Research on Spatial Regeneration Design Strategies for the Old Industrial Zone in Zhengzhou from the Perspective of Stock Planning

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Abstract. As a key carrier promoting economic growth after the reform and opening up, industrial zones have played a significant role in urban development. However, as China's urban development enters a new stage dominated by internal quality improvement, a refined development model centered on stock planning is gradually replacing the extensive spatial expansion driven by growthism. Against this backdrop, this paper selects the old industrial zone in Zhengzhou as a representative research object, aiming to systematically sort out the phased characteristics displayed in its renewal process, analyze the internal driving mechanism of its transformation and development, and based on this, explore the research on future-oriented regeneration design strategies. Through the analysis of the phased characteristics and problem diagnosis of the old industrial zone in Zhengzhou, it attempts to reveal the universal laws and local experiences of industrial zone functional reshaping and spatial regeneration in the stock era, providing referenceable ideas and methods for the renewal and transformation of industrial zones in similar regions, and assisting cities in achieving higher-quality and sustainable development in the stock development stage.

Keywords: old industrial area, stock planning, renewal design

1 Introduction

Under the dual strategic impetus of new urbanization and ecological civilization construction, the renewal of old industrial areas has become a key entry point to solve the problems of urban development transformation. With the deep evolution of the market economy and the iterative reconstruction of urban spatial patterns, the old industrial areas in large and medium-sized cities in China are undergoing profound changes in terms of industrial grade leap and spatial value revaluation.

At present, urban renewal is facing a major contradiction. Although benchmark projects such as the 798 Art District in Beijing and the Yangpu Riverside in Shanghai have set examples for the revitalization and utilization of industrial heritage, most renovation projects are still trapped in the development obstacles of "form imitation - industry homogenization - benefit decline". In the industrial heritage renovation projects in the

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Yangtze River Delta region, most simply apply the template of cultural and creative parks, resulting in historical building spaces becoming homogenized commercial containers; in the renewal projects of central and western cities, the concept of science and technology towns is forcibly implanted in the absence of industrial chain support, leading to a significant increase in the secondary vacancy rate after renovation. The fundamental problem of this simple copycat model lies in the insufficient understanding of urban renewal and the lack of true innovation drive.

This research takes the urban renewal of the old industrial area in Zhengzhou as its subject. From the perspective of urban renewal, it analyzes the symbiotic relationship between industrial heritage protection and urban development through multiple dimensions, and systematically explores the mechanisms for the preservation of urban memory, the implementation paths for renewal, and strategies for enhancing the quality of public spaces. The research focuses on constructing an urban renewal model centered on the inheritance of industrial cultural context, supported by the improvement of spatial efficiency, and guided by sustainable development. The aim is to achieve the coordinated development of environmental quality improvement, cultural heritage preservation, and the revitalization of regional economic vitality, providing a theoretical framework and methodological system with practical value for the transformation of similar industrial areas[1].

2 The Phased Characteristics of the Old Industrial Area in Zhengzhou: the Logical Starting Point of Design Intervention

The economic and industrial characteristics of the old industrial area in Zhengzhou have shown significant phases of disruption and reconstruction. During the planned economy period, large state-owned enterprises such as the cotton mills built with Soviet aid and Zhengzhou Coal Mining Machinery Company formed a vertically closed industrial chain dominated by textile and machinery industries. After the reform and opening up, the market-oriented transformation brought a shock, and the restructuring of state-owned enterprises led to a large-scale layoff wave. In the 1990s, the reform of state-owned enterprises caused the outflow of young and middle-aged labor force, and the aging rate of the community rose to 27.6%. Although the private economy gradually filled some of the vacancies, it was limited by technological barriers and insufficient capital, and the industry as a whole fell into a "diversification recession" predicament. Entering the 21st century, under the impetus of the "Rise of Central China" strategy, Zhengzhou guided the relocation of traditional industries through the "retreat from secondary to tertiary" policy. Projects such as the Second Sand Cultural and Creative Park and 1958 Sesame Street marked the emergence of new industries such as cultural creativity and digital economy(see Fig. 1).

stage of development	industrial characteristics	spatial feature	social characteristic	typical case
early years of the new nation (1950s-1980s)	Textile machinery takes the lead The Soviet assistance project has been implemented	Concentrated and contiguous layout Production-oriented functions dominate	Formation of a unitary community The gathering of the workers' group	National Cotton Textile Factory, Zhengzhou Coal Machinery Factory
after the reform and opening-up (1980s-2008s)	Diversification decline State-owned enterprise reform, industrial adjustment	Fragmentation of space Land lying idle and being underutilized	The aging population is accelerating The phenomenon of population outflow has emerged	At the beginning of the transformation of the Ersha Factory Area
Since the 21st century (2008s-present)	The emergence of the cultural and creative industry The penetration of the service industry and the digital economy	Function replacement acceleration Mixed-use land development	Community Vitality Revitalization The trend of return migration of the migrant population and their youngerization	Ersha Park, Zhengzhou Sesame Street 1958

Fig. 1. The stage characteristics of the old industrial zone in Zhengzhou City

2.1 Planned Economy Period (1950s-1980s): the Formation of Standardized Industrial Spaces

Under the influence of the Soviet aid construction model, the spatial form of the old industrial area in Zhengzhou presented highly planned and functionalist features. Industrial areas represented by the state-owned cotton mills feature a sawtooth-shaped factory designs with north-facing lighting, maximizing natural lighting efficiency through continuous and repetitive roof units, forming a unique industrial aesthetic language. These factories not only met the technological requirements of textile production but also provided a structural basis for later renovations with their modular layouts. The "unit system communities" centered around red-brick family compounds integrated production areas, living areas, and service facilities into closed units, shaping a space model of integrated work and residence.

The design heritage of this period is particularly valuable: the Bauhaus-style casting workshop of the Second Sand Factory, with its simple geometric forms and exposed steel structure, embodies the spirit of modernism, while the rigorous British red brick masonry technique in Soviet-style buildings has become an important material carrier of industrial culture[2]. Although these industrial heritages were oriented towards production efficiency, they have provided historical anchor points and transformation potential for subsequent regeneration.

2.2 Market-Oriented Transformation Period (1980s-2008s): Spatial Fragmentation and Functional Disorder

After the reform and opening up, the layout of industrial land in Zhengzhou City has diffused in a group form from the central urban area to the development zones. The agglomeration effect of development zones such as the High-tech Zone and the Economic Development Zone has accelerated the relocation of industries outside the urban area. However, the extensive expansion has also led to the emergence of inefficient land use. With the advancement of urbanization and industrial upgrading, some

traditional industrial plants have fallen into disuse due to outdated production capacity, insufficient enterprise funds or market changes. At this stage, the design intervention mostly remained at the passive repair level, such as simple green coverage or temporary reinforcement, failing to touch upon the systematic logic of spatial regeneration.

2.3 Transformation and Upgrading Period (2008s-Present): Design-Driven Regeneration Experiments and Contradictions

Current renewal practices are oriented towards cultural creativity and technology, attempting to activate the multi-dimensional value of industrial heritage through design(see Fig. 2). The Ersha Cultural and Creative Park, driven by "science and technology" and "cultural creativity", attempts to construct a material carrier of industrial memory by preserving the Soviet-aided grinding wheel production equipment and Bauhaus-style factories. The Zhima Street 1958 Innovation and Entrepreneurship Park, based on the old factory area of Zhengzhou Coal Mining Machinery Company, attempts to bridge the gap between industrial memory and modernity by preserving the rusty gantry cranes, gear groups, and Soviet-style red-brick factories. However, this spatial narrative strategy, which seemingly realizes the dialogue between history and the present, has exposed deep contradictions in practice: excessive commercialization of the renovation has turned industrial memory into a consumption symbol. This "technological gilding" style of renewal has exposed the split between technological worship and humanistic care in the revitalization of industrial heritage.

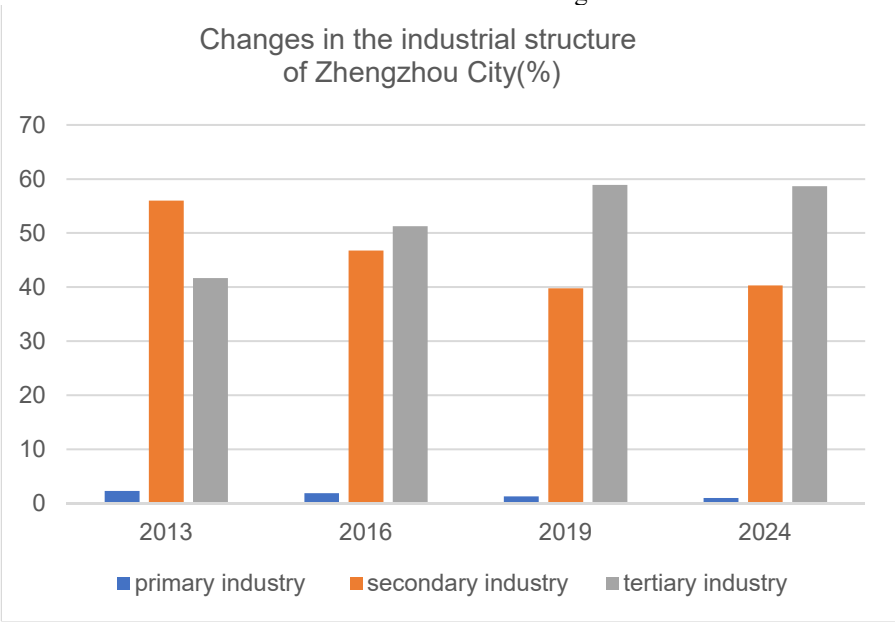

Fig. 2. Changes in the industrial structure of Zhengzhou City

3 Diagnosis of the Core Issues in Zhengzhou's Old Industrial District

With the process of deindustrialization, design, as a medium for spatial reshaping, needs to seek a balance among heritage translation, ecological resilience, and community co-governance.

3.1 From the Perspective of Spatial Design: Structural Imbalance Between Protection and Activation

In the renewal practice of the old industrial base in Zhengzhou, there is a significant contradiction between the "static protection" and "functional activation" of industrial heritage. Take the sawtooth-shaped factory buildings of the state-owned cotton mill as an example. They have been designated as historical buildings that cannot be altered, and the functional implantation is restricted, resulting in a space utilization rate of less than 15%. The factory buildings have become cultural symbols detached from urban life. Such "museum-like" protection, while maintaining the integrity of the physical form, has severed the functional connection between the heritage and contemporary society. At the same time, excessive commercialization transformation has led to another extreme: the Baohua Workshop in the Ersha Cultural and Creative Park was cut into independent shops, disrupting the original large-span spatial logic, and the cost of steel structure reinforcement increased by 40%, exposing the conflict between technical rationality and historical authenticity in functional adaptive transformation.

3.2 From the Perspective of Ecological Design: Technological Short-Sightedness and Lack of System Resilience

Some projects adopt rapid coverage restoration, completing landscape transformation in the short term, but deep-seated pollution is not completely removed, which may cause environmental risks in the long term. The hard paving in industrial areas intensifies the heat island effect, and the removal of native vegetation leads to a significant reduction in shading area. The drainage system renovation focuses only on landscape beautification and fails to enhance flood control capacity, resulting in frequent waterlogging problems.

3.3 From the Perspective of Sustainable Development: Sustainability Crisis and Fading Traffic

In the initial stage of the transformation of Zhengzhou's old industrial district into a popular destination, it quickly gained popularity with various popular tags - the gear square in the Ersha Cultural and Creative Park and the rusted iron installations in Zhima Street 1958 once dominated social media platforms. However, the traffic dividend quickly faded: the check-in photos were all the same, lacking in-depth experience design. When "industrial ruin aesthetics" became a standard feature of cultural and

creative parks across the country, Zhengzhou failed to cultivate a unique IP and eventually fell into the awkward situation of "same everywhere, no one cares"[3].

4 Regenerative Design Strategy Framework

As a core city along the Yellow River, Zhengzhou's regeneration of its old industrial areas faces complex challenges such as the loss of cultural memory, ecological risks, and imbalances in community rights. From an environmental design perspective, a three-dimensional collaborative framework of "space activation - ecological restoration - sustainable empowerment" is proposed to explore the transformation path of industrial heritage from "physical space renewal" to "complex system regeneration", providing a theoretical reference for the sustainable development of other old industrial cities.

4.1 Spatial Regeneration Design

The spatial renewal of old industrial areas should focus on dynamic adaptability, creating multi-dimensional scenarios that interweave historical memory and contemporary needs. The translation of industrial symbols involves preserving iconic components and transforming them into composite spaces that serve both cultural display and public activities, enabling historical objects to switch between static preservation and dynamic use, and achieving a non-linear dialogue between material heritage and behavioral events.

4.2 Ecological Symbiosis Design

The regeneration of industrial areas is not only about ecological restoration but also a re-engagement between humans and nature. Through strategies of layered governance, climate adaptation, and natural symbiosis, abandoned factory areas are transformed into vibrant spaces that combine ecological resilience and cultural memory.

The renewal of the old industrial area here is not merely about greening; it is about using creativity to mend the rift between industry and ecology - preserving the memories of the steel age while allowing nature to take root again, providing the city with a breathing oasis[4].

4.3 Synergistic Path for Cultural and Tourism Attraction

The regeneration of industrial heritage requires the construction of multi-dimensional collaborative strategies, integrating circular economy, cultural capital, and community participation to drive the symbiotic development of ecological restoration and tourism value(see Fig. 3). The dynamic interpretation of production memory is key. Digital technology is used to restore historical production processes, creating immersive virtual-real interaction scenarios[5]. Visitors can generate personalized souvenirs by operating simulation equipment. Industrial terms and techniques are transformed into

digital assets, building a cultural IP matrix and deriving educational courses and art installations, achieving a balance between academic value and mass communication.

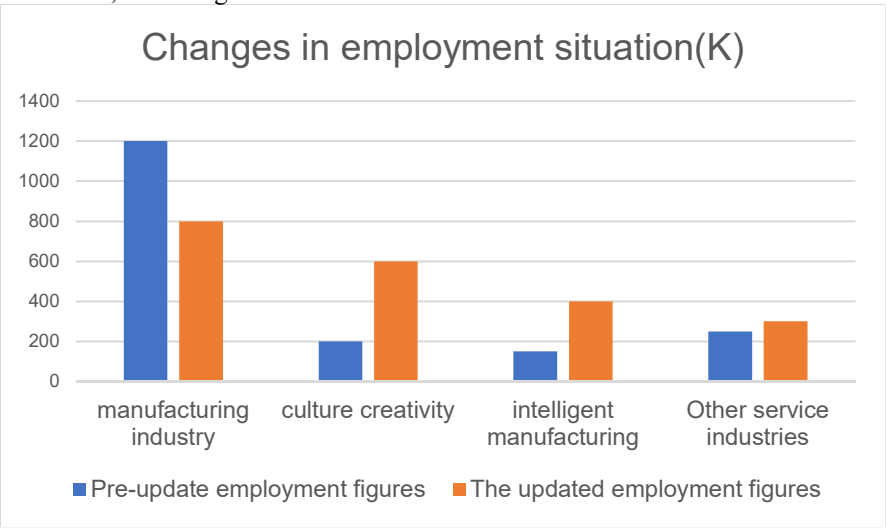

Fig. 3. Changes in employment situation

5 Conclusion

Regenerative design serves as a key driving force for the transformation of old industrial areas. Through systematic creative transformation, it re-plans spaces, stimulates the vitality of new industries, and awakens cultural memories. Its core value lies in transforming industrial heritage into places that can perceive history, storylines that can be participated in, and resources that can be recycled. Thus, old industrial areas can become a continuous source of new value for urban innovation. When spatial renewal, economic vitality, and cultural identity work together, a unique model for the revitalization of industrial areas can be created.

The future design research for industrial zone renewal centers on the application of technological innovation to reshape the symbiotic relationship between the value of historical heritage and ecological sustainability. Under this objective, design must transcend superficial beautification and adopt systematic strategies - enhancing the ecological functions of space, achieving material recycling, and revitalizing existing industrial facilities - to transform industrial remnants into dynamic models of renewal and educational carriers of technology. Meanwhile, artificial intelligence generative design (AIGC) is revolutionizing heritage protection models. It can generate cultural symbols based on regional characteristics, promote dynamic public participation, and simulate the long-term evolution of heritage in virtual environments, driving the continuous evolution of heritage value[6].

When design shifts from surface decoration to systemic reconstruction, the transformation of the old industrial zone in Zhengzhou reveals the path for future industrial zone renewal: pollution control and ecological restoration; mechanism innovation and

collaborative governance; and the transformation of old factories into continuous innovation "urban reactors". This is not merely spatial renewal but also profoundly reveals the transformation path of industrial civilization from decline to rebirth - in the development torrent of the Yellow River Basin, the once-rusted industrial heritage is forging the resilient force that supports sustainable civilization.

Acknowledgments

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