Research on the Influencing Factors of Rural Revitalization Based on the Entropy Weight Method

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Abstract. This study explores the pivotal factors influencing the success of rural revitalization under the strategic framework of rural development. The research delves into the five critical dimensions: industrial prosperity, ecological habitability, rural civilization, effective governance, and wealth generation. Data was sourced from historical statistical yearbooks and the CNKI database on rural revitalization. Employing the entropy weight method, data was standardized to calculate the weights of these factors. Moreover, the study's approach of using the entropy weight method could be applied in other multidisciplinary research areas to assess the weightage of different factors influencing various socio-economic phenomena. This could be particularly useful in the field of rural development studies, where understanding the relative importance of different factors is crucial for effective policy formulation and implementation. The study also underscores the importance of continued research and practice in rural governance, which is vital for achieving the goals of a prosperous, harmonious, and sustainable rural society.

Keywords: Rural Revitalization, Rural development, Entropy weight method.

1. Introduction

In today's world, the wealth gap has become a universally prevalent global issue [1], affecting not only the stable development of the socio-economy [2] but also posing a severe challenge to social equity and justice [3]. To address this challenge, China has proposed the strategic goal of common prosperity [4], aiming to reduce the wealth gap and achieve comprehensive and harmonious social development [5]. In this strategy, the revitalization of rural areas has become a key link [6], as the economic development level of rural areas is directly related to the stability and prosperity of the nation [7].

In the practice of rural revitalization, existing research has encountered a series of problems, such as the lag in infrastructure construction [8], the uneven distribution of educational resources, and the inefficiency of the agricultural industry, especially in the 3d scenes [9, 10]. Therefore, this study puts forward a research question within the framework of the rural revitalization strategy, which aspects have a more significant impact on the success of rural revitalization in terms of industrial prosperity, ecological livability, rural civilization, effective governance, and affluent life? In order to narrow the gap between urban and rural rich and poor, we study the main influencing factors of rural revitalization strategy, provide corresponding targeted advice, such as through the rural revitalization of influential factors to increase investment, to promote rural construction, thus narrow the gap between urban and rural rich and poor, and help to achieve a broader goal of common prosperity.

To address the question, the research has posed methodology which involves a systematic approach with three distinct phases:

Initially, the methodology involves a rigorous process of identifying and selecting a comprehensive set of indicators that reflect the diverse facets of rural revitalization. These indicators are crafted to gauge the progress and efficacy of rural development initiatives across multiple dimensions.

Subsequently, an exhaustive data collection process is undertaken, sourcing information from a variety of reputable sources such as governmental reports, comprehensive databases, extensive surveys, and scholarly studies. This approach ensures that the data collected is not only accurate but also reflective of the contemporary landscape of rural revitalization efforts.

Ultimately, the study employs the entropy weight method to allocate weights to the identified indicators, thereby assessing the performance of various regions based on their proximity to an ideal solution. This methodological approach provides a robust framework for evaluating the multifaceted nature of rural revitalization.

2. Methodology

2.1. Data collection

In the process of studying which factors have a greater impact on the rural revitalization strategy, this paper follows the principles of data reliability and availability, and mainly relies on two data sources: National Statistical Yearbook and CNKI rural revitalization thematic database. This paper provides an in-depth analysis of several key indicators of rural revitalization between 2017 and 2021. As an official data set, the National Statistical Yearbook provides comprehensive and detailed macroeconomic and social development data, which provides basic data support for this paper. The CNKI rural revitalization thematic database gathers a large number of academic research and policy documents on rural revitalization, providing a wealth of theoretical support and practical cases for this paper. In the process of data screening and processing, scientific methods and standards are strictly followed to ensure that the data used can truly reflect the actual situation of rural revitalization. At the same time, this paper also fully considers the practicability of the data, and strives to provide useful reference and inspiration for policy making and practical operation through in-depth analysis of the laws and trends behind the data.

2.2. Description of factors

Rural revitalization is a multifaceted endeavor that hinges on five key factors: Thriving Industries, Ecological Living, Civilized Rural Culture, Effective Governance, and Prosperous Life. Thriving Industries lay the economic foundation, driving income growth and poverty alleviation. Ecological Living ensures environmental sustainability, enhancing the quality of rural life. Civilized Rural Culture fosters social harmony and preserves traditional values. Effective Governance maintains order and equity, safeguarding farmers' interests. Lastly, Prosperous Life aims to bridge the urban-rural income gap, promoting shared prosperity. Together, these factors create a comprehensive framework for rural development, addressing economic, environmental, social, and governance aspects to uplift rural communities.

2.2.1 Thriving Industries

Thriving industries form the backbone of rural revitalization, serving as the material basis for rural development. It is essential to develop competitive and sustainable agricultural industries that not only increase farmers' income but also eliminate rural poverty, leading to overall prosperity. This factor is chosen for its direct impact on the economic growth and self-sufficiency of rural areas, aligning with the need to modernize agriculture and integrate rural areas into the broader economic development of the nation.

2.2.2 Ecological Living

Ecological living emphasizes the importance of a healthy and sustainable environment in rural areas. It involves the protection and enhancement of natural resources, the promotion of green development, and the improvement of rural living conditions. This factor is crucial for ensuring the long-term viability of rural communities and for creating a high quality of life for their residents, which in turn attracts talent and investment to the countryside.

2.2.3 Civilized Rural Culture

Civilized rural culture refers to the cultivation of social etiquette, civility, and the promotion of core socialist values within rural communities. It involves the preservation and promotion of traditional rural culture, the enhancement of public cultural services, and the improvement of the

overall moral and ethical standards of rural society. This factor is chosen for its role in fostering social harmony and cultural richness, which are essential for the spiritual and cultural well-being of rural residents.

2.2.4 Effective Governance

Effective governance in rural areas is characterized by the establishment of a robust governance system that combines self-governance, rule of law, and moral governance. It is about training a workforce that understands agriculture, loves rural areas, and cares for farmers, ensuring that rural communities are well-managed and that the interests of farmers are protected. This factor is vital for maintaining social order, promoting fairness and justice, and ensuring the smooth implementation of policies and regulations in rural areas.

2.2.5 Prosperous Life

A prosperous life in rural areas means increasing farmers' income through various means, such as developing the rural economy, organizing off-farm employment and business opportunities for farmers, and increasing property income for farmers. This factor aims to narrow the income gap between urban and rural residents and achieve common prosperity for all farmers. It is chosen for its focus on improving the material well-being of rural residents, which is fundamental to the overall goal of rural revitalization.

Table 1 Evaluation index system of influencing factors of rural revitalization

Primary indicators	Secondary indicators	Attribute Description	Unit
Industry prosperity	x_1+	per capita output of grain	kilogram
	x_2+	Index of total agricultural output value (calculated at comparable prices)	(Last year =100)
	x_3+	farm machinery production	ten thousand kilowatts
	x_4+	Grain output per unit area	kilogram per hectare
Ecological livable	x_5-	Water-saving irrigation area in rural areas	thousand hectares
	x_6-	Pesticide use	ton
	x_7+	Forest tending area	thousand hectares
	x_8+	Area of soil erosion control	thousand hectares
Rural civilization	x_9+	Number of health personnel in township health centers	people
	x_{10}+	The dependency ratio of the elderly population	percent
	x_{11}+	Juvenile and juvenile dependency ratio	percent
	x_{12}+	Rural residents to spend on education, culture and entertainment	yuan/person
Effective governance	x_{13}+	Levees to protect the area of the cultivated land surface	thousand hectares
	x_{14}+	Number of biogas digesters used in rural households	ten thousand
	x_{15}+	Rural sun stove	set
	x_{16}+	Rural household fixed assets investment in housing	hundred million yuan
Prosperity in living standards	x_{17}+	Per capita disposable income of rural residents	yuan
	x_{18}-	Comparison of urban and rural residents' income level	(Rural residents =1)
	x_{19}+	Rural residents average per 100 households at the end of the year	part
	x_{20}+	Per capita consumption expenditure of rural residents	yuan/person

Therefore, based on the data found, this study established an evaluation index system of influencing factors for rural revitalization as shown in Table 1, and selected four secondary indicators that this study believe can represent the indicators from the industrial prosperity, ecological livability, rural civilization, effective governance and affluent life, and took this as the main research direction to find relevant data for data processing and analysis.

2.3. Data Pre-processing

In the realm of comprehensive evaluation systems, the inherent complexity arises from the fact that each evaluation index encompasses both positive and negative effects. This duality is further compounded by the heterogeneity in units of measurement and the varying orders of magnitude among different indices. Such disparities lead to a lack of direct comparability, which can significantly impede the accuracy and reliability of the evaluation process. To address these challenges and establish a unified standard for evaluation, it is imperative to undergo a process of standardization. This standardization transforms the original data of the indices into a set of standard values that are devoid of dimensional or magnitude differences, thereby facilitating a more objective and equitable comparison. In this study, the difference method is used to standardize the original data of the index. The specific calculation formula is as follows:

If the index is required to play a positive role, the positive treatment is given to:

$$p_{ij} = \frac{x_{ij} - \min\limits_{j}\{x_{ij}\}}{\max\limits_{j}\{x_{ij}\} - \min\limits_{j}\{x_{ij}\}},$$

$$(i = 1,2,3, \dots, \ m; j = 1,2,3, \dots, n). \tag{1}$$

If the indicator is required to have a negative effect, the negative treatment is given to:

$$p_{ij} = \frac{\max\limits_{j}\{x_{ij}\} - x_{ij}}{\max\limits_{j}\{x_{ij}\} - \min\limits_{j}\{x_{ij}\}},$$

$$(i = 1,2,3, \dots, \ m; j = 1,2,3, \dots, n). \tag{2}$$

where $\max\limits_{j}\{x_{ij}\}$,$\min\limits_{j}\{x_{ij}\}$representing the largest and smallest sample values of the j index, p_{ij} is the value of the undimensionization in year j of the i index, $0 \leq p_{ij} \leq 1$, this value indicates the ideal degree of each index, equal to 0 and 1 indicates the least ideal situations and the most ideal situations.

2.4. Entropy weight method

The entropy method is used to calculate the weight values of each evaluation index, which represent the importance of each attribute in the decision-making process. Then, these weight values are multiplied by the original data to obtain a new data matrix. It is an effective multi-criteria decision analysis method that can comprehensively consider the importance of each indicator and the actual situation, providing a scientific basis for decision-making.

In the first step, through the above normalization process, the normalized data set $X' = (x'ij)n * m$ is obtained, and then the weight of the i-th sample value under the j-th indicator is calculated. It is calculated as follows:

$$y_{ij} = \frac{x'_{ij}}{\sum_{i=1}^{n} x'_{ij}}. \tag{3}$$

The second step is to calculate the entropy value of the j-th indicator, the larger the entropy value, the smaller the amount of effective information provided by the indicator and the smaller its weight. Conversely, the smaller the entropy value, the greater the amount of effective information provided by the indicator and the greater the weight which is calculated as follows:

$$e_j = -\frac{1}{\ln n}\sum_{i=1}^{n} y_{ij} \ln y_{ij}. \tag{4}$$

Finally, the weight of the j-th indicator is calculated, and the formula is as follows:

$$\omega_j = \frac{1-e_j}{\sum_{j=1}^{m}(1-e_j)}. \quad (5)$$

3. Results

3.1. The metric weight value

Based on the above data processing and calculation, this study have obtained the following results, the detailed relevant weights and rankings of the indicators at all levels, and this study analyze and discuss the results in Table 2 below.

Table 2 The weight and development of each indicator of rural revitalization

Index	Weight2	Rank2	Weight1	Rank1
x_1	0.059444535	4	0.21888295	2
x_2	0.044751606	15		
x_3	0.052851762	7		
x_4	0.061835047	3		
x_5	0.041950318	16	0.161374472	5
x_6	0.039928219	17		
x_7	0.03218468	20		
x_8	0.047311255	12		
x_9	0.046541336	13	0.232150392	1
x_{10}	0.054017575	6		
x_{11}	0.079997944	1		
x_{12}	0.051593537	8		
x_{13}	0.039865693	18	0.190674094	4
x_{14}	0.045513752	14		
x_{15}	0.0562829	5		
x_{16}	0.049011749	10		
x_{17}	0.049052829	9	0.196918091	3
x_{18}	0.064871701	2		
x_{19}	0.034965197	19		
x_{20}	0.048028364	11		

In an in-depth study of the rural revitalization strategy, from the weights in Table 2, it has been observed that "rural culture" and "industry prosperity" are two pivotal factors that significantly influence the success of this initiative. The development of rural culture not only enhances the spiritual outlook of rural residents but also fosters social harmony and strengthens the cohesion and appeal of the countryside. By promoting traditional culture and cultivating civilized rural customs, the intrinsic vitality of the countryside can be stimulated, providing a powerful spiritual and cultural support for rural revitalization. Industry prosperity serves as the material foundation for rural revitalization. By developing characteristic industries and advancing the modernization of agriculture, it is possible to increase the income of farmers, improve the standard of living in rural areas, and thus provide a solid economic foundation for rural revitalization. The prosperity of industries can also attract more talent and capital to flow into rural areas, further promoting the comprehensive development of the countryside.

In summary, rural culture and industry prosperity complement each other and together form the dual driving force behind rural revitalization. Only with the coordinated development of both can comprehensive rural revitalization be achieved, making the countryside a desirable and beautiful homeland for people.

3.2. Discussion

The analysis of the data has revealed that among the five dimensions of rural revitalization—industry prosperity, ecological livability, rural culture, effective governance, and affluent living—'rural culture' and 'industry prosperity' stand out as particularly influential. 'Rural culture' encompasses not only the preservation of traditions but also the nurturing of social norms and values that foster a sense of community and identity. The 'youth dependency ratio' within this dimension indicates the significant role of dependency ratios for children and adolescents in shaping the cultural of rural areas. This suggests that investing in the education and development of the younger generation is crucial for the transmission of cultural heritage and the enhancement of social capital, which are vital for rural areas' ability to attract and retain talent.

The 'industry prosperity' dimension, on the other hand, is closely tied to the economic vitality of rural regions. It is the driving force behind job creation, income generation, and the overall improvement of living standards. The interaction between industry prosperity and rural culture is symbiotic; a thriving industry can provide the resources necessary to support and enrich cultural activities, while a vibrant cultural life can enhance the quality of life and make rural areas more attractive to investors and a skilled workforce.

However, it is essential to recognize the contributions of the other three dimensions as well. 'Ecological livability' ensures that rural development is sustainable and does not compromise the environment. 'Effective governance' provides the stability and regulatory framework necessary for rural areas to flourish. Lastly, 'affluent living' is the outcome of the successful integration of the other dimensions, reflecting the material well-being of the rural population.

To maximize the potential of 'rural culture' and 'industry prosperity,' it is recommended that policymakers focus on developing cultural programs that leverage local heritage, while simultaneously creating an enabling environment for industry growth through infrastructure development and market access. Additionally, addressing the youth dependency ratio through targeted education and skill development programs can help cultivate a future generation poised to lead rural revitalization efforts.

4. Conclusions

In order to explore the main influencing factors of China's rural revitalization in depth, this paper mainly spends a lot of time and energy on finding and collecting data, processing data, calculating data weights and analysis, through the research and analysis of data, this study find that "rural culture" and "industrial prosperity" are the two most important indicators affecting rural revitalization strategy, and at the same time, this study should understand that rural revitalization requires joint efforts and promotion from many aspects, and the success of these indicators is closely related to other aspects of rural development. In order to achieve comprehensive revitalization, a balanced approach must be taken that addresses the economic, social and environmental aspects of rural life. In this regard, the following recommendations are made in this paper.

First, enhancing cultural education programs to preserve and promote rural traditions, particularly among the youth, to foster a sense of belonging and cultural pride. Second, developing industry-specific policies that encourage sustainable and inclusive economic growth in rural areas, creating jobs, and improving livelihoods. Then, ensuring that ecological considerations are integrated into all aspects of rural development to maintain the natural environment and resources for future generations. Strengthening governance structures to provide efficient and effective leadership that can navigate the complexities of rural revitalization. Focusing on improving the overall living standards in rural areas by addressing issues related to health, education, and social welfare.

Future research can further explore new issues and challenges in rural revitalization, such as the application of digital inclusive finance in rural revitalization, the development of rural e-commerce, and how to better utilize technological means to promote rural revitalization. Additionally, interdisciplinary approaches can be adopted, integrating knowledge from various fields including economics, sociology, and environmental science, to comprehensively analyze the complexity and

multidimensionality of rural revitalization, thereby providing more holistic solutions for rural development.

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