

Literature Study on Technical Indicators of Rural Information Infrastructure

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Abstract

The quality of rural informatization construction is often constrained by the state of rural information infrastructure. Therefore, effectively promoting the construction of rural information infrastructure is crucial for enhancing the level of rural informatization. However, due to the numerous and complex technical indicators of rural information infrastructure, there is a lack of study specifically focusing on which indicators should be prioritized for construction and which indicators can be temporarily postponed to save costs. This study adopts a method of literature synthesis and comparison to address these issues. Through the study, it is found that the technical indicators that researchers generally focus on are Data Transmission Rate and Network Coverage; while the technical indicators that researchers pay less attention to mainly include Network Management Level, Data Management Level, and Online Service Level, among others. Additionally, the study explores other related issues. The findings of this study can provide fundamental decision-making support for many countries' rural information infrastructure construction.

Keywords: Rural Information Infrastructure, Technical Indicators, Literature Study

Introduction

Accompanied by the rapid development of global informatization, many countries around the world attach great importance to the construction of their rural information infrastructure (Li, 2011). To assist these countries in clarifying the technical indicators of rural information infrastructure, especially in identifying those indicators that are widely and relatively less focused on, will provide theoretical support for the next steps in rural information infrastructure construction (Tang & Cui, 2023).

Problem Statement

Currently, there are not many study outcomes specifically focusing on the technical indicators of rural information infrastructure, and most of the existing studies only concentrate on a few or very limited technical indicators of rural information infrastructure (Ahmed et al., 2021;

Martínez-Domínguez & Mora-Rivera, 2020; Mora-Rivera & García-Mora, 2021; Changjiang & Chenghua, 2011; Yuying et al., 2021; Lei, 2020). Such a small number of indicator studies are obviously not systematic, and their conclusions are not comprehensive. Therefore, this study will systematically organize, compare, and summarize various technical indicators of rural information infrastructure, and then draw more comprehensive study conclusions.

Limitations

Although this study plans to conduct relatively comprehensive and systematic study, it will be subject to some limitations. Firstly, during the study process, the number of retrieved documents may be limited due to the inherent shortcomings of search tools. Secondly, the field involved in this study experiences rapid technological updates, and the speed of literature updates often cannot keep pace with technological advancements, which may affect the timeliness of the study conclusions. Lastly, the beneficiaries of this study might come from various countries around the world. Therefore, when referring to the conclusions of this study, these international audiences may need to appropriately adjust the conclusions based on their own regional characteristics, culture, and customs.

Literature Review

Review of Literature on Paper Documents

A study has pointed out that the technical indicators of rural information infrastructure mainly include broadband network coverage, user penetration rate, download speed, network stability, and user satisfaction (Iablonski et al., 2024). Other study highlights that these indicators primarily consist of fixed broadband, average end-to-end 4G user download speed, user satisfaction, and information service quality (Wollman et al., 2022). The additional study indicates that the indicators encompass broadband access speed, mobile broadband quality, international bandwidth capacity, network coverage, data transmission rate, and user satisfaction (Chen et al., 2018).

Moreover, the study has identified that the technical indicators include fixed broadband quality, mobile broadband quality, international bandwidth capacity, network coverage, data transmission rate, user satisfaction, and ICT usage rate (Seidemann, 2024). Other study emphasizes information technology extension service rate in agriculture, informatization rate of agricultural production, and user satisfaction as key indicators (Ko et al., 2019). Another study indicates that these indicators include broadband coverage rate, the number of 5G base stations, coverage rate of information service stations, network stability, data transmission speed, and information service quality (Steen, 2020).

Other study has shown that the technical indicators consist of data transmission rate, data processing capacity, and system reliability (Shen et al., 2012). Another study highlights network latency, data transmission rate, and system stability as crucial indicators (Zhong, 2023). Other study identifies network coverage, data transmission speed, and information service quality as main indicators (Yi et al., 2020). Another study points out that the technical indicators include network stability, user satisfaction, and service response time (Sun et al., 2021). Additionally, other study highlights information technology extension service rate in agriculture and informatization rate of agricultural production as important indicators (Hu, 2023).

Review of Literature on Report Documents

Reports have indicated that the technical indicators of rural information infrastructure mainly include fixed broadband quality, mobile broadband quality, international bandwidth capacity, network coverage, data transmission rate, user satisfaction, and ICT usage rate (ITU, 2021, 2022, 2023). Moreover reports highlight indicators such as broadband access speed, mobile broadband quality, international bandwidth capacity, network coverage, data transmission rate, and user satisfaction (Trendov et al., 2021; World Bank, 2009, 2016).

Additionally, a report mentions indicators like network coverage, data transmission speed, level of agricultural production informatization, level of operational networking, level of management data utilization, and level of service onlineization (Baller et al., 2016). Another report emphasizes indicators such as network coverage, data transmission speed, and information service quality (Ministry of Agriculture and Rural Affairs of China, 2021a).

Moreover, there is a report highlighting indicators such as data processing capacity, information transmission efficiency, and system reliability (Ministry of Agriculture and Rural Affairs of China, 2020).

Review of Literature on Official Documents

A guideline document suggests that the technical indicators of rural information infrastructure primarily encompass network access speed, information service quality, and user satisfaction (Cyberspace Administration of China, 2022). Another guideline document points out that the technical indicators include network coverage rate, data transmission speed, and informatization management level (Ministry of Agriculture and Rural Affairs of China, 2021).

A policy document states that the technical indicators mainly consist of broadband network coverage rate, user penetration rate, and download speed (State Council of China, 2013). Another policy document suggests that the technical indicators mainly include broadband access capacity, network coverage scope, and website accessibility performance (National Development and Reform Commission of China, 2015).

A general document also indicates that the technical indicators primarily involve network coverage breadth, information service penetration rate, and user experience quality (State Council of China, 2022).

Research Questions

What are the primary and secondary technical indicators of rural information infrastructure?
What recommendations can be provided on selecting technical indicators that assist in decision-making for investment in rural information infrastructure?

Research Objectives

To identify the primary and secondary technical indicators of rural information infrastructure.
To recommend suitable technical indicators that enhance the rationality of decision-making in investments for rural information infrastructure.

Research Methodology

In this study, a literature synthesis and comparative analysis approach is employed. Through preliminary organization, charting, and summarization steps, the target conclusions are gradually derived.

Literature Analysis Plan

Confirming Retrieval Tools

Search for various literature retrieval tools to collect relevant literature as comprehensively as possible, laying the foundation for the next stage of the study.

Literature Screening

For a large number of useless or duplicate literature, eliminate them through automatic or semi-automatic means, retaining relatively valuable literature data.

Organizing and Summarizing

Through overall analysis, advantage indicator analysis, and disadvantage indicator analysis, explore the technical indicators most commonly focused on by researchers and those that are less focused on.

Literature Analysis

Overall Analysis

After the preliminary organization in section 4.0, we can now summarize the literature comparison of various technical indicators, as shown in Table 9.1 and Figure 9.1.

Table 1.1

Literature Comparison table of Various Technical Indicators

No.	Technical Indicator	Reference Count	Document Type
1	Data Transmission Rate	16	Paper, Report, Official Document
2	Network Coverage	14	Paper, Report, Official Document
3	User Satisfaction	9	Paper, Report, Official Document
4	Information Service Quality	5	Paper, Report, Official Document
5	International Bandwidth Capacity	4	Paper, Report
6	Network Stability	4	Paper
7	Agricultural Technology Promotion Rate	3	Paper, Report
8	Agricultural Production Informatization Rate	3	Paper, Report
9	System Reliability	2	Paper, Report
10	User Penetration Rate	2	Paper, Official Document
11	Fixed Broadband Quality	2	Report
12	Mobile Broadband Quality	2	Report
13	Service Response Time	1	Paper
14	Network Latency	1	Paper
15	ICT Usage Rate	1	Paper
16	Number of 5G Base Stations	1	Paper
17	Information Processing Capacity	1	Report
18	Agricultural Production Informatization Level	1	Report
19	Network Management Level	1	Report
20	Data Management Level	1	Report
21	Online Service Level	1	Report

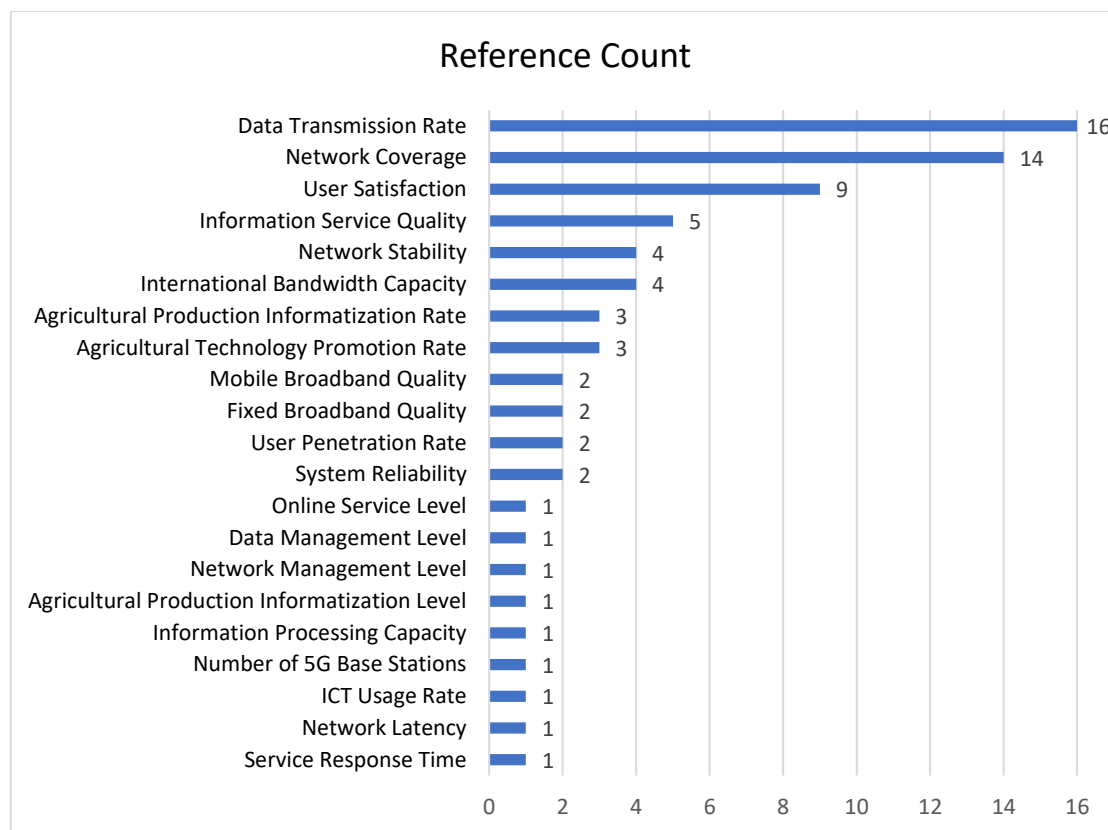


Figure 1.1 Literature Comparison Chart of Various Technical Indicators

Analysis of Widely Focused Indicators

From Figure 9.1, it can be observed that the top two significantly represented technical indicators are Data Transmission Rate and Network Coverage. This indicates that researchers highly prioritize these two technical indicators. Studies suggest that the foremost consideration in rural information infrastructure construction should be on Data Transmission Rate and Network Coverage, as only then can farmers have access to quality information services (Chun et al., 2019; Zheng, 2009; Yanqiu et al., 2013).

From Figure 9.1, it can be seen that the top five technical indicators are Data Transmission Rate, Network Coverage, User Satisfaction, Information Service Quality, and International Bandwidth Capacity, with International Bandwidth Capacity and Network Stability tying for fifth place. The study indicates that User Satisfaction, Information Service Quality, and International Bandwidth Capacity (or Network Stability) play a direct and crucial role in ensuring a good experience for farmers using information services (Xiaoming, 2021; Jian et al., 2022; Yanqiu et al., 2013).

Analysis of Less Focused Indicators

From Figure 9.1, it can be seen that the bottom nine technical indicators are Service Response Time, Network Latency, ICT Usage Rate, Number of 5G Base Stations, Information Processing Capacity, Agricultural Production Informatization Level, Network Management Level, Data Management Level, and Online Service Level. Based solely on Figure 9.1, it appears that there is no difference in the number of references between 'Agricultural Production Informatization Level, Network Management Level, Data Management Level, Online Service Level' and 'Service Response Time, Network Latency, ICT Usage Rate, Number of 5G Base Stations, Information Processing Capacity.' However, Table 9.1 reveals that the former indicators are

all sourced from reports, while four of the latter indicators are sourced from academic papers, with only one from reports. Some studies suggest that the former indicators pertain to the agricultural production and operation domain and are relatively rare in academic papers (Honghan, 2020; Yanqiu et al., 2013). Other studies indicate that the latter indicators are typical metrics commonly found in academic study in the information and communication field (Feng et al., 2023; Tao et al., 2021).

Findings and Conclusion

Recommendations for Priority Decision-Making

To ensure that farmers have a tangible sense of gain from information services, the primary task is to enhance Data Transmission Rate and Network Coverage. This means first ensuring that farmers have access to information service resources and then gradually improving the quality of these resources. Here, 'quality' generally refers to the technical indicators ranked third and beyond in Table 9.1.

Recommendations for Cautious Decision-Making

From the comprehensive analysis above, it is evident that it is not suitable to directly improve the latter four indicators in Table 9.1 during the initial stage of informationization construction, as they represent efforts in later stages of informationization. Therefore, we must not reverse the sequence, invest haphazardly, or hastily construct, but rather wait for the opportune moment before striving towards the latter four indicators.

Recommendation

After identifying the macro technical indicators that most researchers focus on, it is recommended to conduct more detailed micro-level study based on these macro technical indicators. For example, Data Transmission Rate can be divided into wired and wireless data transmission rates for study. Network Coverage Rate can be divided into agricultural production network coverage rate and rural residential network coverage rate for the study, thereby obtaining more specific and practical decision recommendations.

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