

Path Selection of Rural Revitalization in Post-poverty Era based on AHP and Fuzzy Evaluation Method: A Case Study of Heilongjiang Province

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Abstract: Implementing the rural revitalization strategy is the primary task in the post-poverty alleviation era. Taking Heilongjiang Province as an example, according to the general requirements of the rural revitalization strategy, the paper establishes the evaluation index system by using the chromatography method, and calculates the hierarchical single order and total order based on the establishment of the judgment matrix and the fuzzy quantitative method of qualitative indicators. According to the level of the total weight value, it can be seen that when Heilongjiang province implements the rural revitalization strategy, The corresponding policies should be implemented from the aspects of rural scientific and technological progress contribution rate, comprehensive grain production capacity and rural residents' Engel coefficient and urban and rural income ratio.

1 INTRODUCTION

Heilongjiang province is China's traditional agricultural province, agricultural land area accounts for 85% of the total area of the province, has the reputation of "the granary of the North". As an important part of the national battle against poverty, Heilongjiang province has lifted 334,000 rural people out of poverty by 2020, a reduction rate of more than 75 percent, and the poverty incidence rate in the province has dropped from 2.46 percent to 0.65 percent. In just one year from 2019 to 2020, Heilongjiang province lifted 101,500 people out of poverty, lifting 98 percent of the population out of poverty. In addition, the per capita disposable income of rural residents in 20 poor counties increased by 10.45 percent annually, 1,136 clinics and 946 cultural rooms and squares were built in poor villages, 464,000 rural houses with mud and straw were renovated, and all poverty-stricken villages had access to paved roads. (Li 2020) Progress was made in poverty alleviation. How to further consolidate the achievements of rural poverty alleviation in

Heilongjiang Province and realize rural revitalization is the important content of this paper.

2 MATERIALS AND METHODS

The main method adopted in this paper is analytic hierarchy process. In the investigation and research, the whole is divided into four stages. Firstly, an evaluation index system (5 first-level indicators and 20 second-level indicators) was established based on the overall requirements of the rural revitalization strategy, namely, the hierarchical structure model. Secondly, in order to determine the weight of factors at each level, a judgment matrix is constructed to compare factors at each level in pairs, and scholars in related fields are invited to rate factors according to their importance. Then, by solving the feature vector of judgment matrix, the priority weight of each element at each level to an element at the next level is obtained. Finally, the final weight of each index to the total index is hierarchical merged through the weighted sum method, and the consistency test is carried out, which is, $CR=CI/RI < 0.1$. And sort

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according to the total weight value, and the final weight value with the highest value is the preferred solution (Ma 2018).

3 RESULTS & DISCUSSION

3.1 Establishment of Evaluation Index System for Rural Revitalization in Heilongjiang Province

According to relevant documents such as "Rural Revitalization Strategic Plan 2018-2022" and "Rural

revitalization Strategic Plan 2019-2022" issued by Heilongjiang Provincial government, this paper establishes a set of evaluation index system for rural revitalization that is suitable for Heilongjiang province. On the basis of 5 criteria levels, namely 5 first-level indicators, the index system is subdivided into 4 second-level indicators, namely specific indicator levels, with a total of 20 indicators (Table 1).

Table 1 Evaluation Index System of Rural Revitalization in Heilongjiang Province.

First-level index Criterion layer	Serial number	The secondary indicators Index layer
Prosperous industry (A)	A1	Overall grain production capacity
	A2	Contribution to agricultural scientific and technological progress
	A3	Agricultural product processing output value and agricultural total output value ratio
	A4	Agricultural labor productivity
Ecological livable (B)	B1	Proportion of villages that treat domestic waste
	B2	Village green coverage rate
	B3	Coverage of sanitary toilets in rural areas
	B4	Comprehensive utilization rate of livestock and poultry manure
Rural civilization (C)	C1	Coverage of comprehensive cultural service centers in villages
	C2	Proportion of civilized villages and towns at and above the county level
	C3	Proportion of full-time teachers in rural compulsory education schools with bachelor's degree or above
	C4	Proportion of expenditure on education, culture and entertainment of rural residents
Effective-governance (D)	D1	Coverage of village planning and management
	D2	Proportion of villages with village rules and regulations
	D3	Proportion of villages with integrated service stations
	D4	The proportion of villages with strong collective economy
Rich life (E)	E1	Engel coefficient of rural residents
	E2	Urban and rural income ratio
	E3	Rural tap water penetration rate
	E4	The proportion of hardened roads in qualified villages

3.2 Establish Pairwise Comparison Judgment Matrix

In this paper, according to the requirements of the strategy of rejuvenating rural total, with prosperous industry, ecological livable, local custom civilization, effective governance, life rich five aspects of the requirements for the rule layer (indicators), and invited have relevant experience in the field, according to certain quantitative value scores, according to the correlation degree between two factors, by comparing its importance, The following judgment matrix is obtained (Table 2).

Table 2: Heilongjiang province rural revitalization index judgment matrix.

Criterion-layer	A	B	C	D	E
A	1	3	4	5	2
B	1/3	1	2	3	1/2
C	1/4	1/2	1	2	1/3
D	1/5	1/3	1/2	1	1/4
E	1/2	2	3	4	1

3.3 Calculate the Weight of Each Layer by Weighting

On the basis of the known judgment matrix, the sum product method is adopted to calculate the weight of five first-level indicators (Table 3), and the weight of second-level indicators below first-level indicators is successively calculated according to the scores of relevant scholars on second-level indicators (Table 4).

Table 3: The weight of first-level indicators.

Z	A	B	C	D	E	ω Arithmetic mean
A	0.44	0.44	0.38	0.33	0.49	0.42
B	0.15	0.15	0.19	0.20	0.12	0.16
C	0.11	0.07	0.10	0.13	0.08	0.10
D	0.09	0.05	0.05	0.07	0.06	0.06
E	0.22	0.29	0.29	0.27	0.24	0.26

Table 4: The weight of secondary indicators.

Index layer	weight	Index layer	weight
A1	0.2775	C3	0.545
A2	0.51	C4	0.0875
A3	0.135	D1	0.41
A4	0.0775	D2	0.295
B1	0.3725	D3	0.15
B2	0.1125	D4	0.14
B3	0.4425	E1	0.41
B4	0.0725	E2	0.355
C1	0.31	E3	0.175
C2	0.055	E4	0.055

Finally, the overall ranking of the levels is carried out, and the weight of each secondary index of Rural revitalization in Heilongjiang Province in the overall target level can be obtained by calculating the synthetic weight through the formula. The weight value of each secondary index in the overall index level in Heilongjiang Province is ω_i = the weight of the criterion level * the weight of the target level. The specific results are shown in Table 5 (after two decimal points).

Table 5: Weight values of secondary indicators ω_i .

Index layer	ω_i	Index layer	ω_i
A1	0.17	C3	0.05
A2	0.21	C4	0.01
A3	0.06	D1	0.02
A4	0.03	D2	0.02
B1	0.06	D3	0.01
B2	0.02	D4	0.01
B3	0.07	E1	0.11
B4	0.01	E2	0.09
C1	0.03	E3	0.05
C2	0.01	E4	0.01

Finally, based on $CI = (\lambda_{max} - n) / (n - 1)$ formula, we know that since the matrix is a positive and negative matrix, $\lambda_{max} =$ order = 5, $RI = 1.1185$ after checking the table. Therefore, $CR = CI / RI = (5 - 5) / 1.1185 < 0.1$, so the consistency test passes. As can be seen from the data calculation, in order to realize rural revitalization, we need to pay attention to the contribution rate of rural scientific and technological progress, comprehensive grain production capacity, rural residents' Engel coefficient and urban and rural income ratio. The following are specific measures:

3.3.1 Improve the Capacity for Technological Innovation and Develop Modern Agriculture

Improve the agricultural science and technology innovation ability is an important guarantee of the development of modern agriculture, Heilongjiang province should strengthen the construction of agricultural science and technology system, enhance the science and technology in the field of agricultural production inputs, in grain production function and important guarantee of the construction of the agricultural production reserve at the same time, actively adjust the planting structure, relying on science and technology, strong research and development, cultivating new varieties and thorough going efforts to promote high-quality food engineering, Reduce agricultural production costs and improve the quality of agricultural products. In the development of modern agriculture, Heilongjiang provincial government should actively implement major science and technology projects and key RESEARCH and development projects, and build a collaborative innovation system of modern agricultural industry technology. To strengthen the agricultural science and technology support, continue to build 250 provincial high standard base "Internet + agriculture", the province should be actively popularized maize, rice, soybeans standardized cultivation soil testing and fertilizer and so on eight big technology, improve the level of mechanization operation times and, on the other hand, the government to step up to the farmer individual financial and operational agricultural financial support of the project, Strengthen policy guidance, give full play to the decisive role of the market in agricultural development, and provide a good environment for the development of modern agriculture (Wang 2019).

3.3.2 Strengthen Agricultural Infrastructure and Increase Overall Grain Production Capacity

According to the implementation plan of the provincial grain production increase action issued in 2020, the Heilongjiang provincial government should consolidate the material basis of "storing grain in land and storing grain in technology". In terms of agricultural infrastructure, the government should constantly improve agricultural related supporting facilities, strengthen water conservancy projects in Songhua River and Nenjiang River basins, and continuously strengthen investment in agricultural

public infrastructure, so as to lay a solid foundation for the development of modern agriculture. In addition, the government should strengthen policy guidance, take the market as the guidance, adjust the planting structure, and highlight the development of high-quality, safe, green and organic agriculture. Perfect the advanced cultivation technology mode of integrated assembly of different crops and varieties, and constantly improve the yield per unit area and increase the total yield. Adhere to the combination of good varieties, good methods and good opportunities, to promote advanced and applicable agricultural mechanization technology and equipment, cultivate and strengthen agricultural machinery service market players, explore the whole mechanization production mode, improve agricultural mechanization infrastructure as the key content, We will consolidate and improve the level of mechanized operations in areas such as deep-sowing soil preparation, precision sowing, mechanical rice transplanting, machine corn and potato harvesting, and effectively increase overall grain production capacity.

3.3.3 Increase Investment in Areas Related to People's Livelihood and Improve the Quality of Life of Rural Residents

As can be seen from Table 6, the table lists the income and expenditure of permanent residents in Heilongjiang province from 2016 to 2020. According to the statistical Bulletin of Heilongjiang Province, the per capita disposable income of permanent residents in the province in 2020 was 24,902 yuan, an increase of 2.7% over the previous year. The per capita living expenditure of permanent residents in the province was 17,056 yuan, down 5.8%. The per capita disposable income of permanent urban residents was 31,115 yuan, up 0.5%; The per capita consumption expenditure of permanent urban residents was 20,397 yuan, down 8.0 percent. The per capita disposable income of permanent rural residents was 16,168 yuan, up 7.9%; The per capita consumption expenditure of permanent rural residents was 12,360 yuan, down 1.1%. The Engel coefficient of urban residents was 29.6%. The Engel coefficient of rural residents was 34.3%. This shows that the living standard of residents has been further improved, but compared with the urban residents, the Engel coefficient of rural residents is still high. In the new period of poverty alleviation, our province should further improve the policies and measures to benefit and protect farmers, and accelerate the formation of a system and mechanism conducive to the development of agriculture, rural areas and

farmers. We will balance urban and rural development, improve urban and rural public infrastructure, accelerate agricultural and rural

modernization, further narrow the gap between urban and rural areas, and improve the living standards of farmers (Yang 2019).

Table 6: Revenue and expenditure of permanent residents from 2016 to 2020 in Heilongjiang province Unit: RMB.

indicators	2016	2017	2018	2019	2020
The per capita disposable income of permanent residents in the province	19838	21206	22726	24254	24902
Per capita living expenditure of permanent residents in the province	14446	15577	16994	18111	17056
Per capita disposable income of permanent urban residents	25736	27446	29191	30945	31115
Per capita living expenditure of permanent urban residents	18145	19270	21035	22165	20397
Per capita disposable income of permanent rural residents	11832	12665	13804	14982	16168
Per capita living expenditure of permanent rural residents	9424	10524	11417	12495	12360

3.3.4 Speed up Urbanization and Promote Urbanization of Rural Population.

On the one hand, we will increase farmers' income through multiple channels, strengthen organizational training for farmers, and speed up the transfer of surplus rural labor. At the same time, we accelerated the adjustment of the rural industrial structure, actively explored domestic and foreign markets for agricultural products, and raised the purchase prices of agricultural products to increase the operating income of farmers' families. We will further develop rural industry and tertiary industry and raise the real wage income of rural workers. On the other hand, we will deepen rural reform, implement the policy of increasing income, and focus on increasing the economic returns of agricultural and sideline products. We will promote the adjustment of rural industrial structure, increase investment in science and technology, establish a new mechanism for diversified investment in agriculture, further optimize the farming system, and accelerate the development of animal husbandry and aquaculture to make them important economic growth points in rural areas. In the area of people's livelihood, the government should increase financial subsidies to farmers to improve the actual income level of farmers. At the macro level, relevant policies should be actively implemented to fundamentally guarantee the living standards of rural

residents by improving the policies benefiting farmers and reforming the social security system, so as to narrow the gap between urban and rural development and improve the quality of life of rural residents.

4 CONCLUSIONS

From the overall ranking of results, the four indicators with the highest weight values are the contribution rate of scientific and technological progress in rural areas, comprehensive grain production capacity, Engel coefficient of rural residents and urban and rural income ratio, indicating that In the process of consolidating poverty alleviation achievements and further realizing rural revitalization, We must improve agricultural science and technology, increase grain output and improve the happiness index of rural residents and urban and rural income ratio as important directions. In the agricultural field, the government should further improve the level of scientific and technological input in the agricultural field, leading the transformation and upgrading of agricultural development with scientific and technological innovation, so as to promote the stable development of agriculture. In terms of grain production, on the one hand, we will actively adjust

the grain planting structure and develop green and high-quality agriculture through policy guidance. On the other hand, through the improvement of agricultural infrastructure construction, strengthen the level of agricultural mechanization work, effectively improve grain production capacity. In terms of engel coefficient of rural residents and urban-rural income ratio, the government should increase fiscal subsidies, increase investment in the field of people's livelihood, narrow the development gap between urban and rural areas by increasing the level of real income, and finally achieve the goal of rural revitalization.

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