Based on Residents' Mental Health Perspective: A Study on the Spatial Spillover Effects of Rural Digitalization on China's Agricultural and Rural Modernization

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Abstract: This study utilizes panel data from 30 provincial-level regions in China from 2011 to 2023 to investigate the impact effects, underlying mechanisms, and spatial distribution characteristics of rural digitalization on agricultural and rural modernization. Methodologically, the entropy weight method quantifies rural digitalization and agricultural modernization levels. A fixed-effects model tests their relationship and operational mechanisms, while spatial econometric models and Moran's I index analyze spatial clustering effects. Findings reveal that driven by increased investment in agricultural technological innovation, rural digitalization continuously advances agricultural and rural modernization, optimizing rural governance and improving residents' living standards. Simultaneously, the study uncovers significant spatial clustering and regional disparities in agricultural modernization. Rural digitalization not only promotes coordinated development among neighboring areas and alleviates livelihood pressures but may also trigger a "siphon effect" in developed regions. The conclusion emphasizes the need to accelerate rural digital infrastructure development, improve regional coordination mechanisms, strengthen talent recruitment, and optimize ecological governance. These measures will enhance farmers' incomes while safeguarding their physical and mental health and quality of life.

Keywords: Rural Digitalization; Agricultural and Rural Modernization; Spatial Econometrics; Physical-Mental Health

1. Introduction

In the process of modernization development, multiple factors work in concert, among which the particularly important ones include: digital technological innovation, industrial structure upgrading, effective rural governance, ecologically livable environments, and enriched spiritual and cultural life. Foremost, digital technologies characterized by intelligent inter connectivity transcend extemporization constraints and reduce information interaction costs, progressively emerging as the core driver of agricultural transformation and upgrading. Second, the rural revitalization strategy, anchored in industrial development, is crucial for addressing the issues related to agriculture, rural areas, and farmers in China. By establishing integrated industrial chain systems and facilitating value chain upgrading, this strategy attracts youth back to rural areas, enhances scientific and technological literacy, and effectively increases farmers' income [1], thereby consolidating the material foundation for agricultural and rural modernization. Critically, farmers serve as the authentic agents and ultimate beneficiaries of rural revitalization. Their comprehensive development—encompassing economic income, scientific and technological literacy, enhanced social status, spiritual and cultural enrichment, and physical well-being—represents the paramount objective of this modernization process.

2. Theoretical Research and Research Hypotheses

2.1 Influence Mechanism of Rural Digitalization on Agricultural and Rural Modernization

Accordingly, agricultural informatization is powerfully propelling the transformation of agricultural production toward precision and intelligence. empirically tested using a panel regression model that digital technologies can promote the integration of agriculture with e-commerce and logistics, accelerate the transformation of agricultural scientific and technological achievements [2], and form a virtuous cycle of “technology research and development—application—iteration” [3]. The popularization of digital technologies in rural areas has prompted farmers to shift from traditional experience-driven production to data-driven decision-making, significantly enhancing their capabilities to access information and apply technologies . As the core engine of agricultural and rural modernization, scientific and technological innovation exerts far-reaching impacts across multiple dimensions: First, it significantly enhances agricultural development efficiency by transforming traditional agricultural production methods and management systems.

Second, it enhances basic rural living facilities, improves the ecological environment, and furthermore strengthens the public service system. Third, it drives the optimization and upgrading of rural industrial structures, broadens employment channels for farmers, increases residents' income, satisfies diversified consumption demands, and improves the quality of farmers' spiritual, psychological, and material lives. Based on the above reasoning, this study proposes the following hypotheses:

Hypothesis H1: Rural digitalization can directly exert a positive impact on China's agricultural and rural modernization.

Hypothesis H2: Rural digitalization can generate positive effects on the construction of agricultural and rural modernization through investments in scientific and technological innovation.

2.2 Spatial Spillover Effect of Rural Digitalization on Agricultural and Rural Modernization

When facing traditional production factors different from land and labor, data factors can break through spatial limitations and exhibit strong mobility, thus demonstrating obvious spatial agglomeration and diffusion effects. Affected by differences in regional development levels, the spatial distribution of digital technologies shows obvious imbalance. Regions with complete infrastructure often take the lead in forming technological agglomeration advantages, driving the diffusion and spillover of economic factors, and exerting positive impacts on surrounding areas. Under the aforementioned background, rural digital transformation can not only enhance the regional development level but also drive the development of neighboring cities through spatial effects.However, between large cities, considering policy management and application levels, there may be phenomena that hinder the exchange and cooperation of the digital economy [4], putting other regions in a relatively disadvantageous position, causing resource misallocation, and presenting a siphon effect. Based on the aforementioned context, a new hypothesis can be proposed:

Hypothesis H3: The development of rural digitalization exhibits positive spatial spillover effects, which can drive the development of neighboring areas.

3. Research Design

3.1 Model Specification

3.1.1 Benchmark model

Based on the aforementioned theoretical foundation, the following regression model is constructed:

$$MAR_{i,t} = \alpha_0 + \alpha_1 RDL_{i,t} + \alpha_2 CVs_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \quad (1)$$

Among them, $MAR_{i,t}$ represents the level of agricultural and rural modernization construction in city i during period t; $RDL_{i,t}$ denotes the development level of rural digitalization in city i during period t; $CVs_{i,t}$ reflects a series of control variables at the regional level that may affect agricultural and rural modernization construction; μ_i represents the city control effect; δ_t represents the time fixed effect; $\varepsilon_{i,t}$ indicates the random disturbance term; and α_0 denotes the model intercept term.

3.1.2 Spatial model

To verify H_3, a Spatial Durbin Model (SDM) is constructed. Using W1 as the economic weight matrix and W2 as the adjacency weight matrix, the model is specified as follows:

$$MARi,t = \vartheta 0 + \rho WMARi,t + \theta 1WRDLi,t + \theta 2WCVsi,t + \vartheta 1RDLi,t + \vartheta 2CVsi,t + \mu i + \delta t + \varepsilon i,t \quad (2)$$

3.2 Data and Variable Description

3.2.1 Dependent variable

China's Agricultural and Rural Modernization (MAR): Referencing the measurement of China's agricultural and rural modernization by

Guo [5] et al (2024), the entropy weight method is adopted to calculate the provincial comprehensive index of agricultural and rural modernization, including: (1) Agricultural modernization. Production modernization includes the degree of agricultural mechanization, agricultural labor productivity, and the level of farmland water conservancy; operation modernization includes the flow of arable land, the volume of import trade of agricultural products, and the level of expenditure on agricultural, forestry, and water affairs [6]; output modernization includes the volume of export trade of agricultural products, the share of agricultural output, and the average grain output per mu; green modernization includes the volume of pesticides per unit area, fertilizer folding, and the amount of agricultural film used (negative attributes), and the livestock and poultry manure Comprehensive utilization rate. (2) Rural modernization. Environmental modernization encompasses indicators related to domestic sewage and household waste, as well as the coverage rates of rural roads and green spaces. cultural modernization includes the level of investment in sports and recreation, and the number of cultural stations in townships and villages; and governance modernization includes the proportion of administrative villages that have compiled village planning or remediation, and the amount of carbon emissions from agriculture (a negative attribute) [7]. (3) Modernization of Farmers. Modernization of consumption encompasses residents' spending power, healthcare, food expenditures, housing and vehicle ownership, and income levels.

3.2.2 Independent variable

Rural Digitalization Level (RDL). Existing studies demonstrate significant divergence in constructing measurement systems for rural digital technologies, with no established consensus. Drawing on seminal works by Yin et al. we develop a multidimensional evaluation framework: (1) Digital Infrastructure Foundation for Agriculture and Rural Areas encompasses: Internet penetration rate, Mobile network coverage density, Terrestrial fiber-optic coverage rate, Fixed-asset investment in computer services/software sectors, Capital formation in transportation or warehousing or postal sectors. (2) Production Digitalization encompasses: IoT-enabled monitoring of production environments, Electrification rate of agricultural systems, Digitalized agricultural demonstration bases. (3) Operational Digitalization encompasses: Enterprise website density, Participation rate in e-commerce, E-commerce sales value, E-procurement volume. (4) Logistics Digitalization encompasses: Postal service accessibility index, Per capita retail volume of consumer goods, Rural logistics network density, Village postal service coverage rate. (5) Digital Service Penetration encompasses: Per capita digital infrastructure investment, Digital payment transaction metrics, Transport or communication expenditure intensity.

3.2.3 Mediating variable

Investment in Scientific and Technological Innovation [2] (LNTIL): Defined as the total per capita expenditure on science and technology in each province, processed by logarithmic transformation.

3.2.4 Control variables

Taking into account the influence of other factors, this study incorporated control variables that may affect the regression results: (1) Urbanization Rate (URB). (2) Rural Average Years of Education (RED). (3) Employment Rate in Primary Industries (ERI): The ratio of the number of people employed in primary industries to the total rural population is obtained. (4) Rural Financial Development (RFD) is measured by the per capita agricultural-related loans of rural residents. (5) Fixed Asset Investment (FAI) is measured by the per capita fixed asset investment of rural residents. (6) Fiscal Support Intensity (FIN) is defined as the ratio of provincial government general expenditure to Gross Domestic Product (GDP).

3.2.5 Data sources

This study examines 30 provinces in China from 2011 to 2023. The data used are sourced from the China Rural Statistical Yearbook, China Statistical Yearbook on Transportation and Post and Telecommunications, CNKI Patent Database, China Economics Statistical Database, provincial statistical yearbooks, and the China Economic and Social Big Data Research Platform. In the Sobel test and Goodman test, the values in parentheses are Z-scores. In the Bootstrap test, the value before [] is the P-value, and the values inside [] are the bias-corrected confidence intervals at a 90% confidence level.

4. Empirical Analysis

4.1 Baseline Regression

First, trim the 1% and 99% tails for all continuous variables [8]. Second, the Variance Inflation Factor (VIF) was used to analyze all explanatory and control variables. The results showed that all VIF values were below 10, with an average of 1.92, indicating no multicollinearity issue. Finally, we conducted a regression analysis on the model, controlling for fixed time and individual effects. See the report results in Table 1. Based on the results of the above table, it can be seen that rural digitalization plays a positive role in promoting the modernization of agriculture and rural areas in China. with regression coefficients significantly positive. This validates Hypothesis 1 above, confirming that rural digitization can exert positive impacts on agriculture, rural areas, and farmers. As the true subjects and beneficiaries, farmers' physical and mental health represent the ultimate goal.

Table 1. Baseline Regression and Mediation Mechanism Test Results

Variable	Baseline Regression			Mediation Mechanism		
	(1) MAR	**(2) MAR**	**(3) MAR**	**(1) MAR**	**(2) LNATI**	**(3) MAR**
RDL	1.8152^{***}	0.5771^{***}	0.4963^{***}	0.8323^{***}	12.2260^{***}	0.6170^{***}
	(6.5277)	(2.7859)	(5.3638)	(14.4668)	(14.6264)	(8.8701)
TIL						0.0176^{***}
						(5.1667)
Sobel Test for Mediation Effect				0.01439^{***}(5.373) Mechanism Valid—Positive Transmission		
Indirect effect test (P-value)				0.000 [0.0096,0.0250] Indirect Effect Holds		
Direct effect test (P-value)				0.000 [0.0101,0.0251] Direct Effect Holds		
Control Variable	no	no	yes	yes	yes	yes
Year and Region Fixed Effects	no	yes	yes	yes	yes	yes
Constant Term	0.1286^{***}	0.1352^{***}	-0.1747^{***}	0.1330^{***}	16.8387^{***}	-0.1635^{***}
	(3.9737)	(10.6948)	(-5.7459)	(9.0885)	(79.1849)	(-2.7662)
R^2	0.3641	0.9792	0.9909	0.9169	0.8460	0.9222
number	390	390	390	390	390	390

4.2 Mechanism Identification

To test Hypothesis 2 proposed earlier, this study employs a mediation effect model to empirically examine the transmission mechanism. The stepwise regression method is used for testing, supplemented by Sobel test, Goodman test, and Bootstrap test to ensure result accuracy. As shown in Table 2: compared with Model (1), the regression coefficient of rural digitization level in Model (3) significantly decreases, and the results of Sobel test, Goodman test, and Bootstrap test all confirm the effectiveness of the mediating variable, verifying the robustness of the findings. Therefore, the mediating effect holds. Rural digitization drives agricultural and rural modernization by enhancing investment in scientific and technological innovation, which validates Hypothesis 2.

Table 2. Robustness Checks

Variable	Systematic Impacts of Macroeconomic Factors		Instrumental Variables Approach		Exogenous Policy Shocks			
	(1) MAR	**(2) MAR**	**(1) RDL**	**(2) MAR**	**(1) MAR**	**(2) MAR**	**(3) LNTIL**	**(4) MAR**
RDL	0.4963^{***}	0.5125^{***}		1.0169^{**}				
	(5.3638)	(7.6618)		(2.28)				
DID					0.0389^{***}	0.0165^{***}	0.2461^{***}	0.0115^{**}
					(4.2139)	(3.5126)	(2.8190)	(2.6448)
IV			0.0276^{***} (10.12)					
LNTIL								0.0203^{**}
								(2.5093)
Id × Year	NO	YES	NO	NO	NO	NO	NO	NO
CVs; Id; Year	YES	YES	YES	YES	YES	YES	YES	YES
Constant Term	-0.1747^{***}	-0.0384	-0.1995^{***}	0.1225^{***}	0.1581^{***}	-0.1337^{***}	18.0213^{***}	-0.5003^{***}
	(-5.7459)	(-0.519)	(-7.19)	(3.76)	(28.2764)	(-2.9494)	(22.9974)	(-3.1709)
Anderson's Canonical Correlation LM Statistic (P-value)			82.44(0.00)	82.439 (0.00)				
Cragg-Donald Wald F-statistic			102.39	102.392				
Sample Size	390	390	390	390	390	390	390	390

4.3 Robustness Checks

4.3.1 Systematic impacts of macroeconomic factors

Cities with higher economic development levels have “unique” advantages in the allocation and competition of various resources, which may give rise to endogeneity issues. Therefore, this study controlled for individual and time fixed effects to mitigate the potential impact of the widespread development of the digital economy on the macro-system environment. The results are shown in Table 2 with all variables being significant. Additionally, referring to the research of Huang Qunhui et al. (2019), an interaction term IV was constructed, defined as the ratio of fixed-line telephone subscriptions per 100 people in 1985 to the national internet investment amount of the previous year. IV is significantly positive at the 5% level, indicating that his explanatory power is exceptionally strong. The regression coefficient of rural digitization in the second-stage regression also passed the positive significance test at the 5% level. Additionally, the LM statistic passed the significance test, and the Cragg-Donald Wald F statistic passed the significance test at the 10% level [9]. Taken together, after accounting for endogeneity issues, the regression coefficients of the explanatory variables remained significant, indicating that the selection of instrumental variables was reasonable and the baseline model results exhibited certain robustness.

4.3.2 Exogenous policy shock

Considering the exogeneity of the "Rural Revitalization Strategy" implemented in 2017, the Difference-in-Differences (DID) method was employed to address endogeneity issues, which has passed the parallel trends test. According to the classification criteria of NBS, central and eastern regions were designated as the treatment group, while western and northeastern regions were set as the control group. Table 2 indicates that the Rural Revitalization Strategy has a significant positive impact on agricultural and rural modernization [5] across all provinces nationwide. For the test of the mechanism, compared with Model (3), the coefficient and significance of the difference term of the "Rural Revitalization Strategy" in Model (4) both decrease, and the regression coefficient of investment in scientific and technological innovation is significantly positive [7], this indicates that under these conditions, investment in science and technology plays a significant role in driving modernization. Additionally, to test the extent to which the above results are affected by omitted variables and random factors, an indirect placebo test was conducted by repeating the above process 1,000 times and plotting the distribution of DID estimated coefficients. The results show that the DID estimation results can be excluded from being caused by unobservable factors.

4.4 Spatial Spillover Effects

4.4.1 Model selection

This section employs a spatial econometric model to test Hypothesis 3. Following the testing procedures of spatial econometrics, a spatial autocorrelation test was first conducted on the explanatory variables. Using Stata16.0 software, the global Moran's I index under the economic distance matrix was calculated. Table 3 shows that both variables exhibit spatial agglomeration, indicating that a spatial econometric model can be employed to investigate whether there is a spatial spillover effect of rural digitization on agricultural and rural modernization. As shown in Table 4, under the W1 and W2 matrices, all statistics passed the significance test at the 5% level. The two-way fixed-effects spatial Durbin model was ultimately selected for analysis.

Table 3. Global Spatial Autocorrelation in Agricultural and Rural Modernization

Year	Moran's I	Z-score	Year	Moran's I	Z-score
2011	0.110^{***}	3.328	2018	0.114^{***}	3.419
2012	0.112^{***}	3.359	2019	0.122^{***}	3.612
2013	0.117^{***}	3.485	2020	0.117^{***}	2.033
2014	0.118^{***}	3.495	2021	0.123^{***}	3.619
2015	0.123^{***}	3.622	2022	0.119^{***}	3.521
2016	0.116^{***}	3.463	2023	0.128^{***}	3.737
2017	0.113^{***}	3.394			

Table 4. Identification Test Results for Spatial Econometric Models

Testing Procedures	W1	W2
LM-Spatial lag	27.723^{***}	9.770^{***}
Robust LM-Spatial lag	33.111^{***}	23.785^{***}
LR-Spatial lag	60.84^{***}	47.59^{***}
Wald-spatial lag	64.67^{***}	50.10^{***}
Husman Test	15.41^{***}	116.65^{***}
Likelihood Ratio Test (time)	1277.84^{***}	1284.66^{***}
LM-Spatial error	4.204^{**}	11.729^{***}
Robust LM-Spatial error	9.592^{***}	25.744^{***}
LR-Spatial error	63.77^{***}	56.74^{***}
Wald-spatial error	68.53^{***}	59.85^{***}
Likelihood Ratio Test (space)	102.84^{***}	188.63^{***}

4.4.2 Spatial econometric model testing and result analysis

The results of both Wald and LR tests rejected the null hypothesis. The spatial autoregressive coefficient was positive and passed the significance test, indicating that there is a positive correlation and obvious positive spatial spillover effect in the modernization of agriculture and rural areas among different provinces. That is, an improvement in the modernization level of agriculture and rural areas in one region will promote the modernization level of adjacent regions, which is consistent with the conclusion drawn from the Moran scatter plot. However, the regression coefficients of the spatial matrix cannot be used to measure the spatial spillover effect of variables at this time. To further explore its spatial spillover effects, the partial differentiation method was used to decompose the variables of the SDM into direct effects, indirect effects (spillover effects), and total effects (all with fixed effects and control variables included).

As shown in Table 5, all effects passed the positive significance test at the 1% level under three different spatial models, consistent with the baseline regression results. Specifically, under the SDM (Spatial Durbin Model) economic distance weight matrix (W1), the direct effect coefficient of rural digitization on agricultural and rural modernization was 0.6672, passing the significance test at the 1% level. This indicates that each 1% increase in rural digitization levels leads to a 0.6672% increase in agricultural and rural modernization. The spillover effect coefficient was 0.6708, also passing the 1% significance test, demonstrating that improving rural digitization in the local region has a significantly positive impact on the agricultural and rural modernization of adjacent regions, exhibiting a synergistic development effect. This validates Hypothesis 3 [10].

Table 5. Spatial Regression Results of Rural Digitalization's Impact on Agricultural and Rural Modernization

Model Specification	SEM		SLR		SDM	
Variable	(1) W1	(2) W2	(3) W1	(4) W2	(5) W1	(6) W2
rho	0.2032	0.9534^{***}	0.2885^{***}	0.5677^{***}	0.1741^{***}	0.3435^{***}
DAR	0.8733^{***}	0.5314^{***}	0.8054^{***}	0.7108^{***}	0.6702^{***}	0.5097^{***}
W×DAR					0.4766^{***}	0.0554
Direct Effect			0.8104^{***}	0.7860^{***}	0.6672^{***}	0.5304^{***}
Spillover Effect			0.3125^{***}	0.8405^{***}	0.6708^{***}	0.3129^{***}
Total Effect			1.1230^{***}	1.6265^{***}	1.3480^{***}	0.8433^{***}
Log L	932.06	1052.32	955.698	1006.36	1058.035	1081.811
R^2	0.5725	0.3173	0.2870	0.1965	0.0280	0.0746

5. Main Conclusions and Implications

Using panel data from 30 provinces from 2011 to 2023, this study first measured rural digitization and China's agricultural and rural modernization using the entropy weight method. Secondly, a fixed effects model was employed to investigate the impact of rural digitization on China's agricultural and rural modernization and its mechanism. Finally, relying on Moran’s I index and spatial models, the study explored the spatial agglomeration of rural digitization and agricultural and rural modernization across regions. Through the above analysis, it can be concluded that: First, China's agricultural and rural modernization significantly improved from 2011 to 2023, and rural digitization has significantly promoted this process. Mechanistic analysis shows that rural digitization enhances agricultural and rural modernization primarily by driving agricultural scientific and technological innovation. Second, both rural digitization and agricultural and rural modernization in each province exhibit unbalanced spatial agglomeration. Rural digitization construction can promote agricultural and rural modernization in adjacent regions, but it may have a siphon effect on top-developed areas. Based on the preceding discussion, the following targeted recommendations are proposed: First, promote rural digital construction and optimize new digital infrastructure. (1) Core regions should prioritize the deployment of 5G base stations, gigabit optical networks, etc., to support real-time data interaction for smart agriculture, rural governance, and residential consumption. (2) Marginal areas can use low-orbit satellite communications and mobile base stations to cover signal-blind zones, reducing redundant infrastructure investment and costs. Second, establish regional cooperation mechanisms and upgrade the industrial structure according to local conditions. (1) Establish a coordinated digital rural construction system under central planning and regional coordination. Attract capital and talent from the eastern regions to participate in rural construction in the western regions. Combine local economic levels, geographical environments, natural resources, cultural customs, and other characteristics to create a “digital IP database for characteristic products”. (2) Promote cross-regional experience sharing in digital rural construction. Strengthen digital knowledge education in western rural areas and enhance the promotion of digital technologies, enabling localities to identify innovation points suitable for their industrial development based on limited experience and achieve better industrial transformation and upgrading. Third, introduce digital technology talent and improve digital governance capabilities. Since the disparities in China's agricultural and rural modernization mainly stem from infrastructure construction: Central and western regions should strengthen the construction of new digital infrastructure, expand the service scope of digital technologies, and introduce digital technology talent from various regions. Improve the digital literacy of rural grassroots cadres, enhance digital governance capabilities, modernize digital governance, improve administrative efficiency in rural governance, and meet residents' living needs. (2) Utilizing information technology and big data to fully understand the public service needs of rural residents. Optimize the rural governance environment, improve rural residents' life satisfaction, and facilitate their physical and mental well - being.

References

[1] Tian, J.J. Industrial Choice for Rural Revitalization in the Post-Poverty-Alleviation Era: A Case Study of Lueyang, Shaanxi. Statistics and Decision 2021, 37(15), 166–169. DOI:10.13546/j.cnki.tjyjc.2021.15.037.

[2] Sheng Y, Guosong W. Research on the Efficiency of Green Agricultural Science and Technology Innovation Resource Allocation Based on a Three-Stage DEA Model—A Case Study of Anhui Province, China.International Journal of Environmental Research and Public Health, 2022, 19(20):13683-13683.

[3] Li, M. Practical Research on Agricultural Big Data in Agricultural Economic Management. China Collective Economy 2025, (02):73–76. DOI:10.20187/j.cnki.cn/11-3946/f.2025.02.001.

[4] Ming, C.Q.; Peng, H.L. The High-Quality Development of Digital and Urban Economies and Spatial Spillover Effects: Based on the Empirical Research for 26cities in the Yangtze River Delta. East China Economic Management 2024, 38(10), 25–35. DOI:10.19629/j.cnki.34-1014/f.240203014.

[5] Guo J, Lyu J. The Digital Economy and Agricultural Modernization in China: Measurement, Mechanisms, and Implications. Sustainability, 2024, 16(12):4949-4949.

[6] Xu R, Ding Y, Hao D, et al. The evolution trend, regional differences, and influencing factors of sustainable development efficiency in rural China under the constraint of water and energy. Natural Resources Forum, 2023, 47(4):699-723.

[7] X. Chao, "Measurement and evaluation of science and technology innovation efficiency," 2020 16th Dahe Fortune China Forum and Chinese High-educational Management Annual Academic Conference (DFHMC), Zhengzhou, China, 2020, pp. 30-34, doi: 10.1109/DFHMC52214.2020.00014.

[8] Zhou D, Peng Y, Qiu Y. Depoliticization and environmental, social, and government: Evidence from China's Rule 18. Journal of environmental management, 2025, 376124475.

[9] Cheng P, Wenting F, Xinyu Z, et al. The impact of subscribing to directors’ and officers’ liability insurance on corporate financialization: Evidence from China. Frontiers in Psychology, 2022, 13986135-986135.

[10]Yan Z, Peng L, Wu X. Evaluation System for Agricultural and Rural Modernization in China. Agriculture, 2023, 13(10).

