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Construction of Evaluation Indicator System for Rural Vitalization and Regional Variance Analysis

Yu Wang [1, 2, 3, 4], Yuankai Jia [1], Zhemin Li [1, *], Shengwei Wang [1, 2, 3, 4], Wen Yu [1, 2, 3, 4], Xiaoyun Zhang [5], Zhou Han [1, 2, 3, 4]

[1] Agricultural Information Institute, Chinese Academy of Agricultural Sciences, Beijing 100081, P. R. China

[2] Research Center of Agricultural Monitoring and Early Warning Engineering Technologies of Beijing, Beijing 100081, P. R. China

[3] Key Open Laboratory of Intelligent Agricultural Early Warning Technologies and Systems, Chinese Academy of Agricultural Sciences, Beijing 100081, P. R. China

[4] Key Laboratory of Agricultural Monitoring and Early Warning Technology, Ministry of Agriculture and Rural Affairs, Beijing 100081, P. R. China

[5] Institute of Agricultural Economics & Information, Xinjiang Academy of Agricultural Sciences, Xinjiang, 100089, P. R. China

*Corresponding author Email: ZheminLi@caas.cn

Abstract. Since the implementation of the rural vitalization strategy, how to set scientific and reasonable evaluation indicators to evaluate the results of rural vitalization has been of great theoretical and practical significance. This article, at the national, provincial and regional level respectively, applies entropy to create the method for determining the weight of parallel indicators, establish basic indicators and sub-indicators, and determine the weight of different combinations of evaluation indicators through official data and survey data. According to research findings, rural vitalization of the whole country and different provinces have all developed between 2018 and 2022 compared to 2017, but to significantly varying degrees. The average score of rural vitalization nationwide shows a slight increase. In the meantime, Beijing, Shanghai, Zhejiang and Shandong rank near the top in terms of their level of rural vitalization, while Chongqing, Xinjiang, Gansu, Guizhou, Qinghai and Xizang rank low. The average level of rural vitalization at the regional level has all improved, but to evidently different degrees. Among them, the average scores of rural vitalization of southeast coastal area and Huang-Huai-Hai area both exceed 0.055, reaching a high level, immediately followed by the northeast China and the middle reaches of the Yangtze River. Rural vitalization in the Loess Plateau region and the arid areas in northwest China is at merely a mid-to-low level nationwide, despite its great improvement in recent 5 years, particularly in the Loess Plateau region. The arid areas in northwest China and the Qinghai-Xizang Plateau region have also made marked progress in recent 5 years, especially the Qinghai-Xizang Plateau region, but still see much room for development. This article suggests making full use of government, society, enterprises and all other forces to balance resources and reduce regional differences by means of policy support, market and entrepreneur cultivation and experience sharing and so on, thus to improve the overall level of the country.

Keywords: Rural vitalization; Evaluation indicators; Basic indicators; Sub-indicators; Regional variance.

1. Introduction

Rural vitalization is essential to national rejuvenation. It is a strategic plan the CPC Central Committee has made to advance rural vitalization across the board and accelerate the building of a strong agriculture, with a view to building China into a great modern socialist country in all respects. From the 19th National Congress of the CPC when the rural vitalization strategy was proposed to the 20th National Congress when “pushing forward all-round rural vitalization” was emphasized, the

rural vitalization strategy has become the focus of China's efforts concerning agriculture, rural areas and farmers in the new era. Efficient implementation of the rural vitalization strategy requires accurate judgment of the basic conditions of rural areas as well as scientific evaluation of the results of rural vitalization implementation. To this end, comprehensive, scientific and timely statistical monitoring is demanded to provide powerful statistical support. At present, abundant literature data on rural vitalization evaluation can be found in the academic circle. Scholars have conducted in-depth research and analysis based on different spatial and temporal scales, evaluation indicators and methods. These studies, covering all aspects of rural development including economy, society, culture and environment, have offered important theoretical support and practical guidance to the implementation of the rural vitalization strategy.

The construction of the indicator system for rural vitalization is generally conducted under the structure of industrial vitalization, talent vitalization, cultural vitalization, ecological vitalization and institutional vitalization. As discovered in the close study of extensive literature, the first-level evaluation indicators chosen by scholars are highly consistent, which generally comprise five aspects, industrial prosperity, livable ecology, rural civilization, effective governance and affluent life. However, these scholars have made different choices in second-level indicators due to different research focuses and data analysis needs. Nonetheless, most evaluations have been conducted centering on the major indicators raised in the Strategic Plan for Rural Vitalization (2018-2022). These major indicators involve various important aspects of rural development, including but not limited to agricultural modernization, rural infrastructure construction, rural environment governance, culture & education and health care. Some scholars have extended or refined certain evaluation indicators according to practical needs, to reflect the changes and achievements in the implementation of rural vitalization strategy in a more comprehensive manner. [1]

Regarding the evaluation method of rural vitalization, most studies have combined entropy with analytic hierarchy process (AHP), [2] [3] [4]factor analysis, [5] TOPSIS, [2] [3] [6] [7]spatial autocorrelation [8]and averaging weight. [9]However, a few studies have solely applied factor analysis, [10] [11]averaging weight, [12]entropy [13] [14] [15]or TOPSIS, [16]or adopted combination-weighting principal component analysis (PCA), but in the meantime selected the coefficient of variation and Theil index to measure and decompose regional variance. [17]Dagum Gini coefficient, Kernel density estimation, QAP, polarization index (PI), spatial econometrics, etc., have also been used to study on spatial correlation effect, sources of regional variance, the spatiotemporal dynamic evolution law of the development level, sources and convergence efficiency of regional variance and identification of regional imbalance and driving factors. [18] [19] [20] [21] [22] [23] [24]Moreover, some scholars have studied on the spatial suitability of urban developing in rural vitalization strategy and other similar issues by combining AHP, entropy, potential evaluation factor and ArcGIS spatial analysis, spatial planning of national land, landscape pattern index (Fragstats), rank-size rule computation model or Zipf's formula. [25]

In respect of content, scholars have found that to accelerate the implementation of the rural vitalization strategy in the context of common prosperity, many problems still need to be resolved, such as the imbalance between urban and rural areas, unsound modern production and operation system in rural areas, insufficient rural infrastructure, undersupply of public services for rural livelihood, and too high proportion of low-income population in rural areas. [26] [27] [28] In view of this, some scholars have constructed the logical mechanism of promoting integrated urban-rural development through urban-rural coordination, and established the evaluation indicator system based on the systems theory and composite theory. [29]Some other scholars focus on the coupling coordination relationship between rural vitalization and new urbanization, new industrialization and rural tourism, [30] [31] [32] [33] and center on the study of coupling coordinated development, spatial distribution and convergence of regional variance based on the theoretical foundation of rural vitalization and common prosperity. The evaluation objects of existing research include not only the macro data at the provincial and regional level, [2] [3] [4] [5] [11] [15] but also the mesoscopic and micro data at the county level. [13] For the data of a specific province, [7]the time-series and cross-

sectional data of the whole country or the province or the panel data of the province are used in most cases. [17] In some studies, the changes in the time-series data at the national, regional and provincial level are combined with the cross-sectional data to generate panel data for research. [9]

This article, at the national, provincial and regional level respectively, applies entropy to create the method for determining the weight of parallel indicators, and establish basic indicators and sub-indicators, thus to highlight the characteristic advantages of different regions under the rural vitalization strategy, and meanwhile evaluate how rural vitalization serves agriculture, rural areas and farmers through the basic indicators. This article gives priority to the major indicators in the Strategic Plan for Rural Vitalization (2018-2022), and creates measurement indicators comprising five aspects, industrial vitalization, talent vitalization, cultural vitalization, ecological vitalization and institutional vitalization. In addition, the basic indicators for measurement are set up in three dimensions, agricultural stability, rural development and farmer prosperity, as the basic references for the evaluation of the implementation of the rural vitalization strategy.

2. Evaluation Indicator System and Method for Rural Vitalization

2.1. Composition of Evaluation Indicator System for Rural Vitalization

Rural vitalization is a concept with rich connotations. Rural vitalization monitoring and evaluation will help to analyze more accurately the prospects of rural vitalization strategy implementation, as it can comprehensively reflect the practical conditions of the implementation of rural vitalization strategy, evaluate the actual achievements of the rural strategy in all places, dynamically grasp the progress of rural vitalization strategy implementation in various regions, and timely discover the weaknesses in rural vitalization. Adhering to the six principles of "systematicity, directionality, scientificity, continuity, operability, and comparability" pursuant to the Strategic Plan for Rural Vitalization (2018-2022), this article takes into consideration the different basic conditions and planning priorities of different areas during indicator design and combines the major indicators and five key tasks of rural vitalization planning. Therefore, the evaluation indicators for rural vitalization are divided into two parts in this article: basic indicators and sub-indicators. Basic indicators are designed to measure the development of agriculture, rural areas and farmers in the context of rural vitalization from a macro perspective, to fully reflect the overall development level of various places. Comprising five dimensions of "industrial prosperity, livable ecology, rural civilization, effective governance and affluent life", sub-indicators reveal the characteristics of different regions in rural vitalization, thus to make the indicator system for rural vitalization statistics, monitoring and early warning more comprehensive and more objective.

2.2. Data Sources and Processing of Rural Vitalization Indicators

The basic data used in this article mainly come from two sources: official data and survey data. Official data include the Statistical Yearbook of China, China Rural Statistical Yearbook, China Civil Affairs' Statistical Yearbook, Statistical Yearbook of China's Rural Poverty Monitoring and statistical yearbooks of all provinces for 2015-2022, CNKI database and agricultural research information center database, with the missing data completed based on the interpolation method.

Considering the inconsistent indicator direction, measurement unit and type, the raw data must be first standardized. The following formulas are adopted in this article:

Positive indicator:

$$X'_{ij} = \frac{X_{ij} - min\{X_j\}}{max\{X_j\} - min\{X_j\}} \quad (1)$$

Negative indicator:

$$X'_{ij} = \frac{max\{X_j\} - X_{ij}}{max\{X_j\} - min\{X_j\}} \quad (2)$$

The formula of data normalization:

$$Y_{ij} = \frac{x'_{ij}}{\sum_{i=1}^{m} x'_{ij}} \quad (3)$$

For different combinations of parallel indicators C_m^n, the weights of the indicator level in different combinations are determined, where m represents the total quantity of parallel indicators under different categories, and n refers to the number of indicators selected from parallel indicators in different combinations.

2.3. Evaluation Method and Weight Calculation for Rural Vitalization

After the different indicator combinations are determined, entropy is applied to set the weight of the preprocessed data. The calculation method is listed below:

Information entropy calculation:

$$e_j = -K \sum_{i=1}^{m} (Y_{ij} * lnY_{ij}) \quad (4)$$

Wherein, $K = \frac{1}{lnm}$.

Information entropy redundancy calculation:

$$d_j = 1 - e_j \quad (5)$$

Indicator weight calculation:

$$\omega_j = \frac{d_j}{\sum_{j=1}^{n} d_j} \quad (6)$$

By multiplying the weight of parallel indicators (see Table 1) and the standardized data for the indicators, the scores of various dimensions of rural vitalization can be achieved. Then, the sub-item scores and total scores of rural vitalization in all counties in China can be acquired through the averaging weight method.

Different weight combinations of different indicators will result in different scores of rural vitalization in the same region, while the highest score will be adopted as the final measurement result. See the specific formula as follows:

$$\omega_j' = \omega_j, \quad when\ score = max(\omega_j * X_{ij})$$

In the meantime, the corresponding calculation combinations and their weights can be determined. Then, the averaging weight method can be used to obtain the total scores of rural vitalization of China and all provinces and regions. See the details in Table 1.

3. Analysis of the Evaluation Results for Rural Vitalization

3.1. Result Analysis of Evaluation Indicator Weight for Rural Vitalization

As shown in Table 1, the first-level indicators include basic indicators and sub-indicators, weighing respectively 0.4 and 0.6. Among sub-indicators, the weights of industrial prosperity, talent vitalization, rural civilization, livable ecology and effective governance are respectively 0.25, 0.05, 0.05, 0.15 and 0.1, which reveal the importance of the basic indicators and sub-indicators in rural vitalization from different perspectives. The second-level indicators consist of the second-level basic indicators and second-level sub-indicators. In the second-level basic indicators, agricultural stability, rural development and farmer prosperity weigh 0.2, 0.1 and 0.1 respectively. The second-level indicators to the sub-indicator industrial prosperity include economic development of rural areas with weight of 0.05, agricultural modernization with weight of 0.15 and non-agricultural industry development with weight of 0.05. The second-level indicators to the sub-indicator talent vitalization include the educational background of rural employees with weight of 0.03 and conditions of agricultural technical personnel with weight of 0.02. The second-level indicators to the sub-indicator rural

civilization consist of rural ideological and moral construction weighing 0.01, public cultural construction in rural areas weighing 0.01 and rural social civilization weighing 0.03. The second-level indicators to the sub-indicator livable ecology comprise the improvement of rural living environment with weight of 0.1 and green agriculture development of 0.05. The second-level indicators to the sub-indicator effective governance include the construction of rural grassroots organizations with

Table 1. Evaluation Indicator System for Rural Vitalization and Combined Weight of Different Indicator Levels

No.	Indicator / weight					Note	Third Indicator layer weight						
	Category	First level	Second level	Third level Indicator	Third level Indicator Calculation (unit)		1st	2st	3st	4st	5st	6st	7st
1	Basic indicators 0.4	Comprehensive objectives 0.4	Agricultural stability 0.2	Overall grain production capacity	Total grain production (10000 tons)	3	0.70			0.63	0.63		0.39
2				Livestock and poultry aquaculture capacity	Total production of livestock, poultry, and aquatic products (10000 tons)	1		0.60		0.20		0.41	0.13
3				Development level of rural tourism	Reception of leisure agriculture and rural tourism (100 million people)	2			0.67		0.16	0.38	0.28
4				Agricultural labor productivity	Total output value of the primary industry/rural employees (10000 yuan/person)	1	0.16	0.22	0.19	0.10	0.12	0.11	0.12
5				Changes in Agricultural Labor Employment Population	Changes in Agricultural Employment Population/Base Period Agricultural Employment Population (%)	1	0.14	0.18	0.14	0.06	0.09	0.09	0.08
6			Rural development 0.1	Per capita regional production level	GDP/Total Population (yuan/person month)	1	0.27	0.27	0.27	0.27	0.27	0.27	0.27
7				Urbanization level of farmers	The proportion of rural residents to urban population at the end of the year (%)	1	0.22	0.22	0.22	0.22	0.22	0.22	0.22
8				The degree of income gap between urban and rural residents	Per capita disposable income of urban residents/per capita disposable income of rural permanent residents (-)	2	0.51	0.51	0.51	0.51	0.51	0.51	0.51
9			Rich Farmers 0.1	The incidence rate of rural poverty	Rural minimum living guarantee number (10000 people)	1	0.18	0.18	0.18	0.18	0.18	0.18	0.18
10				Rural resident security level	Net disposable transfer income of rural residents (yuan/person year)	1	0.12	0.12	0.12	0.12	0.12	0.12	0.12
11				Engel's coefficient for rural residents	Food expenditure/consumption expenditure of rural residents (-)	2	0.46	0.46	0.46	0.46	0.46	0.46	0.46
12				Cost of completed houses for rural farmers	Growth of rural households' fixed assets investment over the previous year - investment in completed houses (100 million yuan)	1	0.10	0.10	0.10	0.10	0.10	0.10	0.10
13				Rural residents' automobile level	Rural residents own vehicles per hundred households	1	0.13	0.13	0.13	0.13	0.13	0.13	0.13
14	Sub indicators 0.6	Industrial prosperity 0.25	Rural economic development level0.05	Growth level of agricultural added value	Gross Domestic Product of Agriculture, Forestry, Animal Husbandry, and Fisheries (100 million yuan)	1	0.62	0.62	0.62	0.62	0.62	0.62	0.62
15				Rural collective development level	Community expenditure level (100 million yuan)	1	0.38	0.38	0.38	0.38	0.38	0.38	0.38
16			Agricultural modernization level0.15	Modernization level of agricultural machinery	Total mechanical power/cultivated land area (kW/ha)	1	0.30	0.30	0.30	0.30	0.30	0.30	0.30
17				Agricultural water conservancy level	Effective irrigation area of farmland/total area (%)	1	0.15	0.15	0.15	0.15	0.15	0.15	0.15
18				Rural informatization level	Rural broadband access users (10000 households)	1	0.28	0.28	0.28	0.28	0.28	0.28	0.28
19				Agricultural land production level	Total output value of planting industry/total cultivated land area (%)	1	0.11	0.11	0.11	0.11	0.11	0.11	0.11
20					High standard farmland area (hectares)	1	0.16	0.16	0.16	0.16	0.16	0.16	0.16

21			Development level of non-agricultural industries0.05	Employment level of rural non-agricultural industries	1-Rural primary industry employment population/total rural population (%)	1	0.16	0.16	0.16	0.16	0.16	0.16	0.16
22		Talent revitalization 0.05	Educational level of rural employment personnel0.03	Academic qualifications of full-time teachers in rural compulsory education schools	Number of rural primary/junior high school specialized teachers (person)	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
23			Situation of agricultural technicians0.02	Situation of various agricultural technology and extension personnel	Number of agricultural technology and extension personnel (person)	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
24		Rural civilization 0.05	The level of ideological and moral construction in rural areas0.01	Education, Culture, and Entertainment of Rural Residents	Rural residents' expenditure on education, culture, and entertainment/total consumption expenditure (%)	2	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25			The level of rural public cultural construction0.01	Accessibility of rural cultural and entertainment activities	Comprehensive coverage rate of radio and television programs (%)	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
26			Rural social civilization level0.03	Coverage rate of comprehensive cultural service centers in villages	Number of villages with comprehensive cultural service centers/total villages (%)	2	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27	Sub indicators 0.6	Ecological livability 0.15	The degree of improvement in rural living environment improvement0.1	Forest coverage rate	Forestry area/total area (%)	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28			Fertilizer usage/cultivated land area (tons/hectare)0.05	Fertilizer usage per unit of cultivated land	Fertilizer usage/cultivated land area (tons/hectare)	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29		Effective governance 0.1	The level of rural grassroots organization construction0.025	The proportion of party members in the village committee	Number of Party Members in Village Committees/Number of Village Committee Members (%)	1	0.32	0.32	0.32	0.32	0.32	0.32	0.32
30				The proportion of villages where the village party organization secretary concurrently serves as the director of the village committee	Number of villages where the village party organization secretary concurrently serves as the director of the village committee/total number of villages (%)	2	0.68	0.68	0.68	0.68	0.68	0.68	0.68
31			Rural comprehensive governance capacity0.05	Coverage rate of village planning and management	The area of villages that have been planned/total area of villages (%)	2	1.00	1.00	1.00	1.00	1.00	1.00	1.00
32			Management level of agricultural public affairs0.025	The proportion of administrative villages that have been mailed	The proportion of administrative villages that have been mailed (%)	1	0.17	0.17	0.17	0.17	0.17	0.17	0.17
33				The proportion of villages with e-commerce delivery stations	Number of villages/total villages with e-commerce delivery stations (%)	1	0.19	0.19	0.19	0.19	0.19	0.19	0.19
34				The proportion of practicing (assistant) physicians among rural doctors	Number of practicing (assistant) physicians and above/total number of doctors (%)	1	0.23	0.23	0.23	0.23	0.23	0.23	0.23
35				The proportion of villages with comprehensive service stations	Number of comprehensive service stations	1	0.22	0.22	0.22	0.22	0.22	0.22	0.22
36				The degree of configuration of rural medical facilities	Number of beds in medical and health institutions per thousand rural population (number)	1	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Note: 3 and 2 represent the binding indicators and anticipated indicators in the major indicators specified in the Strategic Plan for Rural Vitalization (2018-2022).													

Weight of 0.025, the comprehensive governance capability of rural areas with weight of 0.05 and public agricultural affairs management of 0.025.

There are 36 third-level indicators. Considering different focuses of agricultural development in various regions, three indicators, overall grain production capacity, livestock, poultry and aquaculture production capacity and rural tourism development, are set under agricultural stability for flexible combination. According to Formula $\sum_1^3 C_3^i$, 7 different combinations of rural vitalization evaluation indicator weight can be calculated respectively, with the combination winning the highest score as the final weight indicator system. As suggested by Table 1, the weight of overall grain production capacity has always been the highest; the income gap between urban and rural residents makes an important factor influencing rural development and shows the highest weight; and Engel's coefficient of rural residents is of the highest weight among farmer prosperity evaluation indicators.

3.2. Scores and Ranks of Rural Vitalization in 2017 and Between 2018-2022

Measurement of the rural vitalization results at the national and provincial level are conducted based on the method above. According to the calculation results (Table 2), the scores of rural vitalization of the whole China and all provinces have increased in 2018-2022 compared to 2017, but to significantly varying degrees. Rural vitalization of the whole country has risen from 1.0301 to 1.0465 by only 1.6%. Regionally, rural vitalization has improved in all provinces, but in different degrees. Beijing, Shanghai, Zhejiang and Shandong have always ranked near the top in terms of their level of rural vitalization. In particular, Beijing and Shanghai have their average level rank No. 1 and 2 nationwide in both 2017 and 2018-2022, hitting a score above 0.06. Guangdong, Tianjin and Heilongjiang show a relatively high score in rural vitalization, with their average scores ranging between 0.05 and 0.06 in 2017 and 2018-2022. The average scores of Jiangsu, Fujian, Anhui, Hainan, Shanxi, Henan, Jilin, Jiangxi, Inner Mongolia, Shaanxi, Liaoning, Hubei and Hebei are above average, ranging between 0.03 and 0.05 in recent 5 years. The scores of rural vitalization of Guangxi, Hunan, Yunnan, Ningxia and Sichuan have ramped up to varying degrees compared to 2017, ranging between 0.01 and 0.03 in recent 5 years. Chongqing, Xinjiang, Gansu, Guizhou, Qinghai and Xizang have scored lower than 0.01 in both 2017 and 2018-2022, ranking low nationwide.

Table 2. Scores and Ranks of Rural Vitalization of China and All Provinces in 2017 and Average from 2018 to 2022

Area	Nationwide	Beijing	Tianjing	Hebei	Shanxi	Neimenggu	Liaoning	Jilin
2017	1.0301	0.0813	0.0541	0.0276	0.0389	0.0249	0.0311	0.033
Rank		1	6	17	11	22	15	14
2018-2022	1.0465	0.0857	0.0629	0.0345	0.0463	0.0377	0.0319	0.0372
Area		1	6	20	12	16	18	14
Rank	Heilongjiang	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Jiangxi	Shandong
2017	0.054	0.0714	0.0491	0.0613	0.0452	0.0365	0.0335	0.0641
Rank	7	2	8	4	9	12	13	3
2018-2022	0.0544	0.0727	0.0526	0.0712	0.0453	0.0461	0.0354	0.0675
Rank	7	2	8	3	10	9	15	4
Area	Henan	Hubei	Hunan	Guangdong	Guangxi	Hainan	Chongqing	Sichuan
2017	0.0291	0.0271	0.0271	0.0542	0.0262	0.0445	0.0057	0.0076
Rank	16	18	19	5	21	10	26	25
2018-2022	0.0391	0.0314	0.0274	0.064	0.0277	0.0442	0.0094	0.0124
Rank	13	19	22	5	21	11	26	25
Area	Guizhou	Yunnan	Xizang	Shanxi	Gansu	Qinghai	Ningxia	Xinjiang
2017	0.002	0.0232	0.0007	0.0264	0.005	0.0026	0.0081	0.0048
Rank	30	23	31	20	27	29	24	28
2018-2022	0.0064	0.0263	0.0048	0.032	0.0092	0.0063	0.0131	0.0094
Rank	29	23	31	17	28	30	24	27

3.3. Overall Scores, Basic Scores and Sub-item Scores of Rural Vitalization

Table 3. Scores and Ranks of Overall, Basic and Subitem Evaluation of Rural Vitalization of China and All Provinces

Area	Overall evaluation	Basic evaluation	Total score of sub items	Overall ranking	Basic ranking	Sub item ranking
Nationwide	0.0126	0.0125	0.0136			
Beijing	0.0513	0.0534	0.0145	4	3	23
Tianjing	0.0199	0.0175	0.0187	10	11	12
Hebei	0.0165	0.0172	0.0196	13	12	9
Shanxi	0.02	0.0199	0.0224	9	8	7
Neimenggu	0.0126	0.0127	0.0151	26	25	20
Liaoning	0.0138	0.012	0.0117	20	26	28
Jilin	0.0144	0.0146	0.0145	17	17	24
Heilongjiang	0.0137	0.0129	0.0147	21	23	22
Shanghai	0.0136	0.0117	0.0126	23	28	26
Jiangsu	0.0203	0.0165	0.0188	8	15	10
Zhejiang	0.0139	0.0144	0.016	19	19	17
Anhui	0.0124	0.0129	0.0137	27	24	25
Fujian	0.3208	0.3319	0.4024	1	1	1
Jiangxi	0.0191	0.0199	0.0225	11	9	6
Shandong	0.0145	0.0151	0.0178	16	16	14
Henan	0.0232	0.0242	0.0284	7	7	5
Hubei	0.0127	0.0132	0.0149	25	22	21
Hunan	0.0059	0.0062	0.0068	30	30	30
Guangdong	0.0141	0.0145	0.0162	18	18	16
Guangxi	0.0081	0.0081	0.0087	29	29	29
Hainan	0.0116	0.0119	0.0123	28	27	27
Chongqing	0.0134	0.014	0.0158	24	20	18
Sichuan	0.0555	0.0505	0.0435	3	5	4
Guizhou	0.0014	0.0015	0.0014	31	31	31
Yunnan	0.0504	0.0525	0.0638	5	4	2
Xizang	0.0137	0.0138	0.0154	22	21	19
Shanxi	0.0161	0.0166	0.0183	14	14	13
Gansu	0.1112	0.1016	0.0172	2	2	15
Qinghai	0.0387	0.0403	0.0477	6	6	3
Ningxia	0.0188	0.0195	0.0221	12	10	8
Xinjiang	0.0159	0.0166	0.0187	15	13	11

By calculating the increase of the average values of different indicators between 2017 and 2018-2022, the development of the whole country and all regions in terms of the basic indicators, sub-indicators and overall indicator can be calculated through the evaluation indicator system for rural vitalization (see Table 3). According to the calculation results, Fujian has won the highest scores in basic evaluation, subitem evaluation and overall evaluation, demonstrating its great progress made in the development of rural areas, agriculture and farmers as well as in industrial prosperity, talent vitalization, rural civilization, livable ecology and effective governance through rural vitalization.

Gansu, Sichuan, Beijing, Yunnan, Qinghai, Henan, Jiangsu, Shaanxi and Tianjin rank high in terms of the overall score, proving their great achievements in rural vitalization. Beijing shows no strength in subitem rank, but ranks high in the basic score, which means there is still much progress to be made in industrial prosperity, talent vitalization, rural civilization, livable ecology and effective governance. The overall rural vitalization in Jiangxi, Ningxia, Hebei, Shaanxi, Xinjiang, Shandong, Jilin, Guangdong, Zhejiang, Liaoning, Heilongjiang, Shanghai, Xizang, Chongqing, Hubei and Inner Mongolia are at the middle level, while Anhui, Hainan, Guangxi, Hunan and Guizhou rank low, with lower basic scores and subitem scores.

The final score of each sub-indicator is calculated with the three-level indicators of industrial prosperity, talent vitalization, rural civilization, livable ecology and effective governance and the evaluation weight of rural vitalization (see Figure 1). Analysis shows that the provinces having acquired rapid progress in industrial prosperity include Hainan, Qinghai, Jiangsu, Yunnan, Ningxia, Hunan, Guizhou, Tianjin, Guangxi and Shanxi; the provinces having acquired rapid progress in talent vitalization mainly include Heilongjiang, Gansu, Shanxi, Sichuan, Guizhou, Liaoning, Ningxia, Anhui, Jilin and Hubei; the provinces having advanced quickly in rural civilization include Jilin, Ningxia, Jiangxi, Shaanxi, Guizhou, Guangxi, Xinjiang, Chongqing, Hebei and Anhui; the provinces moving ahead quickly in livable ecology mainly include Zhejiang, Jilin, Beijing, Tianjin, Shanghai, Chongqing, Guizhou, Guangxi, Hainan and Sichuan; and the provinces triggering fast advance in effective governance include Guizhou, Xinjiang, Qinghai, Sichuan, Hainan, Inner Mongolia, Guangdong, Gansu, Yunnan and Beijing.

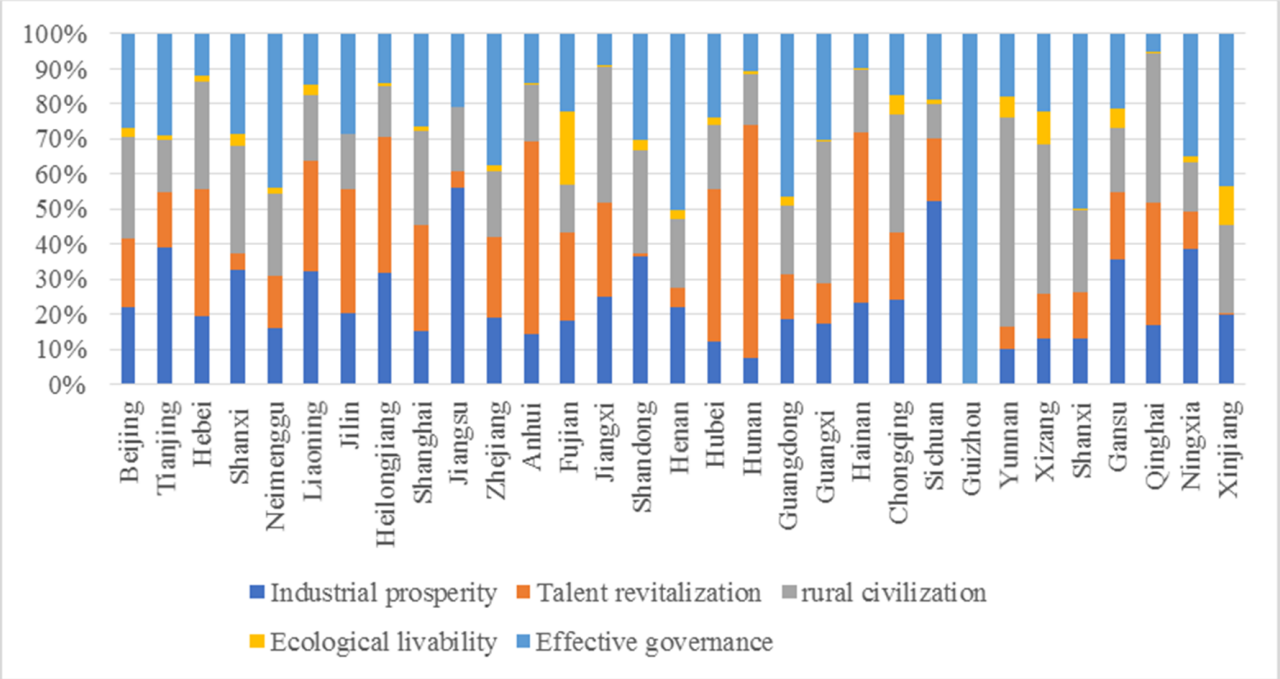

Figure 1. Sub-item Scores for Rural Vitalization of All Provinces in China

3.4. Analysis of Regional Variance of Rural Vitalization

In this article, China is geographically divided into the northeast area, Huang-Huai-Hai area, the middle reaches of the Yangtze River, southeast coastal area, southwest area, the Loess Plateau region, the arid areas in northwest China and the Qinghai-Xizang Plateau region. According to the analysis of calculation results (Table 4), the average level of rural vitalization in all regions in China between 2018 and 2022 has improved compared to 2017, but to significantly varying degrees. Among them, the average scores of rural vitalization of southeast coastal area and Huang-Huai-Hai area both exceed 0.055, reaching a high level, immediately followed by the northeast area and the middle reaches of the Yangtze River. Rural vitalization in the Loess Plateau region and the arid areas in northwest China

is at merely a mid-to-low level nationwide, despite its great improvement in recent 5 years, particularly in the Loess Plateau region. The arid areas in northwest China and the Qinghai-Xizang Plateau region have also made marked progress in recent 5 years, especially the Qinghai-Xizang Plateau region, but still see much room for development.

Table 4. Evaluation of Rural Vitalization at the Regional Level and Progress Analysis

Area	Northeast	Huang-huai-hai region	Middle reaches of the Yangtze River region	Southeast coastal area	Qinghai Tibet Plateau region	Southwest region	Loess Plateau region	Arid areas in northwest china
2017	0.0394	0.0512	0.0332	0.0249	0.0016	0.0129	0.0234	0.0126
2018-2022	0.0412	0.0579	0.0349	0.0585	0.0055	0.0164	0.0291	0.0201
Progress evaluation	0.014	0.0251	0.0125	0.0126	0.0262	0.0258	0.0491	0.0158

4. Conclusion and Suggestions

This article measures the current level and progress of rural vitalization in all provinces, regions and the whole China in 2017 and 2018-2022 and analyzes the regional variance. According to the analysis results, rural vitalization has considerably promoted agricultural stability, rural development and farmer prosperity in all provinces and the whole China. The level of rural vitalization nationwide as well as industrial prosperity, livable ecology, rural civilization, effective governance and affluent life have been growing with time, among which the level of affluent life achieves the most rapid improvement and industrial prosperity shows minimum improvement. Regionally, rural vitalization in Huang-Huai-Hai area, the middle reaches of the Yangtze River, northeast area and southeast coastal area presents a significantly higher level than the Loess Plateau region, southwest area, the arid areas in northwest China and the Qinghai-Xizang Plateau region. Provincially, Beijing, Zhejiang and Shanghai have been ranking high in terms of the level of rural vitalization, while the level and ranks of provinces in the east and central regions fluctuate evidently.

According to comparative analysis, rural vitalization plays a positive role in developing industries concerning rural areas, agriculture and farmers, but is meanwhile exposed to some problems and weaknesses. First, we shall continue to develop industries, enhance efficiency and attach great importance to agricultural industries in rural vitalization, thus to constantly promote industrial prosperity. Second, we shall strengthen policy support for rural vitalization in western and plateau areas, since the provinces in western and plateau areas show a low level of rural vitalization nationwide and western and plateau areas are considered the key areas for consolidating and developing the connections between poverty alleviation achievements and rural vitalization. Finally, we shall constantly narrow down the differences among all provinces in the eastern area and the variance among the eight regions in rural vitalization. Seeing the serious imbalanced development of rural vitalization within the eastern region and among different regions, we shall make full use of government, society, enterprises and all other forces to balance resources and reduce regional differences by means of policy support, market and entrepreneur cultivation and experience sharing and so on.

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