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Research on the Dilemma and Optimization Strategy of Rural Digital Governance under the Urban-Rural Co-Governance Pattern

-- Based on the empirical study in rural areas of Anhui Province

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Abstract: Under the concept of "co-construction, joint governance and sharing", digital technology has become an important driving force for the co-governance of urban and rural communities, which is of great significance to improve the modernization level of governance. At the same time, the digital transformation of rural governance can promote the digital transformation of rural agriculture, ecology, governance, culture, life style and other aspects, and promote the process of agricultural and rural modernization. On the basis of practical investigation, this topic uses AHP-SWOT analysis to comprehensively analyze the influencing factors and strategic choices of rural digital governance, and discusses the application scenarios of digital governance combined with factor analysis, and puts forward an optimization strategy for how to effectively promote rural digital governance at the present stage. This paper aims to explore how digital technology can promote the improvement of rural governance level, and provide practical inspiration for the government's governance decisions in rural life and production.

Keywords: Urban and rural governance, Rural governance, Digital governance.

1. Introduction

The party's 20th annual report pointed out that we should improve the social governance system and improve the social governance system featuring joint development, joint governance, joint governance and shared benefits. With the continuous improvement of rural infrastructure construction, digital governance has been widely used in the process of rural governance, which provides a foundation for the rural modernization construction. But the use of big data, cloud computing and other intelligent technology to promote rural governance is still in the early stage of development, there are still many constraints in the process of application, such as poor data quality, information sharing degree is not high, rural governance resources, intelligent technology promotion, greatly restricted the application of digital technology in rural governance and popularization. So this subject combined with practical research based on the status of rural digital governance, explore the urban and rural work pattern of digital rural governance development strategy choice and path optimization, can provide a realistic reference for digital rural governance development, make digital governance better for rural governance mass transfer efficiency, promote urban and rural work pattern formation.

2. Analysis of the Influencing Factors of the Development Path of Rural Digital Governance Based On the SWOT Method

2.1. Internal Advantages

(1) Initial scale of digital construction in rural areas (S1)

In recent years, in order to improve rural digital infrastructure, China has implemented national projects such as "Jinnong Project" and "broadband to village and households project". These projects will bring optical fiber and 4G networks to over 98 percent of administrative villages, increase the coverage of rural information networks, and accelerate the process of upgrading rural information networks.

(2) The digital model in rural areas has achieved initial results (S2)

Digital technology has been popularized in rural areas, and various localities have explored new models of digital rural governance. Hubei with digital government empowerment, Hunan construction of Sanxiang e supervision platform. These innovative measures have changed the way of social governance in rural areas and met the needs of farmers for a convenient and efficient life.

(3) High acceptance of digital construction in rural areas (S3)

Digital technology will help improve the effectiveness of rural public services, narrow the gap between urban and rural areas, and enhance governance capacity. Technologies such as big data, cloud computing, blockchain and AI reconstruct public service processes, simplify work, improve efficiency, integrate departmental resources, realize data sharing, reduce intermediate links, and innovate service methods. At the same time, digital technology improves residents 'experience and efficiency of life and agricultural production, meets life needs, and enhances residents' happiness.

2.2. Internal Disadvantages

(1) Lack of digital thinking consciousness and insufficient willingness to participate (W1)

The lack of villagers 'digital thinking consciousness and the limited understanding of digital governance concept lead to the villagers' low willingness to participate, which hinders the process of governance modernization in rural areas.

(2) Backward digital infrastructure and poor data fusion (W2)

New infrastructure projects in rural areas are limited by factors, such as transportation, population and economic and social development, resulting in backward digital infrastructure. In addition, the data exchange ability in rural areas is weak, the data between multiple departments is incompatible frequently, the information collection is single, the data coordination is poor, and it is difficult to give full play to the advantages of multiple coordination.

(3) Difficulties in the governance and transformation of cadres in rural grassroots communities (W3)

Due to older age and poor information skills, cadres in rural areas are accustomed to adopting traditional governance methods, which are difficult to be competent for the work of digital social governance in rural areas.

2.3. External Opportunities

(1) Selection of national Development strategy (O1)

In 2021, the No.1 document of the CPC Central Committee emphasized that in order to promote the modernization of rural social governance, digital and intelligent construction must be strengthened. Promoting rural digital construction has become an important part of the rural revitalization strategy, and policy support has provided a basis for promoting rural digital governance.

(2) Continuous progress of rural society (O2)

China's rural economic and social development has made remarkable achievements. At the economic level, the annual per capita disposable income of farmers has increased from 133.6 yuan in 1978 to 21,700 yuan in 2023, showing a trend of continuous growth. In the social aspect of society, rural areas have achieved stable and harmonious development, laying a solid foundation for digital construction and providing a good social environment. This progress not only highlights the vitality of China's rural development, but also provides a strong support for the digital construction in rural areas.

(3) Rapid development of information technology (O3)

In recent years, with the rapid development of digital technology, its application scenarios are increasingly rich and expanded. Digital technologies such as blockchain and big data are gradually applied to rural construction, agricultural production and farmers' lives, promoting informatization to digitalization, and providing technical support for digital construction in rural areas.

2.4. External Challenges

(1) Lack of digital talents and development power (T1)

At present, the supply of digital talents in China is insufficient, and the rural areas are more lack of talents with digital literacy and digital technology. The lack of digital talents not only hinders the construction of rural digital governance, but also aggravates the gap between urban and rural areas.

(2) The digital regulatory system is imperfect, and the data security has hidden dangers (T2)

The laws and regulations in the field of rural digital governance are still insufficient. Under the digital mode of rural governance, data assets have increased in massive numbers. However, the authority and responsibilities of data collection, storage, use, income distribution and security have not been clearly defined at present. The lagging legislation makes it difficult to guarantee the development of digital governance.

(3) Low enthusiasm for market and social participation (T3)

On the one hand, due to the concentration of population, capital and resources in urban areas, the hollowing out phenomenon appears in rural areas,

On the other hand, the enthusiasm of the market and the society to participate in the digital construction and operation of rural social governance is not high, failing to play the role of the government, the market and the society, and restricting the sustainable promotion of the digital construction of rural social governance.

3. Exploration on the Optimization Path of Rural Digital Governance Based On AHP Method

Based on the results of SWOT analysis, the influencing factors of the development of rural digital governance are summarized, and accurate development strategies are formulated for further comparing the influence weight of each factor. This paper introduces the hierarchical analysis method (AHP method) to evaluate the development degree of rural digital governance.

3.1. Hierarchical Structure of the Optimization Path of Rural Digital Governance

According to the steps of hierarchical analysis, the hierarchical structure of the optimization path of rural digital governance is established, as shown in Table 1.

Table 1. Hierarchy structure of the development path of digital technology

Superiority	Initial scale of digital construction in rural areas (S1)
	The digital model in rural areas has achieved initial results (S2)
	High acceptance of digital construction in rural areas (S3)
Inferior strength or position	Lack of digital thinking awareness and insufficient willingness to participate (W1)
	Backward digital infrastructure and poor data fusion (W2)
	Difficulties in the governance and transformation of rural grassroots community cadres (W3)
Chance	The Selection of the National Development Strategy (O1)
	Rural social progress (O2)
	Rapid Development in Information Technology (O3)
Threaten	Lack of digital talent and development power (T1)
	Insufficient digital regulatory system and potential data security (T2)
	Low enthusiasm for market and social participation (T3)

3.2. Establish a Matrix of the Judgment

Through literature reading and field investigation, 12 factors mainly affecting rural digital governance are summarized. According to Table 2, pairwise comparisons of influential factors were performed to construct a judgment matrix. The details are shown in Table Table 2.

Table 2. Table of quantified values

Factor i / factor j	Quantification value
Equal impact	1
The impact is slightly heavier	3
Significant impact	5
The median value of the two adjacent judgments	2, 4, 6

Relevant personnel are invited to comprehensively score each factor, and conduct weight analysis and consistency test.

Table 3. Determines the matrix

	Superiority S	Inferior strength or position W	Chance O	Threaten T	ω
Superiority S	1	6	3	1/3	0.3555
Inferior strength or position W	1/6	1	1/5	2	0.1087
Chance O	1/3	5	1	4	0.3111
Threaten T	3	1/2	1/4	1	0.2248

The weight ratio of each index layer was further analyzed to determine the advantage judgment matrix, disadvantage judgment matrix, opportunity judgment matrix and threat judgment matrix. Make the advantage judgment matrix, and the other matrices also calculate the results using the same method.

Table 4. Determines the matrix

	Initial scale of digital construction in rural areas (S1)	The digital model in rural areas has achieved initial results (S2)	High acceptance of digital construction in rural areas (S3)	ω
Initial scale of digital construction in rural areas (S1)	1	3	1/2	0.3920
The digital model in rural areas has achieved initial results (S2)	1/3	1	1/5	0.1096
High acceptance of digital construction in rural areas (S3)	2	5	1	0.5813

3.3. One-time Test and Eigenvalue Calculation

Finally, a one-time test and the eigenvalues were calculated. To test the accuracy of the obtained data and the credibility of the judgment matrix, according to the relevant calculation formula of AHP analysis,

$$\lambda \max = \sum_{i=1}^{n} \frac{[A\omega]_i}{n\omega_i} \quad CR = \frac{CI}{RI} = \frac{\lambda \max - n}{n-1}$$

Agreement test RI value, order 3, RI value 0.52; order 4, RI value 0.89.

Secondly, the characteristic values λ max of advantage judgment matrix, disadvantage judgment matrix, opportunity judgment matrix and threat judgment matrix are calculated as 4.0150, 3.1366, 3.2070, 3.1023 and 3.1433 respectively, and the calculated CR values are less than 0.1, indicating that the constructed matrix has passed the one-time test.

3.4. Strategic Strength Analysis

Through calculation, rural digital governance development main factors weight results as table 5, it is concluded that the total weight of the highest factors, respectively for rural digital construction high acceptance (S3), urban and rural grassroots community cadres governance transformation difficult (W3), the choice of national development strategy (O1), low market and social participation enthusiasm (T3).

Table 5. Total ranking of the index layer

SWOT	Influence weight	Index layer	Within-group weights	Total weight
Superiority S	0.3555	S1	0.3920	0.1934
		S2	0.1096	0.0390
		S3	0.5813	0.2067
Inferior strength or position W	0.1087	W1	0.2536	0.0276
		W2	0.1982	0.0215
		W3	0.5482	0.0596
Chance O	0.3111	O1	0.4562	0.1419
		O2	0.3121	0.0971
		O3	0.2317	0.0721
Threaten T	0.2248	T1	0.2774	0.0624
		T2	0.3212	0.0722
		T3	0.4014	0.0902

In the strategic development coordinate system, with advantages, disadvantages, opportunities and threats as the coordinate axis, according to the four coordinate points of S3, W3, O1 and T3, the quadrangle of S3W2O1T3 strategy is constructed to calculate the largest area of the triangle S1OO1 in each triangle area. Therefore, the development strategy of rural digital governance is SO> WO> ST> WT, and the development of SO strategy should be given priority.

4. Research on the Degree of Residents' Expectations for the Application Fields of Rural Digital Governance

4.1. Reliability Test

Through the reliability analysis of the questionnaire, we can judge whether a questionnaire is stable and reliable. The reliability statistical coefficient obtained by using the statistical software is shown in Table 6.

Table 6. Reliability statistics table

Clone of Bach, Alpha	Clone Bach Alpha based on the normalization term	number of terms
0.948	0.948	7

According to the evaluation criteria, the reliability of our questionnaire data is 0.948, so the scale has good reliability, so we can continue to use the data for subsequent analysis.

4.2. KMO versus the Bartlett's Test

KMO and Bartlett's test was used to judge the data for factor analysis. KMO and Bartlett's test for KMO and Bartlett's test are shown in Table 7.

Table 7. KMO and Bartlett tests

Number of KMO sampling suitability quantities		0.911
Bartlett sphericity test	Approximate chi square	622.291
	free degree	21
	conspicuousness	0.000

As can be seen from Table 7, the test value of KMO is 0.911, greater than 0.6, the approximate chi-square of Bartlett's test is 622.291, and the P-value of significance is 0.000, so the topic is a factor analysis.

4.3. Factor Analysis

To test the construct validity of the scale, the resulting data were first analyzed with exploratory factors using principal component analysis with maximum variance orthogonal rotation. Through factor analysis, a total of four factors with eigenvalues greater than 1 were extracted. The common factor variance (common degree) describes the contribution of the whole common factor to the total variance of the variable, reflecting the influence of the common factor on the variable. As can be seen from Table 8, the extraction of public factors is basically around 80%, indicating that the public factors explain a high degree of primary variables.

Table 8. Table of factorial variance

	initial	draw
Industry amalgamation	1.000	0.827
Public service	1.000	0.787
Ecological livable	1.000	0.699
Employment and entrepreneurship	1.000	0.871
Education and entertainment	1.000	0.939
Hospitalization insurance	1.000	0.711
Facilities construction	1.000	0.988

The contribution rate of cumulative variance reflects the cumulative effectiveness of the common factor to the scale or questionnaire. According to Table 9, the cumulative contribution rate of the top four factors has reached 83.156%, so the top four factors are retained, indicating that the cumulative effectiveness of the common factor to the scale or questionnaire basically meets the actual requirements.

Table 9. Table of cumulative variance contribution rates

ingredient	Initial eigenvalue			The sum of the load squares was extracted		
	amount to	variance percentage	accumulate%	amount to	variance percentage	accumulate%
1	3.104	58.622	58.622	4.104	58.622	58.622
2	1.700	10.005	68.626	1.700	10.005	68.626
3	1.514	7.344	75.971	1.514	7.344	75.971
4	1.503	7.185	83.156	1.503	7.185	83.156
5	0.747	6.390	89.546			
6	0.681	5.447	94.993			
7	0.550	5.007	100.000			

Factor load reflects the degree of correlation of the original variable with a common factor. And the factor expressions can be written using the rotated factor load matrix.

Table 10. Factor load table

	Ingredient			
	1	2	3	4
Industry amalgamation	0.792	-0.254	-0.070	-0.360
Public service	0.791	-0.345	0.135	-0.155
Ecological livable	0.819	-0.115	0.079	-0.089
Employment and entrepreneurship	0.761	-0.206	-0.006	0.499
Education and entertainment	0.715	0.444	-0.461	-0.133
Hospitalization insurance	0.778	0.069	-0.162	0.273
Facilities construction	0.694	0.509	0.496	-0.024

The four factor expressions are follows:

$$Y_1 = 0.792X_1 + 0.791X_2 + 0.819X_3 + 0.761X_4 + 0.715X_5 + 0.778X_6 \quad + 0.694X_7$$

$$Y_2 = -0.254X_1 - 0.345X_2 - 0.115X_3 - 0.206X_4 + 0.444X_5 + 0.069X_6 + 0.509X_7$$

$$Y_3 = -0.070X_1 + 0.135X_2 + 0.079X_3 - 0.006X_4 - 0.461X_5 - 0.162X_6 + 0.496X_7$$

$$Y_4 = -0.360X_1 - 0.155X_2 - 0.089X_3 + 0.499X_4 - 0.133X_5 + 0.273X_6 - 0.024X_7$$

Considering the factor load matrix and the variance contribution rate of each item, it can be concluded that the structure validity is high, and the factor analysis can measure the areas that users mainly expect.

4.4. The Application of Rural E-Commerce Development to Urban and Rural Integration

Through the above series of factor analysis, it has been concluded that four factors can reflect the relationship between the expected contribution rate of the application field and the direction of change. In order to develop more rapidly and realize the urban and rural co-governance, the key is to grasp the areas that the masses think. Therefore, we should focus on the following four areas in order to better develop the rural digital governance and realize the urban and rural co-governance as soon as possible.

Table 11. Score coefficient table

	Ingredient			
	1	2	3	4
Employment and entrepreneurship	0.580	-0.065	-0.318	-0.031
Industry amalgamation	-0.259	0.976	-0.257	-0.139
Education and entertainment	-0.175	-0.199	1.099	-0.175
Public service	-0.255	0.546	0.254	-0.103

It can be seen from the score coefficient matrix that the common factor score has a relatively large coefficient in employment and entrepreneurship, industrial integration, education, entertainment and public service, which shows that these four areas are the focus of users' attention and expectation. Therefore, in the further development of these four areas, on the one hand will give greater play to the benefits of rural digital governance; on the other hand, it has also made a certain contribution to the early realization of urban-rural governance pattern.

5. Optimization Strategy of Rural Digital Governance under the Urban-Rural Co-Governance Pattern

Based on the above data analysis results, the current solutions and development suggestions are given for the index layer of large influence weight and the priority development of SO strategy.

5.1. Improve Digital and Other Infrastructure Construction to Meet the Actual Needs of Residents

We will strengthen the development of telecommunications networks, increase network penetration, and enhance the capacity of rural power grids and network signals. When promoting rural digital services, we should consider the needs of different groups, and provide basic public services and traditional offline channels. Create a barrier-free information environment, accelerate the improvement of aging and barrier-free, and ensure the rights and interests of information-limited groups.

5.2. Innovate the Governance Organizational System and Improve the Level of Rural Governance

Innovate governance, optimize services, use the "Internet +" to improve the service mode of Party organizations, and promote the construction of rural informatization. At the same time, the "Internet Plus" promotes innovation in agriculture, tourism and other fields, integrates rural governance resources, solves the problem of fragmentation, and improves the effectiveness of governance. Secondly, speed up the construction of digital governance team, select innovative personnel with high knowledge level to enrich the governance and revitalization team, strengthen education and training, and improve the application ability of digital technology.

5.3. Build a Comprehensive Service Platform for Urban and Rural Communities, and Promote Equal Access to Public Services

We will build a diversified collaborative mechanism to promote the digitalization of urban and rural communities. The government needs to clearly define its position, optimize its services, improve its laws and regulations, and mobilize the market and social forces. At the same time, we will realize the mutual recognition and sharing of digital resources in urban and rural communities, remove departmental barriers and information islands, and tap the advantages of digital in community governance. Secondly, we should standardize data sharing with the concept of rule of law, build demonstration villages, and promote all departments to consciously promote data sharing, reduce management costs, and improve management efficiency.

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