

Study on the Coordinated-Development of Urbanization-Carbon Emission-Ecological Environment Coupling in Sichuan Province

Wutong Xie¹, Hongxia Zeng^{1,*}, Jingxiang Yang², Xinyang Jiang¹, Long Tang¹

¹School of Economics and Management, Southwest Petroleum University, Chengdu, 610500, China

²Sichuan Huasheng Energy Development Group Co. Ltd, Chengdu, 610056, China

* Corresponding author: Hongxia Zeng

Abstract

There is a strong link between urbanization, carbon emissions and the ecological environment. In order to realize sustainable development and ensure the sustained, stable and high-quality development of the national economy, it is necessary to seek coordinated development among the three. As a major economic province in China, Sichuan Province relies heavily on fossil energy for its energy structure, and the task of energy conservation and emission reduction is very arduous. Therefore, how to reduce carbon emissions while improving urbanization and protecting the environment has become a key issue in the economic and social development of Sichuan Province. In order to solve this problem, this paper chooses Sichuan Province as a typical case to carry out the research on the coupled and coordinated development of urbanization, carbon emission and ecological environment, and puts forward the proposal of the path of high-quality construction in Sichuan Province with the focus on the green, low-carbon and high-quality development and ecological environmental protection, taking the perspective of the synergistic development of urbanization region.

Keywords

Sichuan Province; urbanization; Carbon emission; Ecological environment; Coupled coordination.

1. Introduction

Low-carbon green development is an inevitable choice for today's social development, and the key to reducing carbon emissions while improving the quality of urbanization and protecting the environment is to deal with the coordination between the three. As the hub of "One Belt, One Road" and "One Belt, One Road", Sichuan Province undertakes major national strategies such as "Chengdu-Chongqing Twin Cities Economic Circle" and "Yangtze River Economic Belt", etc. However, due to the vast area and complex geographic location of Sichuan Province, there is a huge gap between its urbanization and carbon emissions between its east and west economic and urban development. However, due to the vast area and complex geographical location of Sichuan Province, there is a huge gap between the economic and urban development in the east and west, and the relationship between urbanization, carbon emission and ecological environment is still unclear. Therefore, how to improve the urbanization level and protect the environment while reducing carbon emission, and how to deal with the coordination among the three has become a bottleneck in the economic and social development of Sichuan Province.

2. Synthesis of Research

Most of the current studies on urbanization, carbon emissions and ecological environment focus on the relationship between the two, and a few study the relationship between the three systems. Regarding the research on urbanization and carbon emission, Chen (2021), a foreign scholar, explored the interrelationship between urbanization and carbon emission by using the autoregressive distributed lag model, and concluded that carbon emission has a negative impact on urbanization. And domestic scholars mainly have two views that there is a linear or non-linear relationship between urbanization and carbon emissions.

Regarding the research on urbanization and ecological environment, Ahmed (2020) believes that the high speed of economic growth has increased its exploitation and consumption of natural resources, and urbanization and economic growth will cause environmental degradation. And the research of domestic scholars mainly involves two aspects: first, the coupling relationship research. Lu Yu (2020) concluded that the coordination degree of ChangZhuTan urban agglomeration shows an "S" type growth trend. The second is qualitative research from the perspective of legal hierarchy and literature review. Du Xue (2019) analyzes the problems in the development of urbanization from the legal point of view and puts forward specific measures to protect the environment.

Research on carbon emissions and ecological environment at home and abroad mainly focuses on the quantitative perspective, Chen (2020) assessed the spatial and temporal differences in carbon emissions and ecosystem survival value (ESV) caused by land use coverage changes in Chengdu-Chongqing urban agglomeration in China, and found that a high regional economic performance corresponds to a high carbon emission and a low ESV. Domestic scholars, Li Wisdom (2021), utilized the model of the degree of coordination of the coupling to analyze the temporal evolution and spatial patterns of Using the coupling coordination degree model, Li wisdom (2021) analyzed the temporal evolution and spatial pattern of the coupling coordination degree of carbon emission efficiency and ecological environment in tourism, and concluded that the coupling coordination degree of the two showed a fluctuating upward trend, but on the whole, the coupling coordination degree was at an intermediate to lower level.

3. Analysis of the Mechanism of Coordinated Development of Urbanization-carbon Emission-ecological Environment Coupling

3.1. Mechanism analysis of the coupled and coordinated development of urbanization and carbon emissions

The process of urbanization is not only an energy-consuming process, but also a process that generates carbon emissions. The process of urbanization generates significant carbon emissions. Urbanization is not only inextricably linked to industrial production, but also directly linked to the inflow of rural migrant populations, who move to cities and change their consumption habits, leading to an increase in carbon emissions, whose increase constrains the development of urbanization. Increasing carbon emissions, poor ecological conditions and other factors have led to large numbers of people migrating out of the country, resulting in a significant drop in productivity and employment, which has had a direct or indirect impact on the urbanization process, and has become a bottleneck constraining the urbanization process.

3.2. Mechanism analysis of coupled and coordinated development of urbanization and ecological environment

The development of urbanization should aim at a good ecological environment, and at the same time, the quality and scale of its development will be limited by the ecological environment. The process of urbanization is conducive to the improvement of the ecological environment. In the

process of urbanization, the inflow of labor and capital helps to adjust and optimize the industrial structure of towns and achieve the saving of resources. The deterioration of the ecological environment will reduce the overall strength of the town, which is very unfavorable to attracting talents, technology, capital and labor and other resource elements, and will result in the investment of more time, capital, and more expenditure on the control of pollution, which in turn has a certain impact on the development of urbanization.

3.3. Mechanism analysis of coupled and coordinated development of carbon emission and ecological environment

In the process of urbanization, there is a mutually restraining relationship between carbon emissions and the ecological environment. On the one hand, in the process of development, carbon emissions will inevitably have a negative impact on the ecological environment, but if the ecological environment is to be kept intact, it will have an impact on the economy, thus hindering development. On the other hand, seawater and soil in nature can absorb the carbon dioxide content in the atmosphere.

3.4. Mechanism analysis of the coordinated development of urbanization-carbon emission-ecological environment coupling

Figure 1 shows the relationship between urbanization, carbon emission and ecological environment in terms of their mutual influence. The ecological environment provides a good foundation for the development of urbanization and an important support for the development of social economy and social culture. However, in the process of urbanization, the large amount of carbon emissions generated by human factors will cause damage and pollution to the ecological environment. In conclusion, ecological environment is the root of urbanization and carbon emission reduction, urbanization is the important support, and carbon emission is the key.

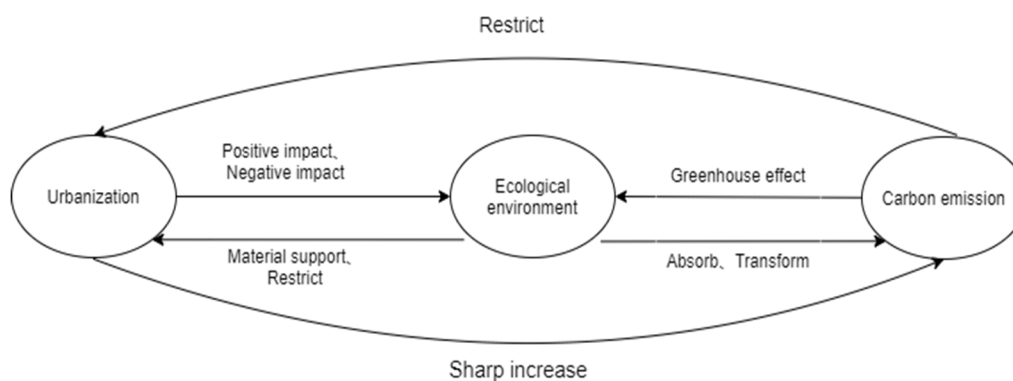


Figure 1. Mechanism of urbanization-carbon emissions-ecological environment

4. Current Situation and Problem Analysis of Urbanization-Carbon Emission-Ecological Environment in Sichuan Province

4.1. Current situation of urbanization, carbon emission and ecological environment in Sichuan Province

Population urbanization is one of the important indicators for measuring the development of urbanization. As shown in Figure 2, the urbanization rate of Sichuan Province is generally on an upward trend, and the upward trend is relatively stable, from 43.5% in 2012 to 57.8% in 2021, with an increase of 14.3% in the urbanization rate, but due to the fact that Sichuan is situated in the western part of the country, the urbanization level of the population is still far away from that of the country as a whole. However, in general, the development of population urbanization in Sichuan Province still has high potential, and the development of population

urbanization has been good in recent years. According to the "s" curve of urbanization and the idea of stage division proposed by Northham, Sichuan Province is in the middle and late stages of urbanization, and the urbanization process is accelerating.

In terms of carbon emissions, after 2015, the proportion of coal energy consumption in Sichuan province is less than 50%, natural gas consumption is gradually climbing, and the structure of energy consumption is gradually diversified. In 2019, among the provinces and cities where the average annual growth rate of carbon emissions declined, Sichuan ranks second, and it is the smallest province in the west with the lowest average growth rate of carbon emissions, which is due to the fact that Sichuan has been vigorously developing the high-tech industry and promoting the prosperous development of tourism in recent years, thus continuously promoting the optimization and upgrading of industrial structure, thus leading the country in the decline of carbon emissions growth rate. This is because in recent years, Sichuan has been vigorously developing high-tech industries and promoting the flourishing of tourism, thus continuously promoting the optimization and upgrading of industrial structure, and thus the growth rate of carbon emissions in Sichuan has declined at a rate that is among the highest in the country. In 2020, the proportion of clean energy consumption in the total energy consumption of Sichuan Province will be 54.5%, an increase of 10.1 percentage points compared with that of 2015, and the efficiency of energy use will continue to improve, with the cumulative decrease in energy consumption per unit of GDP of 17.4%.

In the area of ecological environmental protection, the Sichuan Provincial Government has continuously stepped up its efforts to control the environment, increase environmental protection enforcement and crack down on illegal emissions. The government also encourages ecological restoration and protection programs to strengthen the protection and restoration of ecosystems and improve the quality of the ecological environment. As shown in Figure 3, Sichuan Province shows a positive trend in air quality conditions and other aspects from 2016 to 2021, indicating that it has achieved significant results in environmental governance.

4.2. Analysis of Urbanization, Carbon Emission, and Ecological Environment Problems in Sichuan Province

It should be noted, however, that although Sichuan Province has made some progress in urbanization, carbon emissions and ecological development, it still faces a number of challenges. In the process of urbanization in Sichuan Province, the population has moved from rural areas to towns and cities, resulting in a sharp increase in urban population and expansion of urban scale. The layout of key industries in some of the sub-central cities is unreasonable. The layout of key industries in some of the cities is unreasonable, and the phenomena of development by river and development of enclosing the city still exist. Such as Yibin, although in the Yangtze River shoreline clearance in a series of work, such as residents demolition and relocation of the shoreline, banning food and beverage barges, enterprises to return to the park, etc., but the Yangtze River, Minjiang River shoreline 1km within the scope of the 2021 there are still 16 chemical enterprises. Meanwhile, Sichuan Province may face increased energy consumption and carbon emissions from transportation in the course of economic development. Especially in the industrial and transportation sectors, especially in some cities where heavy industries are concentrated, carbon emissions may be higher. Addressing climate change, reducing carbon emissions, and promoting clean energy and sustainable development are important tasks. The complex terrain of Sichuan Province makes ecological environmental protection particularly important. In the process of urbanization and economic development, it may face problems such as over-exploitation of land, deforestation, and pollution of water resources. These problems can negatively affect ecosystems and species diversity, and may lead to frequent natural disasters. Therefore, strengthening ecological environmental protection and promoting

the harmonious development of ecological and economic construction are of great importance to the economic construction of Sichuan Province.

5. Suggestions for the Coordinated Development of Urbanization-carbon Emission-ecological Environment in Sichuan Province

5.1. Optimize the green spatial pattern and promote the high-quality development of provincial sub-centers

First, it will strengthen the green and coordinated development of the inner space of the sub-center city. It will continue to green the national territory, build street green spaces, wetlands and country parks, and strengthen the ecological restoration of urban rivers, lakes and other wetlands, so as to form an urban ecosystem that is interwoven with blue and green, gray and green, and continuous. Secondly, promote the green layout of industries in the sub-center city. Promote the optimization of the industrial layout of the Yangtze River Economic Belt to achieve green transformation, strengthen the awareness of the bottom line of environmental risks, and resolve the hidden environmental risks of the industries along the river and in the city.

5.2. Promote energy restructuring and strengthen the clean and efficient utilization of energy resources

Taking the goal of carbon peak attainment and carbon neutrality as the lead, promoting the shift from "dual control" of energy consumption to "dual control" of total carbon emissions and intensity. Promote the clean and efficient utilization of coal and other fossil energy sources, and promote the transformation of coal power units to save coal and reduce consumption and flexibility. It will implement a plan to improve industrial energy efficiency, promote the green and low-carbon transformation of coal chemical enterprises, strictly control energy consumption in key industries such as iron and steel, cement and chemicals, and implement the reduction of production capacity and energy consumption in energy-intensive industries.

5.3. Focusing on green development and joint efforts to build regional ecological barriers

To promote the construction of ecological civilization in Sichuan Province with green development as the core concept, fully recognizing that coordinated development is the foundation of green development, Sichuan Province has first-class colleges and universities such as Sichuan University, the University of Electronic Science and Technology, and Southwest Petroleum University in academics, and top technology companies such as Huawei and Tencent in enterprises, so we can rely on the joint advantages of colleges and universities and enterprises to set up the three core innovation bases of scientific research, colleges and universities, and enterprises. To realize the sharing of talents and resources, to combine scientific and technological innovation with low-carbon transformation, to form an effective low-carbon scientific and technological innovation chain, to carry out research on how to save energy and reduce emissions, to use clean energy, to improve environmental pollution and other green technologies, to integrate science and technology into the ecology, and to realize the construction of high-tech, low-consumption, all-around ecological system.

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