

Exploring the Challenges and Strategies of Sustainable Urban Renewal in Industrial Cities in Northeast China

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Abstract: Industrial cities in Northeast China were once developed areas of industry. However, with the economic restructuring and excessive resource exploitation leading to depletion, industrial cities in Northeast China face many challenges such as the difficulty of traditional industrial transformation, the decline of market economy, a large outflow of population, and difficulties in talent introduction. This article aimed to explore the challenges and strategies for sustainable urban renewal in industrial cities in Northeast China, and propose strategies and suggestions for green economy, low-carbon environmental protection, and the transformation of traditional industries into new low-carbon industries.

Keywords: Northeast China; Industrial Cities; Sustainable Urban Renewal; Challenges and Strategies; Structural Transformation

1. Introduction

The Northeast region of China has many resources and a mature foundation of heavy industry. However, with the changes in the global economic environment and the adjustment of China's economic structure, sustainable urban renewal of industrial cities in Northeast China needs to face many challenges. Some of these challenges are influenced by the overall environment of China's opening-up to the outside world, while others belong to endogenous challenges originating from industrial cities in the Northeast region. A series of problems such as environmental pollution, resource depletion, economic transformation, and population outflow have become important factors restricting the sustainable development of industrial cities in the Northeast region. Therefore, exploring the challenges and strategies for sustainable urban renewal in industrial cities in Northeast China also has significant theoretical and practical significance.

In order to address the aforementioned issues, this article proposes the following changes and transformations for sustainable urban renewal in industrial cities in Northeast China, including environmental protection, traditional industrial transformation, urban future planning, social participation, funding investment, policy support and guidance, technological innovation, and talent introduction and cultivation, so as to promote the transformation of industrial cities in Northeast China towards sustainable development. This article analyzes the existing problems of sustainable urban renewal in industrial cities in Northeast China, and then provides targeted solutions to related issues in sequence. Innovative industrial development models, innovative urban planning and design, and innovative talent policies are established to achieve sustainable urban renewal in industrial cities in Northeast China.

2. Related Work

With the transformation of economic structure and the depletion of resources, industrial cities in Northeast China are facing a common problem of difficulty in traditional industrial transformation. The economic development of industrial cities in Northeast China is overly dependent on traditional industry, which seriously hinders the sustainable urban renewal of industrial cities in Northeast China^[1-2]. The transformation and upgrading of traditional industries to green and efficient new industries faces challenges such as technological development, capital introduction, market changes, economic downturn, and population outflow. Therefore, the challenges and strategies for exploring sustainable urban renewal in industrial cities in Northeast China are the focus of this article^[3]. ZHU Xiaodan used CiteSpace software to conduct a systematic review of sustainable city research, analyze its evolution and research hotspots, and explore its implications for national spatial planning. He proposed a scientific evaluation index system for sustainable smart cities, attached importance to urban-rural co govern-

ance based on national conditions, and integrated these concepts into national spatial planning ^[4]. Wang Mou proposed based on the national conditions that sustainable urban construction under the background of ecological civilization is not simply “downscaling” the concept of sustainable development to the urban level, but endowing sustainable development with more specific, situational, and localized connotations at the urban level. It is internalizing sustainable development into various dimensions of urban construction at the special time and spatial scale of the city. Concrete, institutionalized, and sustainable urban development plans were designed as top-level urban development plans that can comprehensively cover low-carbon, ecological, industrial, spatial, and other specialized urban development plans ^[5]. Chen Ruishan studied the development process of the concept and indicator system of urban sustainable development evaluation, which determined the quality and progress of China’s future development based on the health and sustainability of cities and urban agglomerations. He focused on examining the methods of conducting urban sustainable development evaluations based on the United Nations Sustainable Development Goals framework and proposed ways to construct sustainable development indices for cities and urban agglomerations. He proposed the idea of promoting the evaluation of urban sustainable development index and establishing a “dashboard” for urban development from the aspects of platform construction, big data foundation, tracking and publishing. He provided important support in comparing cities in different regions, identifying development goals, and identifying existing problems ^[6]. However, there is a lack of feasibility in addressing a series of issues such as resource depletion, economic transformation, and population outflow. This article conducted research on various aspects such as environmental protection, industrial transformation, talent introduction and training, urban planning and construction, social participation and co construction and governance. A series of problems such as resource depletion, economic transformation, and population outflow were further addressed to promote the sustainable urban renewal and development of industrial cities in Northeast China ^[7-8].

3. Exploring the Challenges of Sustainable Urban Renewal in Industrial Cities in Northeast China

3.1 Difficulty in Transforming Traditional Industries

With the arrival of the new era, the Chinese economy has shifted from a stage of high-speed growth to a stage of high-quality development. From the perspective of traditional industry, with the rise of costs, increasing pressure on resources and environment, and overcapacity, the growth model that relied on factor driven and low-cost competition from industrial cities in Northeast China has become increasingly difficult to sustain. These problems seriously constrain the sustainable development of cities and urgently require the transformation and development of new industrial models. However, the transformation and upgrading of traditional industries still face many difficulties and challenges ^[9-10].

(1) One is that the technology of traditional industry is relatively mature, the market is basically fixed; the industry is structured, and the thinking is fixed and not easy to change. Many business owners are passionate about short-term profits and are determined to make quick money, making it difficult to focus on core technologies and gradually moving away from reality to illusion. As the saying goes, there is no backward industry, only backward concepts, fixed standards, outdated technology, and cumbersome management.

(2) The second is that the transformation system of industrial development needs to be improved. For example, administrative intervention and approval have created many “policy opportunities”, leading companies to profit by renting technology rather than relying on technological innovation. Enterprises use this to reduce taxes and fees, and transaction costs are also significant. Traditional industries face a “crowding out effect” in the credit market, which has led to the formation of the so-called “dual track credit system”.

(3) The third issue is the insufficient supply of technology, which increasingly highlights the constraints on the transformation and upgrading of traditional industries. Many enterprises rely on purchasing equipment and introducing production capacity, or have to seek cooperation from research institutions to develop equipment in technological transformation, which requires a large amount of upfront costs. These problems seriously hinder the sustainable development of industrial cities in the Northeast region. Due to the insufficient supply of common technologies, the path of enterprise transformation and upgrading is very difficult ^[11-12].

(4) The fifth issue is insufficient protection of intellectual property rights. The common problem for transformation and upgrading en-

terprises is that new products are prone to counterfeiting. The cost of violating intellectual property rights is relatively low, while the cost of anti-counterfeiting and rights protection for enterprises is high, resulting in a large number of negative phenomena, which inevitably seriously undermines the enthusiasm of enterprises for innovation. Therefore, in the process of traditional industrial transformation and upgrading, the whole society's awareness of intellectual property protection and commercial secrets is also facing challenges.

3.2 Environmental Pollution and Resource Depletion in Industrial Cities

The industrial structure of industrial cities in Northeast China is mainly dominated by heavy industry, with high energy consumption and pollution emissions, as well as high environmental pressure.

(1) When the economic development of industrial cities in the Northeast region overly relies on the extraction of one or a few local natural resources, over time, such resources also inevitably deplete. Once new growth points or economic sources cannot be found, the economy of the region would also fall into a long-term stagnation or even regression, unable to achieve the goal of sustainable development and renewal^[13].

(2) As a non renewable resource, the total amount of natural resources is limited, and after being exploited to a certain extent, they may become depleted. Generally speaking, if the collection reaches more than 70% of the original measured total amount, or if the current technological level and mining capacity can only sustain mining for 5 years, the city would be called a resource depleted city, which is difficult to form an industrial city for sustainable development .

(3) Environmental pressure: From the perspective of the overall international development trend, China is facing environmental pressure in the process of rapid development. China is also changing its economic development model and proposing the concept of green GDP, with sustainable development at its core. This is both a challenge and an opportunity for sustainable cities in industrial cities in the Northeast region.

3.3 Population Outflow from Industrial Cities

(1) From an economic perspective, workers seek to maximize economic benefits in order to better meet their own needs. Therefore, generally speaking, excluding other factors, as workers, they tend to prefer industries with higher incomes and choose regions with higher incomes. If the economic pressure that workers need to bear is significant, this trend is more pronounced, which poses certain obstacles to the sustainable urban renewal of industrial cities in the Northeast region. As a gathering area of large state-owned enterprises, the Northeast region has implemented its family planning policy well under the organizational form of the unit system, resulting in a large number of only children. After marriage, only children face a "four two one" family structure, and the pressure of raising offspring and supporting the elderly is very great for only children. They usually need more economic income to maintain family operation. Therefore, how to improve the local economic belt would be an important factor in the sustainable urban renewal of industrial cities in the Northeast region.

4. Explore Strategies for Sustainable Urban Renewal in Industrial Cities in Northeast China

4.1 Adjusting Industrial Structure and Developing New Industries

(1) The orientation and overall strategy of overcapacity governance policies is optimized and adjusted, and an effective market mechanism is established to resolve overcapacity through fair competition and survival of the fittest. There is a need to relax and gradually eliminate unnecessary investment and access controls; it is necessary to clean up and standardize the preferential policies of local governments for specific enterprises, such as subsidies and tax reductions; it is necessary to actively promote the reform of the environmental protection system and strengthen environmental supervision; it is necessary to strengthen the supervision of product quality and the enforcement of anti unfair competition laws; it is necessary to do a good job in providing social support and properly resettle unemployed workers in the process of reducing production capacity.

(2) The transformation and upgrading of traditional industries have been promoted, and the transformation of people's concepts has

been actively promoted, making efficiency and quality a common belief of the whole society, forming a social atmosphere that advocates efficiency and quality. The market system and environment have been improved, and the role of market mechanisms has been fully utilized. The construction and improvement of the market legal system have been accelerated, the intellectual property and related legal system and enforcement mechanisms have been improved. Market reform has been accelerated, and the consumer rights protection system has been improved. The evaluation system for industrial cities in Northeast China has been constructed, and the Management Consulting Association for Large and Small Enterprises has been established to assist small and medium-sized enterprises in improving their management level, thereby promoting the strategy of sustainable urban renewal in industrial cities in Northeast China.

4.2 Energy Achievements of Sustainable Urban Renewal in Industrial Cities in Northeast China

According to the governance policies of optimizing and adjusting overcapacity, the new industries, new forms, and new models of sustainable urban renewal in industrial cities in Northeast China are growing rapidly. In recent years, high-tech manufacturing has increased significantly in industries above designated size. The following is a comparison chart of energy and traditional heavy industry in industrial cities in Northeast China.

4.3 Optimizing Export Structure and Strengthening Talent Development

(1) In recent years, the export scale of industrial cities in Northeast China has gradually expanded, but the export structure is single, and the export scale of primary materials such as steel and aluminum, as well as low value-added products, is relatively large. Therefore, it is necessary to guide enterprises in the Northeast region to actively adjust their export product structure, increase investment in science and technology, research and development of new products, improve their technological innovation capabilities, enhance the added value and technological content of products, in order to achieve the goal of optimizing the export product structure and promote the strategy of sustainable urban renewal in industrial cities in the Northeast region.

(2) The application and promotion of science and technology in industrialization are vigorously promoted, and policy support is applied to improve management and technology. By extending the industrial chain, the added value of products is increased; the construction of commodity export bases is given priority support, and a number of demonstration bases for foreign trade transformation and upgrading with strong export driving effects, obvious industrial advantages, and distinctive regional characteristics are cultivated.

(3) The revitalization of Northeast China cannot be achieved without the support of technological innovation and mid to high end talents. To provide talent guarantee for the construction of an open economy, on the one hand, efforts should be made to introduce a group of technology leading talents and senior management talents, and targeted introduction of professional talents in logistics, finance, and service fields, comprehensively improving the internationalization level of talents; on the other hand, efforts should be made to increase the cultivation and training of local talents in Northeast China, focusing on cultivating a large number of versatile talents, focusing on developing a group of high-quality investment and international trade talents, accelerating the cultivation of a group of high-quality entrepreneurs with international vision, etc., in order to accelerate the process of promoting sustainable urban renewal in industrial cities in Northeast China.

4.4 Leveraging the Advantages of Industrial Cities in Northeast China

(1) The Northeast region has vast natural ecological resources, which can leverage the advantages of ecological environment protection, develop ecotourism and green industry, attract more investment and tourists, promote a win-win development of economic growth and ecological environment protection, and realize a virtuous cycle of economic growth and ecological environment protection.

(2) The industrial cities in Northeast China are located in the transportation hub of Northeast Asia, which can leverage their geographical advantages, strengthen economic cooperation with neighboring countries such as Russia and North Korea, and expand international markets.

(3) Releasing the advantages of traditional industry and promoting digital transformation and upgrading are key measures for the revitalization of Northeast China. Northeast China has a strong industrial foundation, a complete manufacturing system, and a complete industri-

al chain.

(4) The traditional heavy industry foundation of industrial cities in the Northeast region is utilized to promote industrial upgrading and transformation, develop emerging industries such as high-tech industry, equipment manufacturing industry, and biomedicine, and improve industrial added value and competitiveness.

In summary, industrial cities in Northeast China can promote sustainable development and sustainable urban renewal by fully leveraging their geographical advantages, strengthening regional cooperation, resource development and utilization, ecological environment protection, and population advantages. At the same time, it is necessary for the government, enterprises, and all sectors of society to work together to form a joint force and promote the development of industrial cities in the Northeast region.

4.5 Solutions to Environmental Pollution and Resource Depletion

(1) The single structure has been changed, and industry has been diversified. Due to the large number of traditional industrial facilities such as factories and coal mines in industrial cities in Northeast China, the environment is facing serious pollution. In addition, with a single economic structure, outdated production capacity is gradually phased out, and support for emerging industries such as high-tech industries and cultural and creative industries is increased, guiding enterprises to transform and upgrade towards high value-added, green and environmentally friendly industries. Capital are actively introduced to promote industrial structure upgrading, while emerging industries and high-tech enterprises are introduced to promote diversified industrial development. According to the actual situation and resource endowment of the city, the industrial layout is reasonably planned to leverage their respective advantages and form a diversified development pattern of industry. Industrial cities in the Northeast region can gradually change their single structure, achieve diversified industrial development, enhance the economic vitality and competitiveness of cities, and promote sustainable economic development, as shown in Figure 1.



(a) Before the industrial transformation in Northeast China (b) After the industrial transformation in Northeast China

Figure 1. Scenery before and after industrial transformation in Northeast China

(2) It is necessary to focus on people's livelihood issues, pay attention to ecological governance, increase environmental governance efforts, reduce pollution emissions, improve air quality and water sources, ensure a healthy living environment for residents, strengthen environmental awareness, promote green energy, clean production, environmental technology and other green industrial development. As shown in Table 1, the environmental governance status can be seen. At the same time, it also improves the quality of life for residents. During governance, efforts should also be made to strengthen the protection of the ecological environment, protect natural ecosystems such as wetlands, water resources, and forests, improve the quality of urban ecological environment, and provide residents with a better living environment. It is necessary to encourage residents to participate in ecological environment governance and urban construction, enhance their awareness and sense of responsibility for environmental protection, and jointly maintain the ecological environment of the city.

Table 1. Air quality in Northeast China from 2014 to 2022

Year	Average air quality index	Quality grade	PM2.5	PM10	SO ₂	CO	NO ₂	O ₃
2014	183	Heavy pollution	170	194	75	2.9383	121	205
2015	176	Heavy pollution	159	178	54	2.5830	97	195
2016	167	Heavy pollution	139	187	53	2.0378	98	187
2017	149	Mild pollution	105	155	32	1.7863	73	178

2018	143	Mild pollution	76	132	22	1.4232	75	142
2019	135	Mild pollution	73	120	20	0.9273	45	157
2020	127	Mild pollution	54	121	23	0.8231	54	135
2021	99	Good	34	78	9	0.9234	29	97
2022	93	Good	23	40	11	0.7456	14	93

(3) The partial achievement of the goal still requires support from multiple parties, and it is necessary to attract more funds to invest in the diversified development of industry, including government guided funds, bank credit, venture capital and other channels of financial support. It is necessary to provide technological innovation support, including establishing technology research and development platforms, providing professional technical training, etc., to help enterprises improve their technological level and innovation capabilities. It is necessary to establish a good social atmosphere, encourage entrepreneurial innovation, and provide good social support and environmental protection. It is necessary to expand the market, expand sales channels, enhance product competitiveness, and provide broader development space for enterprises. The sustainable urban renewal of industrial cities in the Northeast region requires support and cooperation from various aspects such as government, enterprises, financial institutions, research institutes, and social organizations to achieve diversified industrial development, forming a joint force and jointly promoting the realization of diversified industrial development.

4.6 Low Carbon and Green Development Achievements of Sustainable Urban Renewal in Industrial Cities in Northeast China

As a pilot project for the “Electricity Auxiliary Service Market” special reform of the national power system reform, the sustainable urban renewal of industrial cities in Northeast China continuously adapts to the new situation of power development in Northeast China, actively establishes a regional circulation system for power consumption, and promotes the construction of a new development pattern for electricity. Figures 2 show the green and low-carbon energy structure in the Northeast region.

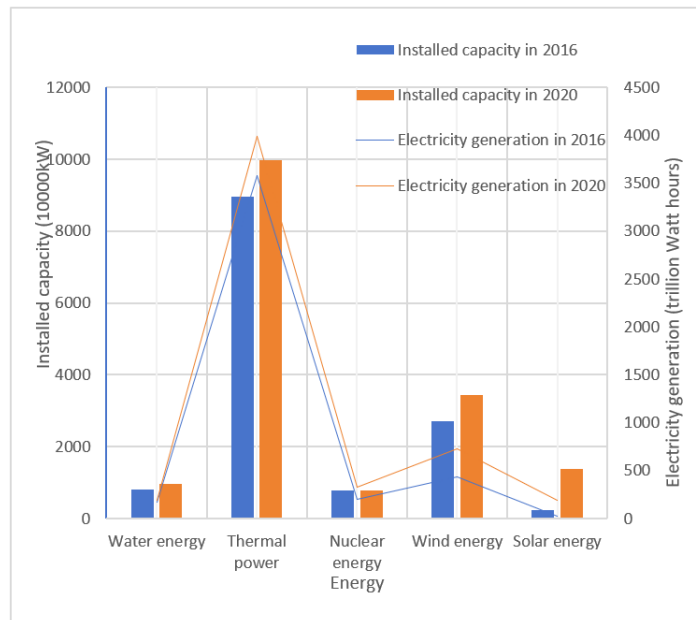


Figure 2. Power generation and installed capacity in Northeast China

4.7 Results of Low Carbon and Green Development for Sustainable Urban Renewal in Industrial Cities in Northeast China

From Figure 2, it can be seen that the development of new energy in 2016 and 2020 is compared, and it can be found that industrial cities in Northeast China are moving towards the path of sustainable urban renewal. Especially for new energy sources, solar energy has increased from 20 trillion watt hours of electricity generation to 187 trillion watt hours in 2020, and wind energy has increased from 437

trillion watt hours to 727 trillion watt hours in 2020. By promoting green energy, clean production, environmental protection technology and other green industrial development, it has become the cornerstone of sustainable urban renewal in industrial cities in Northeast China.

5. Conclusion

Although the sustainable urban renewal of industrial cities in Northeast China faces many challenges, it is still necessary to firmly adhere to sustainable development, take corresponding measures to address the challenges, seek the benefits of economic globalization, promote reform and development through openness, the rise of the Central Plains, benefit the Central Plains, and assist in the realization of the Chinese Dream, in order to achieve sustainable urban renewal of industrial cities in Northeast China. Taking into account multiple factors such as environment, industry, talent, and urban renewal, comprehensive policies and measures have been adopted to form a joint force and jointly promote the sustainable urban renewal and development of industrial cities in Northeast China.

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