Research on the Design of Digital Village Construction Indicator System from the Perspective of Policy Tools

Shandong as an Example

Min Li[1], Xiaohui Li[2(✉)], Gang Li[1], and Yiming Liu[3]

[1] Shandong Computer Science Center, Shandong Academy of Sciences, Qilu University of Technology, Jinan, China
{lim,lig}@sdas.org

[2] School of Finance, Shandong Academy of Sciences, Qilu University of Technology, Jinan, China
17865812937@163.com

[3] Shandong Computer Science Center, Jinan, China
liuym@sdas.org

Abstract. The construction of digital countryside requires a proper understanding of its concept and scientific evaluation. The policies on digital countryside released in China are fragmented and have not been systematically sorted out. Taking Shandong Province as an example, a two-dimensional analysis framework based on the policy tool - the concept of digital countryside - was used to quantitatively analyze 14 policy samples using content analysis to study the government's policy system for digital countryside construction. From the conceptual layer of digital village, most of the current policies focus on the three aspects of digital life, digital governance and digital economy; and under the perspective of policy tools, the policy texts are more evenly distributed in the supply side, environment side and demand side. Four primary indicators and 15 secondary indicators were extracted from the research results to form the digital village construction assessment index system, which can identify the key tasks and shortcomings of digital village development, provide ideas for the next development of digital village, accelerate the pace of digital village development, and better realize rural revitalization.

Keywords: Digital Village · Policy Tools · Indicator System · Content Analysis Method

1 Introduction

Digital countryside refers to the development and transformation of agricultural and rural modernization in the countryside based on digital technology [1]. With modern information networks becoming an important vehicle, digital technology has become a major driving force for rural development. The use of digital technology to accelerate

A. Luqman et al. (Eds.): PMIS 2022, AHCS 6, pp. 864–875, 2023.
https://doi.org/10.2991/978-94-6463-016-9_85

the development of digital agriculture has become an important way to increase the agricultural capacity of countries and has greatly improved the efficiency of agricultural operations [2]. The development and application of digital technology in rural areas has contributed to the upgrading of rural industries and increased development speed [3].

In studying rural social security issues, when certain types of policy instruments are not effective in solving the problem, the government will consider increasing the use of policy instruments to improve policy effectiveness [4]. The study of digital village construction from the perspective of policy tools is a hot issue for theoretical and policy research, which is more helpful to promote economic transformation.

At present, China's digital village construction is in its initial stage, and is bound to face many challenges. To realize the digital construction of villages in a targeted and comprehensive way, the construction of a set of scientific evaluation index system for digital village construction has become the focus of relevant scholars' research. By sorting out relevant policy documents, this paper proposes an index system for the construction of digital villages, with the aim of providing a reference method for the evaluation of the construction of digital villages and promoting the development of the construction of digital villages.

1.1 Research Ideas

The first person to introduce the concept of "policy analysis" was Charles E. Lindblom. He defines it in Policy Analysis as an analytical method that combines qualitative and quantitative analysis to analyze problems [5]. The most typical current classification is that proposed by Roy Rothwell and Walter Zegveld, which divides policy instruments into supply-side, demand-side, and environmental-side. The classification has been widely accepted by scholars in China.

In this paper, a total of 14 policy documents from 2018–2020 are selected as the core sample, and using content analysis method and drawing on existing research results, the two most concerned factors in this level are selected from two dimensions as the source of indicators for assessing the development of digital villages, in the hope of evaluating the construction status of digital villages in different regions.

The two-dimensional analysis framework of this paper is the policy tool dimension and the digital village concept system dimension.

① Policy tool dimension. Based on the available studies on policy instruments, the policy instruments are categorized and organized into supply side, environmental side, and demand side.

The secondary categories under the supply side are human support, scientific and technological information support, infrastructure development, financial investment, technical support, target regulation, and financial support. Manpower support means that the government provides education and training, talent introduction and other methods to cultivate relevant talents; Scientific and technological information support means collecting advanced information on digital village construction, integrating and analyzing it, and providing guidelines for digital village construction; Infrastructure construction means that the government builds roads, 4G base stations and other infrastructure to lay the foundation for the construction of digital villages; Financial investment means that the government makes special financial allocations for the construction of digital

villages and provides technical assistance for the construction of digital villages; Goal regulation means to make a general plan for the construction of digital village; Financial support refers to the government's relaxation of restrictions on loans and financing for digital village related businesses.

The environmental side is divided into tax incentives, regulatory controls, incentives for innovation, procurement, and outsourcing. Tax incentives are tax policies that reduce the taxation of digital countryside related industries; Regulatory control refers to the development of relevant government policy documents to control the activities of the digital industry, Encouraging innovation means that the government enacts policies such as protecting intellectual property rights and encouraging the establishment of R&D centers to stimulate innovation; Procurement refers to the procurement and bidding activities for the construction of digital villages; outsourcing refers to the government outsourcing the works related to the construction of digital villages to private enterprises.

The demand side mainly includes trade management, technical standards and applications, and public services. Trade regulation refers to the various policies enacted by the government to regulate or encourage trade; Technical standards and applications refer to the government's development of technical standards for model villages, etc. and specifications for technical applications; Public service means that the government provides supporting support services to guarantee the development of digital village.

② The conceptual system dimension of digital village construction. The establishment of the digital village concept can be borrowed from the basic architecture of digital village construction proposed by Cui Kai and other scholars. The core concept is derived from four levels: digital environment, digital life, digital economy, and digital governance [6]. According to the understanding of China's digital village construction ideas, the general framework of digital village construction made in this paper is shown in Fig. 1. The four levels can be further refined through the organization of the policy documents as follows. The digital environment includes infrastructure such as artificial intelligence, big data and the Internet of Things. Digital life means that by laying a solid foundation for the digital sector, villagers can fully enjoy the dividends gained from smart healthcare, smart education and environmental protection, and they can upgrade their services through feedback experiences. In terms of digital economy, current political documents all mention digital agriculture, digital service industry and standardized operations. In terms of digital governance, it can be summarized as villagers' participation, digital party building and digital government.

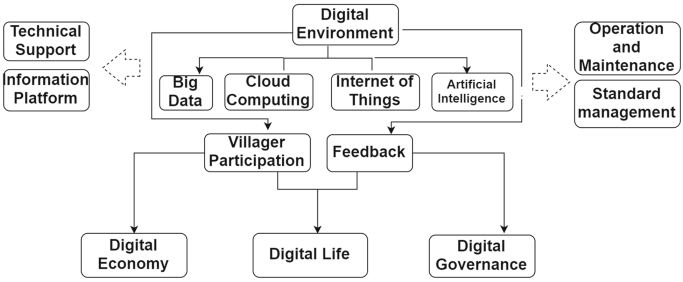

Fig. 1. General framework of digital village construction.

1.2 Sources and Screening of Policy Texts

The data presented in this paper come from the policy documents issued by the government on the construction of digital villages. The government website was searched to obtain public documents about digital villages, and the following 14 data information was finally obtained. Data selection is mainly based on the following two rules: (1) Policies related to digital countryside involve a small number of documents containing rural information construction, in addition to those targeting rural development. (2) Policies can clearly express the government's attitude toward digital rural development.

At the national level, seven departments, including the Central Internet Information Office and the Ministry of Agriculture and Rural Development, issued a notice on the National Digital Countryside Pilot Work in July 2020 (numbered 1); four departments, including the Central Network Security and Informatization, issued the Key Points of Network Security and Informatization Work of the Ministry of Agriculture and Rural Development in 2020 (numbered 2) in May 2020; the Ministry of Agriculture and Rural Development in May 2020 released on the "Key Points of Digital Rural Development Work in 2020" (numbered 3); the Ministry of Agriculture and Rural Affairs and the Office of the Central Committee for Network Security and Informatization released on the "Digital Agricultural Rural Development Plan (2019–2025)" (numbered 4) in December 2019; the Central Committee of the Communist Party of China and the State Council released in May 2019 about the Outline of Digital Rural Development Strategy (No. 5)"; the Ministry of Agriculture and Rural Affairs released about the Implementation Plan of Science and Technology Support Action for Rural Revitalization (No. 6) in September 2018; the Central Committee of the Communist Party of China and the State Council released about the Opinions of the Central Committee of the Communist Party of China and the State Council on the Implementation of Rural Revitalization Strategy (No. 7) in January 2018.

At the level of Shandong Province, the People's Government of Shandong Province issued Opinions on Supporting the Development of the Digital Economy in Shandong Province in July 2019 (No. 8); the Agricultural and Rural Committee of the Shandong Provincial Committee issued Support Policies on Accelerating the Promotion of Rural Revitalization and Consolidating and Improving the Results of Poverty Alleviation in July 2019 (No. 9); the Ministry of Finance and the Ministry of Industry and Information Technology of Shandong Province issued in April 2019 issued in February 2019 on the Implementation Plan for the Remaining Central Financial Subsidy Funds for the 2018 Telecommunications Universal Service Pilot in Shandong Province (No. 10); the People's Government of Shandong Province issued in February 2019 on the Digital Shandong Development Plan (2018–2022) (No. 11); the Shandong Provincial Party Committee and the Provincial Government issued in January 2019 on the Promotion of Healthy Mobile Internet in the Province Implementation Opinions on the Orderly Development of Mobile Internet in the Province" (No. 12); Shandong Provincial Party Committee and Provincial Government issued a special plan on "New Generation Information Technology Industry in Shandong Province (2018–2022)" (No. 13) in November 2018; Shandong Provincial Party Committee and Provincial Government issued a plan on "Implementation Plan for the Promotion of Information into Villages and Homes in the Whole Province of Shandong Province" (No. 14) in September 2018.

1.3 Policy Content Analysis Module Code

This paper adopts the form of "policy number - specific articles/chapters" for coding the content of the policy text. The policy numbers are in the order of document release, from 01 to 14.

For example, the content analysis units of the "Notice on Launching National Digital Village Pilot Work" numbered 1 are to carry out the overall planning and design of digital village, improve the new generation of rural information infrastructure, explore the new business mode of rural digital economy, improve the mechanism of integration and sharing of facilities and resources, and basically establish the guarantee system of e-government network and information security, coded as 1-1, 1-2, 1-3, 1-4, 1-5 respectively. And so on, the implementation plan of "Shandong Province's information into the village to promote the whole province" with the number 14, the content analysis units are to determine the provincial operating body, build the provincial comprehensive service system, deepen the application of agricultural information society, build a number of agricultural characteristics of the Internet town, smooth the service channels, improve the information service capacity, build the sharing economy ecology, implement the village information officer training plan, carry out the farmers' cell phone application skills training, coded as 14-1, 14-2, 14-3, 14-4, 14-5, 14-6, 14-7, 14-8, 14-9 respectively.

The coding and classification of the policy instruments in this study were done independently by the coders, so there was no need to check the classification and compatibility of the codes, and the results were more reliable.

2 Policy Statistics and Results Analysis

2.1 Policy Analysis of the Policy Instrument Dimension

The dimensional distribution of policy tools for digital village construction policy is shown in Table 1.

Table 1. Dimensional distribution table of policy tools

Tool Type	Tool name	Policy Content Keywords	Subtotal	Percentage	Percentage
Supply side	Manpower Support	Training Professionals, Personnel Training, Enhancement of professional skills	6	18.18%	34.02%
	Infrastructure Development	Upgrading the scale of rural network facilities, Modern Digital Infrastructure, Integrated construction and layout of infrastructure, Digitalization and intelligent transformation of smart agriculture and smart logistics	12	36.36%	

(*continued*)

Table 1. (*continued*)

Tool Type	Tool name	Policy Content Keywords	Subtotal	Percentage	Percentage
	Capital investment	Funding and improving efficiency of use, Engineering and construction funds, Financial Support, Investment and financing channels, Financial and Tax Support, Financial Security	2	6.06%	
	Technical Support	Infrastructure upgrade maintenance, Network facility size	13	39.39%	
Demand side	Government Procurement	Technical Services, Infrastructure, Construction Information	6	22.22%	27.84%
	Internet + Government Services	Public Services, Public service capacity, Decision-making information service level, Office Business Applications, Government Governance Precision, Government service system construction	8	29.63%	
	Internet Technology Applications	Value-added data utilization, Data Resource Management	13	48.15%	
Environmental	Goal Planning	Main Objectives, Overall Mission, Strategic Approach, Work Objectives	14	37.83%	38.14%
	Financial Support	Financial Support, Engineering and construction funds, Procurement infrastructure information, Investment and financing channels	3	8.11%	
	Tax Benefits	Increase financial and tax support	1	2.70%	
	Legal Control	Policy Regulation, Personal Information Protection, Supervision System, Network Management, Sound Rule of Law Environment	7	18.92%	
	Encourage innovation	Technology Innovation, Innovative system mechanism	2	5.41%	

From Table 1, we can see that the distribution of policy texts in each aspect is more balanced, and the proportion of each level is mostly 1/3. It can be understood that the government attaches more consistent importance to digital village construction support policy, guarantee policy and application policy. In the demand side, the government

focuses on insufficient financial investment and technical support, and does not provide source motivation for the innovation of digital technology, which may weaken the subsequent technical guarantee work of the digital village to a certain extent.

Further analysis shows that in the supply layer, the most important thing is infrastructure construction (36.36%) and technical support (20.51%), which indicates that China is in the primary stage of digital village development, and the government attaches importance to infrastructure coverage and source power support, hoping to lay a good foundation for the subsequent development. This is followed by manpower support (18.18%) and financial investment (6.06%), indicating that the current digital village construction in these two aspects also the importance has not kept up, should focus on strengthening.

On the demand side, Internet technology application (48.15%) is the most concerned item, which indicates that the focus of digital village construction is on creating capacity, and the value-added and utilization of data resources is also an important means to pull the development of digital village. There is also a greater concern on Internet government (29.63%) and government procurement (22.22%), indicating that the government also puts part of its focus on government construction, hoping to better serve the people through rationalizing government functions.

On the environmental side, target planning (37.83%) and legal control (18.92%) account for the largest proportion, indicating that the current construction of digital countryside has a clear development direction and development goals, while also strengthening the protection of institutions and regulations to create a good development environment. Less attention is paid to tax incentives (2.70%), financial support (8.11%), and encouragement of innovation (5.41%), and there is still a need to strengthen financial support for the digital countryside, while encouraging innovation for all.

The most concerned items in each dimension were proposed from the above analysis and analyzed in combination with the factors in the digital village concept dimension below to provide ideas for the construction of the digital village evaluation index system. The factors extracted are infrastructure construction (36.36%) and Internet technology application (48.15%).

2.2 Policy Analysis of the Digital Village Concept Dimension

The distribution of policy elements in the digital village is shown in Table 2.

Table 2. Policy content dimension distribution table

Dimension	Key Factors	Policy Content Keywords	Subtotal	Percentage	Percentage
Digital Environment	Macro-control	Market Regulation, Information Resource Market, Market Development Mechanism	12	85.71%	18.39%
	Legal norms	Online Trading Platform, Legal regulation of transactions, Monitoring Platform, Investigate and punish wrongdoing, Industry Order	3	21.43%	

(*continued*)

Table 2. (*continued*)

Dimension	Key Factors	Policy Content Keywords	Subtotal	Percentage	Percentage
	Development according to local conditions	Local, Uniqueness, Actual situation, Classify and promote digital village construction	1	7.14%	
Digital Life	Smart Healthcare	"Internet + Medical", Township and village medical institutions, Telemedicine, Service form.	9	64.29%	27.59%
	Intelligent Environmental Protection	Rural Ecosystem Monitoring Platform, Governance Data, Ecological environment monitoring and protection monitoring system, Beautiful countryside construction level.	9	64.29%	
	Smart Education	"Internet + Education" model, Boutique Courses	6	42.86%	
Digital Governance	Villager participation in decision-making	Online opinion exchange, Policy Interpretation, Information Literacy Training	5	35.71%	26.44%
	Digital Party Building	Grassroots Party Building Information Platform, Modern Distance Education, Online Party Education, Online Public, Integrated Governance	8	57.14%	
	Digital Government	Government Implementation, E-Government, Integration of resources, Business Application System, Government Information Data, Resource Sharing	10	71.43%	
Digital Economy	Digital Agriculture	Agricultural production efficiency, Agricultural Technology, Regular information access, Dynamic Spatial Information System	12	85.71%	27.59%
	Digital Services	New Infrastructure for Service Industry, Service consumption, Consumer Iteration, Demand Dynamics	9	64.29%	
	Digital Culture Industry	Featured Culture, Cultural Industry, Cultural Consumption, Spiritual and cultural needs	3	21.43%	

From Table 2, it can be seen that most of the current policies focus on three aspects: digital life (27.59%) digital governance (26.44%) and digital economic side (27.59%), while digital environment (18.39%) accounts for a weaker percentage than these three. This shows that the purpose of the country's development of digital countryside is more important to pull economic development and improve people's living standards.

The most important dimensions extracted from each dimension are: macro control (85.71%), digital government (71.43%), and digital agriculture (85.71%). Since the factor of "macro-control" mainly examines the government's contribution to the construction of digital village, it cannot highlight the construction of digital village in the region, so this factor is not used.

3 Digital Village Assessment Index System Design

3.1 Content of Digital Village Indicator System

According to the extracted four first-level indicators, further content analysis of the currently available policy documents is conducted, and factors with high frequency and different representations in the policy texts are selected, and further collation is made to design the second-level indicators by combining the existing studies of scholars. The specific results are shown in Table 3.

Table 3. Design of the first and second level indicators for digital village construction

Target layer	Tier 1 Indicators	Secondary indicators	Introduction of indicators
	Infrastructure Development	Mobile Broadband Coverage	Infrastructure construction is the key guarantee for the development of digital countryside, and the lagging infrastructure construction will restrict the development of digital countryside. Rural communication equipment is outdated, resources for e-commerce development are scarce, roads and traffic conditions are poor, and drinking water safety is not guaranteed, which hinders the construction of digital countryside
		Number of people using mobile data as a percentage of total	
		4G base station coverage	
		Rural e-commerce service stations (points)	
		Number of IoT end users	
		Number of rural postal and courier outlets	

(*continued*)

Table 3. (*continued*)

Target layer	Tier 1 Indicators	Secondary indicators	Introduction of indicators
	Digital Government	Number of digital village business training/year	Digital government is a direct application of digital technology in rural construction and is mainly used to reflect the level of modernization of rural management in the rural construction process. An annual survey of the number of training sessions on digital village operations could increase rural residents' understanding of existing digital village operations and improve digital village efforts.
		Villagers' motivation to participate in online legal system	
		Number of party affairs open online	
		Number of online disclosure of village affairs	
		The amount of online party class learning	
	Digital Agriculture	Digital level of agricultural production	Agriculture is the primary industry and science and technology is the first productive force. Considering the quantifiability of indicators, Digital Agriculture Index has selected these seven indicators to measure the construction of digital countryside. By strengthening the innovative provision of agricultural science and technology, the comprehensive use of science and technology in agriculture promotes the reform of traditional agriculture as well as the implementation of the transformation of agricultural development from quantitative to qualitative change.
		Number of agricultural Internet data service platforms	
		Number of online companies	
		Share of online retail sales of agricultural products	
		Scale of agricultural fertilizer use	
		Environmental monitoring of farmland	
		Rural greening coverage	

(*continued*)

Table 3. (*continued*)

Target layer	Tier 1 Indicators	Secondary indicators	Introduction of indicators
	Internet Technology Applications	Social security card coverage of insured persons	Internet technology application appears as a general indicator that the purpose of the construction of digital countryside is to improve the living standard of residents, and the technology application breaks the information barrier of some industries and drives the development of a number of new industries. Currently, the most significant social problems in China's rural areas are mainly concentrated in the fields of education, pension and medical care.
		Rural schools open and complete the national curriculum learning volume	
		Broadband network coverage of small-scale rural schools and township boarding schools	
		Number of large medical devices	

4 Conclusions

In summary, this paper designs and constructs a rural digital economy indicator system with 4 primary indicators and 23 secondary indicators covering infrastructure, agriculture, government affairs, and Internet technology. It should be noted that the specific application of the indicator system does not mean that the indicator system should be applied uniformly in all districts and counties. For example, in areas where the Internet is less developed, more attention should be paid to the construction of the basic digital environment and more investment in digital talents. In areas where agricultural production is the main focus, the emphasis should be on the integration of digital technology with traditional agriculture, which serves to improve production capacity and reduce costs. In regions with a high level of rural economic development, attention should be paid to the development of new forms of trade in regions with a more developed agricultural economy, the focus should be on the development of new business models and digital services. Such as Taobao villages, tourism villages, need to highlight the characteristics of regional development and camera selection evaluation criteria.

Acknowledgment. This work was financially supported by the project of the Shandong Province Social Science Planning Project "Research on the Construction of Digital Village in Shandong Province" (Project Approval No: 20CSDJ51).

Shandong Province Social Science Planning Project "Research on the Construction of Digital Village in Shandong Province" (Project Approval No: 20CSDJ51).

References

1. Liu S, Wang R, Shi G (2018) Historical transformation of China's agriculture: productivity changes and other key features. China World Econ 26(1).
2. Midrigan V, Xu D Y (2014) Finance and misallocation: evidence from plant-level data. Am Econ Rev 104(2)
3. Frick F, Sauer J (2018) Deregulation and productivity: empirical evidence on dairy production. Am J Agr Econ 100(1).
4. Shamim F (2007) The ICT environment, financial sector and economic growth: a cross-country analysis. J Econ Stud 34(4).
5. Kar A K (2011) Microfinance Institutions: A Cross-Country Empirical Investigation of Outreach and Sustainability. J Small Bus Entrep 24(3).
6. Zhang X, Zhang X, Chen X (2017) Happiness in the air: how does a dirty sky affect mental health and subjective well-being? J Environ Econ Manage 85.