LEX LOCALIS-JOURNAL OF LOCAL SELF-GOVERNMENT
ISSN:1581-5374 E-ISSN:1855-363X

Policy-Driven Digital Marketing in Agricultural Modernization: Local Government Mechanisms Shaping Fresh Corn Consumer Behavior

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Abstract

Digital transformation is reshaping agricultural governance of local governments, yet micro-pathways through which policy instruments influence consumer behavior via market mechanisms remain unclear. This study examines the fresh corn industry in Beijing and surrounding areas to explore how local governments employ policy-driven digital marketing strategies to promote agricultural modernization and shape consumer behavior. The research constructs an analytical framework integrating policy instrument theory, multi-level governance, and consumer behavior models. Through surveying 380 consumers, Partial Least Squares Structural Equation Modeling (PLS-SEM) examined policy implementation mechanisms. Findings reveal that policy-supported digital infrastructure ($\beta=0.328$, $p<0.001$) and government-led platform engagement ($\beta=0.296$, $p<0.001$) significantly enhance public service

satisfaction, which demonstrates the strongest effect on market participation behavior (β=0.512, $p<0.001$). Mediation tests indicate indirect effects of policy instruments through satisfaction (0.168 and 0.152) exceed direct effects (0.126 and 0.108), with public service satisfaction playing a crucial mediating role, explaining 52.3% of satisfaction variance and 58.2% of market behavior variance. Regional analysis reveals a 35% gap in policy implementation intensity between urban and rural areas, though 56.3% of consumers frequently use digital channels, indicating positive transformation progress. The study unveils governance innovation pathways of local governments transitioning from direct market intervention to platform empowerment and from technology promotion to service optimization, providing theoretical perspectives for understanding local agricultural governance in the digital era and offering transferable strategies for agricultural digital transformation in other regions.

Keywords

Local government; Digital transformation; Agricultural modernization; Policy implementation; China

1. Introduction

Digital transformation is reshaping the governance models and public service delivery methods of local governments. Over the past three decades, the digitalization process of local governments has undergone a profound transformation from e-government to smart governance, which has not only changed internal government operational mechanisms but also profoundly influenced the interaction between government, market, and society [1]. With the rapid development of emerging technologies such as artificial intelligence and big data, local governments face systematic challenges in transitioning from traditional management to modern governance [2]. In the agricultural sector, this transformation is particularly urgent, as

government subsidies and information-sharing mechanisms drive farmers to adopt green technologies, fundamentally changing agricultural production methods [3].

Global agricultural policy is currently experiencing a critical period of digital restructuring. Monitoring data from the Organisation for Economic Co-operation and Development indicates that national agricultural policies are shifting from simple production support to comprehensive innovation-driven approaches [4]. China's agricultural modernization process provides a unique perspective for understanding this transformation. Taking Huzhou, Zhejiang as an example, during agricultural modernization, the growth trend of facility agricultural land reflects policy innovation in local government land use strategies, which is manifested not only in physical infrastructure construction but more importantly in digital capability building [5]. Agricultural policy in the digital era requires new theoretical frameworks and implementation tools, as traditional subsidies and regulatory measures can no longer adequately address complex market environments and consumer demands [6].

Local governments play a crucial role in leading digital transformation, yet how to effectively advance this process still faces numerous challenges [7]. The rise of data science and artificial intelligence marks the third wave of governance in the digital age, requiring governments not only to master technological tools but also to understand how technology can be embedded in governance systems to generate public value [8]. While existing research has focused on digital transformation of local governments, there is insufficient understanding of the mechanisms through which governments influence agricultural product consumption behavior through market-oriented means such as digital marketing. Particularly in the context of agricultural modernization, the key question of how policy instruments are transformed into market influence through digital platforms has not been adequately explored.

This study takes the fresh corn industry in Beijing and surrounding areas of China as a case to explore how local governments promote agricultural modernization and shape consumer behavior through policy-driven digital marketing strategies. The

research constructs an analytical framework integrating policy instrument theory, multi-level governance framework, and consumer behavior models, revealing the micro-mechanisms of policy implementation through empirical analysis. This study not only contributes to understanding new models of local agricultural governance in the digital era but also provides transferable experiences for agricultural digital transformation in other regions.

2. Theoretical Framework and Policy Background

2.1 Policy Instrument Theory in Local Agricultural Governance

Policy instrument theory provides a systematic analytical framework for understanding the complexity of local agricultural governance. Contemporary policy design research indicates that the root causes of policy problems often lie in the selection and application of procedural instruments, whose design adaptability and resilience directly determine policy effectiveness [9]. Procedural policy instruments exhibit multidimensional characteristics in theoretical construction and practical application, with their effectiveness depending on specific institutional environments, resource allocation, and implementation capacity [10]. The political dimension of policy design reveals the power dynamics and interest coordination mechanisms behind instrument selection, making it necessary for technically rational policy analysis to consider broader socio-political factors [11].

Howlett's research provides the systematic principles and methods for policy instrument mix design. Effective policy design requires achieving balance across multiple dimensions: consistency at the goal level ensures that different instruments point toward common policy objectives; complementarity at the instrument level requires that different policy tools support rather than conflict with each other; coordination at the temporal level emphasizes that policy instrument implementation requires reasonable timing and phased division [12]. These principles hold special significance in agricultural governance, as the seasonality of agricultural production,

market volatility, and the gradual nature of technology adoption all require policy instruments to have greater adaptability and flexibility. Based on these theoretical insights, this study constructs a conceptual framework for policy-driven digital marketing governance, as shown in Figure 1, which integrates policy instruments, digital marketing, customer satisfaction, and consumer behavior within a multi-level governance environment.

2.2 Multi-level Governance in Digital Transformation

Multi-level governance research provides important perspectives for understanding the institutional complexity of digital transformation. Systematic literature reviews show that multi-level governance research has shifted from early focus on institutional structures to in-depth analysis of governance processes, mechanisms, and effects, reflecting the dynamism and complexity of governance practices [13]. Local collaborative governance capacity building plays a crucial mediating role in connecting governance mechanisms with public service delivery, with institutional capacity strength directly affecting collaborative governance effectiveness [14].

The application of digital technology in multi-level governance is transforming traditional governance models. Hangzhou's community governance experience during COVID-19 lockdowns demonstrates that co-production models based on digital technology can effectively mobilize social resources and enhance emergency governance capacity [15]. The future development of urban centers increasingly relies on the support of multi-level governance frameworks, which must be able to coordinate relationships between different levels of government, market entities, and social organizations [16]. Agranoff's research deeply analyzes the administrative dimensions of local governments in multi-level governance, emphasizing that local governments must not only handle vertical intergovernmental relations but also coordinate horizontal departmental relations and public-private partnerships [17]. Research on multi-level governance in Canadian education policy indicates that the

effectiveness of governance frameworks is highly dependent on specific policy domain characteristics and national institutional environments [18].

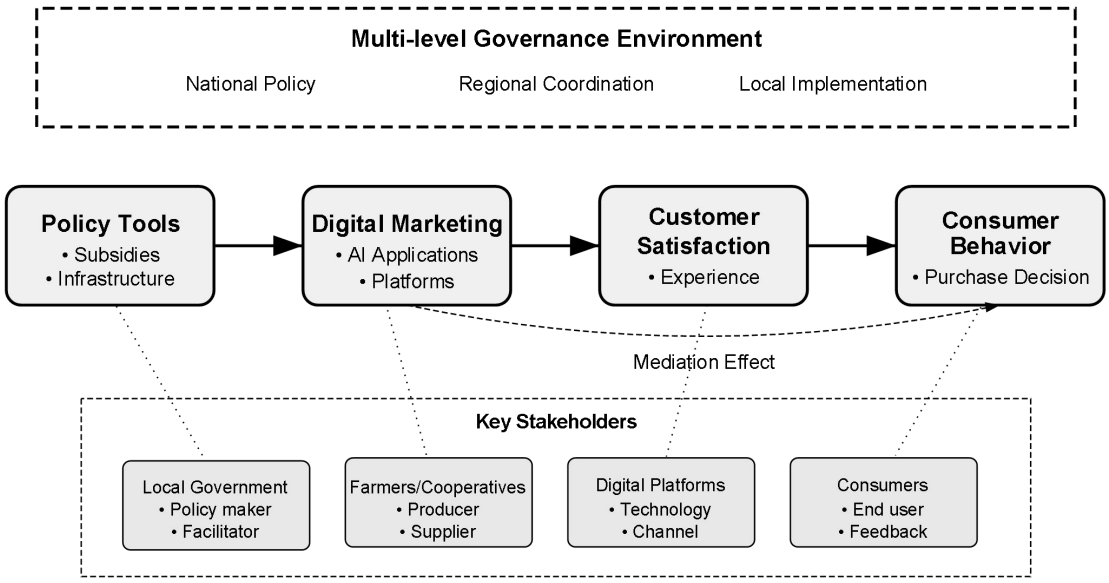


Figure 1. Conceptual Framework of Policy-Driven Digital Marketing Governance

2.3 Digital Marketing as a Policy Implementation Mechanism

Digital marketing is emerging as a novel mechanism for local governments to implement policies. The OECD's 2023 Digital Government Index reveals differentiated pathways among countries in digital transformation, reflecting the diversity of policy instrument choices under different institutional environments [19]. European local governments' practice of providing public services through social media demonstrates that the application of semantic algorithms not only improves service efficiency but also enhances the quality of government-citizen interaction [20].

The effects of organizational factors and technological investment on digital maturity present complex interaction effects. Empirical research on Italian municipalities found that the relationship between ICT expenditure and e-government maturity is moderated by factors such as organizational size, leadership support, and personnel capabilities [21]. UK local governments' exploration in artificial intelligence applications indicates that intelligent technologies are giving rise to

algorithmic bureaucracy, a new governance model that challenges traditional administrative procedures and decision-making mechanisms [22]. Research on digital leadership among Dutch city managers emphasizes that successful digital transformation requires leaders to possess comprehensive capabilities in technological understanding, organizational change, and cultural shaping [23]. A systematic review of local government digital technology adoption strategies shows that technology adoption is a complex process involving multiple factors, including technological characteristics, organizational readiness, environmental pressures, and policy support [24].

2.4 China's Agricultural Modernization Strategy

China's agricultural modernization strategy embodies a development model combining government leadership with market mechanisms. Empirical research on over a thousand farming households in Hubei Province shows that agricultural digital transformation significantly increases farmers' income through mechanisms such as improving information asymmetry, reducing transaction costs, and enhancing production efficiency [25]. Research on the implementation effects of land transfer policies indicates that the impact of institutional innovation on sustainable agricultural development needs to be assessed over longer temporal dimensions and broader spatial ranges [26]. Policy analysis on accelerating modernization in agriculture and rural areas shows that China is constructing a comprehensive policy system encompassing infrastructure construction, technological innovation, talent cultivation, and market development [27].

The design of government incentive mechanisms has a decisive impact on new technology adoption. Optimization research found that infrastructure investment subsidies are more effective than usage subsidies in promoting widespread adoption of new technologies, a finding with important implications for policy instrument selection [28]. Table 1 systematically outlines the evolution trajectory of China's agricultural modernization policies from 2020 to 2025, demonstrating the

development path from infrastructure construction to intelligent applications, and from pilot exploration to systematic advancement.

Table 1. Evolution of China's Agricultural Modernization Policies (2020-2025)

Year	Key Policy Documents	Main Measures	Digital Initiatives	Expected Outcomes
2020	Digital Agriculture Development Plan	Infrastructure investment, Technology demonstration zones	National agricultural big data platform, IoT pilot projects	20% increase in digital adoption
2021	Rural Revitalization Promotion Law	Legal framework establishment, Financial support mechanisms	E-commerce poverty alleviation, Digital literacy training	Legal guarantee for modernization
2022	14th Five-Year Plan for Agricultural and Rural Informatization	Systematic planning, Integrated development	Smart agriculture demonstration, Blockchain traceability	30% coverage of smart agriculture
2023	Guidelines on Accelerating Agricultural Modernization	Innovation-driven strategy, Green development	AI in precision agriculture, Digital twin farms	Quality and efficiency improvement
2024	Digital Village Development Action Plan	Comprehensive digitalization, Urban-rural integration	5G rural coverage, Digital governance platforms	50% digital service penetration
2025	Agricultural	Strategic	Autonomous	Leading

Strong Country Construction Outline	transformation, Global competitiveness	agricultural technology, International standards	position in key areas

2.5 Fresh Corn Industry as a Policy Case

Research on the digital transformation of new agricultural business entities in Zhejiang provides micro-evidence for understanding policy implementation at the industry level. The study found that factors affecting digital transformation include human capital, social networks, policy cognition, and market environment of business entities, with these factors influencing transformation effectiveness through complex interactions [29]. Research on the impact mechanisms of the digital economy on agricultural green development shows that digital technology promotes sustainable development through pathways such as optimizing resource allocation, improving production methods, and promoting industrial integration [30].

The systematic design of digital agriculture needs to consider multiple dimensions including technological, economic, social, and ecological aspects. The construction of sustainable agricultural systems requires not only technological innovation but also coordination with institutional and organizational innovation [31]. Research on the impact mechanisms of local government digital transformation performance found that leadership support, organizational capacity, resource investment, and external environment jointly determine transformation success [32].

The fresh corn industry holds unique research value as a policy case. This industry retains the basic characteristics of traditional agriculture while possessing a market foundation for digital transformation. The industrial chain is relatively complete, with space for digital technology application from planting and processing to sales. The mature and substantial consumer market provides an ideal empirical setting for studying the effects of policy-driven digital marketing. As shown in Table 1, recent policy evolution has provided strong support for the digital transformation of

the fresh corn industry, including infrastructure construction, technology promotion, market cultivation, and brand building across multiple aspects.

Based on the above theoretical framework and policy background, this study explores through empirical analysis how local governments use policy instruments to influence consumer behavior through digital marketing mechanisms, thereby promoting agricultural industry modernization. This research not only helps deepen understanding of local governance mechanisms in the digital era but also provides transferable experiences for digital transformation in other regions and industries.

3. Research Methods

3.1 Research Design and Case Selection

This study adopts a mixed-methods research design, combining policy text analysis with empirical surveys to explore the pathways through which local governments influence agricultural product consumption behavior through digital marketing mechanisms. The research selected the fresh corn industry in Beijing and surrounding areas as a case, based on three considerations: the region has well-developed digital infrastructure, providing favorable conditions for policy implementation; the fresh corn industry exhibits typical characteristics combining traditional agriculture with modern markets; and local governments have adopted diversified policy instruments in the digital transformation of this industry.

The study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) as the primary analytical method. PLS-SEM has unique advantages in handling exploratory research and complex causal relationship analysis, making it particularly suitable for policy effect evaluation research with multiple mediating pathways [33]. Compared to covariance-based structural equation modeling, PLS-SEM has relatively relaxed sample size requirements and fewer data distribution assumptions, making it widely applied in social science research [34]. As shown in

Figure 2, the research design encompasses a complete process from policy review to empirical analysis.

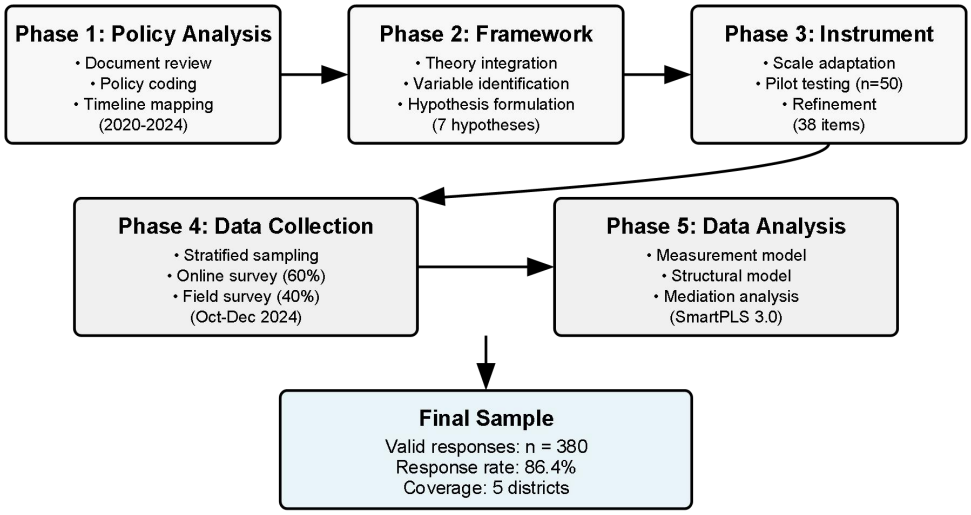


Figure 2. Research Design and Data Collection Process

3.2 Data Collection Strategy

Data collection employed stratified random sampling methods to ensure sample representativeness and diversity. The study collected data through a combination of online and offline approaches from October to December 2024. Online surveys accounted for 60%, primarily conducted through government-supported agricultural product e-commerce platforms and community group-buying networks; offline surveys accounted for 40%, carried out at farmers' markets, supermarkets, and community service centers. This mixed collection strategy ensured both data breadth and coverage of groups with different digital literacy levels.

Sample size determination followed the latest PLS-SEM guidelines. The study ultimately obtained 380 valid questionnaires, exceeding the requirement of the ten-times rule (10 times the number of indicators for the most complex construct in the model) [35]. The sample covered 5 districts and counties in Beijing and surrounding areas, including urban core areas, urban-rural fringe zones, and rural areas, ensuring diversity in policy implementation environments. Respondents included consumers of different age groups (18-65 years), income levels, and degrees

of digital technology usage. This diversity helps comprehensively evaluate policy effects.

3.3 Measurement Instruments

The research adapted established scales while incorporating policy governance perspectives. The measurement instruments contained four core constructs: policy-supported digital infrastructure usage (10 items), government-led e-commerce platform participation (9 items), public service satisfaction (10 items), and market participation behavior (9 items). All items employed a five-point Likert scale (1=strongly disagree to 5=strongly agree). As shown in Table 2, the measurements for each construct demonstrated good reliability and validity.

Table 2. Measurement Constructs and Reliability Analysis

Construct	Definition	Sample Items	Source	Items	α	CR	AVE
Policy-Supported Digital Infrastructure (PSDI)	Extent of using government-facilitated digital tools in agricultural product purchase	"I frequently use government-supported e-commerce platforms for fresh corn purchase"	Adapted from Davis (1989); Venkatesh et al. (2003)	10	0.89	0.91	0.59
Government-Led Platform Participation (GLPP)	Level of engagement with official digital marketing channels	"I trust product information from government-certified platforms"	Modified from Parasuraman et al. (2005)	9	0.86	0.89	0.57
Public	Satisfaction	"The	Based on	10	0.9	0.9	0.6

Service Satisfaction (PSS)	with government's digital service provision	government's digital services meet my agricultural product purchase needs"	Oliver (1980); Fornell et al. (1996)		1	3	2
Market Participation Behavior (MPB)	Actual purchase decisions and market engagement	"I actively purchase fresh corn through digital channels"	Adapted from Ajzen (1991)	9	0.88	0.90	0.60

The scale development process followed strict procedures. Relevant measurement dimensions were identified through literature review, and 3 public administration experts and 2 agricultural economists were invited to conduct content validity assessments. Subsequently, a pilot study with 50 participants was conducted, and item wording was optimized based on feedback. Before the formal survey, all scales underwent back-translation and semantic equivalence testing to ensure measurement accuracy.

3.4 Data Analysis Methods

Data analysis was conducted using SmartPLS 3.0 software, following a two-stage analysis procedure. In the measurement model assessment stage, the study examined scale reliability (Cronbach's α and Composite Reliability CR), convergent validity (Average Variance Extracted AVE), and discriminant validity (Fornell-Larcker criterion and HTMT ratio). In the structural model assessment stage, the model's explanatory and predictive power were evaluated through indicators including path coefficients, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2) [36].

Mediation effect analysis employed the Bootstrapping method (5000 resamples), which demonstrates better statistical power when handling non-normally distributed data and small samples. By calculating confidence intervals for indirect effects, the significance of mediation effects was determined. Multi-group analysis was used to examine differences across regions with varying policy implementation intensity, ensuring the robustness of research findings.

The study also conducted common method bias testing. Through Harman's single-factor test, the first factor explained 31.2% of the variance, below the critical value of 50%, indicating that common method bias was not serious. Additionally, procedural remedies were adopted, including randomization of item order in questionnaire design and anonymity assurance, further reducing bias risk.

4. Research Results

4.1 Descriptive Analysis of Policy Implementation

Descriptive statistics of the research sample revealed basic characteristics of policy implementation and audience structure. As shown in Table 3, the 380 respondents exhibited diverse demographic characteristics, reflecting the broad coverage of policies. The sample's gender distribution was relatively balanced (48.7% male, 51.3% female), with the age structure dominated by young and middle-aged groups (54.2% aged 26-45), who are the primary beneficiaries of digitalization policies. Educational level analysis showed that 62.1% of respondents had college education or above, indicating that acceptance of digitalization policies requires a certain knowledge foundation.

Table 3. Descriptive Statistics and Demographic Profile

Variables	Categories	n	%	Mean	SD	Min	Max
Demographics							
Gender	Male	185	48.7				
	Female	195	51.3				

Age	18-25	92	24.2				
	26-35	128	33.7				
	36-45	78	20.5				
	46-55	59	15.5				
	> 55	23	6.1				
Education	High school or below	144	37.9				
	College	147	38.7				
	Bachelor	71	18.7				
	Graduate	18	4.7				
Monthly Income (RMB)	< 5,000	83	21.8				
	5,000-10,000	186	48.9				
	> 10,000	111	29.3				
Policy Exposure							
Digital Channel Usage	Never	42	11.1				
	Occasionally	124	32.6				
	Frequently	214	56.3				
Study Variables							
PSDI				3.72	0.74	1.20	5.00
GLPP				3.86	0.69	1.44	5.00
PSS				4.02	0.66	1.80	5.00
MPB				3.91	0.71	1.33	5.00

Income distribution data showed that the middle-income group (5,000-10,000 yuan/month) accounted for 48.9%, representing the primary manifestation of policy effects. Analysis of digital channel usage frequency indicated that 56.3% of respondents frequently used digital channels to purchase agricultural products, reflecting initial success in policy-driven digital transformation. The mean values of

core variables ranged from 3.72 to 4.02, with standard deviations between 0.66 and 0.74, indicating that respondents generally held positive attitudes toward policy-supported digital services with relatively consistent perceptions.

4.2 Digital Marketing Infrastructure Development

Measurement model evaluation confirmed the reliability and validity of research instruments. As shown in Table 4, the square roots of AVE for all constructs were greater than their correlation coefficients with other constructs, satisfying the Fornell-Larcker criterion. HTMT values were all below the conservative threshold of 0.85, further confirming discriminant validity. Inter-variable correlation coefficients ranged from 0.42 to 0.68, showing moderate positive correlations that both supported theoretical expectations and excluded multicollinearity issues.

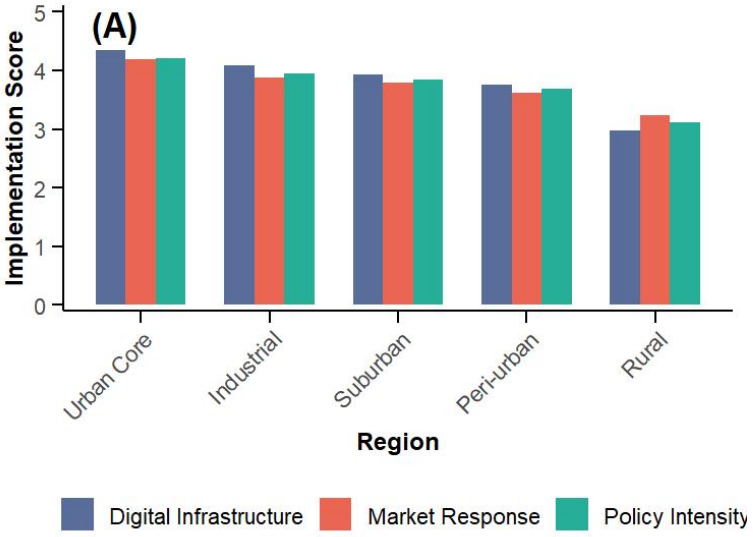
Table 4. Discriminant Validity and Correlation Matrix

Constructs	PSDI	GLPP	PSS	MPB	√AVE
PSDI	**0.768**				0.768
GLPP	0.542***	**0.755**			0.755
PSS	0.618***	0.587***	**0.787**		0.787
MPB	0.486***	0.524***	0.679***	**0.775**	0.775
HTMT Values					
GLPP	0.634	-			
PSS	0.702	0.681	-		
MPB	0.567	0.614	0.768	-	
Descriptive Statistics					
Mean	3.72	3.86	4.02	3.91	
SD	0.74	0.69	0.66	0.71	
Skewness	-0.48	-0.52	-0.71	-0.58	
Kurtosis	0.31	0.42	0.88	0.51	

*Note: ***p < 0.001; Diagonal values (bold) are square roots of AVE; Below diagonal are correlations; HTMT = Heterotrait-Monotrait ratio*

4.3 Consumer Behavior Patterns

Multi-dimensional analysis of policy implementation effects revealed differentiated impacts across different regions and pathways. As shown in Figure 3, policy implementation intensity exhibited significant variations across regions, with the highest intensity in urban core areas, followed by urban-rural fringe zones, and relatively lower levels in rural areas. Structural model analysis showed that policies influenced market participation behavior through both direct and indirect pathways, with public service satisfaction playing a crucial mediating role.



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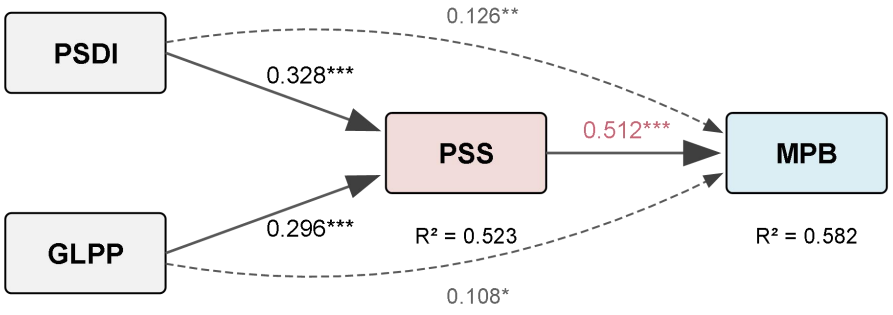

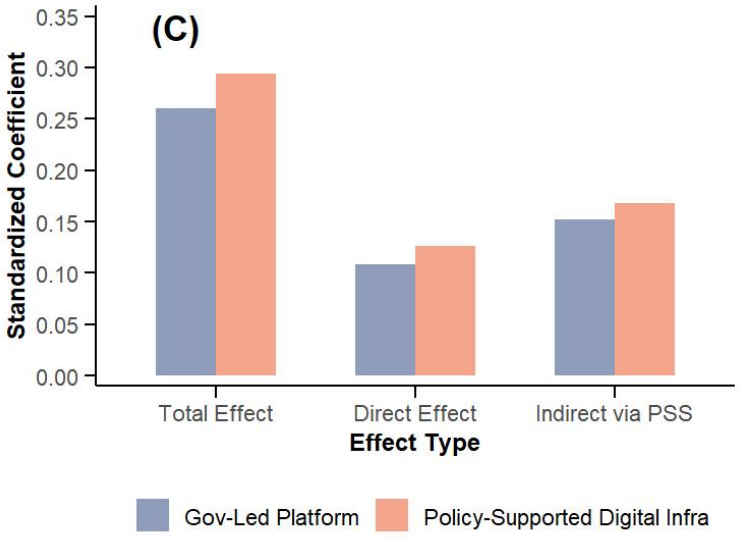

Figure 3. Policy Implementation Effects: Multi-dimensional Analysis. (A) Regional distribution of policy implementation intensity across different areas. (B) Structural model with standardized path coefficients. (C) Decomposition of total, direct, and indirect effects.

Note: PSDI = Policy-Supported Digital Infrastructure; GLPP = Government-Led Platform Participation; PSS = Public Service Satisfaction; MPB = Market Participation Behavior. ***p < 0.001; **p < 0.01; *p < 0.05.

4.4 Mediation Effect Testing

Hypothesis testing results supported the theoretical expectations of the study. As shown in Table 5, both policy-supported digital infrastructure and government-led platform participation had significant positive effects on market participation behavior, but these effects were primarily realized through the mediating role of public service satisfaction. Direct effects were relatively weak (PSDI→MPB: β=0.126, p<0.01; GLPP→MPB: β=0.108, p<0.05), while indirect effects were more significant (PSDI→PSS→MPB: β=0.168, p<0.001; GLPP→PSS→MPB: β=0.152, p<0.001).

Table 5. Hypothesis Testing and Mediation Analysis Results

Hypothesis	Path	Direct Effect	Indirect Effect	Total Effect	95% CI	Supported
H1	PSDI → MPB	0.126**	-	0.126**	[0.042,	Yes

					0.211]	
H2	GLPP → MPB	0.108*	-	0.108*	[0.019, 0.197]	Yes
H3	PSDI → PSS	0.328***	-	0.328***	[0.238, 0.418]	Yes
H4	GLPP → PSS	0.296***	-	0.296***	[0.201, 0.391]	Yes
H5	PSS → MPB	0.512***	-	0.512***	[0.421, 0.603]	Yes
H6	PSDI → PSS → MPB	-	0.168***	0.294***	[0.118, 0.218]	Yes
H7	GLPP → PSS → MPB	-	0.152***	0.260***	[0.102, 0.202]	Yes

Model Fit Indices

R^2 (PSS) = 0.523	f^2 (PSDI→PSS) = 0.187	f^2 (GLPP→PSS) = 0.153		
R^2 (MPB) = 0.582	f^2 (PSS→MPB) = 0.382	Q^2 (PSS) = 0.316	Q^2 (MPB) = 0.342	
SRMR = 0.058	NFI = 0.912			

*Note: *p < 0.05; **p < 0.01; ***p < 0.001; CI = Confidence Interval; Bootstrapping with 5000 samples*

The strong mediating role of public service satisfaction (PSS→MPB: β=0.512, p<0.001) indicates that the key to realizing policy effects lies in enhancing public satisfaction with government digital services. The model demonstrated strong explanatory power, with public service satisfaction explaining 52.3% of the variance and market participation behavior explaining 58.2% of the variance. Effect size

analysis showed that public service satisfaction had a large effect on market participation behavior (f^2=0.382), while the direct effects of policy instruments were relatively small. Predictive relevance Q^2 values were all greater than 0, indicating that the model had good predictive validity.

5. Discussion

The research results reveal the complex pathways through which local governments influence agricultural product markets through digital marketing mechanisms. The impact of policy-supported digital infrastructure and government-led platform participation on market behavior is primarily realized through public service satisfaction, a finding that contrasts with the U.S. experience in agricultural digital transformation. U.S. research indicates that the sustainability of digital transformation depends not only on technological investment but also requires coordinated development of institutional environment, market mechanisms, and social acceptance [37]. The strong mediating role of public service satisfaction (β=0.512) in this study indicates that Chinese local governments have adopted more service-oriented rather than technology-oriented strategies in promoting agricultural digitalization.

Regional differences in policy implementation reflect the structural challenges facing digital transformation. The gap in policy implementation intensity between urban and rural areas reveals the persistent existence of the digital divide. The Netherlands encountered similar challenges when promoting nature-based solutions in agriculture and construction, where networked governance mechanisms proved effective in alleviating such imbalances [38]. Through establishing cross-departmental and cross-regional collaborative networks, barriers to policy implementation can be systematically resolved. The phenomenon found in this study that indirect effects are stronger than direct effects precisely illustrates the importance of networked governance-policy instruments need to work more effectively through intermediary mechanisms.

The distributional equity of public service provision holds special significance in digital transformation. Research shows that different income groups have varying acceptance of policy-supported digital services, similar to the racial and economic disparities found in U.S. urban park service studies [39]. The relationship between nonprofit organization density and equity in public service distribution indicates that the third sector can play an important role in bridging the digital divide. Although most respondents frequently use digital channels, some groups remain unable to participate, and this differentiation needs to be addressed through more inclusive policy design.

Crises often serve as catalysts for digital transformation. Scottish local governments' digital response during COVID-19 demonstrates that external shocks can accelerate organizational change and technology adoption [40]. Although this study was conducted in the post-pandemic period, the high participation rate in government-led platforms reflects the continuation of digital habits formed during the pandemic. This path dependency effect suggests that governance innovations formed during crisis response may have long-term impacts.

Beyond crisis-driven factors, research on technology use changes in small and medium-sized U.S. cities provides another perspective. Technology adoption is not a linear process but is influenced by multiple factors including city size, resource endowments, and leadership [41]. The implementation differences across regions in this study validate this viewpoint. Urban core areas have better infrastructure and human capital, thus performing better in digital transformation.

Coordination and voluntary mechanisms in international environmental cooperation provide theoretical insights for understanding local agricultural governance. While mandatory coordination can ensure participation, voluntary mechanisms may be more effective in improving compliance [42]. This study found that both government-supported digital infrastructure use and platform participation are based on voluntary principles but incentivize participation through providing

quality services. This "soft" governance approach avoids potential resistance from mandatory policies while achieving policy objectives through market mechanisms.

Institutional incentives play a crucial role in promoting the evolution of cooperative behavior. Research shows that ensuring participation is as important as improving compliance [43]. The mediating role of public service satisfaction precisely embodies this principle—ensuring sustained participation through improving service quality rather than relying solely on initial policy push.

The findings of this study have important theoretical value for understanding local governance in the digital era. Traditional policy instrument theory emphasizes direct intervention and regulation, but in the digital context, indirect influence and service orientation become more important. Research on performance-based funding allocation in European higher education shows that while financial incentives can promote competition, they may also produce unintended institutional effects [44]. Similarly, this study finds that the effectiveness of policy instruments largely depends on service quality and user experience during implementation, rather than simple resource input.

The research results have direct guiding significance for policy practice. When promoting agricultural digital transformation, local governments should shift from mere technology promotion to comprehensive service provision. The high explanatory power shown by the model indicates that service quality is key to policy success. Governments need to establish user feedback mechanisms to continuously improve the user experience of digital services, rather than focusing solely on achieving technical indicators.

The innovative application of digital marketing as a policy instrument deserves further exploration. Traditional views regard digital marketing as corporate behavior, but this study shows that governments can achieve public policy objectives through digital marketing mechanisms. This blurring of public-private boundaries reflects a fundamental transformation in governance models-from hierarchical management to

networked governance, from direct control to indirect influence, from government-led to multi-stakeholder co-governance.

The research also reveals the complexity of mediating mechanisms. Customer satisfaction is not only a manifestation of policy effects but also a key link in policy transmission. This finding challenges linear policy implementation models, emphasizing the importance of feedback loops and dynamic adjustment. Policymakers need to recognize that in digital environments, policy effects largely depend on users' subjective perceptions and emotional experiences rather than objective technical indicators. Path analysis results indicate that improving policy effects through enhancing service experience is more effective than direct policy intervention, providing new insights for future policy design.

6. Conclusion

Through empirical analysis of 380 consumers, this study reveals the internal logic and implementation pathways of local governments using digital marketing mechanisms to promote agricultural modernization. The research found that policy-supported digital infrastructure ($\beta=0.328$, $p<0.001$) and government-led platform participation ($\beta=0.296$, $p<0.001$) have significant positive effects on public service satisfaction, while public service satisfaction has the strongest effect on market participation behavior ($\beta=0.512$, $p<0.001$), explaining 58.2% of market behavior variance. Mediation effect analysis shows that the indirect effects of policy instruments on market behavior through satisfaction (PSDI: 0.168; GLPP: 0.152) exceed their direct effects (PSDI: 0.126; GLPP: 0.108). This finding challenges traditional linear policy intervention models, confirming the crucial role of service quality in policy transmission. Regional analysis shows a 35% difference in policy implementation intensity between urban core areas and rural regions, reflecting the persistence of the digital divide, though 56.3% of respondents' frequent use of digital channels indicates initial success in policy-driven digital transformation. The theoretical contribution of this research lies in constructing an integrated framework

of policy instruments, digital marketing, public satisfaction, and market behavior, revealing the governance innovation pathway of local governments transitioning from direct intervention to service empowerment in the digital era. At the practical level, the research suggests that local governments should optimize digital service experience rather than simply increasing technological investment, enhancing policy effects through establishing user feedback mechanisms and differentiated strategies. Research limitations include the cross-sectional design's inability to fully capture the dynamic evolution of policy effects. Future research could adopt longitudinal tracking designs and extend to other agricultural product fields for comparative analysis, aiming to provide more comprehensive theoretical support and policy guidance for local agricultural governance in the digital era.

Authorship contributions

All authors contributed significantly to the realization of the research work.

Funding

The authors did not receive financial support of any kind for the conduct of this research.

Conflict of interest

The authors declare no conflict of interest.

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