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Research on the New Urbanization Model Based on the Sustainable Concept of Chemical Industry

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The chemical industry based on the concept of sustainable development is the power of the city, and the new city development is the basic support of sustainable development and chemical industrialization, their coordinated development is the inevitable choice under the new economic norm. Based on the present situation of China's socio-economic and resource environment development, this paper proposes a collaborative development model of chemical industry and new urbanization based on sustainable concept. The synergistic development between the two will be directly related to the overall efficiency and quality of local social and economic development. Through the establishment of sustainable development of chemical industrialization indicators, the new urbanization indicators, sustainable development of chemical industrialization and the new urbanization synergy indicators and the factors affecting the development of the two models, the conclusion is drawn. The results show that sustainable development of chemical industrialization and new urbanization can interact with each other, and the relationship between them is positive correlation. The effective development of chemical industry based on sustainable concept can promote the development of new urbanization.

1. Introduction

Industry is a natural process from agriculture to industry, and there is a general law. However, under different systems, the different stages of industrialization have different development paths and patterns. With the improvement of the level of industrialization, urban land area has been expanding and the population has been increasing. Accordingly, with the acceleration of the urbanization process, it brings a series of problems such as traffic congestion, environmental pollution and chaos. Chemical industry is an important part of industrial development, which plays an important role in the national economy. It is also the basic industry and pillar industry in many countries. The pace and scale of the development of the chemical industry have a direct impact on the various sectors of the society and economy. At the same time, the chemical industry is also a big polluter. In the processing, storage, use and waste disposal and other links, chemical products are likely to produce a large number of toxic substances and affect the ecological environment, thus endangering human health. The sustainable development of chemical industry is of great practical significance to human economic and social development. Epting et al., (2017) chose a redox economic approach to achieve the valorization of waste biomass to platform chemicals. Fujii et al., (2013) examined the relationships between environmental performance and economic performance in Japanese manufacturing firms, and figured out the consequences of environmental firm behavior and sustainable development. Urbanization and industrialization are two wheels of economic advance. If there is no industrialization, urbanization will lose the power of development. If there is no urbanization, industrialization will lose the support of development. Farhani et al., (2015) group assessed the relationship among energy consumption, financial development, economic growth, industrialization and urbanization in Tunisia from 1971 to 2008. Jedliński et al., (2016) made a comparative study between urbanization with and without industrialization. Kauko (2014) examine the causal relationship between CO2 emissions, real GDP, energy consumption, financial development, trade openness, and urbanization in Tunisia over the period of 1971-2012, the result showed that financial development plays a vital role in the Tunisian urbanization development. New urbanization and new industrialization are put forward in the new situation. It is not only the socialist path with Chinese characteristics of promoting the building of a

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well-off society and realizing the dream of China, but also a comprehensive development strategy of promoting new industrialization and new urbanization. In particular, the current construction of new urbanization requires the coordinated development of the chemical industry with sustainable development (Delmastro et al., 2015; Fichera et al., 2015; Fichera et al., 2016; Nieto et al., 2016; Swarno et al., 2017; Mittal et al., 2017; Yeo et al., 2017; Chang and Li, 2016).

2. Theory and method

2.1 Sustainable development of chemical industrialization

The sustainable development of chemical industry requires the development of green industry in chemical industry. First, we should adopt the principle of cleaner production, use the clean energy and raw materials, and apply the advanced technology and equipment to improve the comprehensive utilization of management and other measures to reduce pollution from the source to improve resource efficiency, in order to reduce or eliminate the hazards to human health and the environment. According to the World Bank and other international organizations, the cost of cleaning technology to solve pollution problems is 25% to 50% less than terminal processing technology. Second, the chemical industry and the development of environmental protection industry is closely related. The research and development capabilities and levels of chemical industry and the technological progress of the chemical industry have a direct impact on the development of environmental protection. Chemical industry is a big polluter, and the development of environmental protection industry can provide technical and material support for the realization of pollutant discharge of chemical enterprises in China. Therefore, the systematization and standardization of chemical waste treatment equipment will greatly improve the level of technology and equipment of chemical industry, so as to realize sustainable development.

2.2 New-type urbanization

Since the industrial revolution, the process of urbanization in many countries of the world has entered a stage of rapid development. The number of urban population is increasing and the scale of cities is expanding. This is not a subjective process, but a result of the development of productive forces, the progress of science and technology, and the optimization and upgrading of industrial structures. Urbanization makes social division more clear. Scale effect and agglomeration effect are given full play, and the huge energy of urbanization is released. Sofeska (2015) linked urbanization strategies to changes in land use and associated impacts on rural communities and agro-ecosystems in a rural area of China, his study showed that urbanization strategies brought pressure on environment. Zhou et al., (2016) concluded that the urbanization leaded to violent land expropriation. Since the reform and opening up, China's economic development has made great achievements, and people's living standards have also been improved. However, the economic and social development between urban and rural areas is not coordinated. The traditional urbanization is taking economic development as the main target, the industrialization as the main line, and the local government as the leading. It belongs to the high cost of low-income urbanization. Traditional urbanization brought about a series of problems of structural imbalance, spatial imbalance, industrial structure imbalance and urban disease. New urbanization is not only the key to the realization of modernization, but also to achieve the potential of building a moderately prosperous society.

2.3 Model establishment

From the five aspects of economy, science and technology, information, human resources and environment, 10 indicators of sustainable development chemical industrialization index were selected. They are: per capita GDP, the proportion of the third industry accounted for GDP; R & D researchers, R & D internal expenses; the number of mobile phone households, the number of Internet users; the number of higher education per million populations, the per capita financial education funds; million yuan output value of coal consumption, chemical industry waste emissions. The mathematical expressions are shown in (1).

$$I = \sum_{1}^{m} c_i x_i \tag{1}$$

In the formula, I represents the sustainable development of chemical industrialization index, c_i indicates the weight of the i-th index in the whole index system, x_i indicates that the original index of the i-th index is normalized (the selected age is a whole). From the model expression, we can see that the greater the sustainable chemical industry index, the higher the quality of sustainable development of chemical industrialization. The smaller the indicator value, the lower the quality of sustainable chemical industrialization.

From the formula (1), we can see that, *I* is an additive indicator, the symbol of x_i will affect the size of *I*. Therefore, we first determine the sign of c_i. On this basis, the weight of the index is determined by regression analysis. The regression equation is shown in (2).

$$Ln\hat{I} = \hat{c}_0 + \hat{c}_1 \ln G_i + \hat{c}_2 \ln X_i + \varepsilon_i \tag{2}$$

$\hat{I}$ is the fitting index of the sustainable development of chemical industrialization index. G_i is the gross national product. X_i is the indicator system after the normalized after the indicators. Among them, $\hat{I}$ is equal to the difference between the value of chemical industry and the investment in chemical industry waste.

3. Results and analysis

3.1 Indicators of sustainable development of chemical industry

We take a province in southern China as an example. Based on the above modeling of chemical industrialization indicators for sustainable development, the regression results of the indicators are shown in Table 1. In this paper, we only take $\hat{C}_2$ as an example to give the regression results. The value in parentheses is p.

Table 1: The return result of sustainable development chemical industrialization (take $\hat{C}_2$ as an example).

Index	Per capita GDP	The proportion of the tertiary industry accounted for GDP	R & D researchers	R & D internal expenses	Number of mobile phone households
$\hat{c}_2$	0.2062 (0.0012)	- (0.2960)	0.1452 (0.1104)	0.1037 (0.0020)	0.1665 (0.0461)
Index	Number of Internet users	The number of higher education per million population	Per capita financial education funding	Million yuan output value of coal consumption	Chemical industry waste emissions
$\hat{c}_2$	0.2163 (0.0003)	0.0817 (0.0531)	- (0.4022)	-0.1130 (0.0420)	-0.0944 (0.0113)

It can be seen from Table 1 that the per capita GDP, R & D researchers, R & D internal expenditure, the number of mobile phone households, the number of Internet users and the number of higher education per million population are positive for the regression coefficient of the new urbanization fitting index. The annual output of coal consumption and the emission of chemical industry waste are negative for the regression coefficient of the new urbanization fitting index. The proportion of tertiary industry in GDP and per capita financial education funding has not passed the test. The symbols of the remaining eight variables are consistent with expectations and passed the test at a significant level of 10%. Thus, the remaining eight variables are used as specific indicators in the proportion of new industrialized aggregate indicators. The coefficients of the eight variables are normalized to get weight: w1 (per capita GDP)=0.1830, w2 (R&D researchers)=0.1288, w3 (R&D internal expenses)=0.0920, w4 (number of mobile phones)=0.1477, w5 (number of Internet users)=0.1919, w6 (number of higher education in the absence of millions of people)=0.0725, w7 (million output value of coal consumption)=0.1003, w8 (chemical industry waste discharge) = 0.0838.

According to the weight value of each index and the comprehensive calculation formula (1), the comprehensive evaluation index of sustainable development chemistry industrialization in 2006-2016 is calculated. The results are shown in Figure 1.

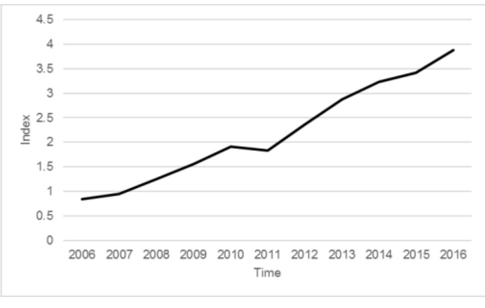

Figure 1: Sustainable development chemical industrialization composite index.

3.2 New urbanization index

We give the regression results represented by $\hat{C}_2$, and the results are shown in Table 2.

Table 2: The regression results of new urbanization(take $\hat{C}_2$ as an example).

Index	Urbanization rate	The proportion of the tertiary industry practitioners	Per capita GDP	Economic growth rate
$\hat{c}_2$	0.6063 (0.0122)	0.4212 (0.0286)	0.1052 (0.0904)	0.3337 (0.0207)
Index	Population density	Area of public facilities	Park land area	Forest cover rate
$\hat{c}_2$	0.3222 (0.0367)	- (0.7743)	- (0.4022)	-0.0965 (0.0874)

It can be seen from Table 2 that the urbanization rate, the proportion of tertiary industry practitioners, per capita GDP, economic growth rate and population density are positive for the regression coefficient of the new urbanization fitting index. The forest coverage rate is negative for the regression coefficient of the new urbanization fitting index.The regression analysis of the public facilities land area and the park land area to the new urbanization fitting index did not pass the significance test. The remaining six variables are passed the test at the significance level of 10%. Thus, the remaining six variable coefficients are taken as specific indicators in the proportion of new urbanization indicators. The coefficients of the six variables are normalized to get the weight: w1 (urbanization rate)=0.6063, w2 (the proportion of tertiary industry practitioners)=0.4212, w3 (per capita GDP)=0.1052, w4 (economic growth rate)=0.3337, w5 (population density)=0.3222, w6 (forest coverage)=-0.0965.
According to the weight value of each index and the formula (3), the comprehensive evaluation index of the new urbanization in 2006-2016 is calculated. The results are shown in Figure 2.

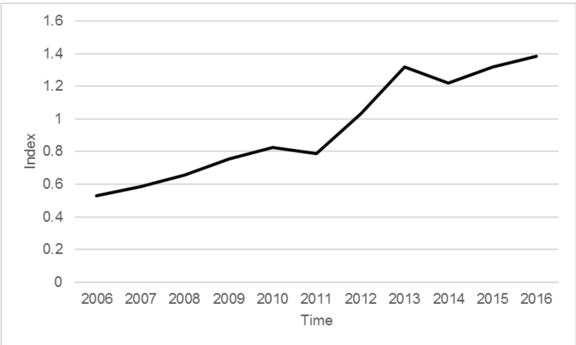

Figure 2: New urbanization composite index

3.3 Synergy index of sustainable development of chemical industrialization and new urbanization

According to the formula (6) and formula (7), the coupling degree and coordination degree of sustainable development of chemical industrialization and new urbanization in 2006-2016 were calculated. The coordination level is shown in Table 3. The values of synergy and coupling are shown in Figure 3.

Table 3: Cooperative classification

Coordination level	Serious imbalance	Severe imbalance	Imbalance	Barely synergy	Medium synergy	Good synergy	Excellent synergy
Range	0-0.3	0.3-0.4	0.4-0.5	0.5-0.6	0.6-0.7	0.7-0.8	greater than 0.8

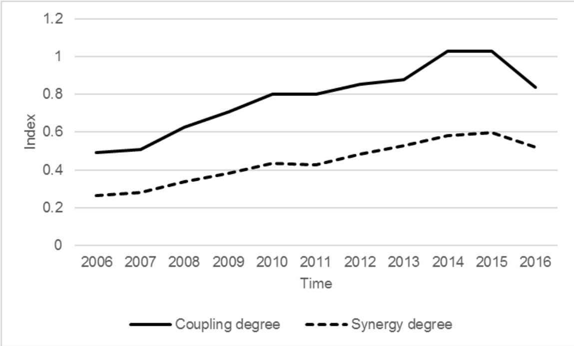

Figure 3: The coupling degree and synergy of sustainable industrialization and new urbanization.

As can be seen from Table 3 and Figure 3, during the inspection period, the new urbanization and sustainable development of chemical industrialization of the coupling degree and synergy are basically on the rise, and the degree of coordination is higher than the coupling degree. However, in 2016, it fell slightly. From the development trend, in 2006-2016, the degree of synergy is increased from 0.264 to 0.596. It is from a serious imbalance to reluctant synergy. During this period, the sustainable development of chemical industrialization and new urbanization are also developing, which indicates that there is a strong interaction between the sustainable development of chemical industrialization and the new urbanization. However, due to the fact that the sustainable development of chemical industrialization and the development of new urbanization level is not high, and the gap is large, which inhibits the synergy between the two. There is a large space for the development of the synergy between chemical industrialization and new urbanization.

3.4 Analysis of factors affecting sustainable development of chemical industrialization and new urbanization

Based on the establishment of a new model of the factors affecting the sustainable development of chemical industrialization and new urbanization, the statistical analysis of the variables was carried out. The results are shown in Table 4.

Table 4: Statistical description of each variable

Index / Variable	Mean	Maximum value	Minimum value	Standard value
D	0.4393	0.60	0.26	0.1146
lr	0.7829	0.83	0.76	0.0275
rgdp	1.8770	3.31	0.75	0.9223
pc	0.7366	1.10	0.44	0.2316
ar	1.0518	1.66	0.53	0.3939

It can be seen from Table 4 that the degree of synergy between chemical industrialization and new urbanization is 0.4393 in 2006-2016, and the difference between maximum and minimum is small. Standard deviation is low. It reflects that the new level of synergy is basically at a low level of stability. Per capita GDP is 1.877 million yuan. However, the difference between the maximum and the minimum is large, which shows that the economic development is uneven.
The time series of the province from 2006 to 2016 are analyzed. The results of the empirical analysis are shown in Table 5. From the regression results, each coefficient has passed the test at a significant significance level of 10%. R^2 is 0.9458, which shows that the model achieves a better fit. The value is D 1.459, and it indicates that there is no autocorrelation.

4. Conclusions

Based on the basic theory of sustainable concept of chemical industry and new urbanization, the sustainable development of chemical industrialization and new urbanization was studied. First, the evaluation index of sustainable development of chemical industrialization and new urbanization was established. The results show that these two indicators were constantly improving. Therefore, the sustainable development of chemical industrialization and the new urbanization level showed a rising trend. Second, the coupling coordination model is introduced to measure the synergy of sustainable development of chemical industrialization and new urbanization. The results show that there is a strong interaction between the two. Finally, the measurement model is established by using the data from 2006 to 2016, and the factors influencing the sustainable development of chemical industrialization and the new urbanization are discussed. The results show that per capita GDP, labor resource utilization and agricultural labor productivity are positively correlated with the sustainable development of chemical industrialization and new urbanization. If the deviation between the sustainable development of chemical industrialization and new urbanization is increased, it will affect the normal development of both. It is further concluded that the industrialization can promote the development of new urbanization.

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