World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Analysis of new urbanization level measurement in Heilongjiang Province

Yuzhong Sun and Yutong Zhang *

School of Economics and Management, Heilongjiang Bayi Agricultural University, Daqing city, Heilongjiang Province, China.

World Journal of Advanced Research and Reviews, 2023, 20(02), 1323–1329

Publication history: Received on 14 October 2023; revised on 23 November 2023; accepted on 25 November 2023

Article DOI: https://doi.org/10.30574/wjarr.2023.20.2.2377

Abstract

In recent years, Heilongjiang Province has made significant contributions to the country based on its resource advantages, but the contradictions and problems in sustainable development have become increasingly prominent. In order to better study the economic upgrading and transformation of resource-based cities in Heilongjiang Province, this article focuses on the new urbanization and industrial structure optimization level of resource-based cities in Heilongjiang Province, Construct and analyze the measurement index system for the level of new urbanization and industrial structure optimization, respectively. Under the concept of regional coordinated development, an evaluation index system for new urbanization and industrial structure was constructed. The coefficient of variation method was used to calculate the weights of various indicators for the new urbanization system and industrial structure optimization system. The grey correlation theory was used to analyze the correlation between the selected indicators for characterizing the level of new urbanization and industrial structure optimization, aiming to make the correlation between the internal indicators of the system more reasonable, By promoting the coordinated development of new urbanization and industrial structure optimization, resource-based cities can achieve economic upgrading and transformation, thereby achieving sustainable economic development. The research results indicate that policy recommendations for coordinated development between the two are proposed.

Keywords: New Urbanization; Development Level; Heilongjiang Province; Coefficient of Variation; Extremum method

1. Introduction

As an important energy and resource guarantee base in China, resource-based cities have an important strategic position and are an important pillar for the sustained and healthy development of China's social and economic development. But as a resource-based city, it is impossible to avoid the development result of resource depletion. Therefore, it is necessary to transform and adjust resource-based cities, and carry out new urbanization construction. The construction of new urbanization is closely related to the optimization and upgrading of industrial structure. The healthy development of new urbanization calls for the optimization of industrial structure, which can promote the healthy development of new urbanization. On the one hand, the adjustment and development of industrial structure can drive the process of new urbanization; On the other hand, the development of new urbanization promotes the transition of industrial structure towards advanced and rational development. At present, new urbanization has entered a period of rapid advancement, and the rapid development of new urbanization requires a corresponding industrial structure as support. Therefore, it is particularly important to coordinate the optimization of new urbanization and industrial structure. However, in the context of extensive development, there have been many problems in the construction and evolution of new urbanization and industrial structure in various regions, such as urbanization lagging behind industrial structure, urbanization lagging behind industrialization, economic growth and mismatch between industrial support and urbanization development, which are not conducive to the upgrading and transformation of resource-based cities. How to promote the coordinated development of new urbanization and industrial structure

* Corresponding author: Yutong Zhang

optimization to promote the economic upgrading and transformation of resource-based cities, Subsequently, achieving sustainable economic development has become an urgent research topic.

2. Literature Review

The level of urbanization is not balanced between developed and developing countries, and even within the same country, there are differences between different regions. The prerequisite for this comparison is the existence of an accurate evaluation standard or indicator for the level of urbanization, and scholars have conducted in-depth research on this issue. From the perspective of chronological order, research on the level of urbanization can be divided into two types: single indicator method and multi indicator method. In the early days, the population indicator method (Shen Chi 1997; Chen Yanguang 2003) and land indicator method (Tan Minghong, Lv Changhe 2003) were mainly used for the level of urbanization. The advantages of a single indicator method were easy to obtain indicators, good data consistency, and convenient mathematical processing. However, there are many shortcomings in using a single indicator to measure the level of urbanization. It is difficult to avoid constraints such as the unique registered residence system in China, and it is difficult to truly reflect the actual level of urbanization. Therefore, scholars have begun to construct a multi indicator system to comprehensively evaluate the level of urbanization. Although these methods use different indicators, they generally start from the dimensions of economic scale, industrial structure, population, environmental factors, etc. related to urbanization, select relevant indicators, and assign different weights to measure the level of urbanization (Hua zhong, Niu Huien 2003; Duqin Jun 2005).

The composite indicator weight method can comprehensively and systematically reflect the true level of urbanization when measuring the level of urbanization. However, when constructing an indicator system, one cannot choose indicators based on personal preferences, but should follow the principles of scientificity, relevance, completeness, systematicity, and accessibility to screen indicators.

Research has shown that resource-based cities are prone to problems such as a single industrial structure and excessive reliance on economic growth resources. The decline of urbanization and industrial decline interact with each other, ultimately affecting the development of cities. Therefore, in enhancing the sustainable development capacity of resource-based cities, it is necessary to fully consider the interaction between new urbanization and industrial optimization, and avoid the decline of regional industries and cities by achieving a positive interaction between the two. From this perspective, research on the coordinated development of new urbanization and industrial structure optimization in resource-based cities is particularly important.

3. Measurement and Analysis of the New Urbanization Level in Heilongjiang Province

3.1. Construction of measurement system

3.1.1. Selection of evaluation indicators

When measuring the degree of development of new urbanization, it should be regarded as a system that mostly uses a single indicator to measure or reflects from the "population society economy" level, with less consideration given to ecological environment and human social security urbanization; When measuring the level of industrial structure development, Multiple followers The evaluation index system for evaluating the coordinated development of new urbanization and industrial structure optimization is based on the measurement of output value structure - employment structure, and less consideration is given to the rationalization of industrial structure. Drawing on existing research experience, this article follows the principles of systematicity, scientificity, and data availability, focusing on the transformation and upgrading of resource-based cities, and closely adheres to the essence and industrial structure of people-oriented new urbanization The connotation of advanced and rational construction has been constructed, and an evaluation index system for the coordinated development of the two has been established. The new urbanization system consists of three subsystems: support system, balance system, and power system. The three subsystems also include 10 tertiary indicators, as shown in the table 3-1.

Similarly, we draw on the principle of order parameters in synergetics. The process of urbanization can be reflected by the level of urbanization, which is the main indicator that reflects and promotes the maximization of social value. A higher level of urbanization can reflect higher social value. On the contrary, the level of urbanization has an impact on all entities in the urbanization system. Therefore, this article chooses "urbanization level" as the order parameter of the urbanization subsystem.

Table 1 Evaluation Index System for the Development Level of New Urbanization

Order Parameter Indicators of The New Urbanization System	**Subsystem Order Parameter**	**Third Level Indicators**	**Indicator Attribute**
New Level of Urbanization	Supporting System - Urbanization Scale and Infrastructure	X1-Urbanization rate of permanent population	Positive
		X2-Every 10000 people have public transportation vehicles	Positive
		X3-Urban gas penetration rate	Positive
		X4-Per capita daily water consumption	Positive
	Balanced System - Basic Public Services for Urbanization	X5-per-capita education spending	Positive
		X6-Every 10000 people have medical technicians	Positive
		X7-Per capita urban construction land	Positive
		X8-Green coverage rate in built-up areas	Positive
	Power System - Urbanized Economic Development	X9-per capita GDP	Positive
		X10-Industrialization rate	Positive

3.1.2. Determination of Index Weights

There are many methods for determining weights, including subjective weighting methods such as expert scoring and equal weighting, as well as objective weighting methods such as factor analysis and coefficient of variation. The objective weighting method relatively reduces human factors and can better reflect the true situation of indicators in the indicator system. Therefore, this article chooses the objective weighting method. In the objective weighting method, the advantage of the coefficient of variation method is that it is simple to calculate, and secondly, from the perspective of entropy, indicators with high variability contain more information and should be given higher weights. Therefore, this article selects the coefficient of variation method to calculate the weights of each indicator.

The calculation method is as follows:.

$$CV_i = \frac{\sigma_i}{\overline{x}_i} \tag{3-1}$$

$$W_i = \sum_{i=1}^{n} CV_i \tag{3-2}$$

In formula (3-1), CV_i is the coefficient of variation of the i-th indicator, i=1,2, N; $\overline{x}_i$ is the average value of this indicator; σ_i is the standard deviation of this indicator. W_i is the weight of the i-th indicator in formula (3-2).

3.1.3. Determination of evaluation methods

The fuzzy comprehensive evaluation method is a comprehensive evaluation method based on fuzzy mathematics. This comprehensive evaluation method transforms qualitative evaluation into quantitative evaluation based on the membership theory of fuzzy mathematics, which uses fuzzy mathematics to make a comprehensive evaluation of things or objects constrained by multiple factors. It has the characteristics of clear results and strong systematicity, which can effectively solve fuzzy and difficult to quantify problems, and is suitable for solving various non deterministic problems.

This article uses the method of multiplying dimensionless data from various indicators by the weights of relevant indicators, and then adding and summing them to measure the level of financial development and urbanization. The relevant formula is as follows:

$$U_{\text{it}} = \sum_{i=1}^{n} W_i \cdot X_{it} \tag{3-3}$$

In formula (3-3), X_{it} is the value of the i-th indicator t time (dimensionless data); W_i is the weight of the indicator; U_{it} is the horizontal value of time t for this indicator.

3.2. Measurement of development level

3.2.1. Analysis of indicator data

This study involves three new urbanization systems and 10 indicators, and the data are mainly from the Statistical yearbook of Heilongjiang Province. Table 3-2 lists the raw data.

Table 2 Raw Data of New Urbanization Indicators

Year	Supporting System				Balanced System				Power System	
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
2010	0.56	13.10	84.67	848.64	780.37	5.00	10.00	34.89	2.17	0.55
2011	0.56	13.70	81.41	919.10	988.45	5.09	11.20	36.32	2.63	0.56
2012	0.57	14.03	83.39	936.10	1462.91	5.25	11.83	35.98	2.96	0.48
2013	0.58	15.21	85.58	944.83	1367.37	5.49	13.15	35.99	3.23	0.43
2014	0.59	14.00	86.23	949.74	1402.26	5.54	13.32	35.98	3.37	0.39
2015	0.60	14.40	86.61	929.53	1557.54	5.60	13.14	35.82	3.31	0.35
2016	0.61	15.10	86.66	926.55	1613.84	5.83	13.71	35.35	3.43	0.31
2017	0.62	15.50	87.77	930.69	1686.12	6.05	13.89	35.45	3.62	0.27
2018	0.63	15.80	89.50	909.58	1636.26	6.12	14.86	36.04	3.86	0.25
2019	0.65	16.50	91.09	825.09	1705.45	6.34	15.22	36.39	4.18	0.24
2020	0.66	15.70	90.82	977.59	1773.70	7.61	15.59	36.88	4.32	0.23

Data source: Statistical Yearbook of Heilongjiang Province

3.2.2. Dimensionless processing of indicator data

Use extreme value method for dimensionless data processing. For positive indicators, which means that the larger the value, the better the indicator. Formula 3-4 is adopted：

$$a^{*}_{ik} = \frac{a_{ik}}{\max a_{ik}} \tag{3-4}$$

i=1,2,...,m

For negative indicators, i.e. indicators with smaller values are better.Formula 3-5 is adopted：

$$a^{*}_{ik} = \frac{\min a_{ik}}{a_{ik}} \tag{3-5}$$

i=1,2,...,m

Dimensionless processing was carried out on the original indicators, and the results are shown in Table 3-3

Table 3 Dimensionless Processing Data of New Urbanization System Indicators

Year	Supporting System				Balanced system				Power System	
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
2010	0.85	0.79	0.93	0.87	0.44	0.66	0.64	0.95	0.5	0.98
2011	0.85	0.83	0.89	0.94	0.56	0.67	0.72	0.98	0.61	1
2012	0.86	0.85	0.92	0.96	0.82	0.69	0.76	0.98	0.68	0.84
2013	0.88	0.92	0.94	0.97	0.77	0.72	0.84	0.98	0.75	0.76
2014	0.89	0.85	0.95	0.97	0.79	0.73	0.85	0.98	0.78	0.7
2015	0.91	0.87	0.95	0.95	0.88	0.74	0.84	0.97	0.77	0.61
2016	0.92	0.92	0.95	0.95	0.91	0.77	0.88	0.96	0.8	0.54
2017	0.94	0.94	0.96	0.95	0.95	0.8	0.89	0.96	0.84	0.48
2018	0.95	0.96	0.98	0.93	0.92	0.8	0.95	0.98	0.89	0.45
2019	0.98	1	1	0.84	0.96	0.83	0.98	0.99	0.97	0.43
2020	1	0.95	1	1	1	1	1	1	1	0.41

3.2.3. Determination of indicator weights

The weights of various indicators of new urbanization calculated according to formulas (3-2) and (3-3) are shown in Table 4.

Table 4 Weights of New Urbanization Indicators

	Supporting System				Balanced system				Power System	
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
mean value	0.91	0.90	0.95	0.94	0.82	0.76	0.85	0.97	0.83	0.63
standard deviation	0.05	0.06	0.03	0.05	0.18	0.10	0.11	0.01	0.13	0.28
coefficient of variation	0.06	0.07	0.03	0.05	0.21	0.13	0.13	0.02	0.15	0.44
Indicator weight	0.05	0.05	0.02	0.04	0.16	0.10	0.10	0.02	0.12	0.34
Subsystem weight	0.16				0.38				0.46	

Multiply and sum the dimensionless data of each indicator by their respective weights to obtain the measurement value of the development level of new urbanization. The results are shown in Table 3-5.

Table 5 Development level of new urbanization system and subsystems in Heilongjiang Province

Year	Development level of new urbanization	Support system level	Balance system level	Power system level
2010	0.75	0.14	0.22	0.40
2011	0.81	0.14	0.25	0.42
2012	0.82	0.14	0.30	0.37
2013	0.81	0.15	0.30	0.36

2014	0.79	0.15	0.30	0.34
2015	0.77	0.15	0.32	0.31
2016	0.77	0.15	0.33	0.29
2017	0.76	0.15	0.34	0.27
2018	0.61	0.16	0.34	0.12
2019	0.79	0.16	0.35	0.28
2020	0.82	0.16	0.38	0.28

4. Result analysis

4.1. Comprehensive analysis of the development level of new urbanization

The result shows that the level of new urbanization in Heilongjiang Province has shown a slow downward trend since, with a sharp decline in 2018. Then it began to rapidly recover and rise again. Compared with the three subsystems of urbanization, the power system has a weight of 0.46, making it the subsystem with the highest weight. The sharp decline in 2018 was mainly due to the rapid decline in the power subsystem. From a single indicator perspective, the weight of X10 industrialization rate is 0.34, which is the indicator with the highest weight.

4.2. Support System Level Analysis

The result shows that the new urbanization support system in Heilongjiang Province has been in a relatively stable state. The weights of various indicators in the support system, such as X1 (urbanization rate of permanent residents), X2 (public transportation vehicles per 10000 people), X3 (urban gas penetration rate), and X4 (per capita daily water consumption), are not significantly different, and the indicator levels are generally stable. Reflecting the serious population loss and slow urbanization process of Heilongjiang students, the living standards of urban residents have basically maintained their original state.

4.3. Balance System Level Analysis

The result shows that the new urbanization balance system in Heilongjiang Province has been in a slow upward trend. Among the indicators such as X5 (per capita education expenditure), X6 (per 10000 people with medical and technical personnel), X7 (per capita urban construction land), and X8 (green coverage rate of built-up areas) in the balanced system, X5 (per capita education expenditure) has a weight of 0.16, with the highest weight. However, from Table 3-2, it can be seen that the per capita education expenditure and per capita medical and technical personnel in Heilongjiang are showing a slow upward trend. And other indicators have also remained basically stable. This reflects that Heilongjiang Province has maintained good investment in the two important areas of people's livelihood, education and healthcare.

4.4. Power system level analysis

The result shows that the new urbanization power system in Heilongjiang Province has been in a rapid decline state. The two indicators of X9 (per capita gross domestic product) and X10 (industrialization rate) in the power system have the highest weight, reaching 0.34. The industrialization rate of Heilongjiang Province has shown a rapid decline in recent years.

5. Conclusion

The level of new urbanization in Heilongjiang Province has shown a slow downward trend since, and there was a sharp decline in 2018. Then it began to rapidly recover and rise again, and the continuous decline in the level of the power system severely constrained the development of new urbanization in Heilongjiang.

Compliance with ethical standards

Acknowledgements

This research is supported by the Philosophy and Social Science Research Planning Project of Heilongjiang Province. The project name is "Research on the transformation and Upgrading of Resource-based Cities in Heilongjiang Province from the Collaborative Perspective of New Urbanization and Industrial structure Optimization". (NO.19JYE266).

Disclosure of conflict of interest

The authors declare that they have no competing interests.

References

[1] Shen Chi. Discussion on calculation method of urbanization level. City Planning Review. 1997 Jan;(01):22.

[2] Chen Yanguang. How high is the level of urbanization in China? -- Why should fractal geometry be used in urban geography research?. Urban Planning Review. 2003 Jun;(07):12-17.

[3] Tan Minghong, Lv Changhe. Urban size distribution in China as represented by built-up area. Acta Geographica Sinica. 2003 Feb;(02):285-293.

[4] Hua Zhong, Niu Huien. Measurement method and empirical study of urbanization level: A case study of Shenzhen Special Economic Zone. Urban Planning Review.2003 Nov;(11):34-38.

[5] Du Qinjun. Research on index system of urban ecological level evaluation. Statistics and Decision.2005 Sep;(09):30-31.

Author's short biography

Yuzhong Sun is an associate professor at School of Economics and Management of Heilongjiang Bayi Agricultural University. His research field is mainly concerned with China's urban-rural integration and other related issues in the macro field. The micro field mainly focuses on the financial performance and financial risk analysis of enterprises.

Yutong Zhang is a postgraduate student at Heilongjiang Bayi Agricultural University. Her research interests are urbanization related issues and enterprise performance evaluation.