Technological Embedding and Rural Adaptation in Digital Rural Governance

Jiayu Fan

College of Business, Beijing International Studies University, Beijing, 100024, China
2023221113@stu.bisu.edu.cn

Abstract. Digital village construction is an important meeting point of the Rural Revitalization Strategy and the Digital China strategy. It is reshaping the way rural governance works. Its effect depends not only on the scale of technology supply, but also on the degree of fit between digital technology and the structure of rural society. This paper focuses on the process of technological embedding in digital rural governance. It analyzes the empowering effects, mismatch risks, and internal mechanisms of digital technology in rural governance. The study finds that the embedding of digital technology in rural governance shows a dual effect of empowerment and mismatch. Empowerment is mainly reflected in infrastructure support, the coordination of institutional supply, and the improvement of information integration ability, which help improve governance efficiency and rural resilience. Mismatch is mainly reflected in the conflict between standardized assessment logic and differentiated governance needs, the tension between efficiency-first governance and the logic of maintaining rural social relations, and the mismatch between homogeneous technology supply and differentiated farmer abilities. Based on this, this paper shows that the key to digital rural governance is not only dependent on the expansion of technology supply, but more importantly, on promoting a higher level of institutional fit and practical adaptation between technological logic and the structure of rural society.

Keywords: Digital Rural Governance, Technological Embedding, Rural Adaptation, Digital Empowerment, Technological Mismatch.

1 Introduction

Digital village construction, as an important meeting point of the Rural Revitalization Strategy and the Digital China strategy, is deeply reshaping the organizational ways and operating logic of rural governance. With the extension of digital platforms, data governance, and intelligent technologies, rural governance has gained new technical support in information integration, resource allocation, public services, and risk response [1]. However, the governance effect does not simply depend on the scale of technology support, but also on whether digital technology can have effective adaptation to the original institutional environment, social relations, and action logic of rural society. Rural society has long been embedded in acquaintance networks,

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informal norms, and differentiated ability structures. When standardized technological tools enter this field, they often create new structural frictions. This may even make digital governance produce mismatch and deviation in addition to empowerment [2].

Around the relationship between digital technology and rural governance, existing studies have discussed this issue from different perspectives. One kind of research mainly emphasizes the empowering effect of digital technology. These studies argue that the construction of digital platforms, the spread of mobile technology, and the improvement of information circulation efficiency can promote the development of rural industries, expand channels for social participation, and improve grassroots governance capacity, thus strengthening the internal driving force of rural development [3]. Moreover, some research from the perspective of rural resilience and sustainable development points out that digital technology can not only improve the conditions for resource access, but also improve the adaptive ability of rural communities when they face risks and uncertainty, thus providing a new organizational basis for rural governance and development [4]. Correspondingly, another kind of research has started to focus on the risks and limitations of digital governance in grassroots practice, and points out that digital village construction may also be accompanied by the strengthening of formalism, the deviation of indicator orientation, the increase of grassroots digital burden, and unequal participation in governance during the process of promotion. Therefore, the application of technology does not necessarily and automatically turn into governance optimization [5].

Overall, existing research has provided an important basis for understanding digital rural governance, but there is still room for further expansion. Firstly, existing discussions focus on empowerment or mismatch from one single side, but there is still a lack of systematic explanation for how digital technology can show both empowerment and mismatch in the same process of governance. Moreover, although existing research has noticed the practical difficulties brought by digital technology, it still rarely places these problems in the structure of rural society and further analyzes the interactive mechanism between technological logic, institutional arrangements, social networks, and ability differences. In other words, why the embedding of digital technology in rural governance produces different results, and why technological empowerment turns into technological mismatch under certain conditions, are still important questions that need to be answered in the study of digital rural governance.

Based on this, this paper discusses the process of technological embedding in digital rural governance. It mainly discusses the dual effects of digital technology in rural governance and the conditions under which these effects are produced. It also starts from the relationship between technological embedding and rural adaptation to analyze the structural tensions that exist in the practice of digital governance, aiming to deepen the understanding of the interactive relationship between technology and rural society in digital rural governance at the theoretical level, and to provide a reference in practice for promoting the effective connection between digital technology and the needs of rural governance.

2 The Dual Effects of Digital Technology: Empowerment and Mismatch in the Process of Technological Embedding.

When digital technology enters rural governance, it does not necessarily bring a single governance result. On the one hand, technological embedding may improve the efficiency of grassroots governance through information integration, resource sinking, and organizational coordination. On the other hand, the application of technology may also cause new governance bias because of the lack of institutional support, social structural conflict, and the widening of ability differences. Therefore, to understand the effects of digital technology in rural governance need to examine the conditions under which empowerment can be achieved and the reasons why technological mismatch happens at the same time. Only by examining these two aspects in the same process of technological embedding understand why digital rural governance shows complex results rather than only a single result.

2.1 The Conditions for Technological Empowerment

The empowering effect of digital technology does not simply come from the technology tools themselves, but is also based on infrastructure, institutional supply, social embedding, and other conditions. Firstly, digital infrastructure is the foundation for technology to show its effect. The more complete the network coverage, platform access, and data circulation environment are, the more easily digital technology can be embedded in the process of rural governance and improve the ability of information access, market connection, and public participation [6,7]. Moreover, institutional supply decides whether technology can truly turn into governance effectiveness. Digital governance is not only a problem of platform construction but also depends on institutional support, such as the division of power and responsibility, resource allocation, and the coordination of multiple subjects. If there is a lack of supporting institutions, the application of technology is more likely to stop at the surface level [8]. Finally, technological empowerment also depends on the degree of social embedding. Only when digital tools are integrated with local social practice can technology turn from external input into a substantial governance resource [9]. As a result, the empowerment of digital technology is not achieved automatically. It is the result of the joint effect of many conditions. In other words, the performance of technological efficiency basically depends on whether external supporting conditions are sufficient and whether technology supply can form a stable connection with rural governance needs.

2.2 The Structural Roots of Technological Mismatch

Accompanying empowerment is the phenomenon of technological mismatch. It is not based on whether technology itself is advanced, but on the fact that after standardized technological logic enters a differentiated rural society, it cannot form a stable fit with grassroots governance. Firstly, in the institutional aspect, digital governance emphasizes record keeping, quantification, and assessment visualization. Although this logic is better for administrative management, it may also make grassroots governance turn to indicator orientation and formal operation. Especially under the

condition of emphasizing construction but ignoring institutional support, technology is more likely to serve assessment rather than the practical needs of governance [5,8]. Moreover, at the social level, the running of rural society depends on acquaintance networks, local knowledge, and informal norms. However, digital technology emphasizes the same process and efficiency first. It is easy for conflicts to arise between the two, and this may cause formal access and actual disembodiment to exist at the same time. Finally, at the ability level, technology supply is often the same, but rural residents are clearly different in educational level, digital literacy, and the ability to face risks. So, this may lead to unequal benefits among different groups and even make vulnerable groups further marginalized in the process of technology diffusion [7,10]. Overall, technological mismatch is a structural result formed by the interaction of several factors, including institutional, social, and ability-related ones. It is also because of this that the problems in digital rural governance cannot be explained only through the level of technology application, but also need to be understood in the structure of rural society.

3 An Analysis of the Tensions Between Technological Embedding and Rural Adaptation

The empowerment and mismatch of digital technology in rural governance are not two basically separated results but differentiated performances of the same process of technological embedding under different institutional, social, and ability conditions. Rural society is not a blank area to be directly transformed by technology. It is a social space jointly shaped by grassroots institutional operation patterns, social relation networks, and the different abilities of social subjects. When digital technology enters rural governance in the ways of standardization, efficiency, and scale, it is easy for it to collide with the original operating logic of rural society and further form multiple tensions. From this perspective, the problem in digital rural governance cannot be simply reduced to whether technology is effective, but should further focus on why technology shows different results in different rural places. It is also in this process that the structural tensions between technological embedding and rural adaptation gradually become apparent and become a key point for understanding the dual effects of digital rural governance.

3.1 The Tension Between Standardized Assessment Logic and Differentiated Governance Needs

Digital governance platforms usually take data recording, process visualization, and indicator quantification as their basic operating methods. This standardized assessment logic helps improve administrative efficiency and makes it easier for higher-level departments to supervise and evaluate. However, rural governance faces highly contextual, differentiated, and flexible challenges, and different regions have clear differences in resource endowment, population structure, industrial foundation, and social relations. So, governance needs cannot be completely covered by the same indicator.

In this situation, the more digital technology pursues standardization, the more likely grassroots governments are to face the risk of replacing problem-oriented governance with indicator-based governance and real governance with trace-keeping [5]. At the same time, digital technology and service-driven governance transformation itself require institutional coordination and diverse tools, so it is difficult to truly respond to specific problems in grassroots governance [8]. Therefore, the core of the tension is not that standardization itself is ineffective, but that there is a clear gap between unified technological logic and differentiated governance realities. Furthermore, if this gap cannot be addressed for a long time, digital governance may only improve administrative visibility in form but reduce governance responsiveness and flexibility in practice.

3.2 The Tension Between Efficiency First and Relationship Maintenance

Digital technology emphasizes better processes, quick response, and efficient resource distribution. This makes it have clear tool advantages in grassroots governance. The operation of rural society does not completely depend on formal rules, but is also deeply embedded in acquaintance networks, local knowledge, and informal norms. The handling of grassroots affairs is not only about whether it is efficient, but also about whether it is reasonable, whether it can be accepted, and whether stable relationships can be maintained. If digital governance pays too much attention to efficiency first, it may make the original negotiation space of rural society smaller and simplify the governance process, which once depended on situational judgment and relationship coordination, into technical procedures. As a result, the social foundation of grassroots governance may become weaker. Existing research has pointed out that although digital technology can improve the ability of rural society to face risks, whether this effect can really work still depends on whether it can be combined with the organizational ways of local society [4]. If technology only enters rural society in form but does not truly interact with local knowledge and social practice, it is easy for a situation to appear in which the platform is present in rural society, but governance is not truly embedded in it. As a result, the efficiency logic in digital governance cannot completely replace the logic of maintaining social relationships in rural society, and a new balance needs to be found between the two. Therefore, if digital technology really wants to enter rural society, it cannot only pursue the improvement of technological efficiency but also needs to keep the necessary negotiation space and relationship flexibility of rural society.

3.3 The Tension Between Homogeneous Technology Supply and Differentiated Abilities

At present, digital rural construction is often promoted by the same platform, the same procedures, and the same technological standards. This homogeneous way of supply helps expand quickly and cover on a large scale, but it also easily ignores the differences among rural subjects in educational level, digital literacy, information access ability, and the ability to face risks. For groups that are stronger in digital ability and have better resource conditions, digital technology can improve their development opportunities and resilience. For the elderly, low-education groups, and farmers with fewer resources, the same technological tools may become new

obstacles. Existing research has shown that the improvement of rural household resilience through digital empowerment does not happen equally, and different groups show clear differences in the extent of benefits they gain from the use of digital technology [7]. When digital technology expands to other areas such as financial services, if there is a lack of institutional protection and support, vulnerable groups may even face more uncertain risks [10]. Therefore, the difference between the unity of technology supply and the differentiation of farmers' ability structures forms another important tension in digital rural governance. As technology expands more quickly, the problem of unequal profit distribution caused by differences in ability needs to be faced more seriously. This means that digital rural construction is not only a process of technology expansion, but also a process of redistribution that is closely related to education, resources, and the social support system.

Overall, the tension between technological embedding and rural adaptation is not caused by only one factor, but is formed by the interaction of institutional structure, social relations, and ability distribution. Standardized assessment logic makes the flexibility space of grassroots governance much smaller, the efficiency-first orientation impacts the relationship-maintaining mechanism of rural society, and homogeneous technology supply may also enlarge the ability differences between different subjects. It is also because of this that the key to digital rural governance does not depend on simply increasing technology investment, but on improving institutional adaptation, social embedding, and ability adaptation between technological logic and the structure of rural society.

4 Conclusion

Digital rural governance is not a process to achieve governance optimization only through technology investment. It is a process of continuous interaction between technological logic and rural social structure. This paper focuses on the practical process of digital technology embedding in rural governance and points out that it shows both empowerment and mismatch at the same time. The former mainly depends on infrastructure support, institutional supply guarantee, and the effective embedding of technology into local society. It is reflected in the improvement of information integration ability, governance efficiency, and rural resilience. The latter mainly results from the maladaptation between standardized assessment logic and differentiated governance needs. It is reflected in the tendency toward formalism, the risk of relationship disembedding, and the unequal distribution of benefits among different subjects.

Furthermore, the key problem in digital rural governance does not lie in whether technology itself is advanced, but in whether technology can form a stable adaptation with the institutional environment, social relations, and subject abilities of rural society. This paper analyzes the dual effects of digital rural governance from the perspective of technological embedding and rural adaptation, which is helpful for having a more comprehensive understanding of the complex results after digital technology enters rural society. It also shows that digital rural construction cannot

only focus on platform setup and technology expansion, but should also emphasize institutional adaptation, social embedding, and ability building, and provide some policy reference for digital rural governance. Of course, this paper still has some limitations, which are mainly reflected in the insufficient discussion of practical differences among different regions and the different influences of different kinds of digital technology. In future research, specific cases can be combined to further deepen the comparative analysis of digital technology embedding paths and their adaptation mechanisms, and provide more targeted reference for digital rural governance.

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