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Research on the evaluation of rural revitalization level in Qiqihar City

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Abstract

This study starts from the system and divides the rural revitalization system into five subsystems and 14 secondary indicators based on the rural revitalization strategy: industrial prosperity, ecological livability, rural civilization, effective governance, and affluent living. The weights of each indicator are determined using the coefficient of variation method and relative weighting method. On this basis, the fuzzy comprehensive evaluation method is used to calculate the level of rural revitalization in Qiqihar City. Research has shown that the level of rural revitalization in Qiqihar City continues to rise due to the sustained development of the thriving rural industry subsystem and the affluent living subsystem. However, the continuous decline in rural greening in Qiqihar City has led to the worst performance of the ecological livability subsystem, and there is a need to continuously improve the level of rural greening. Further enhancing the consumption expenditure of rural residents in education, culture, entertainment, and other areas is necessary to promote the continuous rise of the rural civilization subsystem.

Keywords: Rural Revitalization; Horizontal Evaluation; Qiqihar City; Coefficient of Variation Method; Fuzzy Comprehensive Evaluation

1. Introduction

The rural revitalization strategy is a major strategic innovation in solving the "three rural issues" in the new era, and it is of great significance for addressing the problem of unbalanced and insufficient development among the main contradictions in Chinese society. Scholars have conducted in-depth research on issues related to rural revitalization, which provides important guidance and reference for the implementation of rural revitalization strategies. From the current research status, the connotation of rural revitalization, measurement of rural revitalization level, and promotion path of rural revitalization are the main research hotspots.

2. Literature Review

Since the proposal of the rural revitalization strategy, scholars have conducted in-depth research from the perspectives of theoretical exposition, policy analysis, and practical cases, producing very rich research results. The focus areas mainly include research on the connotation of rural revitalization, evaluation of the development level of rural revitalization, and research on the promotion path of rural revitalization.

2.1. Research on the Connotation of Rural Revitalization

The connotation of rural revitalization is very rich. Scholars have conducted a more in-depth deconstruction of the connotation of the rural revitalization strategy around the overall requirements of "prosperous industries, livable ecology, civilized rural culture, effective governance, and prosperous life". The goal of rural revitalization is to achieve

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comprehensive modernization in the fields of agriculture, rural areas, and farmers. Specifically, rural revitalization aims to achieve coordinated development in five aspects: industry, culture, ecology, life, and society (Wang, 2017); The essence of rural revitalization is to pursue comprehensive revitalization of economy, ecology, governance system, and other aspects (Wei, 2018). The multidimensional nature of rural revitalization is not simply a parallel relationship. Industrial revitalization is the premise and foundation of rural revitalization (Chen, 2018), while cultural and spiritual revitalization of rural areas is the core of rural revitalization (Xue, 2018); In addition, the improvement of social and ecological governance is not only the foundation of rural revitalization, but also the main content of rural revitalization in the new era (Wen, 2018). The systematic interpretation of the connotation of rural revitalization provides specific ideas for evaluating the development level of rural revitalization.

2.2. Research on Evaluation of Rural Revitalization Development Level

The evaluation of rural revitalization development level presents diversified indicators and methods. Since the proposal of China's rural revitalization strategy, scholars have also conducted rich exploration and research in the evaluation of rural development level.

In terms of evaluation dimension design, most scholars are consistent with national planning and use the "20 character policy" for rural revitalization as five primary indicators to construct an evaluation system (Zhang et al., 2021). While conducting overall evaluations, some scholars have also focused on specific aspects such as industrial development, rural ecology, rural governance, and affluent living (Zhan, 2019).

Scholars have conducted extensive discussions on the construction and evaluation of indicators at the provincial, county, and rural levels in determining the evaluation objects (Jia et al., 2018). In other related research areas, rich explorations on the measurement and evaluation of rural development processes nationwide and in various regions, as well as the evaluation of agricultural green development level and the measurement of high-quality agricultural development, have provided a research basis and reference for the design and improvement of China's rural revitalization evaluation system and the specific selection of indicators.

In terms of evaluation method selection, comprehensive evaluation is mainly based on quantitative research, mainly using methods such as Analytic Hierarchy Process (Chen et al., 2019), Factor Analysis (Ma and Xia, 2019), Entropy Method (Chen et al., 2018) to measure the level of rural revitalization and development in specific regions or at specific times. Scientific and reasonable evaluation of the development level of rural revitalization is the prerequisite and foundation for determining the path of promoting rural revitalization.

2.3. Research on Promoting the Path of Rural Revitalization

The "20 character policy" for rural revitalization is not only a goal and task, but also provides direction and path for the specific implementation of the strategy. Scholars have conducted extensive and in-depth discussions from multiple dimensions, including strengthening industries, mechanism innovation, governance systems, and education and training.

Industrialization and informatization play an important role in driving agricultural development, promoting the development of agriculture, forestry, animal husbandry, and green industries in combination with regional characteristics, and advancing the implementation of rural revitalization strategies. Only by promoting the gradual integration of rural industries, optimizing and upgrading the industrial structure of rural areas, can we increase the added value of agriculture; Accelerating the improvement of rural infrastructure and laying the foundation for the integration of agriculture and e-commerce is a necessary way to strengthen the agricultural industry; Innovation in policy mechanisms is conducive to the implementation of the rural revitalization strategy, and using the "Party branch+cooperative+farmers" as a multi-party collaborative model is more conducive to promoting the implementation of the rural revitalization strategy; The innovation of rural governance is the first step in rural revitalization, so it is necessary to strengthen the reform of rural land system, enhance the management of property rights system, and improve the mechanism of rural factor allocation. Fully tap into the value of rural land, establish a sound market-oriented system for land transfer and trading as soon as possible, and clarify the relationship between ownership, contracting rights, and management rights in order to sustainably promote the rural revitalization strategy (Shen et al., 2020). The continuous promotion of the rural revitalization strategy also relies on strong financial support from the government, especially in the development of rural industries and infrastructure construction, which require local finance to lead the development of rural finance (Mao and Wang, 2020).

2.4. Research Review

The existing research has produced rich results in the theoretical logic, connotation deconstruction, measurement and evaluation, and promotion path of rural revitalization. These results have good inspiration and reference value for this study. However, there are still areas for improvement and continuous in-depth research on rural revitalization, including:

Firstly, it is necessary to dynamically elaborate on the scientific connotation, key tasks, and internal logic of rural revitalization. Redesign the evaluation index system for rural revitalization based on current environmental and policy changes, as well as the development concepts and specific requirements of the new development stage. Improve the construction of the evaluation system criteria layer and the selection of specific indicators (such as introducing food security, industrial modernization, greening, and integration as criteria layers in the aspect of industrial prosperity, and adding considerations for preventing poverty relapse in the dimension of affluent living).

Secondly, it is necessary to specify the evaluation hierarchy and evaluation objects. At present, research focuses more on the comprehensive consideration and measurement evaluation of the development level of rural revitalization in China at the macro and meso levels of "national provincial". In fact, rural revitalization is more prevalent in specific rural areas. Therefore, it is necessary to measure and evaluate from the micro level of cities, counties, and villages in order to better grasp the specific implementation progress and performance characteristics of rural revitalization in China.

Thirdly, it is necessary to differentiate the possible paths and specific implementation models for rural revitalization. The vast territory, large population, and uneven development foundation are the basic characteristics of China's rural economic development. The rural revitalization strategy cannot be manifested as just one model and one path. Therefore, based on a macro understanding of the process and spatiotemporal pattern of rural revitalization in China, it is necessary to combine the economic characteristics, resource endowments, and development trends of different regions, and apply systematic differentiation thinking and practice.

3. Evaluation of Rural Revitalization Level in Qiqihar City

3.1. Construction of Measurement Index System for Rural Revitalization Level in Qiqihar City

3.1.1. Principles of System Construction

Only by scientifically and reasonably constructing an evaluation system for the level of rural revitalization in Qiqihar city can it be accurately and reasonably evaluated. This study comprehensively measures the level of rural revitalization in Qiqihar city according to the following five principles:

- The principle of adaptability. The selected evaluation indicators should adapt to the characteristics of rural revitalization and meet the requirements of the connotation of rural revitalization.
- The principle of integrity. The selected indicators for rural revitalization should be comprehensive and specific, reflecting the integrity of the rural revitalization indicator system. And different indicators of rural revitalization should maintain relative independence and represent different aspects of financial and rural revitalization.
- Sensitivity principle. The selected indicators for urban-rural integration can reflect and predict changes in the level of urban-rural integration in a timely manner.
- Scientifically reasonable, establish an indicator system that is more in line with the characteristics of urban-rural integration, thereby making the measurement model more representative of the actual urban-rural integration status of regional cities, in order to scientifically and reasonably reflect the situation of urban-rural integration in cities.

3.1.2. Selection of evaluation indicators

The basic premise for analyzing and evaluating the level of rural revitalization and development in Qiqihar City is to construct a reasonable evaluation index system. This article is based on the theory of complex systems and regards rural revitalization as a complex system. Rural revitalization is an evolutionary process of a complex system. Therefore, this study starts from a systemic perspective and divides the rural revitalization system into five subsystems based on the rural revitalization strategy: industrial prosperity, ecological livability, rural civilization, effective governance, and affluent living. Referring to existing research, combined with the current reality of rural revitalization, and fully considering the availability of data and the hierarchy of evaluation indicators, 14 secondary indicators were selected.

- Industrial prosperity subsystem indicators

The prosperity of industries emphasizes the need to vigorously develop related industries for rural revitalization. Industrial development is the foundation of economic growth and the driving force behind rural revitalization. The development of rural industries is first manifested in agricultural production efficiency (X1), which is calculated by dividing the total output value of agriculture, forestry, animal husbandry, and fishery by the number of rural population; The level of agricultural industrialization (X2) is closely related to rural electricity consumption, therefore the ratio of rural electricity consumption to rural population represents the level of rural industrialization; Whether the industry is thriving also depends on the level of agricultural mechanization in rural areas (X3), which is characterized by the total power of agricultural machinery divided by the planting area of crops.

- Ecological livability subsystem indicators

The key to ecological construction in our country is ecological livability, which is also the dream of farmers' lives. Ecological environment is the foundation of livability. Only when the ecological environment is improved can people's quality of life be guaranteed. Rural areas have unique natural conditions and terrain, and beautiful landscapes such as green mountains and colorful wildflowers are the foundation for achieving ecological livability. This requires the development of a green economy, the promotion of green living, and the control of environmental pollution, in order to build a more comfortable living environment for rural residents. Therefore, attention should be paid to the chemical input intensity (X4) in agricultural production, which can be characterized by the ratio of fertilizer application rate to crop sowing area; Pay attention to the degree of clean fuel use in rural areas (X5), characterized by the rural gas penetration rate; Pay attention to the degree of rural greening (X6), characterized by the coverage rate of rural greening.

- Indicators of Rural Civilization Subsystem

Rural civilization is the soul of rural construction. Rural civilization not only refers to the progress of rural material civilization, but more importantly, emphasizes the improvement of rural spiritual civilization. It requires improving the education level of farmers and meeting their spiritual needs. Therefore, attention should be paid to two aspects: first, the consumption level of farmers' education, culture, and entertainment (X7), expressed as the proportion of farmers' education, culture, and entertainment expenditure to total expenditure; The second is the education level of rural population (X8), which is characterized by the proportion of illiterate population in rural areas. The lower the proportion of illiterate population, the higher the education level of rural population.

- Effective governance subsystem indicators

Effective governance is a new requirement for rural governance. In the past, democratic management focused more on village autonomy, while effective governance now emphasizes collaborative governance led by the government and involving social forces. It requires innovative grassroots governance methods, improving grassroots governance capabilities, forming a social governance pattern of co construction, co governance, and sharing, and providing effective protection for farmers' lives. Therefore, attention should be paid to the minimum living allowance level in rural areas (X9), which is represented by the number of people per 10000 in rural areas who enjoy the minimum living allowance. The lower this indicator, the more effective rural governance is; Rural infrastructure accessibility (X10), expressed as the proportion of farmers' transportation and communication expenditures to total expenditures, the higher the indicator, the better the accessibility of rural infrastructure; The level of rural medical and health development (X11) is characterized by the number of health technicians per thousand people in rural areas.

- Indicators of the Wealthy Life Subsystem

Wealthy living is one of the goals of rural revitalization. Wealthy life includes not only the improvement of material living standards, but also the enrichment of spiritual life and the improvement of social well-being. It requires following the goal of building a moderately prosperous society in all respects and the new goal of building a socialist modernized country in two steps, so as to make farmers' lives more prosperous and happy. From a practical perspective, the increase in farmers' income is the foundation and manifestation of a prosperous life. Therefore, attention should be paid to the degree of income gap between urban and rural residents (X12), represented by the ratio of disposable income of urban residents to per capita net income of rural residents. The higher this indicator, the poorer and less affluent rural residents are compared to urban residents; Pay attention to the income level of rural residents (X13), represented by the per capita disposable income of rural residents; Pay attention to the Engel coefficient (X14) of rural residents, which is characterized by the proportion of per capita food, tobacco, and alcohol consumption expenditure of farmers to total expenditure. The higher this indicator, the less affluent the lives of farmers.

The evaluation index system for rural revitalization in Daqing is shown in Table 1.

Table 1 Indicators for characterizing the level of industry city integration

Complex System	Subsystems	Characterization Indicators	Meaning of Indicators	Index Attribute
Rural Revitalization	Industrial prosperity	X1: Agricultural production efficiency	Total output value of agriculture, forestry, animal husbandry and fishery/rural population	Positive
		X2: Rural industrialization level	Rural electricity consumption/rural population	Positive
		X3: Agricultural mechanization level	Total power of agricultural machinery/crop sowing area	Positive
	Ecological livability	X4: Chemical input intensity	Fertilizer application rate/crop sowing area	Negative
		X5: Rural clean fuel usage degree	Rural gas penetration rate	Positive
		X6: Rural greening degree	Rural green coverage rate	Positive
	Rural cultural civilization	X7: Education, culture, and entertainment expenses for farmers	Culture, and entertainment expenditure to total expenditure	Positive
		X8: Education level of rural population	The proportion of rural education	Negative
	Effective governance	X9: Rural minimum living guarantee level	The proportion of rural residents who enjoy the minimum living guarantee per 10000 people	Positive
		X10: Rural infrastructure accessibility	total expenditure on transportation and communication, as well as	Positive
		X11: Rural medical and health development level	the number of health and technical personnel per thousand people in rural areas	Positive
	Prosperous life	X12: Degree of income gap between urban and rural residents	Per capita disposable income of urban residents/per capita net income of rural residents	Negative
		X13: Income level of rural residents	per capita disposable income of rural residents	Positive
		X14: Engel's coefficient of rural residents	per capita food, tobacco, and alcohol consumption expenditure as a percentage of total expenditure	Negative

3.1.3. Determination of evaluation methods

This study uses the coefficient of variation method and relative weighting method to determine the weights of evaluation indicators, and uses the fuzzy comprehensive evaluation method to measure the level of rural revitalization and development in Qiqihar.

- Coefficient of variation method and relative weighting method

The weight that indicators should occupy in the indicator system is related to their own characteristics and can be considered from two dimensions: one is the variability of the indicators themselves. According to the theory of entropy, indicators with high variability contain more information and therefore require higher weights to be assigned; The second is to consider the relationship between indicators and other indicators as well as the entire system. The interrelationships between indicators reflect the degree of mutual influence between each indicator and the overall impact on the system. The greater the degree of mutual influence between indicators, the greater the correlation; On the contrary, the lower the correlation. At the same time, the correlation between a certain indicator and all other indicators in the indicator system can be summed up. The higher the value, the greater the impact of the indicator on other indicators, and its weight should be higher. The coefficient of variation method can be used to reflect the degree of change in the indicator itself, while the correlation between the indicator and other indicators as well as the overall system can be calculated using the correlation weighting method.

Based on the above considerations, the combination of correlation coefficient method and correlation weighting method can effectively calculate the weight of indicators. This article chooses to use this method. The basic steps are as follows:

The first step is to use the coefficient of variation method to calculate the degree of change of the indicator itself, as shown in formula (3-1):

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

In the formula, \bar{x}_i is the average value of this indicator; σ_i is the standard deviation of this indicator;

Step 2, calculate the correlation between the indicator and the entire indicator system, as shown in formula (3-2).

$$R_i = \sum_{k=1}^n r_{ik} \tag{3-2}$$

In the formula, R_i is the correlation between the i-th evaluation indicator and the entire indicator system; r_{ik} is the correlation between the i-th and k-th indicators.

Step three, calculate the importance of the indicator in the entire indicator system, as shown in formulas (3-3):

$$E_i = C_i \times R_i \tag{3-3}$$

In the formula, E_i is the importance of the i-th evaluation indicator in the entire indicator system. The higher the degree of influence, the greater the weight it should hold.

Step 4: Regarding E_i normalization processing is used to calculate the weights of each indicator in the indicator system, as shown in formulas (3-4):

$$W_i = \frac{E_i}{\sum_{i=1}^n E_i} \tag{3-4}$$

3.1.4. Fuzzy comprehensive evaluation method

The use of fuzzy comprehensive evaluation requires normalization of the raw data of indicators. Due to differences in the nature of indicators, the processing methods for indicators may also vary. r_{ij} is the standard value for the i-th indicator and the j-th evaluation object.

For the selected positive indicators, use equations (3-5) for standardization: .

$$r_{ij} = \begin{cases} [X_{ij} - \min_j(X_{ij})]/[\max_j(X_{ij}) - \min_j(X_{ij})], X_{j \max} \neq X_{j \min} \\ 1, X_{j \max} = X_{j \min} \end{cases} \quad (3-5)$$

For the selected negative indicators, use equations (3-6) for standardization:

$$r_{ij} = \begin{cases} [\max_j(X_{ij}) - X_{ij}]/[\max_j(X_{ij}) - \min_j(X_{ij})], X_{j \max} \neq X_{j \min} \\ 1, X_{j \max} = X_{j \min} \end{cases} \quad (3-6)$$

For moderate indicators, use equations (3-7) for standardization:

$$r_{ij} = \begin{cases} [X_{ij} - \min_j(X_{ij})]/[M - \min_j(X_{ij})], X_{i \min} \leq X_{ij} < M \\ 1, X_{ij} = M \\ [\max_j(X_{ij}) - X_{ij}]/[\max_j(X_{ij}) - M], M \leq X_{ij} \leq X_{i \max} \end{cases} \quad (3-7)$$

Among them, M is the theoretical optimal value of the moderate indicator.

In the formula: X_{ij} represents the value of the j th evaluation indicator in the i -th year, $\min \{X_j\}$ and $\max \{X_j\}$ are the minimum and maximum values of the j th evaluation indicator in all years, $k=1/nm$, where m is the number of evaluation years and n is the number of indicators.

After standardization, the matrix R is obtained. Therefore, the standardized matrix of various indicators in the evaluation system is shown in the table below:

$$R = \begin{pmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ r_{i1} & \cdots & r_{ij} & \cdots \\ \cdots & \cdots & \cdots & \cdots \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{pmatrix}$$

Calculate single indicator evaluation score:

$$S_{ij} = W_i \times r_{ij} \quad (3-8)$$

3.2. Comprehensive measurement of rural revitalization level in Qiqihar City

3.2.1. Data processing

Normalize the raw data of the indicators of Qiqihar Rural Revitalization System using formulas 3-5 and 3-6, and the results are shown in Table 2.

Table 2 Normalized Data of Daqing Industry City Integration System Indicators

index		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Industrial Prosperity	X1	0.00	0.19	0.25	0.35	0.36	0.36	0.42	0.58	0.81	0.82	1.00
	X2	0.00	0.20	0.24	0.42	0.59	0.71	0.74	0.85	0.95	0.99	1.00
	X3	0.00	0.26	0.52	0.73	0.84	0.90	0.98	0.78	0.83	0.91	1.00
Ecological livability	X4	1.00	0.88	0.72	0.58	0.63	0.61	0.16	0.52	0.80	0.00	0.15
	X5	0.00	0.05	0.10	0.11	0.11	0.58	0.64	0.77	0.82	0.95	1.00
	X6	0.74	0.83	0.92	1.00	1.00	0.81	0.85	0.00	0.03	0.03	0.04
Rural cultural civilization	X7	0.02	0.00	0.66	0.76	0.80	0.76	0.69	1.00	0.25	0.38	0.33
	X8	0.36	0.38	0.39	0.40	0.00	0.32	0.59	0.47	0.95	0.95	1.00
Effective governance	X9	0.25	0.16	0.22	0.12	0.00	0.41	0.80	1.00	0.11	0.17	0.19
	X10	0.00	0.20	0.36	0.62	0.90	0.97	0.72	0.90	0.63	0.86	1.00
	X11	0.00	0.05	0.15	0.20	0.28	0.33	0.37	0.46	0.50	1.00	0.99
Prosperous life	X12	0.00	0.14	0.24	0.17	0.17	0.23	0.40	0.52	0.85	1.00	0.97
	X13	0.00	0.10	0.21	0.28	0.35	0.43	0.54	0.66	0.77	0.93	1.00
	X14	0.37	0.38	0.64	0.63	1.00	0.75	0.84	0.81	0.66	0.67	0.00

Data source: manually calculated

3.2.2. Calculation of Weights

Based on the normalized data in Table 2, the mean and standard deviation of various indicators such as X1-X12 were calculated using EXCEL. Then, the coefficient of variation formula was used to calculate the coefficient of variation of various indicators such as X1-X12. The results of weights for indicators are shown in Table 3 and its continuation.

Table 3 Weights of Indicators for Daqing Rural Revitalization System

index	Industrial prosperity			Ecological livability				
	X1	X2	X3	X4	X5	X6		
weight	0.0837	0.0763	0.0532	0.0634	0.1117	0.0843		
index	Rural cultural civilization		Effective governance			Prosperous life		
	X7	X8	X9	X10	X11	X12	X13	X14
weight	0.0374	0.0661	0.0356	0.0578	0.1090	0.1066	0.0934	0.0217

Data source: manually calculated

3.2.3. Calculation of Rural Revitalization Level

After calculating the weights of indicators X1-X12, the normalized data in Table 2 was used to calculate the scores of rural revitalization level and various subsystems of rural revitalization using Formula 3-8. The results are shown in Table 4.

Table 4 Rural Revitalization System Level and Subsystem Level Scores

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total score	0.1523	0.2593	0.3416	0.3737	0.3780	0.4608	0.5066	0.5329	0.6261	0.7965	0.8427
Industrial prosperity	0.0018	0.0303	0.0427	0.0654	0.0875	0.1032	0.1153	0.1365	0.1595	0.2144	0.2286
Ecological livability	0.1029	0.1191	0.1282	0.1126	0.0980	0.1443	0.1578	0.1114	0.1305	0.1485	0.1536
Rural cultural civilization	0.0275	0.0277	0.0591	0.0635	0.0388	0.0544	0.0659	0.0730	0.0643	0.0703	0.0696
Effective governance	0.0115	0.0325	0.0450	0.0624	0.0825	0.0799	0.0647	0.0778	0.0807	0.1423	0.1348

Data source: manually calculated

3.3. Result analysis

Table 4 and Figure 1 show that the level of rural revitalization system in Qiqihar has shown a continuous upward trend from 2012 to 2022.

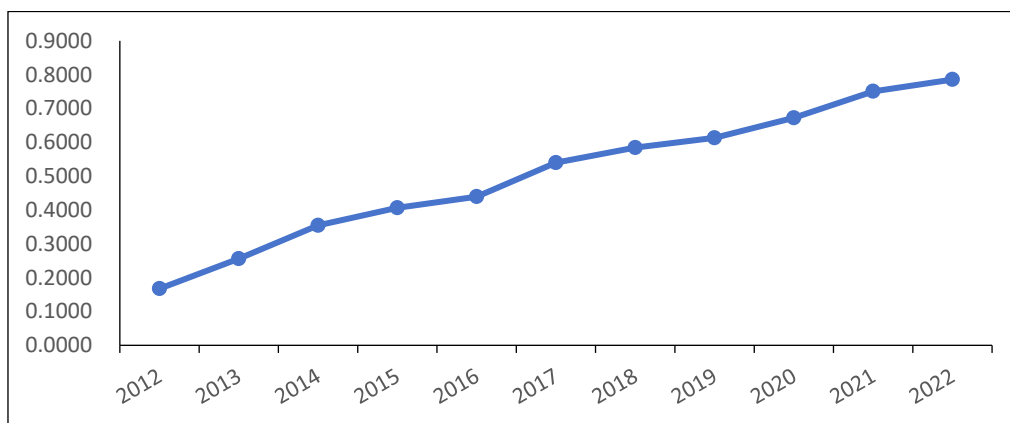


Figure 1 Score of Daqing Rural Revitalization Level

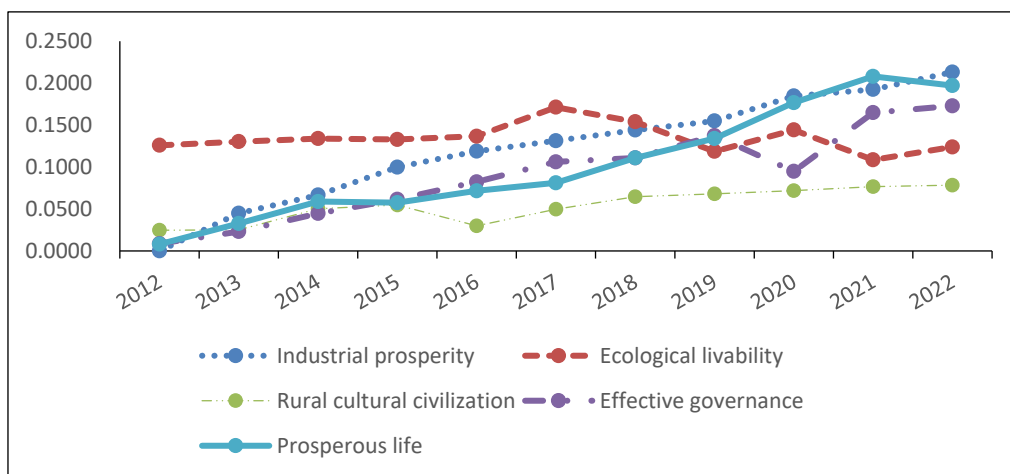


Figure 2 Situation of Various Subsystems in Daqing Rural Revitalization

Figure 2 shows the changes in scores of five subsystems in the rural revitalization system of Qiqihar. It can be seen that from 2012 to 2022, the two subsystems of prosperous industries and affluent living have developed the best; The

ecological livability subsystem performs the worst, while the rural civilization subsystem and effective governance subsystem develop slowly.

Table 4 and its continuation show that in the industrial prosperity subsystem, indicators X1 (agricultural production efficiency) and X2 (rural industrialization level) have the highest weights, representing the continuous increase in rural electricity consumption, which is also the foundation and manifestation of the sustainable development of rural industries. In the subsystem of affluent living, indicator X12 (the degree of income gap between urban and rural residents) has the highest weight. As the income of farmers in Qiqihar continues to increase, the income gap between urban and rural residents in Qiqihar continues to narrow. In the ecological livability subsystem, the weights of indicator X5 (degree of clean fuel use in rural areas) and indicator X6 (degree of rural greening) are the highest and close. However, X5 (the degree of clean fuel use in rural areas) continues to rise, while X6 (the degree of rural greening) continues to decline, leading to a sustained decrease in the score of the ecological livability subsystem. In the rural civilization subsystem, the weights of indicator X7 (education, culture, and entertainment consumption level of rural residents) and indicator X8 (education level of rural population) are close, and the two indicators show a stable state with little change, resulting in slow growth of the subsystem's score.

The level of rural revitalization in Qiqihar City continues to rise, thanks to the sustained development of the Qiqihar Industrial Prosperity Subsystem and Qiqihar Life Prosperity Subsystem. However, the balance between clean fuel use and rural greening in Qiqihar city has led to significant fluctuations in the ecological livability subsystem, and there is a need to continuously improve the level of rural greening. Further enhancing the consumption expenditure of rural residents in education, culture, entertainment, and other areas is necessary to infer the continuous rise of the rural civilization subsystem.

4. Conclusion

The level of rural revitalization in Qiqihar City continues to rise, mainly due to the sustained development of the prosperous industrial subsystem and the prosperous living subsystem. However, the ecological livability subsystem in Qiqihar city fluctuates greatly, and the development of the village civilization subsystem is slow. Qiqihar City should adopt a promotion path of leading rural revitalization with industrial prosperity, consolidating rural revitalization with ecological livability, and promoting rural revitalization with rural customs and civilization.

Compliance with ethical standards

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Disclosure of conflict of interest

No potential conflict of interest was reported by the authors.

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