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Promoting the Sustainable Development of a City by Building a Resilient City
A Case Study of Huangshi City, Hubei Province

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ABSTRACT
Based on the literature and field research, this paper discussed the basic concept of resilient city, combed the achievements of the construction of Huangshi, a typical resource exhausted city in China, from three aspects of water system, urban economic system and ecological livable system, and pointed out that the construction of resilient city was one of the good ways to realize the sustainable development of the city.

Keywords: *Resilient Cities, Sustainable Development, Huangshi City.*

1. INTRODUCTION

Since the industrial revolution, the over exploitation of resources and the continuous expansion of population have led to a series of global environmental problems [1], these problems are especially obvious in Huangshi City, a resource exhausted city in Hubei province. The rise of Huangshi City is due to mineral resources, and it is also facing unprecedented challenges due to the depletion of mineral resources.

Huangshi, as a representative of China's resource transformation cities, is striving to build a "National demonstration area for transformation and development of resource exhausted cities ". In 2017, Huangshi was successfully selected into the Global 100 resilient city project, aiming at enhancing the resilience of the city and realizing the sustainable development of the city, and actively seeking the transformation and development of the city. Since Huangshi was selected into the construction of resilient cities, it has achieved the preliminary goal of sustainable development through the construction of resilient cities. The successful experience of Huangshi has important reference significance for other resource exhausted cities. This paper discussed the sustainable development of Huangshi City from the perspective of building a resilient city.

2. THE CONNOTATIONS OF RESILIENT CITIES

The United Nations estimates that nearly 68% of the world's population will live in cities by 2050, with the city becoming larger and more complex. The city is a huge system, in this system any subsystem problems will lead to the city crisis. As an indispensable carrier of human production and life, the sustainable development of cities has always been the focus of research in various countries. Resile was originally used to describe the recovery ability of an object after it changes under the action of external forces. In 1971, Holling, an ecologist in Canada, applied the idea of resilience to the study of systems ecology for the first time, to express the stable state of ecosystem [2]. Later, researchers applied the concept of resilience to human ecosystems [3]. Resilient city refers to a city that can withstand the impact, respond and recover quickly when disasters happen [4], and ensure the basic functions of the city to operate well, so as to cope with future disasters through adaptation [5]. When external disasters come, resilient cities should have three abilities: resisting external shocks, adapting to changes and self-repairing [6]. In this paper, the author defines a resilient city as a complex system, which can absorb, resist and adapt to the impact after being subjected to various external shocks, maintain the normal operation of all basic functions of the urban system, adjust and adapt to the new environment in time according to the changes of

the environment, has the ability to learn, and can make itself recover in a spiral upward manner.

3. THE STATUS OF HUANGSHI'S CONSTRUCTION OF A RESILIENT CITY

In 2017, Huangshi was selected into the "Global 100 resilient cities" project founded by Rockefeller Foundation of the United States, which aimed to improve the resilience of cities and better resist natural disasters. Before that, Huangshi City was listed as a resource exhausted city by the state. As a former resource-based city, Huangshi has been over exploited and smelted for nearly a century, resulting in serious damage to the ecological environment, especially serious soil and water pollution. These unfavorable conditions restrict the sustainable development of Huangshi. Promoting the construction of a resilient city has become a strategic choice for Huangshi to restore its ecological environment and accelerate its transformation and development.

The main difficulties of Huangshi city development were: water pollution, urban flooding, environmental degradation, economic recession, backward infrastructure. Huangshi City had written urban resilience construction into the 13th five year plan, which was also the first city in China to write urban resilience construction into urban planning. In 2016, Huangshi City completed the preliminary evaluation report on the resilience construction of Huangshi City in combination with its own reality. The report identified the following three key areas for the resilience construction of Huangshi City: water system, economic system and ecological livable system. Accordingly, Huangshi City was mainly to strengthen the resilience of the city from three aspects: Engineering resilience (architecture and infrastructure), urban economic resilience and ecological resilience.

3.1. Water System

Water pollution and flood disaster are the most threats to Huangshi city. In order to control water pollution, Huangshi City has carried out the transformation and upgrading of municipal sewage pipe network facilities and information construction. A geological investigation team was set up to investigate the groundwater resources in the city, and a groundwater information database was established in combination with GIS. It carried out special treatment actions for black and odorous water bodies, introduced assessment methods for sewage and black and odorous water bodies to guide the city to carry out water protection and pollution prevention.

In order to deal with the city's flood disaster, Huangshi city actively carried out the construction of sponge City, through the green corridor, forest, field, park, lake ,water system and other natural elements to build the city sponge network. The existing urban rainwater pipe network was upgraded, and the urban flood discharge channels were increased to increase the flood discharge capacity; Combined with the old city reconstruction, Huangshi city reduced the building density, increased green space, permeable pavement and water storage facilities. By making full use of the rainwater absorption and infiltration function of community greening, rainwater could be digested on the spot. The flood disaster and water regime monitoring and early warning system were improved to realize the rapid transmission and early warning of disasters.

3.2. Economic System

In order to get rid of the excessive dependence on mineral resources and seek the transformation and development of economy and industry, Huangshi formulated the development strategy of "building the city by ecology and strengthening the city by industry". It took promoting high quality development of manufacturing industry as the direction, and focused on the development of high-tech industries, new energy industries, financial services and promoted the integrated development of modern service industry and manufacturing industry. Huangshi city actively promoted the development of the combination of production, study and research, which speeded up the transformation of scientific and technological achievements

Huangshi city adheres to the external development policy of external integration and regional coordination, and actively integrates into Wuhan city circle and Yangtze River economic belt. Give full play to the advantages of port and air, smooth the logistics channel, increase the investment and construction of transportation network, and improve the accessibility of transportation.

Huangshi makes full use of the beautiful natural scenery and rich historical sites, vigorously develops the tourism industry, and according to the characteristics of its own mining city, develops unique tourism projects such as mine ruins park and geological and mineral science popularization base. As a result, Huangshi has become a well-known industrial tourism city in China. At present, Huangshi is also actively building a world healthy city. The beautiful natural scenery and good ecological environment attract many tourists from all over the country to experience the healthy journey.

3.3. Ecological Livable System

Combining urban planning with the requirements of resilient urban development, Huangshi is actively building a resilient livable system. Through the construction of urban ecological environment and the

transformation of the old city, Huangshi is gradually improving the living environment of residents, upgrading the infrastructure of the old city, and which enhances the disaster resistance ability of buildings and urban infrastructure. In the old city reconstruction, Huangshi improved the living environment of the old community and the supporting facilities and functions of the old city through "micro transformation".

Huangshi relies on the Internet of Things to build an intelligent transportation system and an intelligent city, and has written ecological space design and scene creation into urban planning. Through the construction of open residential areas, Huangshi has optimized the block and road network structure, and created a convenient living circle. The measures created a beautiful environment, a harmonious neighborhood living environment, and enhanced residents' happiness.

4. THE SUSTAINABLE DEVELOPMENT OF HUANGSHI

Sustainable development is to meet the basic needs of human beings without destroying the natural life system on the earth [7]. Sustainable development and the construction of resilient cities have the same goal, which is to improve people's lives and improve people's happiness [8]. Resilient cities can resist the impact of disasters and recover quickly, and due to the self-repairing ability of city, so resilient cities must be sustainable cities. The construction of a resilient city is not only an investment, but also an engine of sustainable economic development while improving the level of urban safety and the quality of life of residents.

This paper expounded the current situation and preliminary results of sustainable development of Huangshi City from three aspects of the improvement of water system, economic transformation and the suitable livable system. In terms of water system, two indicators of urban sewage treatment and industrial wastewater discharge were used to show the status of sustainable development; in terms of economic transformation, two indicators of GDP energy consumption and the proportion of high-tech industries were used; in the suitable livable system, we selected three indicators: superior air days, appropriate amount of urban green space area, and urban maintenance and construction fund expenditure.

4.1. Continuous Improvement of Water System

In terms of water system, the urban sewage treatment capacity has been significantly enhanced, and the industrial wastewater discharge rate has increased year by year (see Figure 1). By 2019, the urban sewage treatment rate reached 94%. At the same time, Huangshi achieved good results in energy conservation and emission reduction, and the industrial wastewater discharge decreased significantly. Compared with 2016, the industrial waste water discharge in 2019 decreased by 25.7%.

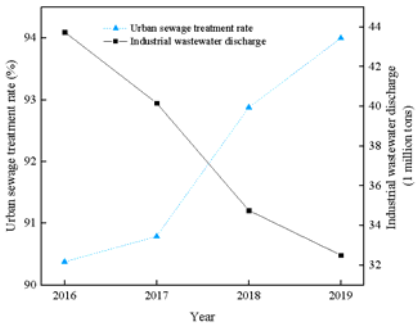

Figure 1 Urban sewage treatment and industrial waste water discharge

4.2. Urban Economic Transformation and Development

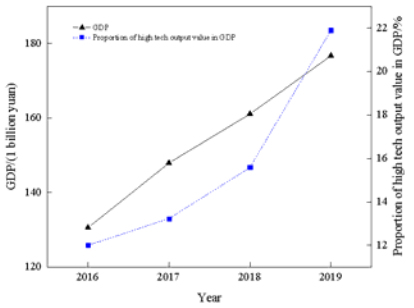

Figure 2 Proportion of high-tech output value in GDP

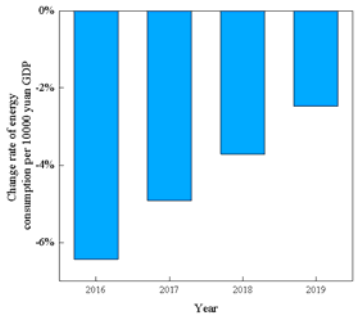

Figure 3 Change rate of energy consumption per 10000 yuan GDP

It can be seen from Figure 2 that with the steady growth of urban GDP year by year, the proportion of high-tech output value in GDP also increases significantly, indicating that the contribution of high-tech industry to GDP is becoming more and more important, and the transformation of urban industry has achieved initial results; it can be seen from Figure 3 that while the urban economic growth, the change rate of energy consumption per 10000 yuan of GDP in 2016-2019 is negative, indicating that the city's energy consumption per 10000 yuan of GDP is decreasing year by year, and the goal of green development is initially realized.

4.3. A Suitable Ecological Livable System

Since 2016, the number of days with good air quality has continued to increase. In 2019, the number reached 286, and the weather excellence rate reached 78.3%. The area of urban green space continued to expand, and the area of urban green space in 2019 increased by 5.2% compared with that in 2016. The expenditure on urban infrastructure maintenance and construction increased rapidly (see Figure 4), with an increase of 19.7% in 2019 compared with 2016. The improvement and upgrading of infrastructure enhanced the city's resilience, greatly improved the quality of life of residents, and improved the convenience of travel.

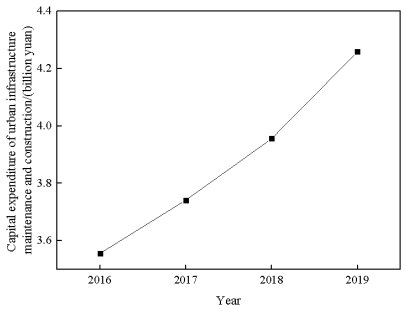

Figure 4 The expenditure on urban infrastructure maintenance and construction

While strengthening the city's ability to resist various external risks and impacts, the construction of Huangshi resilient city improved the city's supporting facilities and ecological environment, enhanced the livability of the living environment, enhanced the residents' sense of happiness, and realized the sustainable development of society and ecology. On the other hand, the construction of urban economic resilience promoted the transformation and development of cities, stimulated the economic vitality of cities, and realized the green and sustainable development of urban economy. Huangshi's practice told us that strengthening the resilience of the city is probably one of the good ways to realize the sustainable development of the city. But the improvement of urban resilience can’t be built overnight. Huangshi still has a long way to go in the exploration of building a resilient city.

5. CONCLUSION

Huangshi is a pioneer in the development of resilient cities in China. In the process of building a resilient City, Huangshi has promoted the sustainable development of the city through ecosystem optimization and economic structure transformation, which provides a blueprint for China's urban development. The successful practice of Huangshi to achieve sustainable development through the construction of resilient cities provided a new way to achieve sustainable development for other cities in China, that is, to enhance the resilience of cities to achieve sustainable development.

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