Performance Evaluation of Digital Village Governance: Case of Nantong

Xiaoyan Zhang[(✉)], Yang Yang, and Chunya Li

School of Business, Nantong Institute of Technology, Nantong 226002, Jiangsu , China
zxyan912@126.com

Abstract. AI, big data, cloud computing and other technologies are embedded in agricultural production and rural life, opening up a new pattern of digital rural governance and development, but also facing problems such as high investment and low efficiency, incomplete construction of data resource system and digital governance evaluation system. From the perspective of "input-output", this paper constructs an indicator system for performance evaluation of digital rural governance, and measures the level of rural digital governance in combination with the actual development of Nantong, and explores the possible problems.

Keywords: Informationize · Digital village governance · Performance evaluation · DEA

1 Background

With the continuous development of digital technology, AI, big data, cloud computing and other technologies are embedded in agricultural production and rural life, opening a new pattern of digital rural development and governance [1]. Beijing, Zhejiang, Jiangsu and other regions are pioneers in the development of digital villages. With the improvement of agricultural production digital level, gap between urban and rural areas is gradually narrowing down. But the development of digital villages also faces problems, such as insufficient integration of technology and industry, high investment and low efficiency, and imperfect construction of data resource system and digital governance evaluation system [2, 3]. The No. 1 document of the Central Committee in 2022 emphasizes the importance of accelerating the standardization construction of digital villages, formulating the development evaluation index system. Nantong of Jiangsu Province, is one of the leading areas in the development of digital villages in China. Under the background of digital economy, this paper analyzes and evaluates the performance of Nantong's digital village governance, finds out its existing problems, and provides referential experience for rural development in the digital era.

2 Literature Review

In the traditional evaluation of rural governance, the indicator system is designed to be supported by social governance theory and performance evaluation theory [4]. The performance of data governance should be comprehensively reviewed from the aspects of

objectives, operation mechanism, behavior and results, and four performance objectives such as strategic guidance, policy support, technical resources and public participation were gaven [5]. Zhang and Ren found that the impact of technology on the social governance system is crucial, and believed that the most important thing in rural governance in the digital era is not digital technology, but the evolution of power relationship and social mechanism which is driven by digital technology [6]. He and Tang believed that digital village needs to realize the transformation of villagers' autonomy in networking, digitization and intelligence, including networking requires villagers' autonomy to expand the space field, digitization requires villagers' autonomy to shape data thinking, and intelligence requires villagers' autonomy to embed intelligent methods [7].

It can be seen that the current research is mainly to explore the relevant theoretical issues of digital rural governance, and evaluation indicators and performance evaluation of digital rural governance have not been seen.

3 Evaluation Index System and Variable Selection

3.1 Evaluation Index System of Digital Rural Governance

The premise for the smooth advancement of digital rural governance is the widespread application of big data and AI in rural area, the popularization of mobile communication tools, and the corresponding special funds and institutional guarantees [8]. Digital rural governance will finally realize fairness and justice, public satisfaction and transparency in the use of power. The measurement and evaluation of the modernization level of rural governance should reflect the uniqueness of the county on the basis of ensuring effective reflection of the governance value orientation. First, we construct evaluation framework from the aspects of process and effectiveness, then carefully screen the subjective and objective indicators, finally build a comprehensive indicator system of county governance [9]. Performance evaluation index system of digital rural governance, on the one hand, shows that digital means promote the efficiency of rural governance, including the improvement of government service efficiency of grass-roots governments, more convenient public services, and more transparent government information. On the other hand, shows that third-party organizations have high participation and strong collaboration ability, public have high satisfaction with digital services [10].

This paper takes districts and counties as the research object, and constructs the evaluation index system of digital rural governance quality from the perspective of "input-output". Among them, the input includes government support for rural governance and the construction of digital platform for rural governance. Government support mainly includes top-level policies, institutional construction, digital infrastructure construction and special investment in rural digitization. The platform construction includes technical personnel investment, number of R&D patents, business coverage, etc. The output is the digital application effect of rural governance. The application effects of digitalization include the treatment of rural government affairs, the openness of "three services", the public's satisfaction with digitalization, the level of rural civilization construction, the level of informatization of rural private enterprises, the level of e-commerce development and the level of agricultural modernization.

3.2 Variable Selection

Nantong has one county (Rudong County) and three county-level cities (Qidong City, Rugao City, Hai'an City). Nantong's rural areas are mainly distributed in these counties and cities. Nantong promotes the realization of rural digital governance through rural digital infrastructure construction, vigorous development of rural e-commerce and big data management.

The sources of all indicator data in this paper mainly include government public documents and Statistical Yearbook. Among them, government public documents, such as "the Bulletin of National Economic and Social Development", "the Bulletin of Postal Industry Development Statistics" of Jiangsu Province, Nantong City and its affiliated districts and counties. Statistical Yearbook, such as China Statistical Yearbook, China Rural Statistical Yearbook, Jiangsu Statistical Yearbook, Nantong Statistical Yearbook, and the statistical yearbook of its districts and counties. Some of the data are calculated.

When measuring efficiency of digital village governance in Nantong, we select the coverage of rural broadband and mobile network infrastructure as the government investment supports, the proportion of financial investment in the GDP of districts and counties to measure the special financial investment in the digital platform, and the proportion of informatization investment enterprises in rural private enterprises to measure the special technical investment in the digital platform. In terms of the effect of output governance, three indicator variables are selected, such as government affairs, party affairs, the number of village affairs open, digital rural public satisfaction and rural e-commerce sales. The evaluation indicator system is shown in Table1.

Table 1. Performance evaluation indicators of digital village governance of Nantong

evaluation	indicators	symbol	Indicator variable	Unit
	government supports	X_1	rural broadband connectivity rate	household/100 people
Input		X_2	Mobile device coverage	household/100 people
	digital platform	X_3	special funds for the platform	%
		X_4	technology investment for platform	%
		Y_1	publicity of government affairs, party affairs and village affairs	piece
Output	effect of governance	Y_2	public satisfaction in digital villages	%
		Y_3	rural e-commerce sales	million yuan

4 Empirical Analysis

4.1 DEA Efficiency Analysis

The level of digital construction and application in rural areas has greatly affected the level of rural governance, which is of great significance to narrow the gap between urban and rural areas. From the perspective of input-output, this paper uses DEA method and Malmquist index to empirically analyze the performance evaluation of Nantong's digital rural governance. Time series from 2017 to 2021 is taken as the decision-making unit(DMU) vertically, efficiencies of Rudong, Rugao, Qidong and Hai'an are calculated by DEAP 2.1 as shown in Table 2, and all units are in the state of diminishing returns to scale. The comprehensive efficiency(TE) is pure technical efficiency(PE) multiply by scale efficiency(SE). If the comprehensive efficiency value is 1, it means that DEA is effective, the development of digital rural construction investment and governance effect is balanced, rural investment in digital infrastructure, digital platform construction funds and technology have effectively improved the quality of digital rural governance, and the input-output efficiency is high [11]. The efficiency grade of this paper is divided as follows. Below 0.9, DEA is invalid. 0.9 ~ 1, basically effective. 1, DEA is valid.

(1) In general, the impact of Nantong digital rural construction investment on the quality of rural governance is not effective. Rudong County and Qidong County are obviously superior to Rugao and Hai'an, and DEA is basically effective. While the digital rural governance efficiency of Rugao and Hai'an is invalid, which are at the lower middle level. In addition, in terms of technical efficiency, the technical efficiency of the quality of digital rural governance in the four counties and districts is close to 1, and the technical efficiency is higher than the corresponding scale efficiency. It indicates that the scale efficiency mainly affects the comprehensive efficiency. This is due to the unprecedented activity of digital technology innovation such as big data, AI and the Internet of Things. The digital technology is the scale economy, and the scale effect is greater than the technical effect.

Table 2. DEA efficiency of digital rural governance in Nantong

	Rudong			Rugao			Qidong			Hai'an		
	TE	PE	SE	TE	PE	SE	TE	PE	SE	TE	PE	SE
2017	1	1	1	1	1	1	0.99	1	0.99	0.76	1	0.76
2018	1	1	1	0.52	1	0.52	1	1	1	0.84	1	0.84
2019	0.94	0.95	0.99	0.51	0.96	0.53	1	1	1	0.5	0.94	0.53
2020	0.86	0.91	0.94	0.44	0.9	0.49	1	1	1	1	1	1
2021	0.95	1	0.95	1	1	1	0.97	0.97	1	1	1	1
avg	0.95	0.97	0.98	0.7	0.97	0.71	0.99	0.99	1	0.82	0.99	0.82

[*] TE refers to the comprehensive technical efficiency, PE refers to the pure technical efficiency, SE refers to the Scale efficiency.

(2) Among the counties and districts in Nantong, the efficiency of Rugao's digital rural governance is the worst, which is due to the slow development of rural e-commerce and Internet government in Rugao, and the failure to form scale effect. Hai'an also needs to make good use of digital information technology, such as big data, AI and the Internet of Things, and vigorously develop its rural economies of scale. In addition, the efficiency of rural governance in the four counties and districts is in a state of diminishing returns to scale. In addition to accelerating the development of rural digital economy in Rugao and Hai'an, Nantong should also make good plans for the development of Rudong and Qidong to promote the sound development of digital rural governance.

4.2 Malmquist Index Analysis

From Table 2, it can be seen that the overall efficiency of digital rural governance in Rugao is the worst, while the overall efficiency of digital rural governance in Qidong is the best and close to the effective level. Because Table 2 is just static efficiency, we need to measure and analyze the dynamic change. Using the DEAP 2.1, we set the DEA-Malmquist parameter to calculate the total factor productivity(TFP) of Nantong digital rural governance from 2017 to 2021. The total factor productivity(TFP) is comprehensive efficiency(TE) multiply by technological progress efficiency(TP). The productivity change of Nantong's digital input on the quality of digital rural governance in the region (each year) are shown in Table 3.

The first half of this table is the annual change of Nantong's rural digital input to the rural governance quality productivity, and the second half is the change of each county's input to the rural governance quality productivity from 2017 to 2021. The average value of TFP in the upper and lower parts are all slightly less than 1, indicating that Nantong's rural digital investment has slightly retrogressed the productivity of rural governance quality. Overall, the efficiency of TP increased by 9%, while TE decreased by 11%.

Table 3. Total factor productivity of digital rural governance in Nantong from 2017 to 2021

		TE	TP	PE	SE	TFP
year	2017–2018	0.81	0.83	0.99	0.83	0.68
	2018–2019	1.29	0.71	1.03	1.25	0.91
	2019–2020	0.8	1.12	0.98	0.81	0.9
	2020–2021	0.76	2.1	1	0.75	1.59
	avg	0.89	1.09	1	0.89	0.97
region	Rudong	1	0.97	1	1	0.97
	Rugao	0.78	1.21	1.01	0.78	0.94
	Qidong	1	1.19	1	1	1.19
	Hai'an	0.81	1	0.99	0.81	0.81
	avg	0.89	1.09	1	0.89	0.97

In terms of time, TFP of Nantong rural digital investment to the quality of rural governance has increased year by year. Although it is less than 1 before 2020, but turns to more than 1 from 2021, which indicates that Nantong rural digital investment is improving the productivity of rural governance, and the contribution of rural digital investment to the quality of rural governance is better. It's because TP in 2021 plays a key role.

In the whole period, Qidong's digital investment has the greatest impact on the TFP of rural governance quality, followed by Rudong, Rugao and Hai'an. From the perspective of each county, TP has mainly affected TFP, but only Qidong's rural digital investment has significantly improved the productivity of rural governance.

5   Conclusions and Suggestions

This paper putted forward the performance evaluation index system of digital rural governance, and measured the level of digital rural governance in Nantong. The study found that the overall performance of Nantong digital rural governance is relatively good and has been in rapid development, but the efficiency development is not in the state of increasing efficiency. The development level of digital rural governance in all counties and districts of Nantong is uneven. Qidong and Rudong are excellent in digital rural governance. The quality of digital rural governance in Rugao and Hai'an is in urgent need of improvement. The infrastructure construction in all counties and districts is significantly different. Digital technology is the power source of Nantong digital rural governance, data is the key element of Nantong digital rural governance, and government support and platform investment are the key to improve the quality of Nantong digital rural governance.

In combination with the development policies related to rural revitalization and digital economy, the following suggestions are put forward.

(1) solve the problem of unbalanced development of digital villages.

Relying on the first-mover advantages of Qidong, we build a typical demonstration area of digital rural governance, explore a new path to better and faster development of digital rural governance, and adopt assistance policies for areas with relatively slow development. Actively use digital technology to expand the scale effect and improve the input-output efficiency of digital rural governance in Nantong.

(2) pay attention to the specific aspects of digital rural governance, solve various problems pertinently.

First, we should continue to strengthen the construction of rural digital infrastructure in Nantong, increase investment in rural Internet of Things, AI and other aspects, and realize the co-construction and sharing of digital infrastructure. Secondly, we should use Internet finance and e-commerce to develop the rural economy and improve the income level of villagers. Finally, apply digital technology to rural social management to improve villagers' satisfaction.

References

1. Jiang Ying. The Support and Application of Digital Technology to Rural Social Governance in the 5G Era [J]. Agricultural Economy, 2021(10):48-50.
2. Song Changying , Zheng Shaofeng, Yu Chongyang. The Construction of Innovation Driving System of Digital Rural Development in the Period of the 14th Five Year Plan Period[J] . Scientific Management Research,2021,39(03):100-107
3. Zhang Huiping, Zhou jingfang, Zhao Baohai. The dilemma and outlet of rural governance from the perspective of rural revitalization [J]. Agricultural Economy, 2019(03):9–11.
4. Zhang Xueling, Wu Tiantian. Research on the Spatial Differentiation Pattern of China's Provincial Digital Economy Development [J]. The World of Survey and Research, 2019(10): 34-40
5. Chen Yangfen, Huang Xiujie, Wang Lijuan. China's Rural Revitalization and its Evaluation from the Perspective of Multifunctional Theory [J]. Chinese Journal of Agricultural Resources and Regional Planning, 2018, 39(06):201-209.
6. Zhang Bingxuan, Ren Zhe. Rural Governance Driven by Digital Technology [J]. Journal of Guangxi Normal University(Philosophy and Social Sciences Edition), 2020, 56(02):62–72.
7. He Yang, Tang Zhiwei. Toward Technical Autonomy: the "Three Changes" of Villagers' Autonomy in Digital Villages[J]. Ningxia Social Sciences,2021(06):71-79.
8. Wang Zhiwei. Path Innovation of Rural Governance Mechanism in Modernization Process [J]. Journal of Beijing Vocational College of Agriculture, 2021, 35(02):56-61.
9. Fan Hongmin , Zhang Yujiao. System of County Social Governance: Approach of Construction and Framework of Evaluation[J]. Journal of Henan Normal University (Philosophy and Social Sciences Edition) ,2017,44(01):26-31.
10. Xu Yueqian, Li Tuo. Measurement and Evaluation of the Modernization Level of Provincial Government Governance in China[J]. Journal of the Party School of CPC Hangzhou, 2020(03):59-65
11. Hu huiyuan. Regional Differences in Operation Efficiency of Provincial Museums in China: Trend, Reasons, and Implications[J]. Journal of Shenzhen University (Humanities & Social Sciences), 2020,37(06):64–71.