

Research on the Measurement of Digital Village Construction Level and Promotion Strategies in Gansu Province

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Abstract: This article constructs an indicator system from five dimensions: digital rural environment, digital infrastructure, digital rural economy, smart green production, and digital development. It employs the entropy weight method and Theil index to analyze the level measurement and regional differences in digital rural construction in Gansu Province from 2018-2023. The study finds that, in terms of level measurement, Gansu Province's digital rural construction faces issues such as slow development speed, small improvement amplitude, inadequate digital infrastructure, and weak digital economic development level. In terms of regional differences, there are problems such as high regional competition pressure, relatively lagging digital economic development, and relatively low overall level ranking. In response to the above situation, this article proposes countermeasures and suggestions such as the government adhering to the principle of adapting to local conditions, strengthening mutual support mechanisms between provinces, increasing fiscal investment.

Keywords: Digital Rural Construction; Level Measurement; Regional Differences and Suggestions.

1. Introduction

In January 2022, ten departments of the State Council jointly issued the Digital Village Development Action Plan (2022-2025), and in February 2022, the No. 1 central document proposed to focus on implementing the Digital Village Construction and Development Project. This marked that digital village construction has become an important lever for promoting rural development, rural governance, and rural revitalization at the national level[1]. On April 27, 2022, the No. 1 document of the Gansu Provincial Party Committee, Implementation Opinions on Focusing on Key Tasks for Comprehensively Promoting Rural Revitalization in 2022, further proposed specific strategic objectives and plans for the implementation of rural construction actions in our province[2]. Therefore, against the backdrop of digital village construction, focusing on the specific practices of rural construction actions currently being implemented in Gansu Province, we clarify the existing problems and influencing factors in the implementation of rural construction actions in Gansu Province, further explore digital technologies such as big data, the Internet, and artificial intelligence, and drive the application scenarios and implementation paths of rural construction in Gansu Province through technology empowerment. We aim to promote the extension and coverage of "Internet plus government services" to rural areas, enhance the upgrading of the three-dimensional space of rural production, ecology, and life in Gansu Province, accelerate the standardized construction of digital villages in Gansu Province, improve the level of digital precision governance in rural construction in Gansu Province, and continuously enhance the service capabilities of digital village construction in Gansu Province to benefit the people.

2. Construction and Measurement Analysis of the Digital Rural Development Level Indicator System in Gansu Province

2.1. Indicator System Design and Data Sources

Based on previous achievements[3], this paper constructs an evaluation index system for digital rural construction in Gansu Province, following the criteria for selecting evaluation indicators. The system comprises five secondary indicators and 21 tertiary indicators, aiming to comprehensively and accurately measure the level of digital rural construction in Gansu. Simultaneously, the entropy weight method is employed to determine the weight of each indicator, and evaluation values are used for judgment. Through scientific quantification, it provides strong support for the evaluation and promotion of digital rural construction in Gansu Province. Additionally, the Theil index is used to measure regional differences in Gansu and major provinces in the western region. This index can decompose overall differences into infra-regional differences at different spatial scales and inter-regional differences, facilitating the formulation of relevant decisions and the rational allocation of resources, and pushing digital rural construction in Gansu Province to a new level. As shown in Table 1, the comprehensive evaluation index system with secondary indicators includes digital rural environment, digital infrastructure, digital rural economy, smart green production, and digital development. The digital rural environment indicator comprises four tertiary indicators: per capita consumption expenditure of rural residents, per-capita disposable income of rural residents, Engel coefficient of rural residents, and total output value of agriculture, forestry, animal husbandry, and fishery. The digital grassroots infrastructure indicator includes five tertiary indicators: total electricity consumption in rural society, mobile phone ownership per rural unit, computer ownership per rural unit,

number of grassroots medical institutions, and total length of rural roads. The rural digital economy indicator comprises four tertiary indicators: added value of agricultural products, number of rural employees, export volume of agricultural products, and assets of small rural financial institutions. The smart green production indicator includes four tertiary indicators: total power of agricultural machinery, number of large and medium-sized tractors, total grain output, and amount of agricultural fertilizer applied. The digital development indicator comprises four tertiary indicators: agricultural meteorological observation stations, rural hydropower generation, expenditure on agriculture, forestry, and

water, and per capital consumption expenditure of rural residents. To ensure the accuracy of the data, this paper utilizes panel data from 2018 to 2023 for Gansu Province and major provinces in the western region as the sample for research, exploring horizontal measurement and regional differences. The primary sources of data include the China Rural Statistical Yearbook, the National Bureau of Statistics, the Gansu Provincial Bureau of Statistics, and the Ministry of Industry and Information Technology of China, supplemented by data from CEIC. Missing data are filled using the mean method.

Table 1. Evaluation index system for digital rural construction in Gansu Province

First level indicators	Second level indicators	Third level indicators	Variable indicators	Attribute indicators
Research on the Evaluation of the Impact of Featured Grain Industry on Farmers' Livelihood Capital	Digital Rural Environment	Per Capita Consumption Expenditure of Rural Residents	X1	Positive Indicator
		Per Capita Disposable Income of Rural Residents	X2	Positive Indicator
		Engel Coefficient of Rural Residents	X3	Negative Indicator
		Total Output Value of Agriculture, Forestry, Animal Husbandry and Fishery	X4	Positive Indicator
	Digital Infrastructure	Total Electricity Consumption in Rural Areas	X5	Positive Indicator
		Mobile Phone Ownership per Unit in Rural Areas	X6	Positive Indicator
		Computer Ownership per Unit in Rural Areas	X7	Positive Indicator
		Overall situation of infrastructure	X8	Positive Indicator
		Total Length of Rural Highways	X9	Positive Indicator
	Rural Digital Economy	Added Value of Agricultural Products	X10	Positive Indicator
		Number of Rural Employed Persons	X11	Positive Indicator
		Export Volume of Agricultural Products	X12	Positive Indicator
		Assets of Small Rural Financial Institutions	X13	Positive Indicator
	Smart and Green Production	Total Power of Agricultural Machinery	X14	Positive Indicator
		Number of Large and Medium-Sized Tractors	X15	Positive Indicator
		Total Grain Output	X16	Positive Indicator
		Consumption of Agricultural Chemical Fertilizers	X17	Positive Indicator
	Digital Development	Agricultural Meteorological Observation Stations	X18	Positive Indicator
		Rural Hydropower Generation	X19	Positive Indicator
		Expenditure on Agriculture, Forestry and Water Conservancy	X20	Positive Indicator

2.2. Research Methods

2.2.1. Entropy Weight Method

The entropy weight method is adopted to measure the development level of digital rural areas in Gansu Province and major provinces in western China from 2018 to 2023. The main calculation steps are as follows[5]:

Standardization of positive indicators:

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

Standardization of Negative Indicators:

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

In Formulas (1) and (2), X_{ij} represents the original value of the i indicator for the j sample, denotes the appropriate value of the j -th indicator, and stands for the value after dimensionless processing. X_j is the moderate value of the j indicator, a and X'_{ij} stands for the value after dimensionless processing[6].

To avoid the occurrence of extreme perform translation processing

$$X''_{ij} = X'_{ij} + B \quad (3)$$

Conduct indicator homogenization, and calculate the

proportion of the j sample in the j indicator, where P_{ij} ($0 \leq 1$):

$$P_{ij} = \frac{X_{ij}''}{\sum_{i=1}^n X_{ij}''} \quad (4)$$

Calculate the entropy value of the j indicator e_j , ($e_j \geq 0$):

$$e_j = \frac{-1}{\ln n} \sum_{i=1}^n P_{ij} \ln P_{ij} \quad (5)$$

Calculate the difference coefficient of the j indicator g_j :

$$g_j = 1 - e_j \quad (6)$$

Normalize and calculate the weight of the k indicator ($j = 1, 2, \dots, m$)

$$W_j = \frac{g_j}{\sum_{j=1}^m g_j} \quad (7)$$

Calculate the comprehensive score F_i :

$$F_i = \sum_{j=1}^m W_j X_{ij}'' \quad (8)$$

Where T_B represents the inter-regional gap, T_w represents the intra-regional gap, y_k represents the share of the sum of regional digital rural construction levels in the sum of construction levels among major provinces in the western region, and y_i represents the comprehensive score of regional digital rural construction levels. Based on this, the contribution rates of inter-regional and intra-regional gaps in digital rural construction levels to the overall gap are estimated. The specific formula is as follows:

$$d_B = \frac{T_B}{T} \quad (11)$$

$$d_w = \frac{T_w}{T} \quad (12)$$

$$d_k = \frac{T_k}{T} \times y_k \quad (13)$$

Among them, d_B represents the contribution rate of inter-

2.2.2. Theil Index

This method can visually present the regional differences in digital rural construction between and within regions, clearly revealing the gap levels in the progress of digital rural construction across different regions. The formula is as follows:

$$T = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{\bar{y}} \ln \left(\frac{y_i}{\bar{y}} \right) \quad (9)$$

Among them, T represents the overall Theil index, y_i indicating the level of digital rural construction in provinces; $\bar{y}$ represents the average level of Gansu and other major western provinces.

Disparities between and within regions:

$$T = T_B + T_w = \sum_{k=1}^k y_k \ln \frac{y_k}{n_k/n} + \sum_{k=1}^k y_k \left(\sum_{k=1}^k y_k \ln \frac{y_i/y_k}{1/n_k} \right) \quad (10)$$

regional disparities, d_w represents the contribution rate of intra-regional disparities, and d_k represents the contribution rate of intra-regional disparities in the level of digital rural construction[7].

3. Level Measurement and Regional Differences of Digital Rural Construction in Gansu Province

3.1. Measurement Results of Digital Rural Development Level in Gansu Province

3.1.1. Comprehensive Level Measurement Analysis

Using the entropy weight method, the comprehensive score of digital rural construction level in Gansu Province from 2018 to 2023 was measured, as shown in Figure 1.

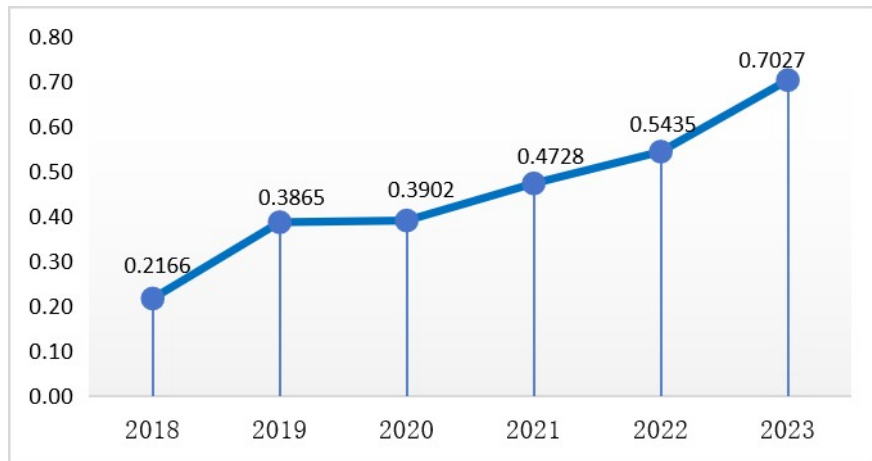


Figure 1. Comprehensive score of digital rural construction level in Gansu Province from 2018 to 2023

Based on the data from Gansu Province, the comprehensive score for digital rural construction showed a notable upward trend from 2018 to 2023. The score rose from 0.2166 in 2018 to 0.7027 in 2023, representing a significant increase of 224.42%. This indicates that during this period, Gansu Province has consistently invested resources in digital rural construction and achieved positive results. This is attributed to the emphasis placed by the national and provincial

governments on digital rural construction and the improvement of the rural development environment. In accordance with the "Rural Revitalization Strategic Plan (2018-2022) issued by the CPC Central Committee and the State Council, Gansu Province launched and implemented the Gansu Provincial Rural Revitalization Strategic Implementation Plan (2018-2022)". From 2018 to 2023, Gansu Province has made steady progress and achieved

remarkable results in the field of digital rural construction. In the early years, the foundation of rural network construction was far from satisfactory, but driven by a series of favorable policies, the situation has significantly improved. Fiber-optic broadband and 4G networks have developed vigorously, and 5G base stations are also being continuously deployed and constructed. Meanwhile, the development of e-commerce has been advancing rapidly. From its initial embryonic stage, with government financial support, platform building, talent cultivation, and other initiatives, online sales of agricultural

products have continued to rise. This not only allows "Gansu-flavored" agricultural products to go beyond the rural areas but also opens up new paths for rural economic growth, fully demonstrating the effectiveness of digital rural construction. By comparing the development level of digital rural construction in Gansu Province with that of other major provinces in the western region, we can more intuitively and accurately reflect the actual construction achievements and position of Gansu Province in this field. The measurement results are shown in Table 2.

Table 2. Comprehensive scores of digital rural construction levels in Gansu Province and other western provinces

Province	2018	2019	2020	2021	2022	2023	mean value	Range
Gansu	0.2166	0.3865	0.3902	0.4728	0.5435	0.7027	0.4521	8
Chongqing	0.3193	0.3450	0.3863	0.5371	0.5085	0.7841	0.4800	3
Sichuan	0.2200	0.2787	0.3844	0.5006	0.5205	0.7984	0.4504	9
Ningxia	0.1805	0.3267	0.5552	0.5612	0.5542	0.7422	0.4866	2
Inner Mongolia	0.1648	0.2588	0.2554	0.4944	0.5360	0.8210	0.4217	11
Shaanxi	0.2669	0.2661	0.4031	0.5222	0.5603	0.7411	0.4599	7
Guizhou	0.1986	0.3271	0.4237	0.5128	0.5859	0.7380	0.4643	5
Guangxi	0.2868	0.3208	0.3826	0.5824	0.6444	0.7696	0.4978	1
Qinghai	0.1657	0.2902	0.3743	0.4956	0.4489	0.8157	0.4317	10
Yunnan	0.2675	0.3074	0.4723	0.5301	0.5677	0.7039	0.4748	4
Xinjiang	0.2066	0.3354	0.3942	0.5421	0.5066	0.8007	0.4643	6

Compared with other major western provinces, Gansu Province has a relatively lower average composite score in digital rural construction when compared to top-ranked Guangxi (average score 0.4978), Chongqing (average score 0.4800), and Ningxia (average score 0.4866). Taking Guangxi as an example, its scores in various years are mostly higher than those of Gansu. For instance, in 2022, Guangxi scored 0.6444, while Gansu scored 0.5435. This reflects that Gansu lags behind these provinces in some key areas of digital rural construction, such as the intelligent application of digital agriculture and the perfection of rural information service platforms. Guangxi excels in promoting smart agricultural planting technology and the efficient operation of agricultural product e-commerce platforms, leading in the composite score. When compared with neighboring Sichuan (average score 0.4504), Shaanxi (average score 0.4599), Guizhou (average score 0.4643), and Xinjiang (average score 0.4643), Gansu Province shows no significant gap. For instance, compared with Sichuan, Gansu's scores in 2020 and 2021 were relatively close, but in 2023, Gansu's score of 0.7027 was slightly higher than Sichuan's 0.7984. This indicates that in the process of digital rural construction, Gansu and these provinces are in similar development tiers, steadily advancing. However, they have different focuses and speeds of development in different years. Both are in the exploratory and gradual improvement stages in areas such as the

digitization of digital rural education resources and rural medical in-normalization. They coexist with competition and cooperation, learning from each other's experiences to promote their own development. Compared with lower-ranked provinces, Gansu Province has a slightly higher composite score in digital rural construction than Inner Mongolia (average score 0.4217) and Qinghai (average score 0.4317). However, the advantage is not very prominent. For example, in 2023, Inner Mongolia's score of 0.8210 was higher than Gansu's 0.7027. This means that although Gansu has a relatively good overall level, it still needs to be vigilant about the risk of being surpassed. It should continuously strengthen long-term planning, sustained capital investment, and talent attraction and retention in digital rural construction to consolidate its advantages and achieve further leapfrog development.

3.1.2. Measurement Results of Each Dimension Level

Table 3 presents the scores for each dimension of digital rural construction in Gansu Province from 2018 to 2023, providing an intuitive reflection of the historical development of each dimension in the province. Figure 2 illustrates the measurement results for five aspects: digital rural environment, digital infrastructure, rural digital economy, smart green production, and digital development in Gansu Province.

Table 3. Scores of various dimensions of digital rural construction in Gansu Province from 2018 to 2023

	Digital rural environment	digital infrastructure	rural digital economy	smart green production	digital development
2018	0.0243	0.0628	0.0599	0.0038	0.0659
2019	0.0607	0.0414	0.1677	0.0242	0.0926
2020	0.0650	0.0870	0.0538	0.0734	0.1111
2021	0.1143	0.1030	0.0750	0.1085	0.0720
2022	0.1273	0.1139	0.1121	0.1563	0.0341
2023	0.1708	0.1778	0.1258	0.1860	0.0424
Comprehensive score	0.5625	0.5858	0.5944	0.5522	0.4180

Regarding the content shown in Table 3, the digital rural environment has shown an overall upward trend, increasing from 0.0243 in 2018 to 0.1708 in 2023. This reflects the continuous efforts made by Gansu Province in building a digital rural environment. The digital infrastructure has gradually developed from 0.0628 in 2018 to 0.1778 in 2023, showing a relatively obvious upward trend. After reaching a relatively high score of 0.1677 in 2019, the rural digital economy experienced some fluctuations, decreasing to 0.0538 in 2020 and slowly recovering to 0.1258 in 2023. The smart green production has steadily climbed, increasing from 0.0038 in 2018 to 0.1860 in 2023, indicating that Gansu rural areas are paying more attention to the smart green production model. The fluctuation in digital development is relatively obvious. It was 0.0659 in 2018, decreased to 0.0720 in 2021, and then sharply decreased to 0.0341 in 2022. Although it rebounded to 0.0424 in 2023, the overall stability is poor. Regarding the content shown in Figure 2, among the five dimensions of Gansu Province, the high score in the digital rural environment dimension (0.5625) indicates that Gansu Province has achieved remarkable results in creating an atmosphere conducive to the development of digital villages. The government has introduced policies to attract resources and has also carried out digital skills training for farmers,

improving their income and making their lives more comfortable and prosperous. In the digital infrastructure dimension (0.5625), the relatively high score indicates that Gansu Province attaches great importance to the construction and improvement of infrastructure in digital rural development. More resources have been invested in the construction of network communication facilities in rural areas, such as actively promoting the coverage of fiber-optic broadband and 4G, 5G networks in rural areas, providing basic support for various application scenarios in digital villages, and laying a good foundation for the overall development of digital villages. In the rural digital economy dimension (0.5944), the high score in this dimension shows that Gansu Province has achieved good results in the integration of the digital economy and rural development. Gansu Province encourages the development of rural e-commerce, builds stations, provides training to expand sales and increase income, actively explores digital financial services, promotes industrial digitization, and increases the proportion of the digital economy, becoming a new driving force for revitalization. In terms of the dimension of smart green production (0.5522 points), the score indicates that there has been some progress in smart green production.

Table 4. Comprehensive scores for digital rural construction levels across various dimensions

	Digital rural environment	digital infrastructure	rural digital economy	smart green production	digital development
Gansu	0.5625	0.5858	0.5944	0.5522	0.4180
Chongqing	0.6449	0.6583	0.6029	0.5692	0.4056
Sichuan	0.5253	0.7222	0.4789	0.5533	0.4236
Ningxia	0.5649	0.7837	0.6594	0.4458	0.4667
Inner Mongolia	0.4923	0.5672	0.5998	0.4669	0.4046
Shaanxi	0.5583	0.6512	0.5468	0.5741	0.4297
Guizhou	0.6877	0.5964	0.5828	0.5771	0.3427
Guangxi	0.5984	0.9344	0.6964	0.3931	0.3650
Qinghai	0.4444	0.7126	0.6033	0.5175	0.3132
Yunnan	0.5084	0.8183	0.5818	0.5352	0.4058
Xinjiang	0.5774	0.5712	0.6294	0.5735	0.4348

For example, some areas such as Ganzhou District in Zhangye City, Suzhou District in Jiuquan City, and Anding District in Dingxi City have adopted smart agricultural technologies such as intelligent irrigation and precise fertilization and pesticide application, which have improved efficiency, saved resources, reduced pollution, and maintained production. They have also strengthened environmental data monitoring and analysis, optimized

production layout and methods, and promoted green agricultural development and ecological protection. In terms of the dimension of digital development (0.418 points), compared to other dimensions, the score of digital development is relatively low, indicating that there are still some shortcomings in the overall digitization process of digital rural construction in Gansu Province. The innovation and promotion of digital applications need to be strengthened,

and the integration depth of digital technology with rural governance, public services, and other fields is not sufficient. When analyzing the five dimensions of digital rural construction in Gansu Province among important provinces in the western region, see Table 4.

The score for digital rural environment is 0.5625, indicating that there has been some progress in creating an environment conducive to rural network coverage and information technology policy support. The score for digital infrastructure is 0.5858, suggesting progress in network base station construction and data center layout, but there is still room for improvement. The score for rural digital economy is 0.5944, indicating the development of rural e-commerce, digital agriculture, and other formats. The score for smart green production is 0.5522, reflecting the initial effectiveness of the application of related technologies in agricultural production. The score for digital development is only 0.4180, indicating that the promotion of digitalization in the overall transformation of rural areas is relatively weak, and aspects such as the construction of a digital governance system need to be strengthened. Compared with Chongqing, Gansu lags behind in terms of digital infrastructure (0.6583) and digital rural environment (0.6449), reflecting Chongqing's leadership in building information technology infrastructure and shaping the overall environment. Compared with Sichuan, Sichuan has a significant advantage in digital infrastructure (0.7222), while Gansu lags in this dimension. Ningxia's digital infrastructure (0.7837) is outstanding, and its rural digital economy (0.6594) is also strong. Gansu can learn from its experience in these two aspects. Inner Mongolia performs relatively evenly across all dimensions but is slightly weaker overall than Gansu. Shaanxi's performance across all dimensions is similar to that of Gansu, indicating fierce competition. Guizhou's digital rural environment (0.6877) is excellent, and Gansu can learn from its environmental optimization measures. Guangxi's digital infrastructure (0.9344) is significantly ahead, and Gansu needs to explore paths to enhance infrastructure construction. Qinghai's digital infrastructure (0.7126) is relatively good, but its digital development (0.3132) is weaker, with each province having its own shortcomings. Xinjiang's performance across all dimensions is relatively balanced, and its rural digital economy (0.6294) is relatively good. Gansu can exchange ideas with Xinjiang on digital economic development models. Overall, Gansu has its own characteristics in digital rural construction, but there are gaps in multiple dimensions compared with some western provinces. It needs to learn from others' strengths and improve its construction level. Overall, Gansu's digital rural construction has achieved certain results and is at a medium level in the western region, but there is still room for improvement compared with advanced provinces. In terms of level measurement, it can be found that Gansu's digital rural construction faces problems such as slow development, small improvement, relatively insufficient digital infrastructure construction, and weak digital economic development level.

4. Conclusion and Suggestions

4.1. Research Conclusion

From the perspective of horizontal measurement, the development of digital villages in Gansu Province exhibits distinct characteristics. In recent years, its development trend has been positive and steady, adhering to the principle of

seeking progress while maintaining stability and achieving results, thanks to the attention and support of the provincial government. The government has issued policies to clarify the direction and focus, invested resources in infrastructure, technology promotion, talent cultivation, and other aspects, laying a foundation for development and creating a favorable environment. Compared with other western provinces and developed provinces, there is a significant gap, and Gansu Province ranks relatively low in relevant comprehensive rankings. Developed provinces have strong advantages in key areas such as the digital economy industry and technological innovation. Gansu Province still needs to work hard to catch up.

In terms of regional disparities, Gansu Province has actively promoted the construction of digital villages, gradually narrowing the gap with other western provinces. In recent years, Gansu Province has vigorously promoted the construction of digital villages by strengthening policy guidance and resource allocation. Developed regions have actively shared digital achievements and experiences, driving underdeveloped regions to quickly catch up in various aspects such as infrastructure construction and information technology application. For example, some impoverished counties have made breakthroughs in projects such as e-commerce poverty alleviation and smart agriculture. This positive change provides a reference model for the construction of digital villages in the western region and effectively promotes overall regional development. However, both intra-regional and inter-regional disparities are increasing. Due to factors such as economic foundation, technological investment, and policy orientation, the imbalance in the construction of digital villages among various provinces in the western region is also continuously intensifying. Some provinces have rapidly emerged relying on their geographical and economic advantages, while others have made slow progress, leading to a widening gap.

4.2. Countermeasures and Suggestions

Based on the issues identified in the analysis of the measurement and regional differences in the construction level of digital villages in Gansu Province mentioned above, the following questions are specifically raised.

(1) the government needs to adhere to the principle of adapting measures to local conditions, closely integrate with the actual development status and construction level of Gansu Province, scientifically and reasonably allocate various resources, and remember not to ignore objective laws. Efforts should be made to focus on typical examples, establish excellent models, and strive to create benchmark demonstration villages for digital rural areas. The remarkable achievements in digital rural construction should be displayed comprehensively and multi-dimensional, making policy benefits tangible and effectively enhancing public recognition and support for digital rural construction. At the same time, leveraging the powerful demonstration effect generated by successful cases, other regions within the province should be effectively stimulated to actively respond to the call for digital rural construction and provide strong financial support, thereby achieving further improvement in the overall development level of digital rural areas in Gansu Province.

(2) strengthen the mutual support mechanism among provinces. Gansu Province should actively establish a close cooperation network with other provinces in the western region and carry out in-depth exchanges and collaboration in

the field of digital rural construction. For example, it can establish counterpart assistance relationships with provinces with higher levels of digital rural development, and quickly learn advanced construction experience and mature technology application models through technology transfer, experience sharing, and talent exchange. At the same time, it can jointly carry out scientific research with provinces with similar levels of development to explore innovative development paths for digital rural areas that are suitable for the characteristics of the western region. By integrating regional resources, achieving complementary advantages, and jointly addressing common challenges in the construction process, such as high costs of digital infrastructure construction and a shortage of rural digital talents, a regional collaborative development force can be formed to accelerate the digital rural construction in Gansu Province to catch up with the level of developed provinces, and promote the balanced and efficient development of digital rural construction in the western region.

(3)increase fiscal investment and optimize the structure. Gansu should attach importance to the leading and guaranteeing role of finance in the construction of digital villages. Provincial finance should set up special funds for rural digital infrastructure, such as base station upgrades, information platform construction, and digital agricultural research and promotion. At the same time, optimize the structure and focus on high value-added areas such as rural e-commerce and talent cultivation. For example, set up a rural e-commerce entrepreneurship support fund to help the rise of e-commerce; establish a talent training base, invite experts to train grassroots cadres and farmer entrepreneurs, build a local talent team, and support the construction with manpower and intelligence to maximize fiscal benefits.

4.3. Shortcomings and Prospects

Based on the analysis of relevant data from 2018 to 2023 in Gansu Province and major provinces in the western region, due to the limited time range involved, it may not reflect the impact of the latest economic policies and social environment on the development of digital villages in the province. Therefore, in subsequent research work, it is necessary to incorporate the latest annual data to accurately capture the trends and dynamic changes in the development process of digital villages in Gansu Province, thus providing more comprehensive and detailed empirical analysis results for related research. In addition, as the data is limited to the province and comparisons are only made within the western region, it does not cover most regions across the country, and

may not fully demonstrate the multidimensional impact of the latest economic policies and social environment on the development of digital villages in the province. Subsequent research should expand the scope of data collection to include more national data to enrich the sample, accurately capture the development trends and changes of digital villages in Gansu Province, and provide empirical analysis results with greater breadth and depth.

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References

- [1] Hu Wen, Rui Guoqiang. Complexity-oriented composite governance: a possible path for building resilience in digital villages [J]. Journal of Hunan Agricultural University (Social Science Edition), 2023, 24(05): 64-73.
- [2] Wang Qiankun. Digital Rural Construction: Connotation, Challenges, and Optimization Paths [J]. Contemporary Rural Finance and Economics, 2023(09):40-43.
- [3] Chen Guisheng, Wang Jing. How to resolve the inherent tension in digital rural construction[J]. Journal of Tianjin University of Commerce, 2024, 44(04): 10-17.
- [4] Chen Jiayu, Zheng Hezhi. Comprehensively Promoting High-quality Development of Digital Village Construction [J]. Village Committee Director, 2024, (17): 121-123.
- [5] Li Na. Overall Framework for Digital Village Construction: How It Is Possible and How It Can Be Done [J]. Agricultural Economics, 2024(08): 56-59.
- [6] Xu Qian, Zhou Zhifang, Liu Dingle, Gao Jing, Mou Wenjuan. Measurement and Analysis of Sustainable Construction Level of Digital Villages in Shandong Province [J]. Journal of Shandong Jianzhu University, 2024, 39(04): 104-112.
- [7] Gao Gui-xian. Measurement, Dynamic Evolution, and Convergence Characteristics of China's Digital Rural Construction Level [J]. Statistics and Decision, 2024, 40(20): 119-124.