

Study on the New Urbanization Evaluation Index System

—Taking 21 Cities (States) of Sichuan as the Example

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Abstract: In this paper, a new urbanization evaluation index system is established to detect and evaluate the process and results of urbanization development. The sample data of 21 cities (states) in Sichuan Province are taken as the example. Expert opinion method and entropy evaluation approach are employed to calculate the comprehensive scores of five aspects, namely economic level, urbanization level, basic public service, infrastructure, as well as resources and environment. Then the 21 cities and states are ranked according to scores they got. It is concluded that the overall urbanization level of Sichuan is not high with low development quality. Due to differences in regional positions, natural resources, industrial bases, economic and social policies as well as other factors, the urbanization development levels of 21 cities (states) are uneven; each city and state has its advantages and disadvantages in the process of urbanization construction. According to the comprehensive scores, the 21 cities (states) could be divided into four development patterns: “high development level”, “medium development level”, “mid-and-low development level” and “low development level”. On the road of new urbanization development, cities with different development patterns must make innovations combined their own characteristics, and actively explore sustainable development path. This paper puts forward countermeasures and suggestions for the development of new urbanization for cities with different development levels.

1. Introduction

The development of urbanization has promoted the rapid development of China’s social economy. Urbanization also led to continuous changes in economy, culture, society and ecological environment. In the 18th National Congress of CPC, the party clearly put forward that urbanization process had entered a new stage of transformation which required development based on quality improvement, and adhered to the road of new urbanization with Chinese characteristics. The policy pointed out the direction of urbanization development in the future. The basic features of “new urbanization” are human oriented, urban and rural integration, industry and city interaction, economical and intensive, as well as green and sustainable development. It is the urbanization progress promoted by the coordinated development and mutual promotion of small and medium-sized cities, as well as small towns and new rural communities.

The comprehensive evaluation on the development quality of new urbanization is of great practical significance. Index systems are usually used to detect and evaluate the development process and urbanization results, and give full play to their goal oriented roles. An evaluation index system should be established to evaluate the development status and quality of new urbanization.

2. The Principles of Establishing a New Urbanization Evaluation Index System

The new urbanization evaluation index system must focus on current policy and economic development trend, and fully reflect the essential characteristics of new urbanization.

2.1 Pay attention to the quality of urban development and the livability of cities and towns

The development of urbanization should take two aspects, quantity and quality into consideration. The traditional urbanization development tends to assess factors like the flow of migrate population, the growth of urban population, housing supply and demand, as well as

economic output. In the early stage of urbanization, the characteristics of extensive growth were obvious; the quality improvement of urban development was ignored. The new urbanization takes human as the core element, pays attention to the assessment of citizens' life quality and living environment. It mainly evaluates the level of urban household registration, the livable level of cities and towns, the intensive conservation of land, air pollution, energy consumption and other aspects.

2.2 Improve the urbanization level and promote the integration of urban and rural areas

The development of traditional urbanization was limited by the dual economic structure of urban and rural areas, resulting in uneven development of production modes and income distribution, as well as the gaps in life style, consumption level and thinking mode between urban and rural areas. With the deepening of reform and the continuous development of economy, the trend of urban-rural coordinated development is becoming obvious; great changes have taken place in agricultural industry and rural areas. The development of urban and rural areas is bound to narrow the production, life and income gaps between rural and urban residents.

2.3 Enhance the social security level, and attach importance to infrastructure construction and public service integration

With the development of urbanization in China, the level of social security has been greatly improved, and remarkable achievements have been made in infrastructure construction and public service construction. However, social security for farmers and migrant workers remains at low level; the efficiency of urban management is not high; public service supply still needs to be improved. Policies need to be implemented and improved on household registration access, the structural change of non agricultural employment personnel, social security, the education of migrant workers' children, as well as employment and training. The infrastructure and public service in urban and rural areas should be gradually improved.

2.4 Pay attention to the speed and quality of economic development

The level of urbanization of China is lagging behind the level of industrialization. In the past, the traditional urbanization paid more attention to the growth of GDP, and took the speed of economic growth as the priority of development. In the process of rapid urbanization, the problem of unbalanced, uncoordinated and unsustainable urban-rural development is outstanding; "urban disease" is becoming increasingly serious. There are also contradictions and problems in the spatial distribution and scale structures of cities and towns. The new urbanization should pay attention to evaluating the growth of second and third industries and the level of scientific and technological innovation. The modernization of industry and agriculture should be promoted to realize the transformation and upgrading of industrial structure.

3. New Urbanization Evaluation Index System and Index Weight Calculation Method

The new urbanization development process of 21 cities in Sichuan Province was taken as the example. Through in-depth analysis and screening, representative, comprehensive and systematic indexes were selected to establish an evaluation system with 5 first level indicators and 26 second level indicators (shown Table 1). First level indicators included economic level, urbanization level, basic public service, infrastructure as well as resources and environment.

3.1 Sample data selection

The selection of sample data followed the principles of comprehensiveness and authenticity. Comprehensiveness means that the sample data must be comprehensively covered. Authenticity means that the source of the selected sample data must be objective, authentic and reliable. The sample data of 21 prefecture level cities (states) in Sichuan province mainly came from the *Statistical Yearbook of Sichuan* and the *Air Quality of Cities in Sichuan Province* of 2016.

Table 1. The weight of new urbanization evaluation index system

First level indicators	Second level indicators	weight
economic level (15%)	per capita GDP (yuan)	0.202
	the proportion of third industry output in total GDP (%)	0.296
	per capita local finance general public budget revenue (yuan).	0.176
	the proportion of R&D expenditure in GDP (%)	0.097
	per capita disposable income of farmers (yuan)	0.082
	urban residents' disposable income (yuan)	0.093
	the ratio of urban and rural residents' income (%)	0.054
urbanization level (15%)	the urbanization rate of permanent residents (%)	0.270
	the urbanization rate of registered permanent residents (%)	0.417
	the ratio of non-agricultural employment in total employment (%)	0.313
infrastructure (25%)	per capita urban road area (m ² / per person)	0.206
	per capita floor space (m ² / per person)	0.115
	popularizing rate of urban water supply (%)	0.143
	popularizing rate of urban gas supply (%)	0.194
	treatment rate of domestic sewage (%)	0.224
	domestic rubbish disposa rate (%)	0.118
basic public service (25%)	pension coverage in urban resident population (%)	0.279
	basic medical insurance coverage in urban resident population (%)	0.207
	Hospital beds for ten thousand people	0.188
	collection of books for ten thousand people (thousand books/ ten thousand people)	0.144
	cable broadcasting and television coverage rate (%)	0.182
resources and environment (20%)	green coverage ratio of built-up areas (%)	0.154
	per capita park green space (m ² / per person)	0.105
	ten thousand yuan GDP energy consumption (tce)	0.265
	ten thousand yuan GDP water consumption (m ³)	0.147
	environmental air quality composite index	0.329

3.2 The calculation of comprehensive index of the evaluation system

The comprehensive indexes of the evaluation system were calculated based on the combination of subjective and the objective weighting approaches.

The calculation of first level indicators' weights. In the new urbanization evaluation index system, the weights of first level indicators were determined through subjective weighting approach; expert opinion method was adopted. In accordance with the system program, the investigator made questionnaire and consulted the expert team. The team members should not discuss with each other; they needed to submit their opinions by anonymity (correspondence). After repeated rounds of consultation and feedback, the opinions of the expert team were gathered. The collective judgment with very high rate of accuracy was adopted.

The calculation of second level indicators' weights. The weights of 26 second level indicators were calculated by entropy method. Entropy method was a mathematical method used to determine the dispersion degree of indexes. In information theory, entropy is used to measure uncertainty. If an index has great variation degree, it will carry large amount of information; its uncertainty decrease with the increasing probability, which lead to small entropy and great weight of this index. Therefore, entropy was used to calculate the weight of each index by the means of information entropy.

The weights of second level indicators were calculated through entropy method. Specific steps were as follows:

a, supposed that m samples were selected, and the system had t first level indicators. Under the kth (k=1, 2, 3... f) item of first level indicator, there were n second level evaluation indicators. Then, the value of jth (j=1, 2, 3...n) second level indicator of the ith (i=1, 2, 3... m) sample of the rth first level indicators item was $X_{i,j}^k$;

b, calculated the jth second level indicator, and the proportion of the index value of the ith item $P_{i,j}^r$:

$$P_{i,j}^k = X_{i,j}^k / \sum_{i=1}^m X_{i,j}^k \quad (1)$$

c, calculation entropy E_j^k of the jth item

$$E_j^k = -G \sum_{i=1}^m P_{i,j}^k \ln P_{i,j}^k \quad (2)$$

In the form $G = 1 / \ln m$: \ln was a natural logarithm;

d, calculating the weight of jth item W_j^k

$$W_j^k = (1 - E_j^k) / \sum_{i=1}^n (1 - E_j^k) \quad (3)$$

The calculation of sub index of first level indicators.

a, quantified the jth index of the kth first level indicator of the ith sample,

$$C_{i,j}^k = X_{i,j}^k / \max(X_j^k) \quad (4)$$

In this formula, $\max(X_j^k)$ was the maximum value of jth second level indicator in all the m samples of the kth first level indicator,

b, then, the sub index of the kth first level index of the ith sample B_i^k

$$B_i^k = \sum_{j=1}^n (W_j^k \times C_{i,j}^k) \quad (5)$$

The evaluation of comprehensive index.

According to the formula (1) to(5), the evaluation sub index of the ith sample could be obtained as Q'_i .

$$Q'_i = \sum_{r=1}^t (B_i^k \times Y^k) \quad (6)$$

In the form: Y^k was the weight of the Kth first level indicator.

In the evaluation system, the overall index of the ith sample Q'_i was obtained at that time; the value was between 0 and 1. In order to achieve more comparative and intuitive figures, the index was multiplied by 100 to make the value lie between 0 and 100. Therefore, the final index of the ith sample in the new urbanization evaluation system was obtained as Q_i :

$$Q_i = Q'_i \times 100 \quad (7)$$

4. Evaluation Results Analysis

According to the weights of indicators in this evaluation system, the scores of the 21 cities

(States) were calculated from five aspects of economic level, urbanization level, basic public service, infrastructure as well as resources and environment. Their comprehensive scores of the new urbanization level were listed and ranked (shown in Table 2).

Table 2. Comprehensive evaluation of the new urbanization of 21 cities (states) of Sichuan Province in 2015

Comprehensive ranking	City	Economic level	urbanization level	basic public service	Infrastructure	resources and environment	Comprehensive score
1	Chengdu	93.61	100.00	87.73	87.58	65.07	85.88
2	Panzhihua	64.15	87.85	87.00	79.88	43.50	73.22
3	Deyang	55.75	66.16	59.27	82.93	62.62	66.36
4	Mianyang	59.32	65.74	54.77	84.46	62.30	66.03
5	Ya'an	46.74	58.83	58.17	84.90	58.90	63.38
6	Zigong	49.57	66.51	48.91	80.38	61.71	62.08
7	Suining	43.33	57.15	43.71	95.81	59.28	61.81
8	Guang'an	45.83	48.23	40.97	93.45	69.93	61.70
9	Leshan	50.45	65.19	55.41	80.54	48.22	60.98
10	Guangyuan	44.13	52.74	48.61	84.47	64.16	60.63
11	Ziyang	43.98	45.86	40.92	87.44	71.10	59.78
12	Nanchong	40.65	54.74	42.83	85.33	63.53	59.05
13	Meishan	48.30	55.45	41.15	84.33	55.61	58.05
14	Lvzhou	46.77	55.42	41.63	82.76	52.58	56.94
15	Neijiang	42.37	60.85	42.52	79.29	53.49	56.63
16	Aba prefecture	50.04	53.54	45.56	67.67	63.67	56.58
17	Bazhong	41.63	50.49	34.21	72.85	65.92	53.77
18	Yibin	47.71	51.32	38.19	69.18	56.76	53.05
19	Liangshan Prefecture	44.51	37.73	26.24	71.28	68.69	50.45
20	Ganzi Prefecture	46.66	30.75	30.48	74.86	59.02	49.75
21	Dazhou	42.15	49.70	34.49	61.92	54.33	48.75

Overall, Chengdu gets the highest comprehensive score, 85.88 points, followed by Panzhihua with 73.22 points. The lowest scores are 49.75 of Ganzi Prefecture and 48.75 of Dazhou. The urbanization levels of other cities are relatively balanced with small differences. The average new urbanization level is 60.23 points; 12 cities are listed above the average level. Except for Chengdu and Panzhihua, the scores of other cities are between 60 points and 66 points. The scores of 9 cities below average level are between 50 and 59 points. The score difference between Chengdu and Dazhou is 37.13 points, indicating the great difference in the highest and lowest level of urbanization. For comprehensive comparison, the 21 cities (states) could be divided into four development patterns: high development level, medium development level, mid-and-low development level and low development level.

Cities with high development level are Chengdu, Panzhihua, Deyang and Mianyang; the comprehensive score of these cities are at the leading position of Sichuan Province. As the provincial capital city, Chengdu has its own regional advantages, as well as convenient transportation and obvious industrial advantages. The industrial base and development of high and new industries, as well as second and third industries are obviously superior to other cities. The urbanization and public service levels are also high. Panzhihua, known as “the city of iron and steel” and “the capital of vanadium and titanium” has solid industrial base. The per capita GDP of Panzhihua is the highest in Sichuan. With the continuous development of urbanization in recent years, the urbanization and basic public service levels of Panzhihua is second only to Chengdu. Its only development disadvantage lies in resources and environment conditions. Deyang is China’s major technical equipment manufacturing base, while Mianyang is an important defense research and electronic industry base of China. Their urbanization development is more balanced in all aspects; the two cities rank at the third and fourth places of the province.

Cities with medium development level are Ya’an, Zigong, Suining, Guang’an, Leshan and

Guangyuan. The comprehensive scores of these six cities are slightly higher than the provincial average level. In the field of economic and urbanization, Leshan and Zigong get the highest score, and the other four cities are at a comparable level. In the field of infrastructure construction, Suining and Guang'an rank the first and second of Sichuan. They get high points at average urban road area and urban sewage treatment, indicating that two cities have invested heavily in infrastructure construction. In the field of basic public service, Ya'an and Leshan rank fourth and fifth of Sichuan. In the field of resources and environment, Guang'an rank the second of Sichuan; the city get high scores in green coverage rate of built-up areas and environmental air quality index. The resources and environmental conditions of Ya'an, Zigong, Suining and Guangyuan are all at the same level. Leshan's resources and environment score ranks penultimate of the whole province, which is also a prominent problem.

Cities with mid-and-low development levels are Ziyang, Nanchong, Meishan, Luzhou, Neijiang, Aba, Bazhong and Yibin. The comprehensive scores of these eight cities and states are slightly lower than the provincial average. Their scores in the five major fields are almost the same. The scores of Ziyang are slightly higher in resources and environment as well as infrastructure than those of other cities. Neijiang has the highest score in the level of urbanization; the score of Aba is slightly higher in economic level, which is attributed to the high proportion of third industry output in GDP.

Cities with low development level are Liangshan, Ganzi and Dazhou. The comprehensive scores of these three cities and states are at the lowest level. Their scores are low in almost all aspects. Dazhou has higher urbanization level compared with Liangshan and Ganzi, but the levels of other areas are the lowest. The economic level of Dazhou is lower than that of Liangshan and Ganzi, which is mainly because the low scores in average public budget and infrastructure construction. The scores and development statuses of Liangshan and Ganzi are similar.

5. Conclusion and Suggestions

Through the analysis of the evaluation results on urbanization development of 21 cities and states of Sichuan Province, it was concluded that the overall urbanization level of Sichuan was not high with low development quality. Due to differences in regional positions, natural resources, industrial bases, economic and social policies as well as other factors, the urbanization development levels of 21 cities (states) were uneven; each city and state had its advantages and disadvantages in the process of urbanization construction.

From the situation and trend of urbanization development, it could be found that the level of economic development determined the degree of urbanization development; the level of economic modernization determined the level of urban modernization; the development of urbanization must be supported by economic development. At the same time, the energy consumption of cities with high industrial development levels was relatively high, resulting in poor resource conditions and relatively bad environment. In the past, it was a common problem in the process of urbanization development. However, the development of new urbanization attaches importance to the quality of economic development, and vigorously promotes the development of high and new industries. The development model of high energy consumption and high pollution has transformed into low energy consumption and utilization of new energy. The new urbanization promotes the reform of industrial parks, emphasizes conservative and intensive development, strengthens environmental comprehensive treatment, and tries to establish a green and harmonious living environment.

On the road of new urbanization development, the 21 cities (states) must make innovations combined their own characteristics, and actively explore sustainable development path. Chengdu, Panzhihua, Deyang and Mianyang have high and balanced development levels. They should focus on improving the quality of economic development, strengthening the management of resources and environment, and trying to become intelligent cities with high technology level and green development patterns. Cities at medium development level, namely Ya'an, Zigong, Suining, Guang'an, Leshan and Guanyuan should learn from Deyang and Mianyang to strengthen their industrial bases, improve their economic modernization levels, then gradually improve their basic

public services as well as resources and environment conditions. Ziyang, Nanchong, Meishan, Luzhou, Neijiang, Aba, Bazhong and Yibin are at mid-and-low development level. These eight cities have slow development speed and different weaknesses. When promoting the development of social economy, it is important to aim at these shortages and put up with relevant countermeasures. Liangshan and Ganzi are at low development levels for their relatively closed geographical conditions, weak industrial bases, backward agriculture and poor natural resources. The government needs to strengthen planning to improve infrastructure and basic public services to promote urbanization. Dazhou has a large population, and is located in the east of Sichuan province. The urbanization cannot be promoted by the radiation of big cities. The city must depend on the development of new industrialization and agriculture to improve its infrastructure and public service, so as to promote the economic and urbanization development.

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