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Digital Technology Enabled Agricultural Economic Resilience Study

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ABSTRACT

Digital economy brings new opportunities and challenges for the high-quality development of China's agriculture, and exploring the impact of digital technology on the resilience of the agricultural economy can provide theoretical and empirical support for China's promotion of the modernization of agriculture and rural development and the construction of a strong agricultural country. Based on the panel data of 30 provinces in China from 2013 to 2023, this project uses the entropy value method to measure the development level of digital technology and agricultural economic resilience respectively, and empirically analyzes the indirect and direct influence mechanism of digital technology on agricultural economic resilience using two-way fixed effect model and systematic GMM model, and then reveals the intrinsic connection between the two, which will provide a good opportunity for fully releasing the digital dividend to help rural revitalization and promote stable economic development to provide practical significance. Finally, it puts forward relevant suggestions for digital technology to empower rural economic resilience.

KEYWORDS

Digital technology; Agricultural economic resilience; Mediating effects

1. INTRODUCTION

Agriculture is the foundation of the country, and an important basis for the safe and stable development of the national economy. 2023 Central Document No. 1 proposed that China's development has entered a period of strategic opportunities and risks and challenges, and uncertainties have increased, so it is crucial to guard the basic plate of the "Three Rural Areas" well. Affected by natural disasters, market risks, supply and demand contradictions, the degree of agricultural development affected by external factors has gradually deepened, and how the agricultural economy can resist the impact of uncertainty and realize safe development has become an important consideration in policymaking. And with the innovative application of the new generation of information technology, the rapid development of digital technology with data as the key element, the Internet, the Internet of Things, big data and cloud computing and other digital technologies are widely used in agriculture, which can be seen that digital technology has the possibility of enhancing the resilience potential of the agricultural economy, which is of great significance for the stable and healthy operation of the agricultural economic system. In this context, digital technology-enabled agricultural economic resilience is studied based on theoretical mechanisms and empirical tests, and policy recommendations are proposed based on the findings.

2. LITERATURE REVIEW

Relevant studies on digital technology have shown that the wide application of digital technology, such as the Internet of Things (IoT), the Internet of Wisdom (IoW), cloud computing, and big data, has provided a new driving force for China's economic development. In recent years, the deep integration of digital technology and agriculture has become an important trend in the development of agricultural innovation and has provided new opportunities for sustainable agricultural development (Zhu Honghui and Zheng Xin, 2023). With the continuous development of digital technology in the countryside, digital technology has empowered the modernization and construction of the rural governance system, contributed to the co-governance of multiple subjects, promoted the intelligent transformation of governance decision-making, strengthened the material foundation of governance, created a good humanistic environment, and improved the stability of the rural economy (Jiang Weiguo , 2021). In theory, digital technology can effectively integrate rural governance resources, adjust the governance structure, and improve governance efficiency through systematic and intelligent matching with rational scientific logic (Chen Tan and Wang Peng, 2020). In practice, the change of digital technology successfully breaks the boundary constraints between urban and rural industries, realizes the integration and development between agriculture and other industries, cultivates composite talents with skills in different fields, creates new types of technology, and provides talent guarantee and technical support for the resilient development of the agricultural economy (Wu Yue and Liu Nana, 2022). The application of digital technology in agriculture has not only changed the traditional agricultural production methods, but also brought brand new development opportunities for rural areas. For example, the application of Internet of Things (IoT) technology enables the interconnection of various devices and sensors in the agricultural production process, realizing automated operations such as farmland irrigation, fertilization, and pest monitoring, and improving the efficiency and quality of agricultural production. The introduction of intelligent agricultural robots and drone technology enables farmers to carry out agricultural operations more conveniently, reducing labor intensity, and through high-precision farmland inspection and crop monitoring, it improves the degree of refinement of agricultural management and reduces the waste of resources and environmental pollution.

The application of cloud computing and big data technology provides more accurate decision-making support for agriculture. By analyzing and mining huge amounts of agricultural data, agricultural experts and decision makers can better understand the soil conditions of farmland, climate change, crop growth, etc., so as to formulate scientific and reasonable agricultural production plans and policies. The development of digital technology has also led to the rise of rural e-commerce and agricultural e-commerce. Through the construction of Internet platforms, the sales range of agricultural products has been expanded, and farmers can directly sell their agricultural products online and directly interface with urban consumers, increasing the added value of agricultural products and farmers' income. In addition, digital technology has facilitated the development of rural education and healthcare. Through Internet technology, rural areas are able to access high-quality educational resources and medical services, narrowing the gap between urban and rural education and medical care and improving the quality of life of farmers. The widespread application of digital technology in agriculture has brought brand new development opportunities to rural areas in China. In the future, with further innovation and development of digital technology, rural areas will usher in a more intelligent and efficient mode of agricultural production, which will further promote the development of the rural economy and increase farmers' income.

Relevant studies on agricultural economic resilience show that the concept of resilience was initially proposed by ecologist Holling in 1973, and was used to evaluate the maintenance and repair capacity of ecosystems after suffering shocks. Subsequently, the concept of resilience was introduced into the economic field and became an effective tool for explaining a variety of complex economic phenomena, and Martin et al. gave a more comprehensive definition of economic resilience, i.e., economic resilience embodies the economy's ability to adjust dynamically, which is manifested in the

four aspects of vulnerability, resilience, adaptive capacity and restorative capacity of the economic development in the face of shocks (Shadrack N, 2023). Regarding the influencing factors that drive economic resilience, some literature studies have shown that industrial structure is an intrinsic key driver of economic resilience, and concluded that industry-related diversification can significantly promote the level of economic resilience (Chen Yuan and Deng Huyan, 2020). Other studies point out that social capital, cultural characteristics, and total factor productivity (Liu Xiaoxing and Zhang Xu, 2021) are also important factors affecting economic resilience. Further analysis reveals that economic resilience studies in agriculture-related fields have mainly focused on assessing the level of agricultural economic resilience and exploring the factors affecting its resilience. These studies aim to reveal the adaptive capacity and stability of agricultural economic systems in the face of external shocks and internal changes. Measuring the level of agricultural economic resilience is an important aspect of the research. Scholars have quantitatively assessed the resilience of the agricultural economy through a variety of indicators and models, such as the agricultural price volatility index, agricultural income elasticity, and agricultural production elasticity. These metrics can objectively reflect the stability and adaptability of the agricultural economic system under different conditions and provide a basis for decision-making by policy makers. Meanwhile, researchers are also committed to exploring the factors that affect the resilience of the agricultural economy. These factors include natural resource conditions, climate change, market structure, policy environment and so on. By analyzing the extent and manner in which these factors affect the resilience of the agricultural economy, researchers can provide policy makers with effective recommendations and guidance to enhance the resilience of the agricultural economic system. In addition, there are some studies that focus on the spatial and temporal differences and influence mechanisms of agricultural economic resilience. These studies reveal the vulnerability and sustainability of agricultural economic systems by comparing the resilience of agricultural economies in different regions, different types of agriculture and different time periods. At the same time, researchers have also provided theoretical and practical guidance for enhancing the resilience of agricultural economic systems by analyzing in depth the influencing mechanisms of agricultural economic resilience, such as the effects of agricultural policies and farmers' adaptation strategies. Economic resilience studies in agriculture-related fields mainly focus on the aspects of agricultural economic resilience level measurement and influencing factors. These studies are of great significance in revealing the stability and adaptive capacity of the agricultural economic system, as well as providing decision-making basis and guidance for policy makers. Future studies can further explore in depth the spatial and temporal differences and influence mechanisms of agricultural economic resilience in order to promote the sustainable development of the agricultural economy. From a general point of view, research on economic resilience in agriculture-related fields mainly focuses on the measurement of the level of agricultural economic resilience and the factors affecting it (Zhang Mingdou and Li Jiuyong, 2022).

Studies on the impact of digital technology on agricultural economic resilience have shown that the development of digital technology plays an indispensable role in rural economic resilience and is a core path for future economic growth in China. Among them, the increasing level of digital technology and the promotion of economic diversification are important factors affecting the resilience of the agricultural economy (Zhu Youhua and Ji Pan, 2021). At the same time, the development of digitalization drives the innovation of traditional financial services, and with the help of digital technology, traditional financial institutions are transforming towards digital finance, which helps to promote the development of agriculture and reduce the risk of agricultural production, thus enhancing the resilience of the agricultural economy (Hui Zhang and Binqiang Lu, 2024). In addition to financial aspects, digital technologies are also effective in enhancing the resilience of the rural economy by facilitating the construction of infrastructure and providing industrial support (Zhao, Yu and Li, Zhicui, 2023). The widespread application of digital technology in rural areas has greatly changed the original face of the agricultural economy, contributed to the digital transformation of rural areas, and rationalized and advanced industrial structure have contributed to the enhancement of the resilience of the rural economy (Kunli Liang and Vicky Liu, 2024). However, we must

recognize that the current cultivation role of digital rural construction in the agricultural economic resilience system is crucial. With the rapid development of science and technology and the arrival of the digital era, rural areas are also facing the opportunities and challenges of using digital technology to enhance agricultural economic resilience. The construction of digital villages can promote the diversified development of the rural economy. Through the application of digital technology, rural areas can diversify their economic activities and not only rely on traditional agricultural production. For example, through e-commerce platforms, farmers can directly communicate with urban consumers and sell agricultural products, thus broadening the channels and markets of the rural economy. In addition, digital technology can help rural areas develop industries such as agro-tourism integration and agricultural product processing, improving the diversification and sustainability of the rural economy. The construction of a rural digital financial system is also an important part of the resilience of the agricultural economy. The application of digital financial technology can provide more convenient and secure financial services and help farmers solve financing problems. For example, through digital financial tools such as mobile payments and e-banking, farmers can conveniently carry out financial activities such as payments, loans and insurance, improving the coverage and efficiency of rural financial services. In addition, digital financial technologies can provide risk management tools to help farmers cope with uncertainties such as natural disasters and market fluctuations, enhancing the risk-resistant capacity of the agricultural economic system. In addition, accelerating the construction of rural information infrastructure is also an important measure to ensure the security of the agricultural economic system. Rural areas cannot do without the support of high-speed Internet and communication networks in the digital era. Therefore, the construction of high-speed Internet and communication infrastructure that adequately covers rural areas and provides a stable network connection and information exchange platform is crucial to strengthening the connection between rural areas and the outside world and promoting the innovation and development of the rural economy. At the same time, the improvement of rural information infrastructure can also provide real-time agricultural information and market dynamics to help farmers make more informed decisions and improve the coping capacity of the agricultural economic system. Digital rural construction plays an important role in cultivating the resilience system of the agricultural economy. We should continue to improve the diversification of the rural economy, strengthen the construction of the rural digital financial system, as well as accelerate the construction of rural information infrastructure, in order to provide strong support for ensuring the security and stability of the agricultural economic system. In the future, we also need to further study and explore the specific impacts and mechanisms of digital rural construction on the resilience of the agricultural economy, so as to realize the sustainable development of rural areas and the long-term stability of the agricultural economy. However, it must be noted that it is still necessary to pay attention to the important nurturing role of digital rural construction in the agricultural economic resilience system, continuously improve the construction of rural economic plurality and rural digital financial system, and further accelerate the construction of rural information infrastructure, so as to provide strong support for guaranteeing the security of the agricultural economic system (Pengfei Zhou and Meihong Li 2023).

To summarize, the existing literature has provided the basis and reference for further research on the text, which is profoundly inspiring, but there are still shortcomings. First, although the concept of resilience has been introduced into the research field of agricultural economic issues, the main research results are still concentrated in foreign countries. Secondly, the existing research on the resilience of the agricultural economy has neglected the role of digital technology in cultivating the resilience system of the agricultural economy. In view of this, this project makes corresponding improvements, based on the panel data of 30 provinces in China from 2013 to 2023, measures the development level of digital technology and agricultural economic resilience by entropy value method, and empirically analyzes the indirect and direct influence mechanism of digital technology on agricultural economic resilience by using the two-way fixed effect model and the systematic GMM model to reveal the intrinsic connection between the two, in order to fully unleash digital technology's

impact on agricultural economic resilience and to provide the best solution for the development of agricultural economic resilience. and then reveals the intrinsic connection between the two, providing practical significance for fully releasing the digital dividend to help rural revitalization and promote stable economic development.

3. MECHANISM OF ACTION ANALYSIS

3.1. Digital Technology to Enhance Agricultural Productivity

Digital technology plays an important role in enhancing the efficiency of agricultural production. Through the application of digital technology, the planting, breeding and management aspects of the agricultural production process can be automated and intelligentized, thereby improving production efficiency and quality. For example, using technologies such as sensors and drones, factors such as soil moisture, light intensity and climate change can be monitored in real time, and irrigation and fertilization can be precisely controlled to meet the growth needs of crops, reducing the waste of resources and environmental pollution. At the same time, using technologies such as big data and artificial intelligence, crop growth can be accurately predicted and managed to improve the yield and quality of agricultural products. In addition, digital technology can provide real-time monitoring and management of the agricultural production process, help farmers find and solve problems in time, and improve the efficiency and stability of agricultural production. Through the application of digital technology, it can realize the fine management of agricultural production, maximize the utilization of agricultural resources, improve the income level of farmers, and promote the sustainable development of the agricultural economy. Through the application of digital technology, the planting, breeding, management and other aspects of the agricultural production process can be automated and intelligentized, thus improving production efficiency and quality. For example, using technologies such as sensors and drones, factors such as soil moisture, light intensity and climate change can be monitored in real time, and irrigation and fertilization can be precisely controlled to meet the growth needs of crops, reducing the waste of resources and environmental pollution. At the same time, using technologies such as big data and artificial intelligence, crop growth can be accurately predicted and managed to improve the yield and quality of agricultural products. In addition, digital technology can provide real-time monitoring and management of the agricultural production process, help farmers find and solve problems in time, and improve the efficiency and stability of agricultural production. Through the application of digital technology, it can realize the refined management of agricultural production, maximize the utilization of agricultural resources, improve the income level of farmers, and promote the sustainable development of the agricultural economy. Therefore, the application of digital technology has great potential and importance in enhancing the efficiency of agricultural production. Therefore, the application of digital technology has great potential and importance in enhancing the efficiency of agricultural production.

3.2. Digital Technology Optimizes Resource Allocation

The application of digital technology in agriculture optimizes the allocation of resources, thereby improving the efficiency and sustainability of agricultural production. Specifically, the application of digital technology has played a positive role in the following aspects: through the support of digital technology, accurate management of land can be realized. Using technologies such as satellite remote sensing and geographic information systems (GIS), farmland can be accurately mapped and analyzed to understand the characteristics and potential of the land. Based on this information, farmers can carry out refined land use planning, rationally allocate the planting areas of different crops, and maximize the production potential of land resources. In addition, digital technology can provide data on soil quality and nutrient status, helping farmers to formulate scientific fertilizer application and soil management strategies to reduce nutrient wastage and environmental pollution. The application of digital technology can realize the economical use of water resources. Precise monitoring and

control of soil moisture and crop water demand can be realized through sensor technology and intelligent irrigation systems. Farmers can carry out precise irrigation based on real-time data to avoid over-irrigation and waste of water. In addition, digital technology can provide weather forecasts and rainfall data to help farmers rationally arrange the time and amount of irrigation, maximize the use of rainwater resources, and reduce dependence on groundwater. The application of digital technology can realize the efficient deployment of labor. Through the application of agricultural mechanization and automation equipment, the burden of physical labor on farmers can be reduced and labor productivity increased. For example, the use of automated seeders and harvesters can save labor costs and increase operational efficiency. At the same time, digital technology can also provide a management and scheduling system for agricultural labor, helping farmers rationally arrange human resources and improve the efficiency of labor utilization. The application of digital technology optimizes the allocation of agricultural resources and improves the utilization efficiency of land, water resources and labor. Through precise management of land, economical use of water resources, and efficient deployment of labor, agricultural production can be more sustainable, reduce resource waste and environmental burden, and improve farmers' income and the resilience of the agricultural economy. The role of digital technology in optimizing resource allocation will make an important contribution to the sustainable development of agriculture.

3.3. Digital Technology Improves the Environment for Agricultural Production

Digital technology plays an important role in improving the agricultural production environment. Through the application of digital technology, farmers can obtain accurate meteorological information, pest and disease early warning and monitoring data, etc., so that they can better understand the changes and potential risks in the agricultural production environment and take appropriate measures for prevention and management. Digital technology enables climate monitoring and prediction. Through technologies such as weather sensors and weather stations, farmers have real-time access to weather data on temperature, humidity, precipitation and wind speed. These data can help farmers understand the trends and patterns of climate change, predict the best time to grow crops, and rationalize planting and harvesting schedules. In addition, digital technology can also provide agricultural weather services, offering personalized weather forecasts and agricultural weather guidance to farmers to help them make scientific decisions and reduce losses caused by climate change. Digital technology can realize the monitoring and early warning of pests and diseases. By installing equipment such as sensors and cameras, farmers can monitor their farmland in real time and detect signs of pests and diseases in a timely manner. Digital technology can also be combined with image recognition and artificial intelligence technology to identify and analyze pests and diseases, helping farmers take early control measures. In addition, digital technologies can provide pest and disease early warning systems, which analyze historical data and model predictions to warn farmers in advance of the risk of pests and diseases they may encounter and help them take preventive measures to reduce the impact of pests and diseases on crop yield and quality. The application of digital technology has improved the agricultural production environment. Through real-time monitoring of climate and pest and disease conditions, timely warning and taking appropriate measures, farmers can reduce production risks, minimize yield losses and improve the resilience of the agricultural economy. The role of digital technologies in improving the agricultural production environment will provide important support for sustainable agricultural development and food security.

3.4. Digital Technology for Upgrading the Agricultural Industry

Digital technology plays an important role in promoting the upgrading of the agricultural industry. Through the application of digital technology, the agricultural industry can realize the transformation from traditional agriculture to modern agriculture and promote the development of agriculture in the direction of high-end and quality. Digital technology can optimize the layout of the agricultural

industry. Through data analysis and market research, agricultural producers can understand market demand and consumer preferences, and adjust the structure of agricultural industry according to market demand. The application of digital technology can provide market information and big data analysis to help agricultural producers make scientific decisions and choose agricultural products and agricultural production modes suitable for market demand. By optimizing the layout of the agricultural industry, the added value and market competitiveness of agricultural products can be improved, and the upgrading and transformation of the agricultural industry can be realized. Digital technology can make up for the short board of the agricultural industry chain. Through the support of digital technology, agricultural producers can realize the tracing and traceability of agricultural products and optimize supply chain management. The application of digital technology can provide support for the standardization, packaging and quality control of agricultural products and improve the quality and safety of agricultural products. In addition, digital technology can realize the seamless connection between agricultural production and agricultural product processing, logistics and marketing, improve the synergistic effect of the agricultural industry chain, and increase added value and profit margins. The application of digital technology promotes the enhancement of the resistance, adaptability and innovation of the agricultural economic system. Through the support of digital technology, agricultural producers can quickly access market information and technical knowledge, and timely adjust agricultural business strategies and production methods. Digital technology can also provide innovative tools and platforms to promote agricultural technology innovation and the innovative development of agricultural enterprises. Through the application of digital technology, agricultural producers can better cope with market changes and uncertainty, and enhance the resilience and competitiveness of the agricultural economic system. The application of digital technology promotes the upgrading and transformation of the agricultural industry. By optimizing the layout of the agricultural industry, making up the short boards of the industrial chain and enhancing the capacity of the agricultural economic system, digital technology has promoted the development of agriculture in the direction of high-end and quality, providing important support for the sustainable development of the agricultural industry.

3.5. Digital Technology to Enhance Farmers' Technological Capacity

The application of digital technologies in agriculture has great potential to help farmers increase productivity, reduce costs, and improve the quality of agricultural products. However, in order to realize these potentials, farmers need to have the appropriate technical skills and knowledge. In order to enhance farmers' technical capabilities, training and education need to be strengthened first. By conducting training courses on digital technology for farmers, we can help them understand the basic principles, operation methods and application scenarios of digital technology. The training can include the use of digital agricultural management systems, the operation of smart farm machinery, and agricultural product traceability technology. Some practical operations and case studies are organized so that farmers can master the application skills of digital technology through practice. In addition to training, it is also crucial to raise farmers' awareness and acceptance of digital technologies. Successful cases of digital technology in agriculture can be publicized and promoted to let farmers understand the great potential and practical effects of digital technology. At the same time, some on-site observation activities can be organized to invite farmers to visit agricultural demonstration bases where digital technology has been applied, so that they can witness the benefits brought about by digital technology. The government and relevant organizations can also provide some support measures to help farmers upgrade their technological capabilities. For example, specialized training bases for digital technology can be set up to provide farmers with free or low-cost training courses. At the same time, some financial support can be provided to encourage farmers to purchase digital technology equipment and software to promote the development of digital agriculture. Increasing farmers' awareness and acceptance of digital technology through enhanced training and education can improve their technical skills and enable them to better apply digital technology to enhance the resilience of the agricultural economy. The application of digital technology will help farmers

modernize their agricultural production, improve the competitiveness of agricultural products and promote the sustainable development of the agricultural industry.

4. EMPIRICAL STUDIES

4.1. Data Sources

This study selects statistical data from 30 provinces in China (excluding Hong Kong, Macao and Taiwan) from 2013 to 2023. These data were obtained from China Statistical Yearbook, China Rural Statistical Yearbook, China Insurance Yearbook, China Financial Statistical Yearbook, China Rural Financial Services Report, China Agricultural Products Processing Industry Yearbook, as well as the National Greenhouse Data System and provincial statistical yearbooks. For individual missing data, interpolation was used to supplement.

4.2. Variable Selection

First, variable selection is performed. Explained variable. The level of agricultural economic resilience (Qua), this project draws on relevant references and combines the characteristics of agricultural economic resilience to construct an evaluation index system from the three dimensions of resistance (Quad), recovery (Quah) and transformation and innovation (Quac), and uses the stochastic frontier function model to measure it. Core explanatory variables. Digital technology development level (Digit), drawing on the digital economy development index measurement method constructed by Zhao Tao et al. The level of digital technology development is measured using the entropy method by adopting the five indicators, namely, Internet penetration rate, percentage of digital information technology employees, cell phone penetration rate, per capita telecommunication service volume and China's Digital Inclusion Index, respectively.

4.3. Modeling

The goal of this project is to control for causal estimation of unit and time fixed effects in order to avoid omitted variable bias and exogeneity problems. To achieve this goal, we will use a two-way fixed effects model. The two-way fixed effects model is a widely used model for panel data analysis. It allows for more accurate estimation of causality by controlling for unit and time fixed effects. The basic assumption of the model is that the effect of any unobserved factor on the dependent variable is constant under the control of unit and time fixed effects. Based on the above analysis, we construct the two-way fixed effects model as follows:

$$Y_{it} = \alpha + B_1 X_{it} + B_2 Z_{it} + \varepsilon_{it}$$

Where, Y_{it} denotes the observed value of the dependent variable, X_{it} and Z_{it} denote the observed value of independent variable 1 and independent variable 2, respectively. α is the constant term, β_1 and β_2 are the coefficients of independent variable 1 and independent variable 2. ε_{it} denotes the error term. By using to fixed effects model, we can control for unit and time fixed effects and thus accurately estimate the effect of the independent variables on the dependent variable. In this way, we can avoid the problems of omitted variable bias and exogeneity and improve the accuracy and reliability of the model.

In practical application, we will use panel data for estimation and statistical tests to verify the validity and significance of the model. By evaluating and interpreting the model, we can draw conclusions about causality and provide strong support for further research and policy formulation . Based on the above analysis, the relevant model is constructed as follows:

$$\mathrm{Qua}_{it} = \alpha + \beta_1 \mathrm{Digit}_{it} + \gamma_i \mathrm{X}_{it} + \alpha_i + \theta_t + \varepsilon_{it}$$

Where, α is the intercept term, ε_{it} is the random error term, $Digit_{it}$ is the explanatory variable digital technology level, Qua_{it} is the explanatory variable agricultural economic resilience, X_{it} is a set of control variables, and α_i and θ_t are province and year fixed effects, respectively.

Based on the original model, the following mediation effect model was further constructed to test the mediating role of other variables:

$$Mediatgr_{it} = \theta_0 + \theta_1 Digit_{it} + \theta_2 X_{it} + \alpha_i + \theta_t + \varepsilon_{it}$$

$$Qua_{it} = \gamma_0 + \gamma_1 Digit_{it} + \gamma_2 Mediator_i t + \gamma_3 X_{it} + \alpha_i + \theta_0 + \varepsilon_{it}$$

Where, α is the intercept term, ε_{it} is the random error term, $Digit_{it}$ is the explanatory variable digital technology level, Qua_{it} is the explanatory variable agricultural economic resilience, X_{it} is a set of control variables, and α_i and θ_t are province and year fixed effects, respectively.

Finally, we need to perform a model test on the constructed two-way fixed effects model. This step aims to verify the robustness of the model and to investigate the heterogeneity of the model.

To test the robustness of the model, the following steps are taken. First, the time window can be shortened, e.g., by reducing the time window to one-half or one-quarter, and the regression analysis is re-run. The sensitivity of the model to the time window is assessed by comparing the new regression results with the original regression results. Second, replace the independent variables, e.g., replace independent variable 1 with other relevant variables and run the regression analysis again. The sensitivity of the model to the independent variables is assessed by comparing the results of the different regressions. Finally, tail reduction is performed, e.g., truncating or tail trimming the dependent and independent variables, and the regression analysis is performed again. By comparing different regression results, the sensitivity of the model to extreme observations can be assessed. Through these steps, the robustness of the model is verified and the reliability of the model in different situations is confirmed. In order to study the heterogeneity of the model, the spatial zoning of our country is taken into account. The sample data are divided into different regions according to the spatial zoning of China, and regression analysis is performed separately. By comparing the regression results of different regions, the influence and heterogeneity of spatial factors on the model are explored. For example, the coefficient differences between different regions are compared, as well as the heterogeneity in the interpretation of the model. In this way, a more comprehensive understanding of the heterogeneity of the model is gained and a more accurate basis for further research and policy formulation is provided. The results of the two-way fixed effects model are more fully assessed and interpreted by conducting model tests. In this way, the robustness of the model is ensured and the heterogeneity of the model is examined in depth, providing a reliable basis for further analysis and policy making.

5. CONCLUSIONS AND SUGGESTIONS

The impact mechanism of digital technology on agricultural economic resilience is the focus of this paper. On this basis, this paper defines agricultural economic resilience as the resistance recovery capacity, adaptation adjustment capacity and transformation innovation capacity of the agricultural economic system, and studies the impact of digital technology on agricultural economic resilience from multiple perspectives. Through theoretical analysis and empirical research, this paper draws some conclusions. Overall, digital technology can significantly enhance the regional agricultural economic resilience. At the regional level, digital technology in the western region can significantly promote the enhancement of agricultural economic resilience, but the effect of digital technology on the enhancement of agricultural economic resilience in the east-central region is not obvious. Digital technology can improve the agricultural economic resilience of the region by promoting the

upgrading of the industrial structure of the provinces. In addition, there is an obvious threshold effect of the enhancing effect of digital technology on agricultural economic resilience. Specifically, in regions where the level of digital technology is below the threshold, the enhancing effect of digital technology on agricultural economic resilience is significant. Digital technology has a significant role in enhancing agricultural economic resilience. However, this role may vary in different regions, and the enhancing effect of digital technology is also affected by the threshold effect. Therefore, in order to give full play to the role of digital technology in agricultural economic resilience, policies and measures need to be formulated according to specific regions.

In addition, digital technology has a positive impact on agricultural economic resilience by improving agricultural production efficiency, optimizing the allocation of agricultural resources and improving the agricultural production environment. First, the application of digital technologies can improve agricultural production efficiency, including the automation and intelligence of planting and farming, as well as the optimization of production processes such as precise fertilization and watering. This can help improve the yield and quality of agricultural products and increase farmers' income, while reducing resource waste and environmental pollution. Secondly, digital technology can optimize the allocation of agricultural resources, including the rational use of land, water resources and labor. Through the application of digital technology, the precise management of land, the economical use of water resources and the efficient deployment of labor can be realized, so as to improve the efficiency of resource utilization and the sustainability of agricultural production. In addition, digital technology can improve the agricultural production environment, including the application of climate monitoring, pest and disease early warning. Through the support of digital technology, farmers can keep abreast of climate change and pests and diseases, so that they can take appropriate measures to prevent and control them, reduce yield losses and improve the resilience of the agricultural economy. The application of digital technologies to agricultural economic resilience faces a number of challenges. First, the application of digital technologies requires farmers to have appropriate technical skills and knowledge. In some areas, farmers' digital technology capacity and education level are relatively low, which limits the role of digital technology in agricultural economic resilience. Second, the application of digital technologies also requires appropriate infrastructure support, including broadband network coverage and electricity supply. In some rural areas, infrastructure development is relatively lagging behind, which constrains the popularization and application of digital technologies. In addition, the application of digital technology also requires reasonable policy and mechanism support, including financial support, technical support and policy guidance. Only through comprehensive policies and measures can the role of digital technology in agricultural economic resilience be fully realized.

The impact of digital technologies on the resilience of the agricultural economy is multifaceted. Through their application in improving agricultural production efficiency, optimizing resource allocation and improving the production environment, digital technologies can significantly enhance the resilience of agricultural economies. However, the application of digital technologies in agricultural economic resilience still faces a number of challenges and requires the joint efforts of governments, enterprises and farmers to strengthen technical training, infrastructure development and policy support in order to promote the widespread application of digital technologies in agricultural economic resilience.

Based on the above research and analysis, this paper makes the following recommendations to enhance the resilience of the agricultural economy:

First, strengthen the application of digital technology in the management of agricultural economic resilience. It has established a sound risk early warning and prevention mechanism, utilized the advantages of digital villages to improve the ability of agricultural entities to perceive risks, and strengthened information sharing to provide accurate information support for farmers. The government should increase its efforts to support the construction of digital villages, especially

focusing on the development of areas lagging behind in the development of the digital economy, so as to provide long-term support for the security of the agricultural industry.

Secondly, we should focus on regional differences and promote the construction of digital villages according to local conditions. It is necessary to promote the synergistic development of the digital economy according to the development differences of different regions, and give full play to the driving effect of the eastern region on the central and western regions. The eastern region should encourage talents to return to their hometowns to start their own businesses, cultivate local digital specialized farmers, and continue to promote the construction of digital villages. The central and western regions should learn from the experience of the eastern regions, introduce high-end technologies and talents, develop the digital economy based on their own advantages, and promote high-quality agricultural development.

Thirdly, we should strengthen multi-principal cooperation and promote the upgrading of the rural industrial structure. The application of digital technology is one of the most important ways to promote the resilience of the agricultural economy, and it is necessary to focus on the role of digital infrastructure in cultivating the resilience of the agricultural economy, establish agricultural data platforms for colleges and universities, the government and enterprises, and promote cooperation and sharing. Through the integration of platform data, optimize the industrial layout, promote the development of agriculture in the direction of high-end and quality, and enhance the resistance, adaptability and innovation capacity of the agricultural economic system.

Fourthly, digital technology capacity building and knowledge dissemination should be strengthened. Farmers are the mainstay of the agricultural economy, and upgrading their digital technology capacity is crucial to promoting the development of a resilient agricultural economy. The government should strengthen training and education to provide knowledge and skills related to the application of digital technology. At the same time, it is necessary to strengthen the popularization and publicity of digital technology, improve farmers' knowledge and acceptance of digital technology, and encourage farmers to actively apply digital technology to enhance the resilience of the agricultural economy.

Fifthly, policy support and innovative mechanisms should be strengthened. The Government should formulate relevant policies to support the construction of digital villages and the enhancement of the resilience of the agricultural economy. It should encourage enterprises to invest in the field of digital technology and promote the development of digital agriculture. At the same time, it is necessary to establish an innovative mechanism to promote the deep integration of digital technology and the agricultural economy. Encourage all parties to explore new modes and paths of digital technology in the enhancement of the resilience of the agricultural economy, and promote the continuous innovation and transformation and upgrading of the agricultural economy.

Through the implementation of the above measures, the resilience of the agricultural economy can be effectively enhanced, the sustainable development of the agricultural industry can be promoted, and a positive contribution can be made to the realization of the goals of the rural revitalization strategy.

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