Five Avenues in Tianjin to create a large community with the theme of industrial heritage (Table 2).

3.5 Tangshan Qixin 1889 Cultural Creative Park

Qixin 1889 Cultural Creative Park is located in Tangshan's Lubei District, covering an area of 10.7hm². It was formerly known as Qixin Cement Factory. The design philosophy of Qixin 1889 Cultural Creative Park is to preserve the form's history and originality. The plan adopts a functional replacement method, which combines the needs of citizens in the context of the new economy with the preservation of original historical appearance. The cement factory has been turned into a cultural and commercial experience center. Through the penetration of creative fashion culture in the regeneration of the post-industrial site, the reconnection between city and people is achieved (Table 2).

4. Landscape Design Strategy of Post-Industrial Site Regeneration in Beijing-Tianjin-Tangshan Region

4.1 Landscape Regeneration with Diverse Goals

Table 2. Summary of post-industrial site regeneration projects

Name	Beijing Shougang Industrial Heritage Park		
Overview	Address	No.68 Shijingshan Road, Shijingshan District	
	Year	2013-2020	
	Area	2.91km ²	
	Original use	Steel industrial area	
Design philosophy	<ul style="list-style-type: none"> The park is dedicated to preserving industrial heritage, with the theme of industrial civilization highlighting industrial features. Ecological restoration techniques are used to improve the environment. 		
Basic object	<ul style="list-style-type: none"> The space preserves the original overall pattern of the steel mill and shows the main production processes of the steel industry. Transformation of industrial buildings into exhibition, cultural and creative, office, and business spaces. 		
Spatial layout	<ul style="list-style-type: none"> The park is divided into five areas: exposition and exhibition area, public recreation area, creative culture area, water-friendly play area, and Shijingshan ancient architecture group. The movement line uses the original road system of the factory as a tour path. 		
Program	<ul style="list-style-type: none"> Exhibition: Transformation of No.3 blast furnace into 'Shougang Museum'. Cultural&Creative: Planning to make the West Ten Silos into a cultural and creative industrial district. Office: Convert the oxygen factory into an office and competition service area. Business: Transformation of the 5-1 theater and the pulverizing workshop into the trade center. Conversion of the supporting facilities of No.3 blast furnace into a cafe. Other function: Conversion of four industrial buildings into a hotel. 		

Table 2. Continued

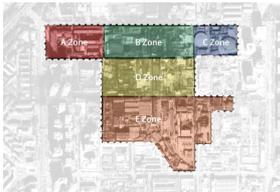
Plantscape	<ul style="list-style-type: none"> Use the internal lake to increase aquatic plants and form an ecological area. Increase aquatic plants to achieve sustainable ecological restoration of water. Preserve original plants. 		
Name	Beijing 798 Art District		
Overview	Address	No.2 Jiuxianqiao Road, Chaoyang District	
	Year	2002-2013	
	Area	600,000m ²	
	Original use	Electronics factories	
Design philosophy	<ul style="list-style-type: none"> The exterior is as old, the interior is renovated. Focus on the long-term potential development value of the site, and use art as the central theme of the site. The unique Bauhaus-style architecture is combined with industrial elements, combining a wide range of art forms and styles to create spaces that are dynamic and energetic. 		
Basic object	<ul style="list-style-type: none"> Based on the original factory pattern, the dense and dilapidated industrial building complex was integrated, the abandoned and low buildings were demolished, and the high-value buildings were retained. Industrial elements are preserved and transformed into outdoor areas. 		
Spatial layout	<ul style="list-style-type: none"> The art district is divided into five spaces, which are 798A, 798B, 798C, 798D, and 798E. The traffic system of the original factory is clearly and relatively neat, so the original road structure is retained and continued. Linear grid arrangement, north-south direction. 		
Program	<ul style="list-style-type: none"> Art exhibition: The original buildings are transformed into the gallery and exhibition hall. Creative design: The art district leaves a random graffiti wall of 8 meters high for artists to paint. Business and office: Add modern stores, restaurants and coffee shops, etc. The new buildings extract elements from the old factory, echoing the old buildings. Culture&leisure: Contemporary sculpture that directly uses abandoned industrial facilities as ready-made products. 		
Plantscape	<ul style="list-style-type: none"> Retain the original tree species such as French sycamore, cedar, poplar and willow, these large trees with a sense of age add a historical atmosphere to the art district. Add some landscape garden plants. They are scattered in the street green of the art district. 		
Name	Tianjin Cotton Three Creative District		
Overview	Address	Haihe East Road, Hedong District	
	Year	2013-2015	
	Area	105,100m ²	
	Original use	Cotton textile factory	
Design philosophy	Prioritize conservation and add cultural and creative elements.		
Basic object	<ul style="list-style-type: none"> Based on the original factory layout, the space area is redefined, and art&leisure, smart office, residential, and sport are added. Keep the main buildings of high value in the site and demolish the few buildings of low conservation value. 		
Spatial layout	<ul style="list-style-type: none"> It is divided into three major parts: 'Art Block', 'Wing Space' and 'Ease of Living'. The district has a main east-west axis and a secondary north-south axis. The main axis divides the city into three districts: south, central, and north, while the secondary axis divides the sport plaza and office courtyard. The original industry's road structure is used to divide movement lines. Art&leisure: The Art Block was converted from the No. 2 textile workshop (1921&1992). There are art galleries, restaurants and fitness centers. 		

Table 2. Continued

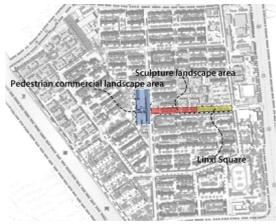
Program	<ul style="list-style-type: none"> Smart Office: The Wing Space was converted from the No.1 textile workshop (1921&1972). It aims to create a modern smart office. With the creative loft form of sawtooth building, it creates a more free office experience. Residential: The ease of living apartment combines a hotel-style apartment with a cloud platform service, enabling greater convenience and freedom of movement. Use various components and materials from the original industrial building in the newly remodeled structure. Sport: S·P·R sport plazze , it gathers a group of skateboarding, parkour, roller skating and other urban sports elements. 	
Plantscape	<ul style="list-style-type: none"> Tianjin's good growing landscaping is being planted. Plant selection and matching are relatively homogeneous, resulting in poor plantscape effects. 	
Name	Tianjin Vanke Crystal City Community	
Overview	Address	No.518 Jiefang South Road, Hexi District
Overview	Year	2002-2005
	Area	440,000m ²
	Original use	Glass factory
		
Design philosophy	Respect for the natural environment and "Creating the future from history" is the philosophy.	
Basic object	<ul style="list-style-type: none"> The original industrial building remains are analyzed for value and selectively retained before being cleverly incorporated into the design. It also considers the architectural style, scale, and charm of the Five Avenues in Tianjin to create a large community with the theme of industrial heritage. 	
Spatial layout	<ul style="list-style-type: none"> Relying on an east-west railway track with industrial memory forms a pedestrian landscape space. 	
	<ul style="list-style-type: none"> The open space is primarily a pedestrian corridor that is divided into three sections: apedestrian commercial scenic area, sculpture landscape area, and Linxi Square. 	
Program	<ul style="list-style-type: none"> Leisure: Linxi Square is located at the east end of the pedestrian street and serves as a place for residents to communicate and engage in leisure activities. It includes a stone art landscape and a dry fountain. Historical memory: Keep the water tower and add new materials to use as a landscape clock tower, retain the railroad tracks overlaid with the walkway, and use the old steam locomotive head as a sculpture. Business: Using the structural system of the hoisting shop, new blocks, glass, and steel assemblies were added and connected by an open steel gallery to form a new community clubhouse. 	
Plantscape	<ul style="list-style-type: none"> Retain more than 600 native trees and dozens of ash trees. With the site's elevation changes, fractured streams and landscape amenities, these plants provide a sense of historical vicissitudes. 	
Name	Tangshan Qixin 1889 Cultural Creative Park	
Overview	Address	Hexi Road, Lubei District
	Year	2011-2014
	Area	105,100m ²
	Original use	Cement factory
		
Design philosophy	<ul style="list-style-type: none"> The philosophy of design is to preserve the historical and morphological authenticity, while honoring the culture of the cement plant's industrial past and the city's development history. 	

Table 2. Continued

Basic object	<ul style="list-style-type: none"> Based on retaining the characteristics of the original site, new features are added, mainly showcasing the birthplace of China's first barrel of cement. The plan is to transform the cement plant into a center for cultural and business experiences.
Spatial layout	<ul style="list-style-type: none"> It is divided into four sections based on function: Happiness Square, Cement Industry Museum, Industrial Relics Exhibition Area, and Creative Art Zone. The traffic system is formed by the building arrangement, and the movement line is too regular and simple.
Program	<ul style="list-style-type: none"> Cultural exhibition: The largest industrial building ruins have been converted into an industrial relics display area and museum. Machine and equipment are transformed into iconic landscapes, and the building's load-bearing columns become landscape facilities in the atrium. Art: Cement silo barrels are transformed into art exhibition galleries. Business: The interior space of the building is transformed into a restaurant, cafe, and wedding photography studio.
Plantscape	<ul style="list-style-type: none"> Plants from the original site are kept and combined with native plants. The plantscape is concentrated at the park's east and south entrances. Because of the more dense buildings, there is a lack of space in the park for planting plants, and thus no rich plantscape is formed.

4.1.1 Industrial heritage preservation-oriented regeneration goal

The original site of Beijing's Shougang Industrial Heritage Park is an post-industrial site with significant value in representing the history of urban development. Therefore, the regeneration model is based on preserving the industrial heritage. Furthermore, 798 Art District, Vanke Crystal City, and Qixin 1889 Cultural Creative Park have renovated industrial buildings and facilities to preserve industrial heritage. Because of the high-intensity plasticity of the landscape, the industrial heritage conservation orientation is highly adaptable for many post-industrial sites (Figure 3).

4.1.2 Cultural creative-oriented regeneration goal

798 Art District, Cotton Three Creative District, and Qixin 1889 Cultural Creative Park adopt the cultural creative oriented regeneration model. In addition, Shougang Industrial Heritage Park injects cultural and creative elements into the old industrial heritage as a new function. The cultural creative-oriented regeneration can significantly enhance urban artistic style and tourism system (Figure 3).

4.1.3 Neighborhood revitalization-oriented regeneration goal

Vanke Crystal City is a regeneration model that uses demolition and reconstruction to create a new urban community. The regeneration model of urban communities is the same as the traditional neighborhood development model. Small-scale neighborhoods are formed by combining well developed infrastructure with a reasonable spatial scale of neighborhood units and landscape facilities. In addition, the design of the Cotton Three Creative District also focuses on the space of neighborhood units and the construction of small-scale

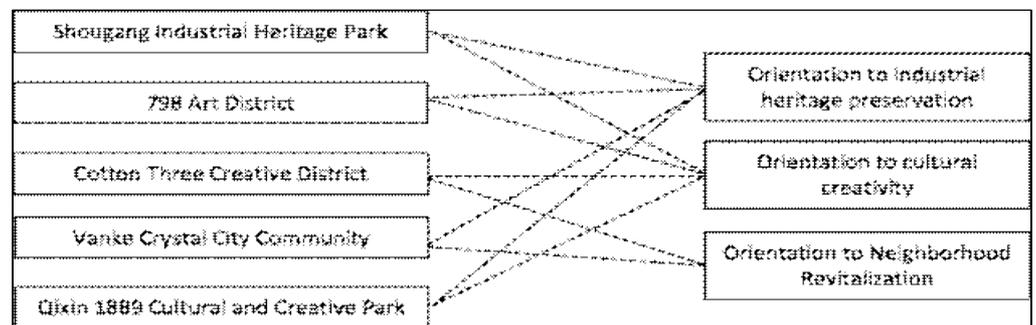


Figure 3. Landscape regeneration with diverse goals

neighborhoods (Figure 3).

4.2 Landscape Space Integration

4.2.1 Enhancement of spatial characteristic

The site's original spatial characteristics and texture structure are respected and utilized. The corresponding landscape functional zone is determined according to the different sites (ex: the original road alignment, the orientation and rhythm of the building arrangement, the layout characteristics of industrial facilities and processes, etc.) (Table 3).

Respectful inheritance is not about maintaining the original but about defining new landscape functions based on the original spatial features and making them echo the original site features. Such as the enclosed open space between the building and the facility served as a staging area for raw materials or finished goods. This enclosed space can be utilized by the landscape designer to create a plaza. At the same time, the design gives more functions to the plaza. Such as the use of unique paving forms or materials to highlight the industry theme (ex: 798 Art District's Old Furnace District Square). The addition of local water features, dotted planting and other landscape elements enrich the spatial changes of the site (ex: Vanke Crystal City Community Linxi Square's water features). The design of small stands and stages gives the square the content of cultural activities (ex: Shougang Industrial Heritage Park Coking Plaza's outdoor performance stage).

4.2.2 Embedment of transitional space

The new elements are embedded in large-scale site spaces or industrial facilities to form a new spatial interface. It can effectively reduce the oppressive and heavy feeling of the original large-scale industrial facilities. 798 Art District has many small shared spaces, including green plants, benches, and sunshades between buildings and industrial facilities (Figure 4a–4c). The air-bridge connecting the buildings has been added to Qixin 1889 Cultural Creative Park. It not only solves the problem of connection between factory buildings, but also breaks the isolation of tall buildings (Figure 4d).

4.2.3 Increase of spatial level

The superposition of vertical spatial levels is designed according to the spatial characteristics of the post-industrial site. Firstly, there are usually recessed spaces below the elevation of the horizon in industrial production, such as silos for raw materials, sinks for sewage treatment, and water tanks in industrial processes. Secondly, the ground level is the most prevalent level of site use. It is also the level with the most

Table 3. Landscape design approaches that enhance spatial characteristics

Space design approach	Manifestation mode	Research project	Design content
Superposition	New landscape features are highly integrated with the original site space.	Shougang Industrial Heritage Park	The park's main landscape nodes and the overall landscape axis alignment are designed based on the industrial layout and spatial characteristics formed by Shougang's long-term production.
Contrast	New landscape features contrast with the original site space.	798 Art District, Cotton Three Creative District	New landscape facilities are contemporary style and reinforce the new features that contrast with the original industrial legacy.
Juxtaposition	New landscape features co-exist with the original site space without interfering.	Qixin 1889 Cultural Creative Park	Different landscape functions are juxtaposed with the industrial remains of the site.
Metaphor	New landscape features establish a connection to the history of the original site.	Vanke Crystal City	The restored clock tower interprets the architectural features of Tianjin's modern era and expresses the combination of the site's history and the present.

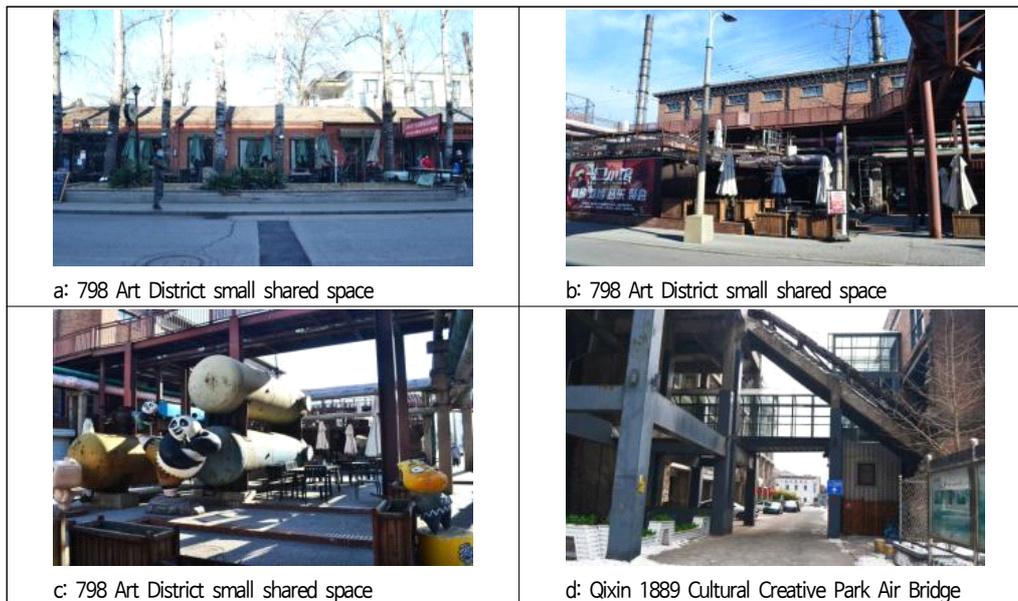


Figure 4. Embedded transition space

concentrated landscape content. Thirdly, the aerial level refers to many tall pieces of equipment, pipelines, and aerial maintenance and operation paths in the post-industrial site.

In the 751D-Park of 798 Art District, the recessed space is transformed into a landscaped pool. The grass, wooden platform, and original concrete materials form a more richer ground level. At the air level, a new north-south air corridor is built using the original overhead industrial pipeline structure. Shougang Industrial Heritage Park also has three spatial levels.

4.3 Landscape Elements Reorganization and Renewal

4.3.1 Original industrial elements integrated into the new environment

The site's existing industrial landscape remains are reasonably utilized and designed to make these industrial landscapes more integral and distinct. Based cases, the author compiled the means of landscape use of the industrial relic elements (Table 4).

4.3.2 New design content is in harmony with the original character

By preserving the relics of the industrial landscape, the new design element harmonizes with the original industrial landscape of the site.

Firstly, this harmony is reflected in the unity of the new design character with the site's historic character. In Shougang Industrial Heritage Park, the facade of the West Ten Silos is hollowed out and carved with circular holes. The silos have a distinctive industrial character and geometric form with a prominent symbolic meaning. In Qixin 1889 Cultural Creative Park, the newly designed facade adds metal and glass elements to the old building frame.

Secondly, this harmony is also reflected in the choice of design materials. The most common local stones are used as floor paving and masonry materials for landscape walls in the Vanke Crystal City community. At the same time, cast-iron railings reflect the heaviness of industry and echo the old factory buildings.

Finally, this harmony is reflected in integrating the original road traffic vein. In Shougang Industrial Heritage Park, the internal roads of the post-industrial site are organically linked to the surrounding environment and traffic. It forms an urban road texture that is independent from the outside world and at the same time connected to it.

Table 4. Landscape utilization means of industrial heritage elements

Industrial heritage element	Landscape utilization design means	Schematic picture
Railroad track	Preserving the original state for display: In 798 Art District and Qixin 1889 Cultural Creative Park, the railroad tracks, steam engine locomotive, and freight cars are preserved in their original form and displayed as landscape sculptures.	
	Combined planting design: In Shougang Industrial Heritage Park, the railroad is combined with native planting to create a naturally lush landscape.	
	Converted into a paved road: In Shougang Industrial Heritage Park, the railroad is filled with paving stone to form a landscape tour route.	
	Landscape reuse: In Vanke Crystal City, the railroad is combined with walking paths and sculptural works for landscape reuse.	
Industrial blast furnace	Reuse of internal function: In Shougang Industrial Heritage Park, the Blast Furnace No. 3 is transformed into a museum.	
	As a landscape landmark: In 798 Art District, the gas cracking blast furnace serves as the landscape landmark of the square.	
Industrial silo	Reuse of internal function: In Shougang Industrial Heritage Park, forty silos are transformed into loft creative office space.	
	As a landscape landmark: In Qixin 1889 Cultural Creative Park, cement silos are used as landscape landmarks to create an industrial atmosphere.	
Industrial tank	As a landscape landmark: In 798 Art District, the steel frame structure of the gas storage package is used as a landscape landmark to create an industrial atmosphere.	
	Reuse of internal functions: In 798 Art District, gas tanks are transformed into a 3D vibrant museum that visitors can play with and visit.	

Table 4. Continued

Industrial heritage element	Landscape utilization design means	Schematic picture
Industrial tank	Facade redesign: The facade of the gas tank in 798 Art District is also redesigned, adding a new set of buildings.	
Machines and equipment	As a landscape sculpture: In 798 Art District, gas compressors are displayed as landscape sculptures.	
	<i>In-situ</i> preservation: Machines preserved in Shougang Industrial Heritage Park are displayed as industrial technology artifacts.	
Chimney	Transformed into a characteristic landscape structure: In 798 Art District, the chimney of the former gas plant becomes a landscape structure that best fits the temperament of the park.	
	As a landscape landmark: Several tall chimneys are preserved as landscape landmarks in Shougang Industrial Heritage Park.	

4.4 Landscape Ecological Restoration

4.4.1 Soil ecological restoration

The various contaminants in the post-industrial site are left in the soil throughout the site. Therefore ecological soil restoration is a crucial part of the process. Ecological restoration with plants not only slowly restores the fertility of the original soil but also is one of the most cost-effective ways to reduce pollutants. The authors summarized the technical means of ecological soil restoration through field research and a review of relevant literature (Table 5).

4.4.2 Plant ecological restoration

After years of use, the post-industrial site typically leaves behind a large quantity of valuable plants. Some are ancient trees with a lengthy past. Their preservation is essential to preserving the site's historical continuity. Some of them are plants that grow naturally in the wild. Over time, they establish a new ecological equilibrium with the surrounding organisms, forming new biological populations. This has a substantial impact on the post-industrial site landscape.

Long-term industrial production has resulted in poor and polluted soils, making post-industrial sites unique. Due to their botanical properties and capacity to improve the soil, the most suitable plant material for such areas will be adapted plants for harsh environments. As a method of ecological management, these

Table 5. Soil ecological remediation technology means

Soil type	Landscape ecological restoration	Specific technical means
Heavy metal pollution	Planting native plant	Phytostabilization: Plant roots reduce the soil's infiltration, migration, and diffusion of heavy metals.
		Phytovolatilization: Plants convert the absorbed pollutants into gaseous substances and then release them into the atmosphere.
		Phytoextraction: Plants absorb metal ions from the environment and transport them to the above-ground parts of the plant body.
Organic pollution	Planting native plant	Plants can directly absorb organic pollutants. The organic pollutants are converted into harmless metabolites stored in the plant or converted to H ₂ O and CO ₂ for volatilization.
	Microbial degradation	Organic type pollution is degraded and transformed by microorganisms. But the operation is difficult and requires skill.
	Integrated plant and microbial management	The organic type pollution is absorbed and degraded by the plant root system and microbial community working together. It is practical and operable.
Barren soil	Increase fertility	Add bio-fertilizers such as dead grass and leaves, animal manure and silt to gradually restore soil fertility by combining the plant growth process to form humus.

plants are adept at decomposing and absorbing harmful substances from the soil. They can attain a natural and wild form on a slightly polluted site and blend harmoniously with the landscape appearance of industrial ruins.

4.5 Combination of Landscape Design and Art

4.5.1 Sculpture art

The sculpture is a typical component of landscape design. Using sculptural artworks in the design of post-industrial site regeneration can achieve twice the result with half the effort.

There are two types of contemporary sculptural art. Artist made sculptures are one category. In 798 Art District and Cotton Three Creative District, sculptures by various artists from different times periods are exhibited. They are placed and arranged in accordance with the requirements of landscape design (Figure 5, 6). In Vanke Crystal City and Qixin 1889 Cultural Creative Park, cast iron sculptures depict living conditions and scenes of industrial production (Figure 7).

The other type of sculpture is ready-made. Many industrial legacy products, machinery, and equipment can be incorporated into the aesthetic scope of ready-made sculptures. As ready-made sculptures, the transportation rack in Shougang Industrial Heritage Park, the industrial gas tank in 798 Art District, the locomotive in Vanke Crystal City, and the mechanical parts in Qixin 1898 Cultural Creative Park have artistic and aesthetic value.



Figure 5. Sculpture in 798 Art District



Figure 6. Sculpture in Cotton Three Creative District



Figure 7. Use of sculpture art

4.5.2 Graffiti art

The use of graffiti art is also a way to utilize the interface of the space for transformation. It is more flexible and less expensive. In 798 Art District, the spatial interface within the original post-industrial site is typically painted with production slogans and period-appropriate posters. These components are representative of history and culture. Graffiti walls contribute significantly to the atmosphere of the entire art district (Figure 8a-8c). There are numerous graffiti art applications in Qixin 1889 Cultural Creative Park. It is the artistic temperament which is added to the post-industrial site (Figure 8d).



Figure 8. Use of graffiti art

4.6 Public Participation

4.6.1 Incorporation of urban events

With a rich industrial history and a variety of site space types, the redeveloped post-industrial sites have a close relationship with the city. They have gradually evolved into venues suitable for a range of commercial, athletic, and artistic activities in the city.

The 2022 Beijing Winter Olympic Organizing Committee relocated to Shougang Industrial Heritage Park in December 2015 under the guidance of the Green Olympics and Frugal Olympics concepts. Utilizing this opportunity, Shougang Industrial Heritage Park has been reborn as a major event. In addition, the park utilizes the site's industrial heritage and matches the light environment effect to create a light and shadow art exhibition. It provides an immersive experience of the charm of industrial heritage and the art of light and shadow. On the basis of the industrial heritage, immersive industrial theme exhibitions have been held to demonstrate the steel industry's workflow in its entirety.

Every year, the Beijing Design Week event chooses 798 Art District as one of its exhibition venues. In addition, the 798 Art District hosts the 798 Art Festival annually from late September to early October and welcomes all types of artists to exhibit their work.

4.6.2 Planning public events

The planning and holding of public events is also an effective way to energize the venue. Cotten Three Creative District has become a gathering centre for art and culture, leisure and entertainment, and business exchange in Tianjin with the help of designers' presence and public activities. A variety of art events are held each year in the streets or courtyards here. From small concerts to advanced design art exhibitions, the public can participate according to their interests. There are various types of interactions broadly divided into economic, artistic, and sports. The economic theme is based on various sales fairs, selling second-hand items, collectibles, handicrafts, etc. artistic themes include various art festivals, design seminars, music festivals, festival-themed events, etc. Sports themes include skateboard competitions, outdoor fitness classes, etc.

5. Conclusion

This paper has attempted to take post-industrial site regeneration practice projects in the Beijing-Tianjin-Tangshan region as specific research objects and summarize the design strategies for post-industrial site regeneration from the landscape level by combining theory and practical examination. The landscape design strategies can be summarized as follows:

First, post-industrial site regeneration projects in the Beijing-Tianjin-Tangshan region pursue a diversity of goals such as industrial heritage preservation, cultural creativity, and neighborhood revitalization. In order to select the appropriate landscape design goals, it is important to consider the site's location, economy, culture, environment and other factors.

Second, in the design process, the characteristics and spatial levels of the space are enhanced by utilizing the original industrial space, incorporating transitional space, and incorporating industrial facilities of varying heights. Maintain the spatial structure of the original site while adding new landscape elements to enhance its spatial characteristics. Embed transitional spaces in order to reduce the distance between the industrial relics and the visitor. Use industrial buildings that have varying heights in order to enhance the level of space.

Third, the old and new landscape elements are harmoniously integrated through the rational use of industrial relics and the appropriate addition of new elements. The new design style should be in harmony with the original industrial landscape scenery of the site.

Fourth, the design emphasizes ecological soil restoration and the use of native and adaptable plants. It also considers the ability of phytore-mediation to purify contaminated soil.

Fifth, the design combines modern artistic means such as sculpture and graffiti art. By utilizing modern

artistic methods to deal with industrial relics, the industrial landscape's aesthetic and the site's vitality are improved.

Sixth, in the aspect of vitalizing the regenerated site, urban events and public activities are actively programmed.

Although post-industrial sites have existed in China for a long time, research into their solutions has been slow. It is imperative to explore the means of regenerating postindustrial sites in the particular social environment of China. It has important theoretical and practical relevance for the regeneration practice of many post-industrial sites in China to summarize the regeneration strategies of post-industrial sites in Beijing-Tianjin-Tangshan from the perspective of landscape architecture, clarifying the site characteristics and regeneration methods. After landscape design, post-industrial sites can be transformed and revitalized comprehensively, thereby improving the value of urban land use and alleviating the contradiction between land supply and demand. In addition, it promotes the creation of diversified urban spaces, the economic revitalization of declining industrial areas, and the orderly and healthy development of cities. The regeneration of post-industrial sites may also allow for the inheritance of industrial culture and preserve industrial memory to some extent.

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