

A Review of Policy Progress in China's Ecological Civilization Demonstration Zone

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Abstract. Under the background of increasing urbanization rate and global warming, China urgently needs to address the issue of promoting economic growth while reducing the intensity of carbon emissions to achieve harmony between economic growth and environmental protection and promote sustainable development. This study takes China's ecological civilization demonstration areas construction policy as the main object of analysis. The literature review method would summarize the specific pathways of this policy to achieve carbon emission reduction in terms of eco-economy and eco-institution. By classifying and analyzing its existing carbon reduction pathways, this study found that reforms and innovations were made in this policy, mainly in eco-economy and eco-institution. China's Ecological Civilization Demonstration Zones (ECDZs) policy, to achieve carbon emission reduction and carbon neutrality, has used both green technological innovation and economic reforms to upgrade the industrial structure and improve the energy structure. However, the above policies are broad and cannot meet the regional differences. Therefore, this paper gives the corresponding recommendations: to increase the support of financial and financing policies, optimize the energy infrastructure in urban areas, and develop green transport and green buildings.

Keywords: Ecological Civilization Demonstration Area, Carbon Emission Reduction, Technological Innovation, Industrial Structure Upgrade.

1. Introduction

Since the 21st century, global climate change has become a tremendous challenge to all human societies due to frequent climate disasters, damage to ecosystems, rising sea levels, and increasing temperatures. China and the rest of the world recognized the importance of environmental protection and sustainable development and reached a consensus. The United Nations adopted The Paris Agreement in 2015 and established a green development model centered on a carbon-reducing approach. As one of the world's largest greenhouse gas emitters and energy consumers, China attaches great importance to the management of carbon emissions. In recent years, China's twentieth National People's Congress declared that China was striving to achieve the goal of carbon neutrality by 2060. With this background, China has introduced many carbon emission reduction policies to achieve the goal of carbon neutrality, including the policy of building China's ecological civilization demonstration zones.

This study focuses on China's national ecological civilization demonstration zone construction policy as the main object of analysis, summarizes the specific pathways of carbon emission reduction in ecological civilization demonstration zones, and evaluates them by reviewing the literature on carbon emission reduction and the effects of ecological civilization demonstration zone policies. Due to the limitation of the length of the article, the research scope of this paper is limited to analyzing the two major ways of carbon emission reduction. One aspect of the ecological economy is explicitly analyzing the carbon emission reduction path of the construction of ecological civilization demonstration zones in the transformation and upgrading of industrial structure, energy structure adjustment, and green technology innovation. The second one is in the aspect of the ecological system, specifically analyzing the carbon emission reduction path of ecological civilization demonstration zone construction in terms of economic measures reform, for example tax subsidy policy, and green

finance. Analyzing the above two aspects, evaluating their advantages and disadvantages, and giving corresponding suggestions.

2. Policy Background and Main Content

China has experienced rapid economic growth since its reform and opening. A series of problems such as pollution and resource waste have arisen due to the continuous development of industrialization and urbanization. This strategic decision was first proposed back in November 2012 at the 18th People's Congress of China, where the vision of building an ecological civilization was elaborated. In March 2013, the Opinions on Accelerating the Construction of an Ecological Civilization was issued by the Central Committee of the Communist Party of China and the State Council, proposing establishing a sound ecological civilization system and promoting ecological civilization construction demonstration projects. This marks the official launch of China's ecological civilization demonstration zone construction plan. In 2014, China's National Development and Reform Commission (NDRC) and other departments issued the Circular on the Construction of Advance Demonstration Areas of Ecological Civilization (the First Batch), with three regions, Fujian, Jiangxi, and Guizhou, becoming the first demonstration areas. The CPC Central Committee and the State Council then decided to promote the construction of national ecological civilization pilot zones nationwide, establishing four experimental zones in Fujian, Jiangxi, Guizhou, and Hainan. In 2016, China officially started the construction of the first batch of national-level ecological civilization demonstration zones. Since then, a new batch of ecological civilization demonstration zones has been approved every year. As of October 2023, China has implemented seven batches of national ecological civilization demonstration zones and has established more than 50 national ecological civilization demonstration zones.

The construction of ecological civilization demonstration zones consists of five main categories: the ecological economy, the ecological environment, the ecological habitat, the ecological system, and the ecological culture. In terms of eco-economy, the main focus is on reducing energy consumption and cutting down on major pollution, including the protection of natural resources and the optimization and upgrading of industrial structures. Regarding the ecological environment, it focuses on the restoration and treatment of the environment and the improvement of environmental quality. It covers a wide range of areas, including the atmosphere, water, noise, soil, forests, and grasses, as well as sea areas. In the area of eco-habitat, the main focus is on increasing the proportion of green buildings, increasing the proportion of eco-friendly finance, and balancing the proportion of eco-land. With respect to the ecological system, the main focus is on improving the innovation of green technology through the improvement of the financial and tax systems.

3. The Conceptual and Analytical Framework

3.1. Definition of Carbon Emission Reduction

In recent years, global climate change has become one of the hottest topics of the moment, and the concept of carbon emission reduction has been widely spread. As early as the 1880s, the idea of emission reduction began to rise globally. The concept of emission reduction refers to measures. It means to reduce emissions of greenhouse gases, which mainly include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆), to minimize the impacts on global climate change [1]. The concept originated in the United Nations Framework Convention on Climate Change, signed in 1992. The 1997 Kyoto Protocol further defined greenhouse gases and quantified emission reduction targets, with CO₂ accounting for the largest share and, therefore, being the primary target for reduction.

3.2. The Specific Paths to Achieving Carbon Emission Reduction in China's Ecological Civilization Demonstration Zones

Since the implementation of the construction of ecological civilization demonstration zones, many scholars have conducted research on this in various aspects. According to the division of research areas, some researchers have found that the construction of ecological civilization demonstration zones has a positive effect in reducing agricultural carbon intensity, promoting green development of agriculture, improving air quality, and improving residents' health and residents' incomes [2-5]. Especially in terms of carbon emission efficiency, an empirical analysis conducted by a scholar using the synthetic control method on four provinces, namely Jiangxi, Fujian, Guizhou, and Hainan, found that the construction of ecological civilization demonstration zones can effectively improve the efficiency of carbon emissions [6]. Meanwhile, some scholars have also explored the impact of ecological civilization demonstration zone construction on carbon emission efficiency and its internal factors by using the Difference in Differences(DID) method and tested the carbon emission effect by using two different indicators, namely carbon emission intensity and total carbon emission, and found that the adjustment and innovation of the mechanism of urban industrial structure, technology, and energy is an important factor to improve the efficiency of carbon emission [7]. To further explore the influence mechanism of energy adjustment and innovation, some researchers used the synthetic control method to empirically analyze the energy use efficiency in three rows of demonstration zones in Fujian, Jiangxi, and Guizhou and found that green technology innovation, as well as industrial structural adjustment within the demonstration zones, are the main factors to improve energy use efficiency [8].

However, there are certain limitations in the above study. Firstly, in terms of the empirical method, the synthetic analysis method relies on the selection and construction of the comparison group, coupled with the fact that in the study, there are certain deficiencies in the selection of panel data, which may affect its rationality and accuracy. Secondly, regarding selecting research objects, the above studies mostly take ecological civilization advanced demonstration zones and experimental zones as the main research objects. However, implementing ecological civilization demonstration zones in China is a wide-ranging policy, and the level of economic development, industrial structure, technological innovation, and urban scale vary among different regions, especially between the south-eastern and north-western regions. Thirdly, the above studies mainly explored the influence mechanism of industrial structure, technology, and energy consumption on carbon emission efficiency, so there is still room for further exploration in the direction of the influence of specific pathways. Finally, the literature review found that most of the literature is empirical analysis of the policy. There is a lack of literature on the theoretical analysis of the relevant policy and the compilation of the literature. Therefore, there is still room for exploration in the research theory. The above limitations of the existing literature provide possible space for breakthroughs and innovations in this paper.

Based on the above literature, this paper has taken China's National Ecological Civilization Demonstration Zone construction policy as the main target of analysis and used the literature review and example analysis methods to explore and evaluate its carbon emission reduction pathways. For the purpose of discussing and summarizing the multifaceted paths of ecological civilization construction, this paper adopts an analytical framework that mainly highlights the carbon emission reduction paths in two dimensions of China's ecological civilization demonstration zone policy. As shown in Figure 1, the first is the ecological economy-related path analysis. The second is the ecological system-related path analysis. In addition, for both dimensions, it is possible to explore this policy's specific pathways of carbon emission reduction in terms of inputs and outputs.

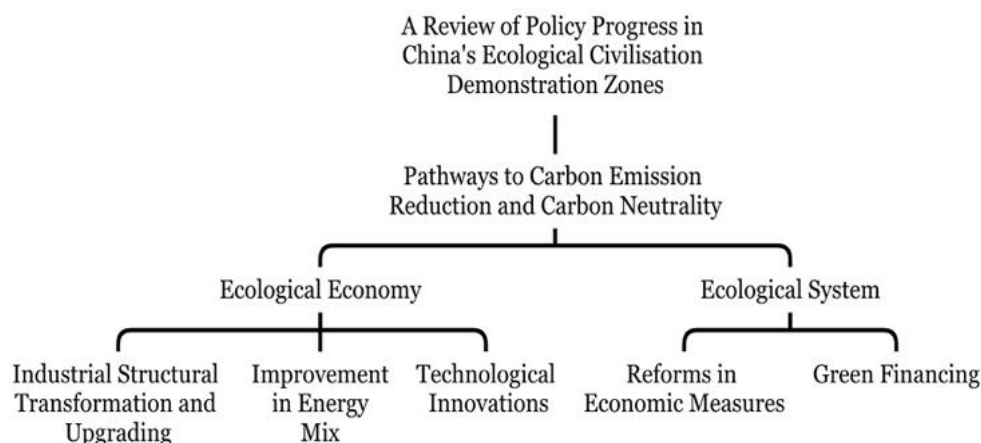


Figure 1. Carbon Emission Reduction Framework (Photo credit: Original)

As show in Figure 1, this study will describe and analyze the carbon emission reduction pathway of China's ecological civilization demonstration area construction from the above three parts. There are two possible marginal contributions. Firstly, this study classifies and summarizes the specific pathways of carbon emission reduction in ecological civilization demonstration zones to provide relevant prior knowledge for subsequent studies and theoretical support for achieving carbon emission reduction. Second, this study expands the research perspectives of different scholars by comprehensively evaluating their views and research methods on ecological economy and ecological systems.

4. Classification and Analysis of Policy Pathways

The construction of ecological civilization demonstration zones reduces carbon emissions in economic production activities by optimizing the energy structure. In 2018, the state promulgated the "Law of the People's Republic of China on the Prevention and Control of Air Pollution" and other relevant laws to clarify the legal status and basic principles of emission rights trading. In the low-carbon governance environment, the government will introduce more stringent environmental regulatory policies to accelerate the construction of ecological civilization, such as Fujian Province's comprehensive implementation of the ecological and environmental protection target responsibility system, strengthening environmental law enforcement and supervision, and issuing a series of policy measures such as the "Fujian Province Emission Rights Trading Rules". Local governments strictly incorporate environmental costs into the production and operation costs of industrial enterprises. For traditional industries with high energy consumption and high pollution, higher environmental taxes or penalties increase the production costs of traditional high-pollution industries, prompting enterprises to carry out green production and avoid the adverse effects of production and operation activities on the ecological environment. Thereby forcing enterprises to assume environmental protection responsibilities, consciously take the path of green development, seek greener and lower-carbon production methods in an unfavorable business environment, and realize their own green and low-carbon transformation.

At the same time, local governments will promote the green transformation of industrial enterprises through various means such as technical support, tax incentives, and subsidies. Strategic emerging industries are vigorously promoted and developed, such as new energy, new materials, and high-end equipment manufacturing. Energy conservation, emission reduction, and high-efficiency modern industrial circular development system have been constructed, reducing dependence on inefficient energy consumption, thereby improving energy utilization efficiency. Beijing has successively issued policy support documents such as "Beijing's Several Policy Measures on Supporting the Development of Hydrogen Energy Industry" and "Beijing Hydrogen Energy Industry Development Implementation Plan", which provide strong support and direction guidance for vigorously promoting the development of hydrogen energy industry. The fiscal support policy system

is fully implemented, and equity investment, ex ante subsidies, fixed subsidies, and awards in lieu of subsidies are adopted to support the Beijing-Tianjin-Hebei fuel cell vehicle demonstration city cluster, accelerate the development of hydrogen fuel cell vehicle batteries, and cover key technology and scientific research and development, hydrogen station construction and operation, and vehicle purchase subsidies. As of the end of 2022, Beijing has 11 hydrogen stations. Chengdu has adopted subsidies, tax incentives, and power retention policies to support the construction of three 500 kV transmission and transformation projects, and the passive situation of energy security has improved. At the same time, Chengdu has fully implemented relevant policies to promote the high-quality development of new energy vehicles, photovoltaics, and other industries, supported the construction of clean energy and clean equipment industries, promoted renewable energy pilot demonstrations, and encouraged the development and application of shallow geothermal energy, biomass energy, and air sources.

The environmental Kuznets curve hypothesis holds that there is an inverted U-shaped relationship between economic growth and environmental pollution. Economic scale, technological progress, institutional factors, etc. can affect the above relationship, and technological progress is the fundamental way to reduce energy consumption and improve environmental quality [9].

The construction of ecological civilization pilot demonstration zones forces enterprises to innovate green technologies through the implementation of administrative penalties, emission taxes and emission restrictions. Industrial enterprises use green innovative technologies, such as clean production and energy conservation and emission reduction, to reduce the cost of energy use and energy consumption per unit of output in the production process, to minimize carbon emissions in the production process, ensure that the production and operation activities of industrial enterprises do not break the bottom line of ecological environmental protection, and achieve source control of carbon emissions. According to the "Porter hypothesis", although pollution control expenditures and green technology innovation R&D expenditures increase the production costs of enterprises, in the long run, technological innovation can slow down or offset the environmental costs of environmental policies to enterprises, resulting in an "innovation compensation effect", so rational enterprises will choose green technology innovation [10]. At the same time, the construction of the ecological civilization pilot zone not only provides sufficient financial and technical support for enterprises and scientific research institutions through incentives such as tax cuts and fee reductions, subsidies and rewards, and preferential loans, but also alleviates the financing and technical constraints faced by green technology innovation, effectively reduces enterprises' concerns about innovation risks, and encourages enterprises to innovate ecological and environmental protection technologies and reduce carbon footprints. It also attracts a large number of high-end talents and enterprises to gather and promote the improvement of the level of green technology innovation. Beijing has adopted project investment subsidies, project loan interest subsidies, rental fee subsidies and other methods to vigorously support the construction of advanced hydrogen energy facilities, encourage the pilot construction of advanced hydrogen production, storage and transportation facilities, and encourage innovative entities in the field of hydrogen energy to establish scientific and technological innovation platforms in Beijing. In 2023, Beijing allocated 555 million yuan to support the construction of the National Hydrogen Fuel Cell Vehicle Inspection and Testing Center, filling the gap in the hydrogenation facilities and hydrogen storage bottle testing capabilities of similar testing centers. Chengdu has promoted the implementation of major projects such as Tencent Future Center, Airbus Aircraft Life Cycle Service Center, and SF Airlines Western Headquarters, supported the implementation of the "Chengdu Immigration Plan", "Chengdu Talent Plan", and "Industry Circle Strengthening Talent Plan", and introduced and cultivated 4,435 high-level talents from the national, provincial, and municipal levels, providing intellectual support for the intelligent and green development of the industry.

The construction of the ecological civilization pilot demonstration zone affects carbon emission intensity through the development of green finance. In the process of demonstration zone construction, green credit is guided by ecological environmental constraints. On the one hand, the restriction of

loan amounts and the implementation of punitive high interest rates for high-pollution and high-emission enterprises have significantly increased the debt financing costs of such enterprises, inhibiting their new investment. When financing is constrained, the production capacity of polluting enterprises will tend to decline, thereby reducing the dependence of enterprises on energy resources for production and playing a role in reducing carbon emission intensity. On the other hand, due to the characteristics of large capital investment, long payback period, and high potential risks of ecological enterprises, most ecological enterprises are unable to obtain commercial loans and fall into financing difficulties. The green financial system encourages more credit funds to flow to ecological enterprises that meet the conditions for green, circular and low-carbon economic development, eases their financing constraints, optimizes the allocation of financial resources, helps expand the scale of enterprise production, and provides high-quality low-carbon products and services. At the same time, the technological innovation of enterprises often requires a large amount of R&D funds. The continuous injection of green credit funds into ecological enterprises will help encourage them to devote more energy to technological research and development and improve the level of green technology innovation. On the other hand, the financing constraints on polluting enterprises will also force such enterprises to carry out technological innovation and product upgrades as soon as possible, to reduce their negative impact on the environment.

Climate investment and financing reform, as a key task in the first batch of authorized items list for Shenzhen's implementation of comprehensive reform pilot projects, is a powerful tool for Shenzhen to achieve green and low-carbon development. The main approach is to make good use of fiscal rewards and subsidies, support the high-standard construction of Shenzhen's climate investment and financing project library, support innovative financial incentives, guide funds to invest in library projects through multiple channels, and support the construction of a climate investment and financing public service platform. Shenzhen explores the establishment of a climate investment fund in accordance with the principles of government funding guidance, social capital participation, and full introduction of foreign capital, and drives social capital to participate in climate investment and financing. The first batch of screening identified 70 projects for inclusion in the database, with a corresponding financing demand of 24.8 billion yuan. After the implementation of the projects, carbon dioxide emissions will be reduced by 2.16 million tons per year. Guangzhou City will coordinate the use of special fiscal funds to support the development of green finance, improve the financing fee subsidy and risk-sharing mechanism for green and low-carbon projects, compensate financial institutions for green credit risks, subsidize the green certification and financing guarantee fees incurred by small and micro enterprises to obtain green financing, and subsidize direct financing of green enterprises in the capital market. Guangzhou City will innovate financing channels, explore asset securitization products based on future income rights of green infrastructure, make full use of real estate investment trusts (REITs) in the infrastructure field, and guide insurance funds to increase medium- and long-term support for key areas such as renewable energy, green agriculture, green buildings, and green transportation.

5. Suggestions

Different regions should fully consider regional heterogeneity and implement differentiated ecological civilization pilot demonstration plans. Different regions should explore and innovate ecological civilization construction models in accordance with their own resource endowments and local conditions. For example, pilot provinces in the developed eastern regions should focus on developing technology industries with green attributes, while pilot provinces in the central and western regions are relatively backward in social and economic development and cannot take into account environmental protection. The government should prioritize the development of local economy while striving to reduce negative environmental effects, so as to form a good situation in which economic development and ecological environment go hand in hand.

5.1. Reform the Fiscal System and Optimize the Energy Foundation

The government should establish a green special fund and increase fiscal and financial policy support. The government should include green and low-carbon industries in the scope of special fiscal funds, provide comprehensive support in terms of enterprise introduction, technology research and development, industrial space, and talent support, actively guide various financial institutions to provide green credit, green bonds, green funds and other financial support for the construction of pilot demonstration projects, and attract various financial capital and social capital to participate in the design, transformation and operation of green projects[11].

Cities should optimize urban energy infrastructure and increase the proportion of renewable energy applications. Cities should promote the construction of smart distribution networks, focusing on improving the effective coverage rate of distribution network automation and the coverage rate of smart distribution rooms. Cities should make full use of the roofs, facades or attached vacant sites of public buildings, industrial parks, enterprise factories, logistics and storage bases, transportation facilities and residential buildings, and actively build distributed photovoltaic power generation facilities [12].

5.2. Develop Green Transportation and Build New Green Buildings

Society should develop green transportation and practice green travel. Relevant departments should optimize rail lines, increase line density, improve the coverage and service level of rail transportation, and achieve full coverage of large-capacity rail transportation network. Society should build a three-dimensional transportation network to improve the planning and construction of slow-moving systems, promote the integration of slow-moving systems with high-speed rail, rail, motor vehicles and comprehensive transfers, and vigorously promote the addition of pedestrian bicycle lanes and the expansion and reconstruction of non-motorized vehicle lanes. New energy vehicle subsidy policies should be fully implemented to exempt the purchase of new energy vehicles from vehicle purchase tax [13].

With the development of technology, green buildings are becoming more and more popular. Compared with traditional buildings, green buildings can save nearly half of energy consumption [14]. Therefore, the development of green buildings is one of the necessary methods to achieve carbon emission reduction. In this context, government departments need to formulate specific green building standards and evaluation systems, clarify the requirements for building energy consumption, water consumption, materials and other indicators, and also provide incentive policies such as financial subsidies and tax incentives to encourage companies to invest in green building projects. The government should issue mandatory regulations to require that new or renovated projects must meet certain green building standards. The government will take the lead in organizing enterprises, universities, research institutions, etc. to jointly carry out green building technology research and development and focus on supporting the research and development and application of key technologies such as building energy conservation, renewable energy utilization, and intelligent control. Through the above methods, a technology achievement transformation platform will be established to promote the promotion and application of achievements in construction companies.

6. Conclusion

In summary, the implementation of China's ecological civilization demonstration zone construction policy has achieved a large reduction in carbon emissions. The policy reform has two important aspects: upgrading industrial institutions and increasing the energy utilization rate. The government improves the efficiency of energy and resource utilization through continuous innovation and promotion of green technologies, thus promoting the transformation and upgrading of industrial structures in the direction of low carbon emission. Secondly, the establishment of a sound ecological system and the reform of the fiscal system are two important ways to upgrade the industrial structure and improve the energy structure to achieve the goal of carbon emission reduction and carbon

neutrality. The above two reforms will promote the sustainable development of China's ecological environment and give other countries a certain reference in terms of ecological civilization and environmental protection policies, thus promoting the sustainable development of the whole human society.

However, this study has some limitations since it mainly focuses on policies at the national level, with insufficient attention to the local level. As China is a vast country with large differences in social development, there is a certain degree of homogeneity in regional studies. In the future, research will pay more attention to local and inter-regional specific policy measures. At the same time, research will deepen and refine the local policy paths to improve the classification and generalization of the paths.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

References

- [1] Bauer C, Treyer K, Heck T, et al. Greenhouse gas emissions from energy systems, comparison, and overview. 2015.
- [2] Xu MQ, Huang SW, Deng ZX, et.al. Impact of national ecological civilization pilot zone construction on agricultural carbon emission intensity: Quasi natural experiment based on panel data of 30 provinces. *Ecological Economy*, 2024, 1 - 18.
- [3] Lan XJ, Hu ZN. Impact and mechanisms of the construction of ecological civilization pilot demonstration zone on the ecological environment quality. *Journal of Beijing Jiaotong University (Social Sciences Edition)*, 2024, 23 (01): 138 - 154.
- [4] Xie HJ, Li J, Li C. Impact of ecological civilization construction on air quality and residents' health level: A quasi-natural experiment based on ecological civilization demonstration area. *Ecological Economy*, 2021, 37 (06): 20 - 26.
- [5] Hu Y. Impact of ecological civilization construction on rural residents' income increase: A Quasi-natural Experiment based on establishment of ecological civilization demonstration area. *Acta Agriculturae Jiangxi*, 2023, 35 (12): 240 - 246.
- [6] Zhang MD, Dai YY. Does the construction of the national ecological civilization pilot zone help improve carbon emission efficiency? Empirical analysis based on synthetic control method. *Journal of Nanjing Audit University*, 2023, 20 (06): 101 - 110.
- [7] Si LJ, Tian JL. Impact of ecological civilization pilot on efficiency of carbon emissions: A quasi-natural experiment based on ecological civilization advanced demonstration zones. *Finance and Trade Research*, 2023, 34 (11): 29 - 41.
- [8] Shan XY, Zeng Y. Study on the influence mechanism of energy utilization efficiency in ecological civilization first demonstration zones. *Journal of Green Science and Technology*, 2023, 25 (23): 187 - 192.
- [9] Ma W, Cao L, Li X, et al. Environmental pollution, green finance, and enterprise growth based on the environmental Kuznets curve perspective. *Finance Research Letters*, 2024.
- [10] Alwahed AD, Yuping S, Nicolas S, et al. Porter in China: A quasi-experimental view of market-based environmental regulation effects on firm performance. *Energy Economics*, 2023, 126.
- [11] Gao X. The fiscal policy research on supporting the green and low-carbon transformation and development of megacity---Taking Chengdu City as an example. *Fiscal Science*, 2023, (09): 141 - 149.
- [12] Li KY. The echnical support and related policy research on the construction of the first demonstration area of ecological civilization in Jiangxi Province. *Jiangxi Agricultural University*, 2017.
- [13] Wu AH, Liu Y. Reflections on the low-carbon development path of high-density urban areas in the guangdong-hong kong-macao greater bay area under the "double carbon" goal: Taking Luohu District as an example. *Urban Development Studies*, 2024, 31 (02): 80 - 88.
- [14] Meena CS, Kumar A, Jain S, et al. Innovation in green building sector for sustainable future. MDPI, Multidisciplinary Digital Publishing Institute, 2022.