

# Analysis of Factors Influencing the Coordinated Development of New Urbanization with Green and Low Carbon under the Ecological Perspective - Taking Heilongjiang Province as an Example

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**Abstract.** Under the ecological perspective, the new type of urbanization, green and low-carbon coordinated development is a powerful engine for economic development. Based on the analysis of the existing results of the new urbanization green development and low-carbon development factors, a new index system of influencing factors for the coordinated development of green and low-carbon urbanization was constructed. And then concludes the results of the analysis by using the relevant statistical data of Heilongjiang Province from 2007 to 2017, using the principal component analysis method and using SPSS statistical software. Finally, puts forward some relevant countermeasures and suggestions on scientific and technological innovation, the industrial structure and cultural education, etc.

## 1 Introduction

The 18th CPC National Congress clearly stated that it is necessary to improve the mechanism for the healthy development of urbanization and stick to the path of new urbanization with Chinese characteristics[1]. However, in recent years, the development of urbanization in our country has shown the characteristics of high speed, low quality, and incoordination. How to transform the traditional model into a new model of urbanization with green and low-carbon coordinated development integrated into the concept of ecological civilization is an inevitable choice for China under numerous constraints, and it is an inevitable requirement for actively and steadily promoting urbanization and improving urbanization quality.

The United Nations Department of Economic and Social Affairs predicts that the urbanization of Chinatown will steadily increase to 68.7% by 2030[2]. According to data released by the National Bureau of Statistics, the urbanization rate of China's population in 2017 was 56.1%. The National New Urbanization Plan (2014-2020) pointed out that the new type of urbanization must be based on the urbanization of people, and take the new urbanization path of Chinese characteristics with people-centered, four-in-one synchronization, optimized layout, ecological civilization, and cultural heritage. In 2020, the urbanization rate of our population will reach 60%. In order to achieve such a development goal, it is necessary to clarify the influencing factors in the development of

China's new urbanization of green and low carbon, so as to promote its healthy development.

At present, research on green development and low-carbon development in urbanization is generally focused on research at the green and low-carbon levels, and has provided rich research results and experiences for China's reference, but it lacks a new type of urbanization. Systematic research on the development of green and low-carbon coordinated development has no successful practical experience to learn from. For the less developed urban areas of Heilongjiang Province, there are relatively few research results on the new urbanization of green development and low-carbon development, and these underdeveloped regions are the potential for the development of urbanization in China. Therefore, this article takes Heilongjiang Province as the research object, and studies the problem of the coordinated development of new urbanization green and low carbon from an ecological perspective, which not only has important practical significance for advancing the new type of urbanization in Heilongjiang Province, but also has new practical significance for the development of new urban areas in underdeveloped regions. To achieve a coordinated development of green and low carbon has a certain guiding role.

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## 2 Establishing a Indicator System for Influencing Factors of the Coordinated Development of Green and Low-carbon New Urbanization

The coordinated development of green urbanization and low carbon in new urbanization is affected by many factors. Different scholars have different views: Zhengming Qian(2013) believes that the development of green economy can establish an index system through GDP, industrial emissions, industrial wastewater discharge, and industrial solid waste production[3]. Yuanfang Zhang(2014) believes that Heilongjiang's green economy is mainly affected by capital, labor, environment, economic development, social development, and environmental quality[4]. Xiaoli Fan(2015) reflects the new urbanization level from the perspectives of economic development level, environmental quality level, infrastructure level, science and technology education level, quality of life, and cultural hygiene level[5].

Taking all aspects into consideration, the coordinated development of the new urbanization of green and low-carbon is mainly affected by resources and environment, industrial structure, technological innovation, population and cultural education, etc: (1) Resource environment. It is the basis for human survival and development. In the past, traditional urbanization led to an ever-increasing contradiction between population, resources, and the environment. The living environment and living conditions of the city deteriorated. Therefore, strengthening environmental pollution control, protecting the ecological environment, and rationally utilizing resources are signs of the healthy development of new urbanization. (2) Industrial structure. The adjustment and optimization of industrial structure is the core driving force for the development of the city. (3) Technological innovation. In recent years, the role and position of technology as the first productive force has become more and more significant. Advanced technology has virtually changed people's production and life style, which plays a crucial role in the healthy development of urbanization. (4) Population. New urbanization will enable the population to gather in cities and towns, leading to a constant change in the proportion of urban population, which will lead to changes in the quality of life of urban residents and rural residents. (5) Cultural education. It is an important driving force for the development of high-quality urbanization. The higher the level of education received, the stronger the awareness of green and low-carbon environmental protection will be.

Based on the existing research results and following the principles of scientificity, comprehensiveness, representativeness, comparability, and data availability, the indicator system for constructing a new type of influencing factors for the coordinated development of urbanization is shown in Table 1.

**Table 1.** Indicator System for Influencing Factors.

Influencing factors	Index name	Indicator code
Resources and environment	Per capita park green area	X <sub>1</sub>
	Industrial solid waste production	X <sub>2</sub>
	Per capita carbon emissions	X <sub>3</sub>
	Energy consumption	X <sub>4</sub>
Industrial structure	The proportion of the second industry	X <sub>5</sub>
	The proportion of the tertiary industry	X <sub>6</sub>
Technological innovation	R&D expenditure	X <sub>7</sub>
Population	Ratio of income of urban and rural residents	X <sub>8</sub>
	The ratio of Engel's coefficient between urban and rural households	X <sub>9</sub>
Cultural education	Per capita annual reading	X <sub>10</sub>
	Every million people own the number of students in colleges and universities	X <sub>11</sub>

## 3 An Empirical Analysis for Influencing Factors of the Coordinated Development of Green and Low-carbon New Urbanization

According to statistics from the National Bureau of Statistics, in 2017, the urbanization rate of the entire population was 58.5%, and in Heilongjiang Province it was 59.4%. In 2016, the urbanization rate of the entire country was 57.4%, and Heilongjiang Province was 59.2%. In contrast, the urbanization rate of population in Heilongjiang Province is higher than the national average level of urbanization, but it still needs to be improved in terms of the quality of new urbanization. In order to analyze the specific effects of various factors on the coordinated development of the new urbanization of green and low-carbon, this paper takes Heilongjiang Province as an example and selects its data for the period of 2007-2017 for analysis. The data are mainly from the Statistical Yearbook of Heilongjiang Province, the Statistical Yearbook of China and so on.

### 3.1 Analysis step

In the first step, the correlation of the selected variables is tested. If the variables have a certain correlation but are not completely related, the absolute value of the correlation coefficient is between 0-1, the index compression may be performed, and the main component is further implemented. analysis. If the correlation coefficient of a variable is equal to 0 or equal to 1, principal component analysis cannot be performed. After testing the indicators, the absolute value of the

correlation coefficient is between 0-1, which is suitable for the principal component analysis.

The second step is data standardization. Since the data units in the index system are different and the magnitudes of the values are quite different, it is difficult to directly compare them. Therefore, through descriptive analysis in the SPSS software, the original data is standardized and new data  $Z(X_i)$  is obtained.

The third step is to determine the eigenvalues and principal components. According to the principles and requirements of the principle component analysis method, the first few principal components with an eigenvalue greater than 1 and a cumulative total variance contribution rate of 85% or greater are generally selected according to the interpreted total variance table. In Table 2, there are two main component eigenvalues greater than 1, where the first principal component explains 78.313% of the original data, and the second principal component interprets 9.920% of the information. The cumulative variance of the two principal components is 88.233%, which retains a large amount of raw data and explains all variables well. The extracted principal components were named F1 and F2, respectively.

**Table 2.** Total Variance Explained.

Component	Initial Eigen Values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.614	78.313	78.313	8.614	78.313	78.313
2	1.091	9.920	88.233	1.091	9.920	88.233
3	.802	7.288	95.521			
4	.321	2.920	98.441			
5	.105	.958	99.399			
6	.036	.330	99.729			
7	.021	.194	99.923			
8	.007	.061	99.984			
9	.001	.011	99.995			
10	.001	.005	100.000			
11	-	-	-			
	3.511E-18	-3.192E-17	100.000			

In the fourth step, calculate the principal component score. According to the component score coefficient matrix (Table 3) multiplied by the data normalized by 11 indicators, the scores of the four principal components are calculated.

**Table 3.** Component Score Coefficient Matrix.

	Component	
	1	2
$Z(X_1)$	.990	-.069
$Z(X_2)$	.977	-.122
$Z(X_3)$	.962	-.040
$Z(X_4)$	.962	-.064
$Z(X_5)$	-.914	.031

$Z(X_6)$	.882	-.044
$Z(X_7)$	.973	-.070
$Z(X_8)$	-.889	.128
$Z(X_9)$	.757	.361
$Z(X_{10})$	.125	.942
$Z(X_{11})$	.943	.153

$$F1=0.99ZX_1+0.977ZX_2+0.962ZX_3+0.962ZX_4-0.914ZX_5+0.882ZX_6+0.973ZX_7-0.889ZX_8+0.757ZX_9+0.125ZX_{10}+0.943ZX_{11}$$

$$F2=-0.069ZX_1-0.122ZX_2-0.04ZX_3-0.064ZX_4+0.031ZX_5-0.044ZX_6-$$

$$0.07ZX_7+0.128ZX_8+0.361ZX_9+0.942ZX_{10}+0.153ZX_{11}$$

In the fifth step, the calculation expression for the comprehensive score F is determined. According to the proportion of the variance contribution rate of each factor to the total variance contribution rate as a weighted summary, a comprehensive score is obtained:

$$F=0.8876F_1+0.1124F_2$$

### 3.2 Analysis results

In Table 3, the main influencing factors of main component F1 are X1, X2, X7, X4, X3, X11, and X5. This indicates an increase in the per capita park green area, a reduction in the production of industrial solid waste, an increase in the proportion of R&D expenditures, a reduction in energy consumption, a decrease in per capita carbon emissions, an increase in the number of students in universities and an increase in the proportion of secondary industry. It is an important part of accelerating Heilongjiang Province's green and low-carbon new urbanization construction.

From Table 3, it can also be seen that the main influencing factor of principal component F2 is X10. It mainly reflects the impact of per capita annual reading volume on the urbanization of green, low-carbon and new urbanization in Heilongjiang Province, and shows that increasing the per capita annual reading volume can also play a role in the rapid development of the new urbanization of Heilongjiang Province.

Through the calculation of the composite score, it can be found that the correlation coefficient of the principal component F1 is 0.8876, and the correlation coefficient of the principal component F2 is 0.1124, which further explains the main influencing factors of the principal component F1 (X1, X2, X7, X4, X3, X11, X5) is an important influencing factor for the coordinated development of green and low carbon in the new urbanization of Heilongjiang Province.

## 4 The measures of promoting the Coordinated Development of Green and Low-carbon New Urbanization

Based on the above analysis results, we can see that the current new type of urbanization in Heilongjiang Province needs to achieve the coordinated development

of green and low carbon, and it is necessary to focus on the following tasks:

#### **4.1 Rely on Science and Technology Innovation to Promote the Coordinated Development of Green and Low Carbon**

From Table 3, it can be seen that among the 11 explanatory variables of the first principal component, the percentage of per capita park green area, industrial solid waste production, R&D expenditure, energy consumption and per capita carbon emissions is relatively high. The figures are 0.99, 0.977, 0.973, 0.962, and 0.962 respectively. This shows that resource environment and scientific and technological innovation are very important influencing factors in promoting the coordinated development of green and low carbon in Heilongjiang Province's new urbanization. Therefore, we must attach great importance to resources and environment and scientific and technological innovation to ensure the coordinated development of new urbanization of green and low carbon.

Actively encourage technological innovation. The use of high technology to transform traditional industries with high emissions, to make it low-carbon, through mergers and restructuring, policies and regulations and financial compensation and other measures to promote backward production capacity to exit.

#### **4.2 Adjusting the Industrial Structure and Accelerating the Development of New Urbanization**

In the foregoing analysis, the proportion of the second industry structure and the proportion of the third industry structure all belong to the explanatory variables in the first principal component, and their respective proportions are 0.914 and 0.882, respectively, demonstrating the promotion of new urbanization in Heilongjiang Province. Closely related to the industrial structure.

Therefore, in order to promote the coordinated development of the new type of urbanization in Heilongjiang Province, green and low carbon should be adjusted according to the actual situation. We will vigorously develop the secondary and tertiary industries. First of all, through the adjustment of the internal structure of the secondary industry to increase the absorption of rural labor force in Heilongjiang Province. Second, in the direction of marketization, industrialization, and socialization, vigorously develop service industries oriented to production and life, and promote the service industry. To expand the field, continuously improve the level of development of the service industry, and create favorable conditions for expanding employment and gathering population.

#### **4.3 Strengthening Cultural Education to Realize a New Type of Urbanization with Human-oriented, Green and Low-carbon Coordinated Development**

In the foregoing analysis, the number of students enrolled in colleges per 10,000 students belongs to the explanatory variable in the first principal component, which accounts for 0.943; the per capita annual reading amount is an explanatory variable in the second principal component. Its share is 0.942. From a whole point of view, the development of cultural and educational development of Heilongjiang Province's new urbanization of green and low-carbon coordinated development is more significant.

Whether the public can actively participate in green and low-carbon actions and how wide and deep the participation will ultimately depend on the degree of cultural education they receive and determine the practical effect of the green low-carbon economy. Therefore, the Heilongjiang provincial government should increase its investment in cultural education and improve the relevant institutional policies so as to improve the overall quality of the workers and provide a continuous driving force for the realization of new urbanization to achieve green and low-carbon development.

## **5 Conclusions**

On the basis of clarifying the background of new urbanization research, this paper constructs a new index system for the factors affecting the coordinated development of green and low-carbon urbanization. Taking Heilongjiang Province as an example, this paper empirically analyzes the factors affecting the coordinated development of the new urbanization of green and low carbon through data. Proposing specific measures to strengthen the coordinated development of new urbanization, green and low-carbon from the aspects of technological innovation, industrial structure, and culture and education.

## **Acknowledgment**

Project: Heilongjiang Social Science Research Project of the Year "Research on Coordinated Development Mechanism and Path of Green and Low Carbon in New Urbanization in Heilongjiang Province" No. 14E070 Northeast Petroleum University School Culture Fund Project "Research on Green Green and Low Carbon Coordinated Development Path of New Towns in China".

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