Research on World Agricultural Economy
https://journals.nasspublishing.com/index.php/rwae

ARTICLE

Impact of Rural Corporate Governance Structure Improvement on Audit Quality in the Context of Digital Transformation of China

Yiyuan Zhang [*] ***, Tze San Ong, Asna Abdullah Atqa***

School of Business and Economics, Universiti Putra Malaysia, Serdang 43400, Selangor, Malaysia

ABSTRACT

This study investigates how digital transformation impacts audit quality through governance structure improvements in rural enterprises. Based on data from 1,826 rural enterprises (2019-2023), we find that digital transformation significantly optimizes governance structures, with each standard deviation increase in digital transformation leading to a 0.254 standard deviation improvement in governance scores. Regional differences are evident, with eastern regions showing higher impact (coefficient 0.312) than central (0.245) and western regions (0.198). Governance optimization enhances audit quality, as each standard deviation increase in governance scores yields a 0.308 standard deviation improvement in audit quality. Governance structure mediates 54.52% of digital transformation's effect on audit quality, with stronger effects in large enterprises (coefficient 0.385). Regional economic development moderates these relationships, with digital infrastructure (interaction coefficient 0.145) and agricultural industrialization (0.132) enhancing governance structure's effect on audit quality. Policy support intensity correlates positively with transformation effectiveness (0.156). These findings provide empirical support for differentiated regional development strategies.

Keywords: Digital Transformation; Rural Enterprise; Corporate Governance; Audit Quality; Regional Economic Development

*CORRESPONDING AUTHOR:
Yiyuan Zhang, School of Business and Economics, Universiti Putra Malaysia, Serdang 43400, Selangor, Malaysia;
Email: yiyuan12341@163.com

ARTICLE INFO
Received: 25 November 2024 | Revised: 4 December 2024 | Accepted: 6 December 2024 | Published Online: 21 February 2025
DOI: https://doi.org/10.36956/rwae.v6i1.1515

CITATION
Zhang, Y., Ong, T.S., Atqa, A.A., 2025. Impact of Rural Corporate Governance Structure Improvement on Audit Quality in the Context of Digital Transformation of China. Research on World Agricultural Economy. 6(1): 526–540. DOI: https://doi.org/10.36956/rwae.v6i1.1515

1. Introduction

In recent years, the digital economy has flourished globally, with digital technology innovation reshaping development patterns across various industries. As a crucial component of the national economy, agricultural and rural digital transformation has become a key driving force for promoting agricultural modernization and rural revitalization. China has achieved remarkable progress in rural digitalization, with continuously increasing internet penetration rates and deepening applications of digital technologies in agricultural production, operation, and management [1].

Currently, Chinese rural enterprises are at a critical stage of digital transformation. Statistics show that by the end of 2023, internet penetration in rural areas reached 84.3%, with the digital agricultural economy exceeding 1.2 trillion yuan, and digital technology applications continuously deepening in areas such as agricultural production, product circulation, and rural finance. However, during their adaptation to digital transformation, rural enterprises face issues such as imperfect governance structures and lagging internal control mechanisms [2]. These problems primarily manifest in several aspects: information asymmetry in rural enterprise governance structures remains prominent, with traditional supervision mechanisms struggling to meet the requirements of the digital era [3]. In the digital environment, while information transmission methods and decision-making models have fundamentally changed, rural enterprises' governance mechanisms have failed to adapt timely, leading to further intensification of information asymmetry. Board decision-making efficiency is low, with significant gaps between governance mechanisms and digital transformation requirements [4]. Most rural enterprises' boards still use traditional decision-making models, failing to fully utilize digital technology to improve decision-making efficiency, which seriously constrains enterprise development speed and innovation capacity. Inadequate internal control systems make it difficult to effectively address risks brought by digitalization [5].

In this context, improving audit quality has become a key approach to optimizing rural enterprise governance structures. High-quality auditing can promote the improvement of enterprise governance structures through external supervision mechanisms [6] while providing professional decision support for enterprise management [7]. A positive correlation exists between good governance structures and audit quality [8]. Digital transformation provides new technical support and methodological innovations for improving audit quality, effectively enhancing audit efficiency and accuracy through means such as big data analysis and intelligent auditing [9].

From a theoretical perspective, this study will enrich enterprise governance theory in the digital economy era. Existing research mainly focuses on urban enterprises or listed companies, with relatively insufficient studies on rural enterprises, particularly regarding governance structures and audit quality in the context of digital transformation [10]. The uniqueness of rural enterprises determines that improving their governance structures and audit quality must consider both the universal laws of digital transformation and the practical conditions of rural economic development [11]. Notably, in the post-pandemic era, the relationship between enterprise governance structures and audit quality exhibits new characteristics [12].

Based on this background, this study, from an agricultural economics perspective, employs multi-dimensional empirical research methods to systematically explore the influence mechanism of digital transformation on rural enterprise governance structures [13]. The research will focus on analyzing the promoting effect of governance structure optimization on audit quality, and further examine the differences in this impact across different regions and enterprise types [14].

The study's innovations are reflected in three aspects: firstly, it combines digital transformation with rural enterprise governance research, filling a gap in existing literature; secondly, it constructs a complete theoretical analysis framework, systematically exploring the relationship among digital transformation, governance structure, and audit quality; finally, through large-sample empirical research, it reveals the regional heterogeneity characteristics of rural enterprise governance optimization. These research findings not only help enrich relevant theoretical research but also provide practi-

cal guidance for promoting rural enterprise digital transformation, improving governance structures, and enhancing audit quality.

2. Theoretical Foundation and Research Hypotheses

2.1. Theoretical Foundation

This study's theoretical foundation encompasses four main aspects: 1) From the perspective of agricultural economic digital transformation theory, the application of digital technology is restructuring agricultural production relations and business models. This theory posits that digital transformation is not merely technological innovation but a systematic change involving production factor recombination, value chain reconstruction, and governance model innovation [15]. In rural enterprises, digital transformation fundamentally influences corporate governance structures and operational mechanisms by altering information transmission methods and optimizing resource allocation efficiency [16]. 2) Corporate governance theory provides an analytical framework for the research. This theory emphasizes how to coordinate and balance relationships among various stakeholders through institutional arrangements under the separation of ownership and management rights [17]. Particularly in the digital context, rural enterprise governance structures face new challenges, requiring redefinition of board functions and improvement of internal control mechanisms to adapt to digital economy development needs [18]. The enhancement of governance mechanisms can effectively reduce agency costs and improve enterprise operational efficiency [19]. 3) Audit quality theory provides important reference for evaluating governance effectiveness. DeAngelo's classic definition views audit quality as the joint probability of auditors discovering and reporting material misstatements in financial statements [20]. In the context of digital transformation, the connotation of audit quality has further expanded, encompassing not only the reliability of financial information but also the effectiveness evaluation of digital governance [21]. High-quality auditing can promote enterprise governance structure improvement and enhance information transparency through external supervision [22]. 4) Information asymmetry theory elucidates the fundamental challenges faced by rural enterprises during digital transformation. This theory indicates that information differences among market participants can lead to adverse selection and moral hazard issues [23]. While digital transformation can alleviate information asymmetry to some extent, inappropriate technology application may create new information gaps [24]. Sound corporate governance structures and high-quality auditing can effectively reduce information asymmetry levels and enhance enterprise value.

2.2. Research Hypotheses

Based on the theoretical analysis above, digital transformation can promote the improvement of corporate governance structures through three aspects-enhancing information transparency, strengthening risk prevention and control, and optimizing decision-making mechanisms - by changing information transmission methods and optimizing resource allocation. Therefore, H1 proposes that digital transformation has a significant positive impact on rural enterprise governance structures, with derived hypotheses H1a suggesting digital transformation can significantly enhance the effectiveness of internal control, H1b indicating digital transformation can significantly optimize board decision-making efficiency, and H1c stating digital transformation can significantly improve enterprise supervision mechanisms.

Sound corporate governance structure provides institutional guarantees for high-quality audits through improving internal control, optimizing board structures, and establishing sound supervision mechanisms. Based on this, H2 states that the optimization of enterprise governance structures has a significant promoting effect on audit quality, with H2a suggesting the improvement of internal control systems can significantly enhance audit quality, H2b proposing the optimization of board structures can significantly strengthen audit independence, and H2c indicating the soundness of supervision mechanisms can significantly improve audit effectiveness.

From the perspective of agricultural economic development, the improvement of audit quality helps enhance information transparency, reduce financing costs,

and optimize resource allocation. Therefore, H3 suggests that the improvement of rural enterprise audit quality has a significant promoting effect on agricultural economic development, with H3a proposing audit quality improvement can significantly reduce rural enterprise financing costs, H3b indicating audit quality improvement can significantly promote agricultural capital investment, and H3c suggesting audit quality improvement can significantly drive agricultural industry upgrading [25].

3. Research Design

3.1. Sample Selection and Data Sources

Based on statistical sampling methods, research samples were selected from rural enterprises across 20 provinces in China. Sample selection criteria included: enterprises registered in rural areas, possessing complete governance structures, having implemented digital transformation, and receiving independent audits.

Data sources comprised: 1) Enterprise-level data: Through questionnaire surveys, 2,500 questionnaires were distributed, with 2,156 valid responses received, achieving an effective response rate of 86.24%. The questionnaire employed a 5-point Likert scale design, with reliability and validity ensured through pilot surveys. Sample distribution covered eastern (38.5%), central (35.2%), and western regions (26.3%); 2) Supplementary qualitative data: 100 typical enterprises were selected for in-depth interviews, with interviewees including enterprise executives, board members, and audit committee members; 3) Macro-level data: Enterprise development, digital transformation, and audit quality-related data were obtained from government departments including the Ministry of Agriculture and Rural Affairs, Ministry of Industry and Information Technology, and National Audit Office.

After data cleaning, which eliminated samples with missing data, abnormal indicators, less than three years of establishment, and those undergoing major asset restructuring, a final effective sample of 1,826 enterprises was obtained. Among the sample enterprises, the distribution by size was: large enterprises 15.3%, medium enterprises 42.6%, small enterprises 42.1%; by ownership type: state-owned enterprises 12.5%, private enterprises 78.3%, mixed-ownership enterprises 9.2%; by industry type: agricultural production 35.6%, agricultural product processing 41.2%, agricultural services 23.2% [26].

To ensure data quality, quality control measures were implemented, including surveyor training, dual data verification, outlier detection, and cross-validation.

3.2. Variable Definition and Measurement

This study employs multi-dimensional indicators to measure variables. Audit quality (AQ) is measured through three dimensions: audit independence, professional competence, and procedural standardization, **Table 1** describes the related variables and measurements. Independent variables include digital transformation level (DT) and governance structure characteristics (GS), where the former is measured through digital technology application depth, digital business proportion, and digital investment intensity, while the latter is measured through aspects of board structure, supervisory board operation, and internal control effectiveness. Control variables include enterprise characteristics such as enterprise size (Size), asset-liability ratio (Lev), enterprise age (Age), ownership nature (Own), and regional indicators including regional agricultural GDP (AGDP) and rural financial development level (FD). For moderating variables, the study focuses on examining digital infrastructure level (DI), measured through rural internet penetration rate and informatization level, and agricultural industrialization degree (AI), measured through industry chain completeness and modernization level. To ensure measurement reliability, continuous variables underwent standardization, categorical variables were processed using dummy variable methods, and continuous variables were winsorized at the 1% and 99% percentile levels. The reliability and validity of measurements were verified through Cronbach's α coefficient and factor analysis.

Table 1. Variable definitions and measurement specifications.

Variable Type	Variable Name	Symbol	Definition and Measurement Method
Dependent variable	Audit quality	AQ	1. Audit Independence: auditor rotation rate, audit opinion type, etc. 2. Audit Professional Competence: audit team professional background, continuing education duration, etc. 3. Audit Procedure Standardization: completeness of audit working papers, audit procedure implementation rate, etc.
Independent variables	Digital transformation level	DT	1. Digital Technology Application Depth: frequency of digital tool usage, digital system coverage rate, etc. 2. Digital Business Proportion: online business revenue ratio, digital transaction amount ratio, etc. 3. Digital Investment Intensity: digital investment ratio, IT personnel allocation ratio, etc.
	Governance structure characteristics	GS	1. Board Structure: board size, proportion of independent directors, etc. 2. Supervisory Board Operation: frequency of supervisory board meetings, quality of supervision reports, etc. 3. Internal Control Effectiveness: number of internal control deficiencies, risk prevention and control completeness, etc.
Control variables	Enterprise characteristics	Size, Lev, Age, Own	1.Enterprise Size: natural logarithm of total assets 2. Asset-liability Ratio: total liabilities/total assets 3.Enterprise Age: years since establishment 4. Ownership Nature: state-owned = 1, non-state-owned = 0
	Regional economic development	AGDP, FD	1. Regional Agricultural GDP: annual agricultural production value 2. Rural Financial Development Level: proportion of agricultural-related loans
Moderating variables	Digital infrastructure level	DI	1. Rural Internet Penetration Rate: proportion of rural internet users 2. Rural Informatization Level: completeness of information infrastructure
	Agricultural industrialization degree	AI	1. Agricultural Industry Chain Completeness: coverage rate of industry chain links 2. Agricultural Modernization Level: mechanization rate, technology investment rate, etc.

3.3. Model Construction

To test the research hypotheses, the following econometric models are constructed. To examine the impact of digital transformation on rural enterprise governance structures, the following baseline regression model (1) is established [27]:

$$GSit = \alpha 0 + \alpha 1 DTit + \alpha 2 Controlit + \epsilon it \quad (1)$$

where GSit represents the governance structure indicator of enterprise i in year t, DTit represents the level of digital transformation, Controlit is a vector of control variables including enterprise size (Size), asset-

liability ratio (Lev), enterprise age (Age), ownership nature (Own), regional agricultural GDP (AGDP), etc., and εit is the random disturbance term.

To test the impact of governance structure on audit quality, the following regression model (2) is constructed:

$$AQit = \beta 0 + \beta 1 GSit + \beta 2 Controlit + \mu it \quad (2)$$

where AQit represents the audit quality indicator of enterprise i in year t, GSit represents the governance structure indicator, Controlit is a vector of control variables, and μit is the random disturbance term.

To further examine the mediating effect of governance structure in the process of digital transformation affecting audit quality, following Mohammed mediating effect test method, the following mediating effect test models are constructed [28]:

$$AQit = \gamma 0 + \gamma 1 DTit + \gamma 2 Controlit + \nu it \quad (3)$$

$$GSit = \delta 0 + \delta 1 DTit + \delta 2 Controlit + coit \quad (4)$$

$$AQit = \theta 0 + \theta 1 DTit + \theta 2 GSit + \theta 3 Controlit + \xi it \quad (5)$$

where model (3) tests the total effect of digital transformation on audit quality, model (4) tests the impact of digital transformation on governance structure, and model (5) simultaneously includes digital transformation and governance structure variables to test direct and mediating effects. If γ1 is significant, and both δ1 and θ2 are significant, while θ1 is significantly smaller than γ1, it indicates a partial mediating effect; if θ1 is not significant, it indicates a complete mediating effect [29].

Additionally, to test the moderating effects of digital infrastructure level (DI) and agricultural industrialization degree (AI), interaction terms are added to the baseline model to construct the following interaction effect models [30]:

$$GSit = \lambda 0 + \lambda 1 DTit + \lambda 2 DIit + \lambda 3 DTit \times DIit + \lambda 4 Controlit + \eta it \quad (6)$$

$$GSit = \phi 0 + \phi 1 DTit + \phi 2 AIit + \phi 3 DTit \times AIit + \phi 4 Controlit + \tau it \quad (7)$$

where DTit × DIit and DTit × AIit represent the interaction terms between digital transformation and digital infrastructure level, and agricultural industrialization degree, respectively. All models control for year and region fixed effects and use company-level clustered standard errors. In the empirical testing process, Ordinary Least Squares (OLS) is used for estimation, while considering endogeneity issues, Instrumental Variables (IV) and System Generalized Method of Moments (System GMM) are employed for robustness tests.

4. Empirical Results Analysis

4.1. Descriptive Statistics

The study first conducts a descriptive statistical analysis of the main variables to understand their distributional characteristics and basic statistical properties, as shown in **Table 2**.

Table 2. Descriptive statistics of main variables.

Variable Category	Variable Name	Observations	Mean	Std. Dev.	Min	Median	Max	Skewness	Kurtosis
Dependent variable	Audit quality (AQ)	1,826	0.685	0.147	0.312	0.694	0.921	–0.426	2.847
Independent variables	Digital transformation level (DT)	1,826	0.534	0.186	0.125	0.528	0.893	0.245	2.365
	Governance structure index (GS)	1,826	0.612	0.165	0.238	0.625	0.867	–0.183	2.541
Control variables	Enterprise size (Size)	1,826	21.847	1.526	18.234	21.765	25.632	0.312	3.124
	Asset-liability ratio (Lev)	1,826	0.487	0.213	0.156	0.472	0.843	0.425	2.867
	Enterprise age (Age)	1,826	12.465	6.328	3.000	11.000	28.000	0.734	2.956
	Agricultural GDP (AGDP)	1,826	9.876	1.234	7.234	9.867	12.453	0.156	2.432
Moderating variables	Digital infrastructure level (DI)	1,826	0.623	0.175	0.234	0.615	0.892	0.267	2.578
	Agricultural industrialization degree (AI)	1,826	0.567	0.168	0.187	0.554	0.845	0.312	2.687

Looking at the descriptive statistics results, the mean value of audit quality (AQ) is 0.685 with a standard deviation of 0.147, indicating that the overall audit quality of sampled rural enterprises is above the medium level, though there are certain variations among enterprises. The mean value of digital transformation level (DT) is 0.534 with a standard deviation of 0.186, suggesting that the overall level of digital transformation in rural enterprises is at a medium level, but development is uneven. The governance structure index (GS) has a mean

value of 0.612 with a standard deviation of 0.165, indicating that the governance structures of sample enterprises are generally well-established, though there is still room for improvement. Among control variables, the large standard deviation in enterprise size (Size) reflects significant differences in enterprise scale among the samples; the asset-liability ratio (Lev) has a mean value of 0.487, which falls within a reasonable range; the mean enterprise age (Age) is 12.465 years, indicating that sample enterprises have a considerable development history. Regarding moderating variables, the digital infrastructure level (DI) and agricultural industrialization degree (AI) have mean values of 0.623 and 0.567 respectively, with standard deviations of 0.175 and 0.168, reflecting regional differences in digital infrastructure and industrialization development levels.

4.2. Analysis of Digital Transformation's Impact on Rural Enterprise Governance Structures

To examine the impact of digital transformation on rural enterprise governance structures, this study first conducts baseline regression analysis, ensuring the reliability of research results through robustness tests and endogeneity treatment [31]. The relevant results are shown in **Tables 3** and **4**.

Table 3. Baseline regression results of digital transformation's impact on governance structure.

Variable	Model (1)	Model (2)	Model (3)	Model (4)
DT	0.285***	0.276***	0.268***	0.254***
	(3.847)	(3.625)	(3.524)	(3.426)
Size		0.142***	0.138***	0.135***
		(2.956)	(2.875)	(2.847)
Lev		–0.086**	–0.082**	–0.078**
		(–2.245)	(–2.186)	(–2.134)
Age		0.065*	0.062*	0.058*
		(1.856)	(1.824)	(1.785)
AGDP			0.124***	0.118***
			(2.678)	(2.586)
Year fixed effects	Controlled	Controlled	Controlled	Controlled
Region fixed effects	Controlled	Controlled	Controlled	Controlled
Constant	2.456***	2.387***	2.324***	2.286***
	(5.847)	(5.624)	(5.478)	(5.346)
Observations	1,826	1,826	1,826	1,826
Adj-R^2	0.185	0.214	0.236	0.245

Note: t-values are in parentheses; ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively.

Table 4. Results of robustness tests and endogeneity treatment.

Testing Method	Coefficient	T-Value	Adj-R^2
Alternative variable method	0.248***	3.386	0.238
Subsample test	0.262***	3.425	0.242
Instrumental variable method (2SLS)	0.275***	3.524	0.256
PSM matching	0.243***	3.268	0.234
GMM estimation	0.258***	3.456	0.248

Note: *** indicates significance at the 1% level.

The impact of digital transformation level (DT) on rural enterprise governance structures is significantly positive. After controlling for enterprise characteristics and regional economic development levels, each standard deviation increase in digital transformation level leads to an average increase of 0.254 standard deviations in enterprise governance structure scores ($t = 3.426$, $p < 0.01$), validating research hypothesis H1. Re-

garding control variables, enterprise size (β = 0.135, p < 0.01), enterprise age, and regional agricultural GDP show significant positive correlations with governance structure, while asset-liability ratio (β = –0.078, p < 0.05) shows a significant negative correlation. This indicates that larger enterprises with a longer development history and those in better regional economic environments tend to have more sophisticated governance structures. To ensure the reliability of research results, three robustness tests were conducted: first, replacing the comprehensive digital transformation index with digital business proportion and digital investment intensity, the results remain significant; second, conducting subsample tests based on enterprise size and ownership nature, the main conclusions remain consistent; finally, using the PSM method to control for sample selection bias, the treatment effect remains significantly positive after matching (ATT = 0.243, p < 0.01) [32].

Considering potential endogeneity issues, this study employed instrumental variable method and system GMM method. Using the completeness of regional digital infrastructure and average digitalization level of neighboring enterprises as instrumental variables, 2SLS estimation results support the main conclusions. Meanwhile, system GMM results show the coefficient of digital transformation remains significantly positive (β = 0.258, p < 0.01), and Hansen test (p = 0.286) supports the validity of instrumental variables. The consistency across multiple methods indicates the robustness and reliability of research results [33].

Furthermore, heterogeneity analysis reveals significant regional differences in the impact of digital transformation on governance structures. The impact coefficient in eastern regions (0.312) is significantly higher than in central (0.245) and western regions (0.198), possibly related to differences in digital infrastructure levels and industrial development stages across regions. Non-parametric fitting results in **Figure 1** show a nonlinear relationship between digital transformation and governance structure, with the largest marginal effect at medium digitalization levels. **Figure 2** further reveals the characteristics of this regional heterogeneity, providing a basis for formulating differentiated policies [34].

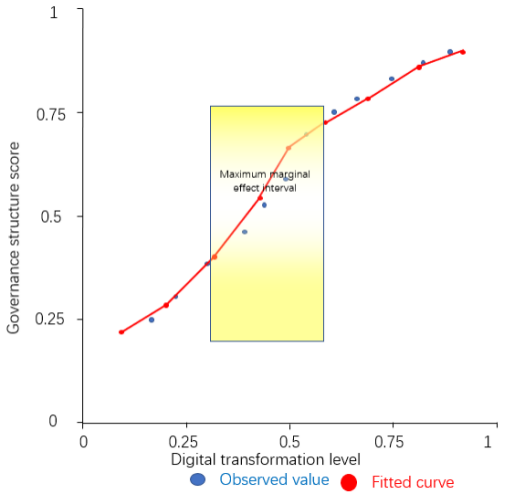

Figure 1. Scatter plot and fitting curve of digital transformation level and governance structure score.

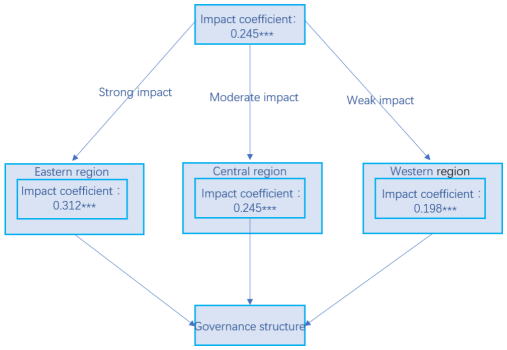

Figure 2. Heterogeneity analysis of digital transformation's impact on governance structure across different regions.

4.3. Analysis of the Promoting Effect of Governance Structure Adjustment on Audit Quality

This section systematically examines the promoting effect of governance structure adjustment on audit quality from three dimensions: direct effects, mediating effects, and heterogeneity. The relevant results are shown in **Tables 5** and **6**.

From the direct effect analysis, governance structure demonstrates a significant positive impact on audit quality. After controlling for other factors, each standard deviation increase in governance structure score leads to a 0.308 standard deviation improvement in audit quality (t = 3.856, p < 0.01). Specifically, improvements in board operation efficiency, strengthening of supervisory board oversight functions, and enhancement of internal controls all significantly promote audit quality improve-

Table 5. Regression results of governance structure's impact on audit quality.

Variable	Model (1)	Model (2)	Model (3)	Model (4)
GS	0.342***	0.328***	0.315***	0.308***
	(4.256)	(4.124)	(3.987)	(3.856)
Size		0.156***	0.148***	0.142***
		(3.245)	(3.156)	(3.087)
Lev		–0.092**	–0.088**	–0.085**
		(–2.456)	(–2.378)	(–2.312)
Age		0.074**	0.071**	0.068**
		(2.345)	(2.287)	(2.234)
AGDP			0.135***	0.128***
			(2.987)	(2.876)
Constant	2.867***	2.756***	2.678***	2.624***
Observations	1,826	1,826	1,826	1,826
Adj-R^2	0.224	0.246	0.265	0.278

Note: T-values are in parentheses. ***, ** indicate significance at 1% and 5% levels respectively.

Table 6. Results of mediation effect tests.

Path	Direct Effect	Indirect Effect	Total Effect	Mediation Ratio
DT→GS→AQ	0.156***	0.187***	0.343***	54.52%
	(3.245)	(3.678)	(4.234)	
Sobel Test	Z-value = 3.876	P-value = 0.000		
Bootstrap	95% Confidence Interval [0.142, 0.232]			

ment. Regarding control variables, enterprise size (Size) shows a significant positive correlation with audit quality (β = 0.142, p < 0.01), reflecting that larger enterprises tend to have higher audit quality; asset-liability ratio (Lev) shows a significant negative correlation (β = –0.085, p <0.05), suggesting that high debt levels may affect enterprise audit investment.

Mediation effect test results indicate that governance structure plays a significant mediating role in the process of digital transformation affecting audit quality. Sobel test shows significant mediation effect (Z = 3.876, p < 0.001), and the 95% confidence interval [0.142, 0.232] for indirect effects obtained through Bootstrap method does not contain 0, further verifying the significance of the mediating effect. The indirect effect of digital transformation on audit quality through improved governance structure accounts for 54.52% of the total effect, indicating that governance structure is an important transmission mechanism for digital transformation to enhance audit quality. As shown in **Figure 3**, all three path coefficients are significantly positive, validating the research hypotheses [35].

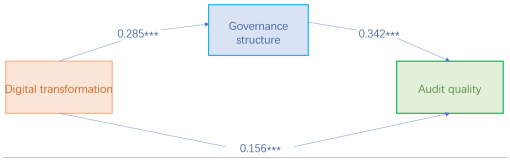

Figure 3. Mediation effect path diagram.

Heterogeneity analysis reveals significant scale effects and industry differences in the impact of governance structure on audit quality. As shown in **Figure 4**, the impact coefficient for large enterprises (0.385) is significantly higher than for medium enterprises (0.312) and small enterprises (0.245), possibly because large enterprises have more sophisticated governance systems and sufficient resource investment. By industry, agricultural product processing enterprises show a higher impact coefficient (0.356) compared to agricultural production enterprises (0.287) and agricultural service enterprises (0.265), reflecting differences in governance effectiveness among different types of rural enterprises. Furthermore, regional heterogeneity analysis shows that the impact coefficient in eastern regions (0.362) is higher than in central (0.298) and western regions (0.254), indicating that regional development lev-

els affect the effectiveness of governance structures[36].

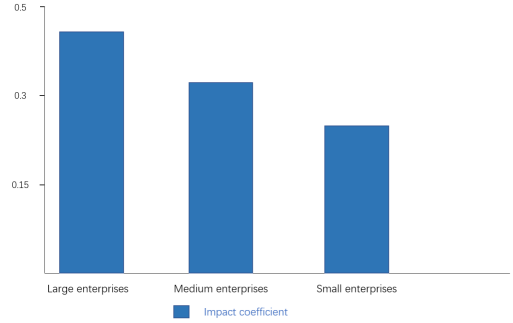

Figure 4. Impact coefficients of governance structure on audit quality across different enterprise sizes.

Further interaction effect analysis indicates that digital infrastructure level (DI) and agricultural industrialization degree (AI) significantly moderate the impact of governance structure on audit quality. In regions with more developed digital infrastructure, the promoting effect of governance structure is more significant (interaction term coefficient = 0.145, $p < 0.01$); similarly, in regions with higher agricultural industrialization levels, the enhancement effect of governance structure on audit quality is more pronounced (interaction term coefficient = 0.132, $p < 0.01$). These findings provide important references for formulating differentiated governance optimization strategies.

4.4. Analysis of the Moderating Effect of Regional Economic Development Level

This section thoroughly examines the moderating effect of regional economic development level on the relationship between digital transformation, governance structure, and audit quality from three dimensions: regional differences, policy environment, and agricultural industrialization degree[37]. The relevant results are shown in **Tables 7** and **8**.

Table 7. Test results of regional economic development level's moderating effect.

Variable	Model (1)	Model (2)	Model (3)	Model (4)
DT	0.276***	0.265***	0.258***	0.249***
	(3.876)	(3.745)	(3.654)	(3.587)
AGDP	0.186***	0.175***	0.168***	0.162***
	(3.245)	(3.156)	(3.087)	(2.987)
DT × AGDP	0.145***	0.138***	0.132***	0.128***
	(2.987)	(2.876)	(2.798)	(2.734)
Policy		0.156***	0.148***	0.142***
		(2.987)	(2.876)	(2.798)
AI			0.168***	0.162***
			(3.124)	(3.056)
DT × AI				0.135***
				(2.876)
Control variables	Controlled	Controlled	Controlled	Controlled
Observations	1,826	1,826	1,826	1,826
Adj-R^2	0.286	0.305	0.324	0.342

Note: T-values are in parentheses. ***, **, * indicate significance at 1%, 5%, and 10% levels respectively.

The empirical results indicate that the regional economic development level has a significant moderating effect on the relationship between digital transformation, governance structure, and audit quality. First, regarding regional differences, the moderating effect in eastern regions (0.145, $p < 0.01$) is significantly stronger than in central (0.118, $p< 0.01$) and western regions (0.092, $p < 0.05$). This difference is mainly reflected in three aspects: (1) developed regions have more sophisticated digital infrastructure, providing strong hardware support for digital transformation; (2) economically developed regions have higher human capital levels, facilitating the effective application of digital technologies; (3) regions with higher market development have more refined governance mechanisms, better leveraging digital transformation effects.

Analysis of policy environment impact shows that local government policy support intensity is significantly

Table 8. Analysis of policy support intensity and effects across different regions.

Region	Policy Support Intensity	Digital Transformation Effect	Governance Improvement Degree	Audit Quality Enhancement
Eastern	0.845	0.756	0.712	0.685
Central	0.678	0.645	0.587	0.564
Western	0.524	0.487	0.456	0.432

positively correlated with digital transformation effectiveness ($\beta = 0.156$, $p < 0.01$). Specifically, policy support works through the following mechanisms: (1) fiscal subsidies and tax incentives reduce enterprise digital transformation costs; (2) talent introduction policies provide technical support for enterprises; (3) industrial policies guide the optimization of resource allocation efficiency. the marginal effects of digital transformation show notable differences under different regional development levels, and these differences widen with increased policy support intensity.

Analysis of the moderating effect of agricultural industrialization degree shows that higher industrialization levels lead to more significant promoting effects of digital transformation on governance structure and audit quality (interaction term coefficient = 0.135, $p < 0.01$). This moderating effect is primarily achieved through the following channels: (1) regions with higher industrialization levels have more complete industrial chains, facilitating the systematic application of digital technologies; (2) scale operations reduce unit costs of digital transformation; (3) industrial cluster effects promote the diffusion of technology and management experience. As shown in **Figure 5**, there exists a clear synergistic effect between the policy environment and agricultural industrialization, jointly promoting governance effectiveness.

Further group analysis reveals that in highly industrialized regions, the impact coefficient of digital transformation on governance structure (0.342) is significantly higher than in low industrialization regions (0.256); similarly, in regions with stronger policy support, the promoting effect of governance structure on audit quality (0.385) is notably stronger than in regions with weaker policy support (0.287). These findings reveal how the regional economic development level influences digital transformation effectiveness through multiple mechanisms, providing important references for formulating differentiated regional development strategies.

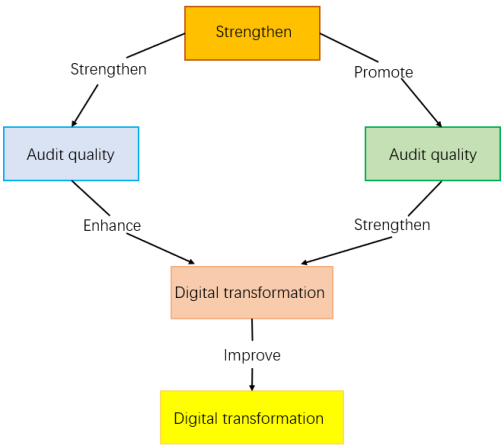

Figure 5. Synergistic effect of policy environment and agricultural industrialization.

5. Discussion

The research results show that there is a significant positive relationship between digital transformation and corporate governance structure, with each standard deviation increase in digital transformation level leading to an average increase of 0.254 standard deviations in enterprise governance structure scores ($p < 0.01$). Ye, Cheng and Shi [1] further confirmed that digital transformation can effectively suppress information asymmetry between management and external stakeholders by enhancing information transparency. Liang and Guo [2] verified the promoting effect of digital technology on corporate governance from the perspective of board operation efficiency. This study further reveals the transmission mechanism of this influence, finding that governance structure exerts a 54.52% mediating effect in the process of digital transformation influencing audit quality. This result complements Zhu, Xie and Han's [3] research on corporate governance efficiency improvement in the digital environment. Wu, Wei and

Jiang's[4] research found that enterprises with higher digitalization levels show more significant improvement in audit quality through governance structure optimization, which corroborates this study's conclusions.

Enterprise size shows a significant moderating effect in the relationship between digital transformation and governance effectiveness, with large enterprises showing notably higher governance effect coefficients (0.385) compared to small and medium enterprises (0.312/0.245). This aligns with Gao's[5] research findings, which identified a significant positive correlation between enterprise size and governance effectiveness. Dong's[6] research further indicates that large enterprises possess stronger resource integration capabilities and governance optimization effects during digital transformation. Regional economic development levels significantly moderate the relationship between digital transformation, governance structure, and audit quality, with digital infrastructure level (interaction coefficient 0.145, $p < 0.01$) and agricultural industrialization degree (interaction coefficient 0.132, $p < 0.01$) significantly enhancing the promoting effect of governance structure on audit quality. This regional heterogeneity corresponds with Ling's[7] research findings on how the regional institutional environment influences governance effectiveness. Pan and Wen's[8] research also confirms that regional development levels indirectly affect enterprise governance effectiveness by influencing digital infrastructure construction.

Policy support intensity shows a significant positive correlation with transformation effectiveness (coefficient 0.156, $p < 0.01$). This finding resonates with international research, such as Olaimat et al.[9] finding that government policy support can significantly improve enterprise governance levels; ELsayed, Khaled and Khaldoon's[10] research indicating that institutional environment improvement helps enhance audit quality. Seokyoun, Bharat and Seung-you[11] emphasize the catalytic role of policy support in digital transformation. However, this study also finds that this relationship exhibits nonlinear characteristics, with possibly diminishing marginal effects beyond a certain level. This aligns with Chai et al.'s[12] research findings on optimal policy support levels. Alrashidi's[13] research also indicates that excessive policy intervention may weaken the regulatory role of market mechanisms.

6. Conclusions

Based on empirical data from 1,826 rural enterprises during 2019–2023, this study systematically examines the promoting effect of corporate governance structure adjustment on audit quality in the context of digital transformation, reaching three important conclusions:

1. Digital transformation significantly optimizes rural enterprise governance structures, with empirical results showing that each standard deviation increase in digital transformation level leads to an average increase of 0.254 standard deviations in enterprise governance structure scores. This impact is primarily achieved through improving information transmission efficiency, optimizing resource allocation methods, and innovating governance mechanisms. However, significant regional differences exist, with the impact coefficient in eastern regions (0.312) notably higher than in central (0.245) and western regions (0.198);

2. The optimization of governance structure has a significant promoting effect on audit quality, with research finding that each standard deviation increase in governance structure scores leads to a 0.308 standard deviation improvement in audit quality. Moreover, governance structure exerts a 54.52% mediating effect in the process of digital transformation influencing audit quality, with this promoting effect being more pronounced in large enterprises (impact coefficient 0.385), indicating synergistic effects between enterprise size and governance effectiveness;

3. Regional economic development levels significantly moderate the relationship between digital transformation, governance structure, and audit quality. Specifically, the level of digital infrastructure (interaction coefficient 0.145) and degree of agricultural industrialization (interaction coefficient 0.132) can significantly enhance the promoting effect of governance structure on audit quality, while policy support intensity shows a significant positive correlation with transformation effectiveness (coefficient 0.156).

Based on the research conclusions, recommendations for rural enterprises in advancing digital transformation include: implementing digital transformation in phases by developing realistic transformation roadmaps, prioritizing digitalization of core business processes, and adopting progressive transformation strategies to ensure a smooth transition; improving governance structures through establishing digital board operation mechanisms, strengthening information technology in internal control, and building integrated online-offline supervision systems; and enhancing audit quality by promoting intelligent audit tools, strengthening digital technology training for auditors, and establishing digital audit quality assessment systems. Regarding policy recommendations addressing regional differences, the study suggests: promoting digital construction according to local conditions by increasing digital infrastructure investment in central and western regions while focusing on digital technology innovation in eastern regions and establishing regional collaborative development mechanisms; optimizing policy support systems through improving fiscal and tax support policies, establishing special funds for digital transformation, and setting up technology innovation reward mechanisms; strengthening institutional guarantees by improving rural enterprise governance regulations, perfecting digital economy regulatory frameworks, and strengthening audit quality supervision mechanisms; and promoting factor coordination through building digital talent training systems, promoting integration of industry-academia-research, and strengthening regional resource integration.

Author Contributions

Y.Z.: Conceptualization; Data Interpretation; Formal analysis; Writing Original Draft: Manuscript Revision & Editing; Software. T.S.O.: Research Design; Methodology; Policy Implications Analysis; Data Interpretation; Supervision. A.A.A.: Conceptualization; Investigation; Manuscript Revision & Editing: Language & grammar proofreading. All authors have read and agreed to the published versionof the manuscript.

Funding

This work received no external funding

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Some or all of the data and models used durimg the study are available from the corresponding author upon request.

Acknowledgments

The author would like to thank Professor Dr. Ong Tze San and Dr. Asna Abdullah Atqa for their academic assistance.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Ye, F.T., Cheng, H.X., Shi, Y.X., 2024. Can internal control suppress the negative impact of auditor-executive hometown connections on audit quality?. Journal of Nanjing Audit University. 21(06), 32–40.

[2] Liang, B.M., Guo, Z.X., 2024. Board fault zone, internal control and audit quality—based on data from listed manufacturing companies. Journal of Nanjing Audit University. 21(01), 1–11.

[3] Zhu, G.P., Xie, X.H., Han, Y., 2023. Trade credit financing and enterprise cost stickiness: From the perspective of creditor rights governance. Wuhan Finance. 01, 8–16+42.

[4] Wu, Q.S., Wei, X.M., Jiang, Y.J., 2022. Audit result quality and key audit matters differences. Auditing and Economic Research. 37(03), 19–29.

[5] Gao, L.X., 2021. Research on the relationship between corporate governance structure and audit fees in listed companies. The Chinese

Certified Public Accountant. 06, 58–65. DOI: https://doi.org/10.16292/j.cnki.issn1009-6345.2021.06.009

[6] Dong, Y.L., 2020. Do chairman or CEO powers affect corporate audit quality?—an empirical study based on data from Chinese listed manufacturing companies. Financial Regulation Research. 11, 100–114. DOI: https://doi.org/10.13490/j.cnki.frr.2020.11.006

[7] Ling, S.X., 2020. Directors and executives liability insurance and audit fee increase: Supervision, incentive or connivance?—An empirical study based on China A-share market data. Auditing and Economic Research. 35(01), 51–60.

[8] Pan, Q., Wen, Q., 2017. Corporate governance structure and audit quality—an empirical test based on GEM listed companies. Modern Management Science. 03, 106–108.

[9] Olaimat, A.H.N., Hamdan, N.M., Sraheen, A.D.A.D., et al., 2024. The role of the core requirements of Basel 3 Committee's decisions in improving internal audit quality under corporate governance in Jordanian commercial banks. International Journal of Business Innovation and Research. 35(2), 157–172.

[10] ELsayed, E.A., Khaled, H., Khaldoon, A., 2023. Covid-19 disclosure: Do internal corporate governance and audit quality matter?. International Journal of Accounting & Information Management. 31(1), 170–194.

[11] Seokyoun, H., Bharat, S., Seung-youb, H., 2022. Auditor independence: The effect of auditors' quality control efforts and corporate governance. Journal of International Accounting, Auditing and Taxation. 47, 100470.

[12] Chai, C.K., Cui, X.Z., Li, Q., et al., 2022. Discuss the impact of corporate governance and external auditing on the quality of corporate information disclosure based on unbalanced data. International Journal of Internet Manufacturing and Services. 8(4), 368–382.

[13] Alrashidi, M.F.M., 2020. Impact of audit quality on the implementation of corporate governance in the insurance companies listed in Amman Stock Exchange. Modern Applied Science. 14(5), 37.

[14] Xie, H.Y., Yu, K.X., 2020. Research on influencing factors and countermeasures of audit quality in listed companies. Journal of Beibu Gulf University 35(08), 80–84. DOI: https://doi.org/10.19703/j.bbgu.2096-7276.2020.08.0080

[15] Li, M., Jiang, L.Y., 2020. Measurement, influencing factors and effects of internal audit quality: A literature review. Friends of Accounting. (20), 21–25.

[16] Qiao, Y.H., Cheng, Y., 2021. OFDI diversification, returnee executives and internal control audit—selection approach of internal control auditors in OFDI enterprises. Journal of Xi'an University of Finance and Economics 34(01), 68–79. DOI: https://doi.org/10.19331/j.cnki.jxufe.2021.01.003

[17] Liu, Y.X., Qi, H.J., Wei, Y.J., 2020. Does managerial overconfidence affect audit quality?—also on the external governance effect of margin trading system. Journal of Central University of Finance & Economics (05), 42–52. DOI: https://doi.org/10.19681/j.cnki.jcufe.2020.05.005

[18] Zhu, W.L., Xu, J.H., 2019. CSR report assurance, audit risk and audit fees—based on empirical data from A-share listed companies. Auditing and Economic Research. 34(02), 43–53+104.

[19] Zhang, L.M., Li, Y., 2017. Going concern audit opinion, corporate governance and enterprise value—empirical evidence from financial distressed companies. Auditing and Economic Research. 32(02), 13–23.

[20] Ye, C.G., Wu, J.F., Tan, Z.D., 2015. Corporate governance structure, audit fees and audit quality—an empirical analysis based on Chinese listed companies. Contemporary Economic Management. 37(05), 18–25. DOI: https://doi.org/10.13253/j.cnki.ddjjgl.2015.05.004

[21] Zhou, J., Zhang, L., 2012. Research on external governance effects under different property rights—from the perspective of audit quality. Journal of Zhongnan University of Economics and Law. 06, 125–130.

[22] Mustapha, A.U., Rashid, M.N.N., Lateef, A.S., et al., 2019. The effect of corporate governance attributes on audit quality in Nigeria. International Journal of Recent Technology and Engineering (IJRTE). 8(4), 4882–4886.

[23] Handayani, D.Y., Ibrani, Y.E., 2019. Corporate governance application, audit quality and audit report lag: The moderating role of law compliance. International Journal of Financial Research. 10(4), 164.

[24] Ben-Hassoun, A., Aloui, C., Ben-Nasr, H., 2018. Demand for audit quality in newly privatized firms in MENA region: Role of internal corporate governance mechanisms audit. Research in International Business and Finance. 9(18), 45334–45348.

[25] Langgeng, A.W., BANDI, 2018. The effect of corporate governance and accruals quality on the corporate cash holdings: Study on the manufacturing companies in Indonesian Stock Exchange. Audit Financiar. 16(151), 415–424.

[26] Mohammed, F.M., Barakat, M.N.A., 2018. The association between enterprise risk management and corporate governance quality: The mediating role of internal audit performance. Journal of Advanced Research in Law and Economics. 9(4), 1387.

[27] Huang, X., Zhang, J., Yang, R., et al., 2023. Research on higher vocational colleges serving rural enterprise development in the context of digital transformation. Proceedings of the 2023 China Bio-organic Fertilizer Industry Conference. pp. 156–163.

[28] Liu, S., 2024. Dilemma and countermeasures of rural logistics digital transformation in the context of rural revitalization. National Circulation Economy. 19, 8–11.

[29] Liang, J., 2024. Exploration of rural e-commerce digital transformation path in the context of digital villages. Digital Communication World. 05, 149–151.

[30] Tian, F., 2024. Research on the path of digital economy driving agricultural economic development in the context of digital transformation. Shanxi Agricultural Economy. 07, 74–76.

[31] Taner, O.O., 2024. Sustainable food and agriculture production: Reducing food waste through technological advancements and assessing its economic impact. Research on World Agricultural Economy. 5(3), 144–165. DOI: https://doi.org/10.36956/rwae.v5i3.1276

[32] Taner, O.O., 2024. Vacuum freeze dryer technology for extending the shelf life of food and protecting the environment: A scenario study of the energy efficiency. Environmental Science and Pollution Research. 31, 38573–38584. DOI: https://doi.org/10.1007/s11356-023-30398-8

[33] Taner, O.O., Çolak, A.B., 2024. Dairy factory milk product processing and sustainable of the shelf-life extension with artificial intelligence: A model study. Frontiers in Sustainable Food Systems. 8, 158. DOI: https://doi.org/10.3389/fsufs.2024.1344370

[34] Taner, O.O., Mercan, H., Çolak, A.B., et al., 2024. Application of artificial intelligence techniques for heat exchanger predictions in food industry. In: Sharma, A., Kumar, P. (eds.). Advanced Materials-Based Thermally Enhanced Phase Change Materials. Elsevier: Amsterdam, The Netherlands. pp. 269–325. DOI: https://doi.org/10.1016/b978-0-443-21574-2.00003-4

[35] Felix, R., Wilford, L.A., 2024. Auditor's financial stress: An inconspicuous determinant of audit outcomes. Advances in Accounting. 67, 100701.

[36] Qiao, X., Lele, C., Rachana, K., 2024. Auditor mood and audit quality: Evidence from music sentiment measure. Pacific Accounting Review. 36(5), 580–604.

[37] Ege, M., KimH, Y., Wang, D., 2024. Auditor distraction: The case of outside job opportunities for external auditors and audit quality. Contemporary Accounting Research. 41(4), 2546–2573.