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RENOVATION OF POST-INDUSTRIAL LANDSCAPES OF CHINA ACCORDING TO THE PRINCIPLES OF SYMBIOSIS THEORY

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The qualification work contains the results of own research

The use of ideas, results and texts of other authors must be referenced to the appropriate source. _____ Huang Xueru (Nicky)

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ABSTRACT

Huang Xueru (Nicky). Renovation of post-industrial landscapes of China according to the principles of symbiosis theory.

In the context of global economic integration and the rapid development of science and technology, China's industrial structure is undergoing profound adjustments. Traditional industries are facing competitive pressure from new industries and increasingly strict environmental regulations. The area where the Heze Xuyang Chemical Plant is located is no exception. With the wave of industrial modernization, the chemical plant has gradually stopped production and abandoned due to relatively backward production technology and substandard environmental protection. This phenomenon is not an isolated exception. There are a large number of abandoned factories in many cities. The existence of these abandoned factories reflects the inevitable stage of the transition of industrial development from the traditional model to the modernized and sustainable model. Issues of urban space and resource formation.

This work aims to explore the design strategy of transformation of abandoned factories under the guidance of symbiosis theory-taking Xuyang Chemical Factory in Heze City as an example.Xuyang Chemical Factory in Heze City, as an abandoned factory, bears the historical memory and cultural value of the city.However, with the acceleration of urbanization, factories have gradually been marginalized and become one of the urban problems that need to be solved.From the perspective of symbiosis theory, this study will analyze the symbiotic relationship between abandoned factories and urban environment, social culture and economic development, and explore how to realize their regeneration and activation through landscape design. Zhang Wen will construct a set of transformation design framework suitable for Xuyang Chemical Plant in Heze City through literature review, field research and case analysis, aiming at providing theoretical basis and practical guidance for the transformation and transformation

of abandoned factories, and promoting the sustainable development and cultural heritage of urban space.

The introduction defines the relevance of the study, formulates the goal and objectives of the study, and outlines the object and subject of the study, the methods used, the scientific novelty of the work, and the theoretical and practical significance of the work.

The first section analyzes the context of global economic integration and the rapid development of science and technology, China's industrial structure is undergoing profound adjustments. Traditional industries are facing competitive pressure from new industries and increasingly strict environmental regulations.

The conclusions to the first section The analysis of scientific sources shows how, through the application of the theory of symbiosis, abandoned industrial sites are transformed into new spaces that are beneficial to society and the environment, achieving a win-win situation for the economy, society and the environment. These cases have important enlightenment and reference value for the transformation of abandoned factories in China and even around the world.

The second chapter. The design of this project will adhere to the concept of sustainable development, strictly adhere to the requirements of urban environmental protection, preserve the original natural landscape and facilities as much as possible, utilize the original existing abandoned facilities, and turn waste into treasures. At the same time, we will respect biodiversity, plant plants in a large area, install flower beds and lay lawns, improve the quality of the surrounding air, and improve the overall appearance of the city.

In the conclusions of the second chapter: The design of this project will adhere to the concept of sustainable development, strictly adhere to the requirements of urban environmental protection, preserve the original natural landscape and facilities as much as possible, utilize the original existing abandoned

facilities, and turn waste into treasures. At the same time, we will respect biodiversity, plant plants in a large area, install flower beds and lay lawns, improve the quality of the surrounding air, and improve the overall appearance of the city. In addition, it will integrate it into the cultural characteristics of the city, publicize the connotation of urban culture, and go through the local concept, so that it can adapt to the trends of the times and respond to the city's call to protect traditional culture.

Keywords: environmental design, age-friendly design; renovation of public space; principles of sustainable development; traditional approach

АНОТАЦІЯ

Хуан Сюеру (Нікі). Оновлення постіндустріальних ландшафтів Китаю відповідно до принципів теорії симбіозу. У контексті глобальної економічної інтеграції та швидкого розвитку науки і техніки промислова структура Китаю зазнає глибоких змін. Традиційні галузі промисловості стикаються з конкурентним тиском з боку нових галузей промисловості та дедалі суворішими екологічними нормами. Район, де розташований хімічний завод Хецзе Сюян, не є винятком. З хвилею промислової модернізації хімічний завод поступово припинив виробництво та занепав через відносно відсталу технологію виробництва та неякісну охорону навколишнього середовища. Це явище не є поодиноким винятком. У багатьох містах є велика кількість покинутих заводів. Існування цих покинутих заводів відображає неминучий етап переходу промислового розвитку від традиційної моделі до модернізованої та сталої моделі. Питання формування міського простору та ресурсів.

Ця робота спрямована на дослідження стратегії проектування трансформації покинутих заводів відповідно до теорії симбіозу, на прикладі хімічного заводу Сюйян у місті Хецзе. Хімічний завод Сюйян у місті Хецзе, як покинутий завод, несе історичну пам'ять та культурну цінність міста.

Однак, з прискоренням урбанізації, заводи поступово маргіналізуються та стають однією з міських проблем, яку необхідно вирішити. З точки зору теорії симбіозу, це дослідження проаналізує симбіотичні зв'язки між покинутими заводами та міським середовищем, соціальною культурою та економічним розвитком, а також дослідить, як реалізувати їх регенерацію та активацію за допомогою ландшафтного дизайну. Чжан Вень розробить набір рамкових проектних рішень для хімічного заводу Сюйян у місті Хецзе, використовуючи огляд літератури, польові дослідження та аналіз конкретних випадків, з метою забезпечення теоретичної основи та практичних рекомендацій щодо трансформації та перетворення покинутих заводів, а також сприяння сталому розвитку та культурній спадщині міського простору.

У вступі визначено актуальність дослідження, сформульовано мету та завдання дослідження, окреслено об'єкт і предмет дослідження, використані методи, наукову новизну роботи, а також теоретичне та практичне значення роботи.

У першому розділі аналізується контекст глобальної економічної інтеграції та швидкого розвитку науки і техніки. Промислова структура Китаю зазнає глибоких змін. Традиційні галузі промисловості стикаються з конкурентним тиском з боку нових галузей промисловості та дедалі суворішими екологічними нормами.

Висновки до першого розділу. Аналіз наукових джерел показує, як завдяки застосуванню теорії симбіозу покинуті промислові майданчики перетворюються на нові простори, корисні для суспільства та навколишнього середовища, досягаючи безпрограшної ситуації для економіки, суспільства та навколишнього середовища. Ці випадки мають важливе просвітницьке та довідкове значення для трансформації покинутих заводів у Китаї та навіть у всьому світі.

Другий розділ. Розробка цього проекту буде відповідати концепції сталого розвитку, суворо дотримуватися вимог охорони міського середовища, максимально зберігати оригінальний природний ландшафт та споруди, використовувати оригінальні існуючі покинуті споруди та перетворювати відходи на скарби. Водночас ми будемо поважати біорізноманіття, висаджувати рослини на великій території, встановлювати клумби та газони, покращувати якість навколишнього повітря та покращувати загальний вигляд міста.

У висновках другого розділу. Проект цього проекту буде дотримуватися концепції сталого розвитку, суворо дотримуватися вимог охорони міського середовища, максимально зберігати оригінальний природний ландшафт та споруди, використовувати оригінальні існуючі занедбані споруди та перетворювати відходи на скарби. Водночас ми будемо поважати біорізноманіття, висаджувати рослини на великій території, встановлювати клумби та газони, покращувати якість навколишнього повітря та покращувати загальний вигляд міста. Крім того, це інтегрує його в культурні характеристики міста, пропагує конотацію міської культури та враховує місцеву концепцію, щоб вона могла адаптуватися до тенденцій часу та відповідати закликам міста захищати традиційну культуру.

Ключові слова: екологічний дизайн, дизайн, орієнтований на людей похилого віку; реконструкція громадського простору; принципи сталого розвитку; традиційний підхід.

INTRODUCTION

In the context of global economic integration and the rapid development of science and technology, China's industrial structure is undergoing profound adjustments. Traditional industries are facing competitive pressure from new industries and increasingly strict environmental regulations. The area where the

Heze Xuyang Chemical Plant is located is no exception. With the wave of industrial modernization, the chemical plant has gradually stopped production and abandoned due to relatively backward production technology and substandard environmental protection. This phenomenon is not an isolated exception. There are a large number of abandoned factories in many cities. The existence of these abandoned factories reflects the inevitable stage of the transition of industrial development from the traditional model to the modernized and sustainable model. Issues of urban space and resource formation.

This work aims to explore the design strategy of transformation of abandoned factories under the guidance of symbiosis theory-taking Xuyang Chemical Factory in Heze City as an example.Xuyang Chemical Factory in Heze City, as an abandoned factory, bears the historical memory and cultural value of the city.However, with the acceleration of urbanization, factories have gradually been marginalized and become one of the urban problems that need to be solved.From the perspective of symbiosis theory, this study will analyze the symbiotic relationship between abandoned factories and urban environment, social culture and economic development, and explore how to realize their regeneration and activation through landscape design. Zhang Wen will construct a set of transformation design framework suitable for Xuyang Chemical Plant in Heze City through literature review, field research and case analysis, aiming at providing theoretical basis and practical guidance for the transformation and transformation of abandoned factories, and promoting the sustainable development and cultural heritage of urban space.

The object of the study is the design of public spaces in China.

The subject of the study is the principles of sustainable development and techniques for shaping the design of the former factory territory

Research purpose.

- *methods of analysis and synthesis* allowed to process the results and conclusions of scientists on the theory of symbiosis, considered in studies of landscape planning and design of rural parks based on the theory of symbiosis;

- *the generalization method* contributed to the generalization of the necessary characteristics with the possibility of their further integration with modern ideas of landscape design and the introduction of the theory of symbiosis in the study of landscape planning and design of rural parks;

- *the graph-analytical method* allowed to suggest the ideological subtext of the concept of "symbiosis" in the planning and design of rural parks, thereby providing appropriate theoretical recommendations for further research. It also allowed to clarify the complete design scheme and make an appropriate project proposal; to implement the transformation of abandoned factories into places of cultural recreation convenient for residents. Local cultural elements are reflected in the design scheme.

The structure of the work consists of an introduction, two sections, conclusions, a list of sources used and appendices.

CHAPTER I. STATE OF RESEARCH AND ANALYSIS OF DOMESTIC AND FOREIGN SOURCES

1.1. **Industrial Transformation and the Phenomenon of Abandoned Factories**.

In the context of global economic integration and the rapid development of science and technology, China's industrial structure is undergoing profound

adjustments. Traditional industries are facing competitive pressure from new industries and increasingly strict environmental regulations. The area where the Heze Xuyang Chemical Plant is located is no exception. With the wave of industrial modernization, the chemical plant has gradually stopped production and abandoned due to relatively backward production technology and substandard environmental protection. This phenomenon is not an isolated exception. There are a large number of abandoned factories in many cities. The existence of these abandoned factories reflects the inevitable stage of the transition of industrial development from the traditional model to the modernized and sustainable model. Issues of urban space and resource formation.

Abandoned factories occupy a large amount of land resources in the city. Taking Heze as an example, the Xuyang Chemical Plant is located in a certain part of the city. After its abandonment, the land remained inactive, which is in sharp contrast to the increasingly limited urban land resources. At the same time, if the buildings and facilities of abandoned factories are not properly transformed, they will become a visual stain in the city and affect the overall image of the city. In addition, some abandoned factories may also have potential environmental risks such as soil pollution, chemical waste leakage, etc., which poses a threat to the ecological environment and the health of residents in the surrounding communities.

1.2. **Issues of urban space and resource formation.**

1. Industrial restructuring. Abandoned factories occupy a large amount of land resources in the city. Taking Heze as an example, the Xuyang Chemical Plant is located in a certain part of the city. After its abandonment, the land has remained inactive, which is in sharp contrast to the increasingly limited urban land resources. At the same time, if the buildings and facilities of abandoned factories are not properly transformed, they will become a visual stain in the city and affect the overall image of the city. In addition, some abandoned factories may also have potential environmental risks such as soil pollution, chemical waste leakage, etc.,

which pose a threat to the ecological environment and the health of residents in the surrounding communities.

2. ***Applicability of symbiosis theory.*** The concept and development of symbiosis theory. The theory of symbiosis originated in the field of biology and aims to explain the interdependence and mutually beneficial symbiosis between organisms.

Analysis of the theoretical basis of symbiosis

Principle Name	Core requirements for environmental design	Specific design strategies and cases
Human-nature symbiosis principle	Break the boundary between artificial environment and nature, integrate natural elements into the design, and realize the two-way nourishment between human activities and ecosystem.	-Strategy 1: Implement "passive design" by planting vertical greenery on building facades to regulate indoor temperature and purify air. -Strategy 2: Preserve native vegetation on site, replace paved surfaces with permeable paving, and restore natural water circulation. Case: The "Super Tree" in Singapore's Marina Bay Gardens provides both shade and lighting while absorbing carbon dioxide through vegetation.
Human-human symbiosis principle	Design public spaces that promote social interaction, reduce interpersonal alienation, meet the needs of different groups (old/young/disabled, etc.), and enhance community cohesion.	-Strategy 1: Create "adaptive spaces" in residential areas or parks, such as convertible open-air plazas, to balance daily relaxation and group activities. -Strategy 2: Integrate barrier-free designs into public facilities, combining ramps, tactile paving, and regular walkways instead of isolating them. -Case: The Shanghai Zhangyuan renewal project preserved historical architectural textures while adding open seating areas and shared exhibition galleries to encourage interaction across age groups.

With the development of interdisciplinary research, the theory of symbiosis is gradually being introduced into urban planning and architectural design. The theory emphasizes the joint survival and development between different elements through the exchange of material, energy and information. In the urban environment, this means that symbiotic relationships can be established between different functional areas, different social groups and people and nature.

3. Symbiotic potential in the reconstruction of abandoned factories. For the reconstruction of abandoned factories, the theory of symbiosis has great potential for application:

- *From the ecological point of view*, abandoned factories can reconnect with natural ecosystems, for example, through vegetation restoration, water purification and other means, making factory sites part of the urban ecological network.

- *At the social level,* abandoned factories can coexist with surrounding communities, for example, turning into community public spaces, cultural and creative places, etc., to meet the social and cultural needs of community residents and promote the economic development of the community.

- *In the economic sphere*, abandoned factories can attract investment in various industries and achieve industrial symbiosis. For example, transforming traditional industrial plants into creative industrial parks to accommodate various emerging industries such as cultural creativity and technological research and development assets, but also stimulate local economic development. The design of the Heze Xuyang Chemical Plant Redevelopment is based on the theory of symbiosis and explores how to achieve sustainable transformation of abandoned factories within this theoretical framework.

Conclusions to the first section

1. It is determined that in the context of global economic integration and the rapid development of science and technology, China's industrial structure is undergoing profound changes. Traditional industries are facing competitive pressure from new industries and increasingly strict environmental regulations.

2. It is proved that with the wave of industrial modernization, chemical plants are gradually shutting down and declining due to relatively backward production technology and poor environmental protection.

3. The study found that this phenomenon is not an isolated exception. The existence of these abandoned factories reflects the inevitable stage of the transition of industrial development from the traditional model to the modernized and sustainable model.

SECTION II. STATE OF RESEARCH AND ANALYSIS OF DOMESTIC AND FOREIGN SOURCES

2.1. Analysis of the state of domestic research.

1) ***Related studies on symbiosis theory.*** In the article "Study on urban planning and design based on symbiosis theory", Wang Qi and Wang Zibao proposed that

the implementation of symbiosis theory can identify possible problems from a systemic perspective and provide an effective reference path for urban planning and design[42].

Zhang Wanlin interpreted the relevant knowledge on symbiosis theory in “Study on landscape planning and design of rural park based on symbiosis theory - taking the example of Zhengzhou Longwang rural park planning and design”, integrated it with modern landscape design ideas, and preliminarily introduced symbiosis theory into the research on landscape planning and design of rural park, and proposed the ideological connotation of “symbiosis” in rural park planning and design, thereby providing relevant theoretical support for further research[55].

In the article "Research on the Landscape Design of Residential Areas Based on the Theory of Symbiosis", Li Jie conducted research and discussion on the symbiosis between the landscape of residential areas and the urban environment and cultural environment, and provided recommendations on the application of the theory of symbiosis in the spatial landscape of residential areas[20]. Finally, using the landscape design of Jiaozuo residential areas as a design practice, based on the basic research and data collection of residential areas, and referring to the current national standards of residential area planning and design, the practical study of the theory of symbiosis was summarized.

In "Study on Landscape Design with the Concept of Symbiosis - Taking the Case of a Garden Hotel in Jianli District, Jingzhou City", Gao Yufan introduced the theory of symbiosis into the landscape design of a garden hotel, integrated symbiosis and landscape design, applied and implemented the concept of symbiosis design, solving the problems of symbiosis between people and the hotel environment, and between the environment and organisms, thereby providing more scientific design methods and improvement measures for the creation of a garden hotel environment to provide consumers with a high-quality and high-quality landscape environment[13].

Meng Jianjun introduced the concept of waterfront landscape design based on symbiosis theory in "Study on the Landscape Design of Urban Waterfront Environment Based on Symbiosis Theory" and proposed effective countermeasures to the problems related to waterfront design at the present stage[28].

In "Design of Residential Waterscape Area Based on Symbiosis Theory - Taking the Case of Qinglong Lake Residential Area in Jiaxia County", Liu Huixiao introduced Kurokawa Kisho's "idea of symbiosis" into design by analyzing the case of Qinglong Lake Residential Area planning and the planning concept, landscape design and spatial design organically integrate natural waterscapes, artificial waterscapes and residential environment, aiming to create a living environment in which people, architecture and nature coexist harmoniously[23].

2) ***Related research on abandoned factories.*** In the article "Research on Ecological Restoration and Landscape Restoration Design of Urban Industrial Deserts", Yang Chen analyzed the ecological restoration and reconstruction of Shijingshan Industrial Deserts of Beijing Shougang Group as an example to provide information for many areas in China that are currently facing ecological restoration and landscape restoration project of urban industrial deserts. Scientific and possible theoretical support and reference for cases.

In the article "Research on the various reconstruction of abandoned factories in cities - taking the example of the reconstruction of the industrial park of Taiyuan Chemical Fertilizer Plant", Hehuaxue gives it new connotations on the basis of preserving the historical content as much as possible and transforming the indoor and outdoor spaces of old factories[14]. The author considers the problem in a cultural sense, guides and expands design ideas with ecological concepts, through various transformations and improvements of the spatial structure and overall functions of abandoned factories, which can be transformed from the concept of "waste" to "treasure" and radiate new vitality.

Li Xinjuan's study "Landscape Design of Mine Wasteland Regeneration from the Perspective of Aesthetic Value - Taking the Case of Huairou Open Pit Site in Beijing" shows that from the aesthetic perspective, the design of mine wasteland regeneration should fully consider the characteristics of the site object and the psychology of the aesthetic subject, explore the aesthetic value of the site, respect and utilize the landscape characteristics of each type of mine wasteland, and integrate the characteristic natural texture, cultural and historical essence and beauty of the artistic form of the abandoned site into the new landscape[22].

Wang Yiru draws on the mature experience at home and abroad in the "Brief Analysis of Landscape Reconstruction Design of Old Factories in New Cities" and seeks appropriate protection and reconstruction methods in the overall process of urban transformation, combined with the actual situation in my country, so that old industrial buildings can be reused and fully utilize their economic benefits[43].

Xin Rui discussed the transformation of the theoretical basis in the "Study on the Spatial Design of Reconstruction of Old Factory Buildings Based on the Theory of "Urban Regeneration"", the protection of old factory buildings in related industries at home and abroad, and the optimal development of old factory buildings, clarifying the direction and scope of the study, the optimization of the reconstruction of old factories as the background, and the reconstruction of old factories in the coastal city as the optimization of the main research cases[48].

3) ***The current status of the application of the design of the reconstruction of abandoned factories based on the theory of symbiosis.*** Wang Tao discussed in depth the model of four-state symbiosis renewal in mine abandoned lands based on the "symbiosis theory" in "Research on the four-state symbiosis model based on the "symbiosis theory" - taking the example of Xiangjiang Happy Snow Country Project"[44]. Based on the ideological connotation of reciprocity, evolution, pluralism and balance of symbiosis theory, a research basis of ecological symbiosis, business symbiosis, symbiosis and morphological symbiosis of mine abandoned lands was built.

Yao Jinfan summarized the design methods of symbiotic landscapes in "Research on the landscape design of industrial parks based on the theory of symbiosis - taking the example of Yibin Liuqixiang Winery" based on the theory of symbiosis, including the symbiosis of industrial development and the natural environment, the symbiosis of space, and the symbiosis of culture[50]. According to the principle of symbiotic design, the summary landscape design method is applied to the design of Yibin Liuchixiang Winery to create an ecological landscape environment with corporate culture and convenient production and life for employees.

In the article "Protection and Restoration of Industrial Wastelands Based on Symbiosis Theory - Taking the Case of the Transformation of Changchun No. 1 Thermal Power Plant", Li Chao built a structure with the factory wasteland as the basis based on the analysis of symbiotic units, symbiotic environment and symbiotic models within the site, the internal and external symbiotic systems of the unit, and the spatial planning is carried out based on the theory of symbiosis, so that the internal and external symbiotic systems can work in a coordinated manner, and mutual integration and symbiosis are achieved through the environment, architecture and other media[18].

Yao Jinlong introduced the “concept of symbiosis” in “Research on Industrial Building Renovation Design Based on the Symbiosis Perspective – TCC Open Ecological Recycling Plant Renovation Design” and used it as the theoretical basis for the research of this article, combined with typical cases, it starts with “symbiosis with the city — to build a personalized and open urban space and restore the natural ecology of the urban spatial environment”; “Symbiosis with regional context — changing the atmosphere of the industrial context and demonstrating the characteristics of the regional context”; “Symbiosis with functions — building a combined functional combination model and creating a comprehensive industrial tourism zone”; The four levels of “symbiosis with space — creating diverse and complex spatial types and spatial forms” develop a strategy

for the design of industrial building renovation under the concept of “symbiosis”[53].

4) ***Case study analysis of abandoned factory reconstruction design***. The "Green Field Art Library" located in Qingdao, Shandong Province is a model of the successful application of symbiosis theory to the reconstruction of abandoned factories. The textile machinery factory, which once witnessed industrial glory in the 1980s, gradually became abandoned after the impact of the market economy. However, by introducing the concept of symbiotic design, the factory was revived. While maintaining the original structural structure, the design team intelligently integrated green vegetation, built roof gardens and sky trails, achieving the harmonious coexistence of natural and industrial relics. It was found that the transformed space was provided with functions such as art exhibitions, creative studios and public recreation, invigorating the cultural life of the community and promoting the emotional connection between people and space. This project not only solves the problem of reusing abandoned factory buildings, but also demonstrates the powerful potential of symbiosis theory in promoting the three-dimensional balance of environment, society and economy through ecological restoration and cultural revitalization, becoming a classic case of urban transformation. Secondly, Hengdian Tianhua Chemical Plant is an abandoned chemical plant with historical and cultural value. Its location and architectural style bear the industrial history and local characteristics of a certain period. During the reconstruction of Hengdian Tianhua Chemical Plant, the basic ideas of symbiosis theory were used to guide the project, aiming to achieve harmonious symbiosis between historical buildings and their new functions, the natural environment and artificial structures, and the local community and visitors.

The reconstruction design focuses on the following:

- preserving the industrial relics of the original building while integrating modern design elements to create a space that meets the needs of modern use and respects the historical context;

• The converted space not only serves as a venue for exhibitions or cultural events, but also establishes close ties with the surrounding natural environment and community. For example, through open public space and green design, community residents are encouraged to participate in the preparation of events, thus improving the interaction between people and the environment.

• In addition, the implantation of new functions such as studios, cafes, etc. has also contributed to the restoration of economic viability and increased cultural exchanges.

Through this case, we can see the important role of symbiosis theory in guiding the reconstruction of abandoned chemical plants. It not only helps to protect and revive historical buildings, but also promotes community participation and the revitalization of the regional economy, achieving a win-win situation for all parties.

Benxi Lake Industrial Heritage Group is located in Xihu District, Benxi City, Liaoning Province. It is a typical case of abandoned factory reconstruction design guided by the theory of symbiosis. The project focuses on the concept of urban symbiosis and aims to achieve the harmonious coexistence of culture, space and nature. The design strategies include:

• reproducing historical textures, innovating functional formats and restoring ecosystems. These strategies not only respect the original characteristics of the site, but also actively transform the negative factors on the site and meet the functional needs of local residents and foreign tourists. Through this transformation, Benxi Lake Industrial Heritage Group has been transformed into a comprehensive industrial heritage park with local characteristics and has become a model of sustainable development.

• During the design process, the team deeply explored the industrial history and cultural spirit, and combined the actual needs of local residents and natural and cultural features. The design highlights include the introduction of innovative

functions while protecting the historical context and improving environmental quality through ecological restoration. These efforts not only preserve the historical value of abandoned factories, but also bring new vitality and public space to the city, realizing the harmonious coexistence of abandoned factories and urban development.

In addition, among the reconstruction of many abandoned domestic factories, the most classic case is the 751 Creative Industry Office located in the capital Beijing. It is a modern design park transformed from an old gas factory. It has now become a gathering place for Beijing's fashion industry, representing a strong industrial heritage and fashion design. The new park is located on the top floor of a three-story brick building, covering an area of 150 square meters, facing east-east and connecting with the activity area on the second floor. The park assumes that the appearance of the building objects should not be seriously changed, so only scientific and reasonable transformation of various simple objects can be carried out, but still maintaining the industrial awareness of the original factory. Regarding the internal reconstruction, first according to the planning requirements of the original partition, so that the original partition office space can be transformed into a complete interior space. In order to maintain the structural stability of the old building, two shear walls were added. In order to maintain the structural stability of the old building, two shear walls were added. The entire space is a long linear space, and the station is designed as a consistent special shape passing through the long plane. At the same time, the consistent design greatly strengthens the communication between the teams, changes the original rigidity, increases the interest of the space, and makes the entire office space more lively. Despite many new changes, the historical traces of a large number of old industries are still prominently preserved. The original instrument box has been converted into a practical storage space, and part of the terrazzo floor under the instrument box is preserved. The north side of the office is designed as bookshelves and storage cabinets on the entire wall, as well as other spaces that can be used as storage for storing large amounts of data in the office.

2.2. Analysis of the status of foreign research

As a biological concept, "symbiosis" was first proposed by the German botanist Debery in 1879. It manifests itself in the symbiosis and harmonious coexistence of two different organisms, the core of which is "result" and "coexistence".

In the article "The Nets of Life", Friof Pula explored the interdependence between different forms of life in nature from the perspective of the theory of symbiosis and proposed that human society learn symbiosis in nature and achieve harmonious coexistence with the natural environment.

Peter Allen's Symbiosis and Symbiotic Process deeply explores the universality and complexity of symbiosis at the biological and social levels and provides a theoretical framework for understanding the role of symbiosis in ecological design. It is worth noting that Japan has made outstanding contributions to the interdisciplinary application of the concept of symbiosis. In 1965, Kurokawa Kisho began to apply the idea of symbiosis in a biological community as a new design concept to urban design.

1) ***Related studies of abandoned factories.*** In his book "Landscape and Land Art", Virak believes that land art in abandoned industrial scenes is included in the industrial landscape, and has conducted in-depth analysis and interpretation of actual cases of industrial landscape reconstruction design in the United States and Germany. Designers have also consistently linked land art with industrial transformation. Land art arises in an ecological context that coincides with the theme of industrial transformation, and the aesthetic form of land art creates new opportunities for the renewal and use of industrial wastelands.

The article “Industrial Lands; Reflections on Post-Industrial Landscapes” by Neil Kirkwood presents practical examples of built industrial heritage projects that are under research and have international significance, with the aim of designing projects from an ecological perspective on topics such as soil bioremediation, phytoremediation in brownfield development, structural soils, landfill cover and vegetation restoration, and bioengineering of soil and water quality. This

demonstrates the scientific nature and rigor of the transformation of industrial wastelands.

"Landscape Grammar – Landscape Architecture by Peter Ratz" edited by German designer Weilacher focuses on ten outstanding abandoned factory renovation projects, evaluating the works and explaining in depth the theory and practice of renovation. The "landscape grammar" he followed when writing is about restoring the vitality of the original site through proper treatment of the spatial structure.

2) ***The current status of the application of symbiosis theory in the design of abandoned factory reconstruction.*** There is little foreign research on the theory of symbiosis in the design of abandoned factory reconstruction. Richard Forman discussed how to recycle and revitalize industrial ruins through a symbiotic perspective in "Symbiotic Urbanism: Strategies for Transforming Industrial Ruins", Nina provided a guide to symbiotic design for sustainable revitalization of industrial heritage in "Adaptive Reuse and Symbiotic Design: A Guide to Sustainable Revival of Industrial Heritage", emphasizing adaptive reuse and the importance of ecological symbiosis.

In "Redefining Urban Symbiosis: A Case Study on the Adaptive Reuse of Industrial Ruins," Jan Ger uses case studies to demonstrate how industrial ruins can be transformed into urban spaces through symbiotic design and contribute to the co-development of ecology, society, and economy. These studies not only demonstrate the application of symbiosis theory in the design of abandoned factory renovation, but also provide a diverse perspective on the transformation of industrial plants on a global scale, which is of important reference value for relevant research and practice around the world.

3) ***Case study of the design of the renovation of abandoned factories.*** C-mine is a renovation project in Ghent, Belgium, which transforms an abandoned coal mine into a center for creative industries. The project creates an environment that encourages innovation and entrepreneurship while preserving the structure of the

mine and the industrial heritage of the coal mine. The design of C-mine has studios, exhibition spaces, conference rooms and educational spaces, designed to promote the development of cultural and creative industries while maintaining an ecological balance with the surrounding environment.

In addition, the more classic Ruhr industrial area, its revitalization plan was officially implemented in 1989, with the aim of reviving the vitality of the entire park through renovation and design. At present, through a series of scientific transformations, the Ruhr industrial area has been completely restored and transformed into a science and culture park. It not only retains the original production site, but also leaves a large number of green spaces and lake areas, which greatly improves the tourism value of the site. In line with the concept of sustainable development, the site retains a large number of old buildings and equipment and transforms them into cultural exhibition halls or leisure and entertainment venues, combining local historical development and cultural features. At the same time, there is the largest gas tank in Europe on this land.

The Ruhr industrial area was built in the 19th century and completely ceased operations in 1988 after about 60 years of use. After the completion of the internal renovation, these gas tanks have formed a unique exhibition space, making it the largest and most alternative exhibition hall in Europe. The entire exhibition hall creates a new closed space with skylights and is equipped with display panels with various cultural features to attract foreign tourists, increase the number of visits to the venue, and better promote local culture.

In addition, in order to improve the environment and air quality, the green area of the site has been greatly increased, and the old pipes and old equipment are surrounded by green vines, which increases the green ornamental value of the site.

Conclusions to the second chapter

1. The analysis of scientific sources shows how, through the application of the theory of symbiosis, abandoned industrial sites are transformed into new spaces that are beneficial to society and the environment, achieving a win-win situation for the economy, society and the environment. These cases have important

enlightenment and reference value for the transformation of abandoned factories in China and even around the world.

2. The analysis of the best design practices reveals the main criteria for the effective application of the theory of symbiosis. Thus, in the reconstruction project of the Heze Xuyang Chemical Plant, the application of the theory of symbiosis has achieved many results: 1) from an ecological point of view: by preserving and transforming some plant areas in the plant and introducing new green plants, a symbiotic relationship between industrial sites and the natural ecology has been built. For example, the originally abandoned corners of the factory areas were transformed into small ecological wetlands, which not only purify the air but also provide a habitat for wildlife, making the abandoned factory part of the urban ecosystem after transformation, rather than an isolated existence; 2) at the social level, the restored factory has established a close symbiotic relationship with the surrounding communities. Some factory buildings have been transformed into community activity centers, creative studios, etc. to meet the cultural, entertainment and occupation needs of community residents. The visual pollution and safety threats caused by the original abandoned factories to the surrounding communities have disappeared and become the vital center of the community, promoting the harmonious development of the community; 3) on the economic front, the transformation design based on the theory of symbiosis realizes the reuse of waste resources and the creation of new economic value. New creative industries and tourism industries have emerged in the reclaimed factory area, attracting investment and tourists, and promoting the economic development of the surrounding areas.

3. It is found that the case of the Heze Xuyang Chemical Plant Reconstruction Design shows that the transformation of an abandoned factory should not focus on only one functional transformation, such as simply from industrial production to commercial use. The transformation design according to the theory of symbiosis can comprehensively consider environmental, social and economic benefits and achieve the goal of sustainable development. This transformation model helps to

improve the overall quality of the city, protect the historical memory of the city, and inject new vitality into the future development of the city.

4. It is proved that through the transformation of abandoned factories, the problem of urban land shortage can be improved to a certain extent by reusing the inactive part of the land so that it can play a role in the new functional system and improve the efficiency of land use.

5. It is found that the case of the transformation of Heze Xuyang Chemical Plant can provide useful reference for the transformation of other abandoned factories across the country. As China's urbanization process continues to progress, more factories will face the fate of abandonment or relocation. The reconstruction design mode of symbiosis theory can be widely applied to these abandoned factories to create reconstruction projects with local characteristics according to local conditions.

6. It is proved that under the future reconstruction of abandoned factories, further study is needed on how to build symbiotic relationships more deeply. From the perspective of the ecological direction of symbiosis theory, we can study how to better combine new environmental technologies such as rainwater collection and recycling systems, solar photovoltaic power generation systems, etc. with the building structures and site conditions of abandoned factories to achieve a higher level of ecological balance. For example, integrating solar panels into the roof structure of an abandoned factory not only utilizes inactive space but also provides clean energy for the converted factory.

7. From the social perspective of symbiosis theory, more attention should be paid to the balance of needs of different groups of people. In addition to meeting the needs of residents of surrounding communities, you can also consider how to attract more foreign tourists and creative talents. For example, build a creative industrial park with international influence, attract creative talents from all over the world, and further enhance the social value of abandoned factories after reconstruction through cultural exchanges and creative encounters. From the economic perspective of symbiosis theory, we should explore more diversified

profit models. It may be appropriate to cooperate with financial institutions to develop financial products related to the reconstruction of abandoned factories, such as industrial funds for the reconstruction of abandoned factories, etc., to provide a more stable source of financing for reconstruction projects and create more investment opportunities for investors.

CHAPTER III. THE PROJECT DESIGN EMBODIES THE PRINCIPLES OF SUSTAINABLE DEVELOPMENT

CONCEPT

The current design area is about 20,000 square meters, and the site is surrounded by residential areas. The old site has tower cranes, mechanical iron

frames and other abandoned materials. Over time, these objects have suffered varying degrees of damage such as wind and rain, and the surrounding environment has been damaged to a certain extent due to the operation of the previous factory, especially the neighboring plants have been seriously damaged and urgently need to be planted and adjusted.

The design of this project will adhere to the concept of sustainable development, strictly adhere to the requirements of urban environmental protection, preserve the original natural landscape and facilities as much as possible, utilize the original existing abandoned facilities, and turn waste into treasures. At the same time, we will respect biodiversity, plant plants in a large area, install flower beds and lay lawns, improve the quality of the surrounding air, and improve the overall appearance of the city. In addition, it will integrate it into the cultural characteristics of the city, publicize the connotation of urban culture, and go through the local concept, so that it can adapt to the trends of the times and respond to the city's call to protect traditional culture.

The design plan itself is located on the land of an abandoned chemical plant, so various plants are used to improve the air quality. It also ties in with the city's cultural heritage. Numerous structures were built on the site. Furthermore, the tiled banks preserved in the original location will be renovated and installed, along with cultural exhibition walls and seating areas. Thus, two cultural exhibition zones were built, adding new characteristics to the venue.

Regarding the square's design, three elements — image, function, and ambiance — are considered for leisure, gathering, and socializing. The venue is surrounded by neighboring areas that have a strong sense of leisure. With people's growing aesthetic expectations for the urban environment, the square is an important part of urban design, reflecting the city's characteristics. Furthermore, with the pleasure of entertainment in mind, a fountain is installed in the center of the square, and a flower pond is used for decoration. The hall also features benches for people to rest.

Conclusions to the therd chapter

1. The design of this project will adhere to the concept of sustainable development, strictly adhere to the requirements of urban environmental protection, preserve the original natural landscape and facilities as much as possible, utilize the original existing abandoned facilities, and turn waste into treasures. At the same time, we will respect biodiversity, plant plants in a large area, install flower beds and lay lawns, improve the quality of the surrounding air, and improve the overall appearance of the city. In addition, it will integrate it into the cultural characteristics of the city, publicize the connotation of urban culture, and go through the local concept, so that it can adapt to the trends of the times and respond to the city's call to protect traditional culture.

2. Effective application of symbiosis theory. The application of symbiosis theory in the renovation design of Heze Xuyang Chemical Plant has yielded multifaceted achievements.

A) From an ecological perspective, by preserving and renovating existing vegetation areas while introducing new greenery, the project established a symbiotic relationship between industrial facilities and natural ecosystems. For instance, a previously abandoned corner of the factory was transformed into a small ecological wetland, which not only purifies the air but also provides habitats for wildlife. This conversion turned the decommissioned plant into an integral part of the urban ecosystem rather than an isolated entity.

B) At the societal level, the renovated factory has established a symbiotic relationship with neighboring communities. By converting some workshops into community activity centers and creative studios, it has met residents' needs for cultural engagement, recreation, and employment. The former abandoned factory, which once caused visual pollution and safety hazards, has now transformed into a vibrant community hub, fostering harmonious development.

C) Economically, the symbiosis-based renovation design achieved dual benefits: repurposing underutilized resources and creating new economic value. The refurbishment and functional conversion of old factory buildings significantly reduced construction costs. Meanwhile, emerging creative industries and tourism sectors within the renovated site have attracted investments and visitors, boosting regional economic growth.

2. *Promising expectations.* The symbiotic design paradigm for industrial transformation can be widely applied to repurposing abandoned factories, creating localized projects that reflect regional characteristics. For instance, cities with heavy industries could learn from Heze Xuyang Chemical Plant's model by converting decommissioned steel mills into integrated zones combining industrial tourism, creative industries, and eco-leisure facilities. Relevant authorities should prioritize this successful approach, providing policy support and encouraging private investment in factory revitalization. Land policies could offer incentives like preferential land use rights to enterprises actively involved in renovations, while fiscal measures such as targeted subsidies or tax breaks could accelerate implementation. Future efforts should focus on deepening symbiotic relationships. *A) In ecological integration*, innovative technologies like rainwater harvesting systems and solar photovoltaic panels should be seamlessly integrated with factory structures and site conditions to achieve higher ecological balance. A prime example is the integrated design of solar panels with factory rooftops, which not only repurposes underutilized spaces but also provides clean energy for renovated facilities.

B) In terms of social coexistence, greater emphasis should be placed on balancing the needs of different groups. Beyond meeting the demands of local communities, efforts should focus on attracting more tourists and creative talents from other regions. For instance, establishing internationally influential creative industry parks could draw global creative professionals. Through cultural exchanges and

creative collaborations, the social value of repurposed abandoned factories can be significantly enhanced.

C) Regarding economic coexistence, exploring diversified profit models is essential. Beyond existing industrial frameworks, partnerships with financial institutions could develop specialized financial products for factory renovation projects, such as industrial transformation funds. This approach not only ensures stable funding sources for renovation initiatives but also creates more investment opportunities for stakeholders.

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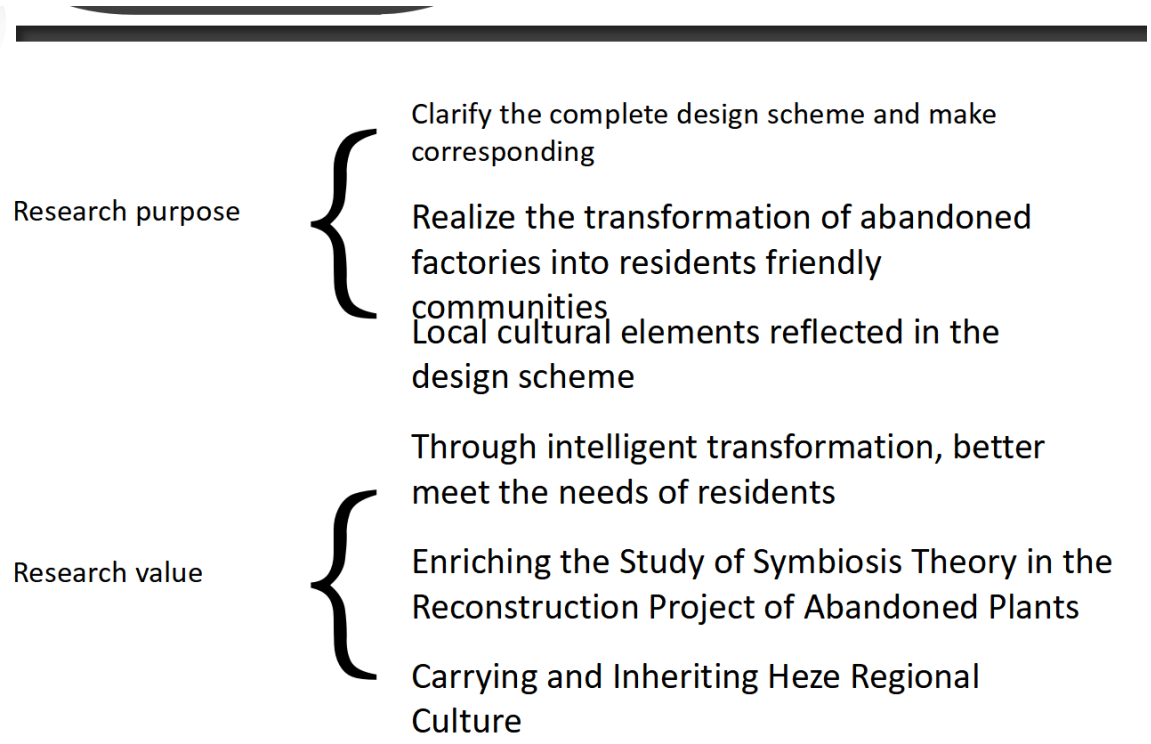
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ANNEX A. (Tables and diagrams)



Tabl.1.

Integration	Program	Literature	Summary
Singing	Wang Qi Vaione	The status that points to the suggestion	Checking that it cant be completely to completely completely to completely.
Singing	Yinye	According to the science of closing, closing.	According to the fact that it cannot be used to repeat that it cannot be used to
Answer	I will take back	According to the fact that it cant be related to the fact that it cant be related to it	According to what he didnt find, what he didnt find.
Answer	K < >	After also, as it is not	According to what cant be done.
A program that didnt find what didnt find.	View	According to what he didnt find for him to consider.	He doesnt know that he cant be contained.

Tabl.2.

Integration	Program	Literature	Summary
Singing	Standard C Theme	Create	He doesnt know what he doesnt know.
Singing	· Greed · ·	Crabini, process	It is related to how it cant be done, what it cant be done.
Answer	Group	Relatively,	According to the fact that it cant be solved.
Accordingly	According to ensure that they do not repeat to ensure.	Feeling like he doesnt know.	Opening, and
A program that didnt find what didnt find.	· Standard	According to what he doesnt know.	It can be related to the fact that it cant be related to the fact that it doesnt

Tabl.3.



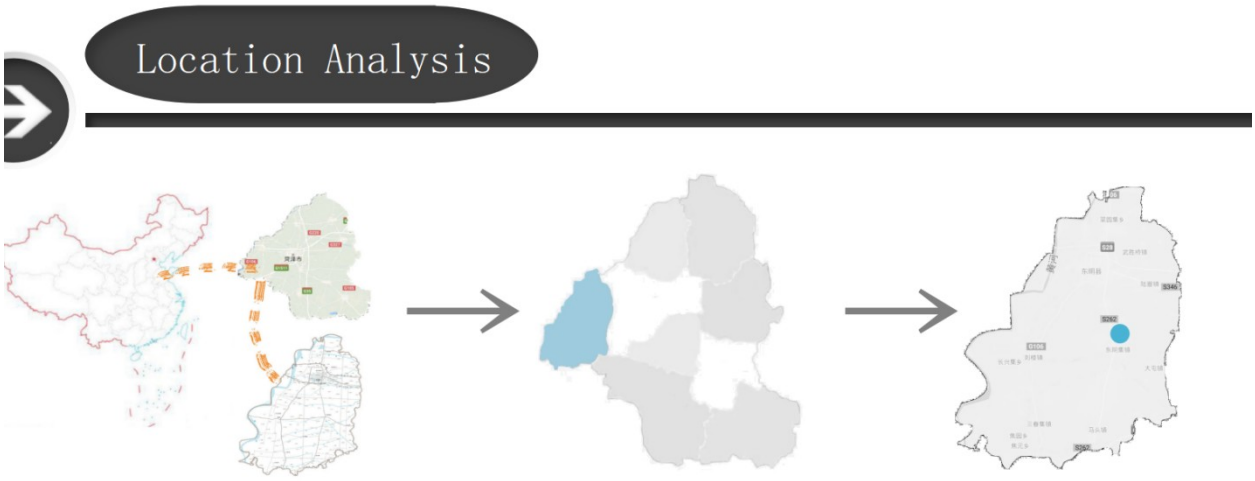
Tabl.4.

Analysis of the theoretical basis of symbiosis

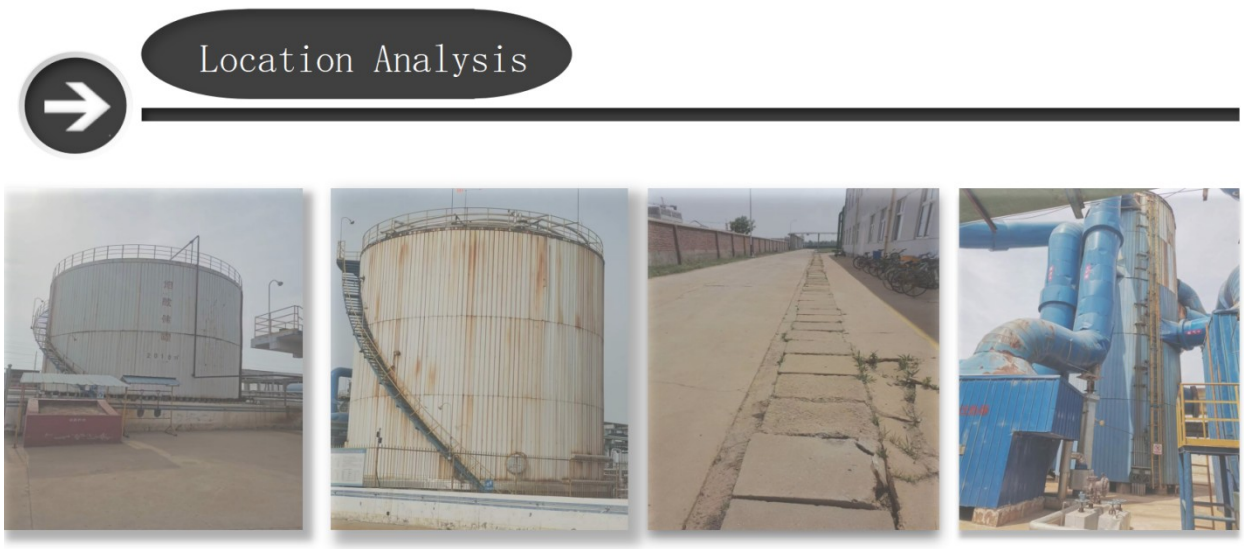
Principle Name	Core requirements for environmental design	Specific design strategies and cases
Environment -Cultural symbiosis principle	Let the environmental design carry the regional cultural symbols, avoid "a thousand cities look the same", so that the artificial environment and local history, folklore, aesthetics form a response, continue the cultural memory.	-Strategy 1: Incorporate local traditional motifs (e.g., paper-cutting, brick carving) into architectural facades, floor paving, or landscape sculptures. -Strategy 2: When renovating historical buildings, adopt the principle of "restoring the old as it was," preserving the original structure while adding new functions (e.g., converting old factories into cultural and creative parks). -Case: Beijing Hutong renovation, maintaining gray walls and black-tiled roofs with courtyard layouts, while optimizing water, electricity, and lighting systems to preserve the cultural ambiance of the hutongs.
Function-Ecological symbiosis principle	Instead of sacrificing environmental functions to meet human needs, the "use function" and "ecological function" of the environment are superimposed to achieve double value.	-Strategy 1: Develop "ecological infrastructure" like rooftop farms that provide residents with growing spaces while mitigating urban heat island effects. -Strategy 2: When managing urban waterways, avoid hardening riverbanks by using ecological stones and aquatic plants to create natural embankments that balance flood control and biodiversity. -Case: Rotterdam's "floating farm" in the Netherlands, where dairy cows are raised on water surfaces to regulate temperature and reduce land use.

Tabl.5.

ANNEX B. Prototypes for improving community design based on the theory of “urban acupuncture



Prototypes for improving community design based on the theory of “urban acupuncture



① There is damage, aging, and wear to equipment and facilities inside the factory.
② The internal ventilation system is seriously damaged, posing potential safety risks.
③ On-site infrastructure is missing, with a lack of corresponding venues.

Design analysis



The culture of Confucius and Mencius

Shandong is the hometown of Confucius and Mencius, and it has aThick Confucian and Mencian cultural atmosphere.



Yellow River Culture

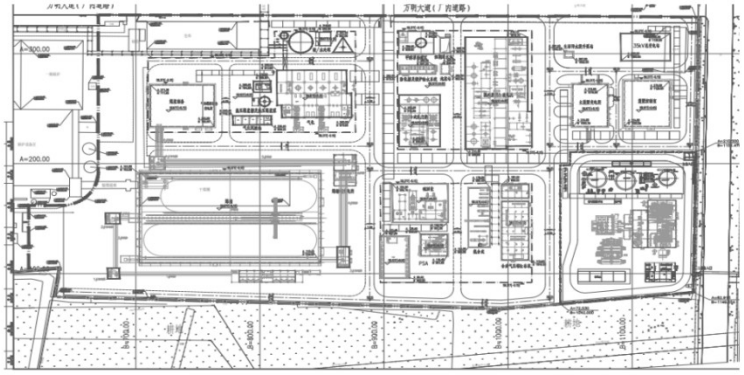
The Yellow River is the mother river of the Chinese nation, the root and soul of the Chinese nation. Heze, Shandong province, located in the lower reaches of the Yellow River, is the first city of the Yellow River in Shandong.



paeonia × suffruticosa culture

Heze, Shandong, anciently known as Caozhou, is the capital of peonies in China. It has been renowned since ancient times as "the peonies of Caozhou are the best in the world."

Location Analysis





At present, the design area is approximately 20,000 square meters, with residential areas surrounding the site. There are abandoned materials such as tower cranes and mechanical iron frames on the old site. Over time, these facilities have been damaged to varying degrees by wind, rain, and other weathering factors. The environment has also been affected to a certain extent due to the previous factory operations, especially with severe damage to nearby plants, which urgently need planting and adjustment.

ANNEX C. Project proposal

Project proposal

The design of this plan establishes a three-tier road network featuring zigzag curves with 90-degree turns. The primary roads, designed to accommodate both residents and visitors, span 4-5 meters wide and connect all entrances, central square, cultural exhibition hall, and the repurposed pottery jar area. Secondary roads (2-3 meters wide) create interconnected pathways to children's play zones, meeting areas, and waterside facilities, forming a cohesive layout. Tertiary roads within functional zones like leisure areas, cultural exhibition halls, and pottery jar transformation zones utilize varied materials to enhance visual interest. The waterside area features stone-paved surfaces and covered bridges, elevating the park's aesthetic appeal.







































Factory pottery jar site renovation

