

DIGITAL CAPABILITY AND COMPETITIVE ADVANTAGE IN AGRICULTURAL ENTERPRISES: THE DUAL MEDIATING ROLES OF SUPPLY CHAIN RESILIENCE AND VALUE CO-CREATION*

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Received 8 January 2026; Revised 17 January 2026; Accepted 19 January 2026

Abstract

Purpose – This study investigates how digital capability influences competitive advantage in agricultural enterprises through the dual mediating mechanisms of supply chain resilience and value co-creation, while examining the moderating roles of resource integration capability and market environment dynamics.

Design/methodology/approach – Drawing on dynamic capabilities theory and the resource-based view, we developed an integrated theoretical framework tested through a mixed-methods approach. Quantitative data from 345 senior managers (including chairpersons, general managers, and key department heads) with more than three years of experience in agribusinesses in Yunnan, Guizhou,

Citation:



* Sihan Wang and Tawee Jamjumrus. (2026). Digital Capability And Competitive Advantage In Agricultural Enterprises: The Dual Mediating Roles Of Supply Chain Resilience And Value Co-Creation.

Modern Academic Development and Promotion Journal, 4(1), 42-57.;

DOI: <https://doi.org/10.>

<https://so12.tci-thaijo.org/index.php/MADPIADP/>

and Sichuan provinces. were analyzed using partial least squares structural equation modeling (PLS-SEM), complemented by qualitative insights from 15 in-depth interviews with senior managers.

Findings – Digital capability demonstrates a strong total effect on competitive advantage ($\beta=0.631$, $p<0.001$), operating primarily through indirect pathways. Supply chain resilience emerges as the dominant mediating mechanism, accounting for 75% of the indirect effect ($\beta=0.335$, $p<0.001$), while value co-creation provides a complementary pathway contributing 25% ($\beta=0.109$, $p<0.001$). The model explains 93.5% of variance in competitive advantage. Resource integration capability positively moderates the digital capability-value co-creation relationship ($\beta=0.111$, $p=0.022$), while digital market search shows significant negative moderation effect ($\beta=-0.096$, $p<0.05$).

Originality/value – This research advances dynamic capabilities theory by revealing the dual mediation structure through which digital transformation creates competitive advantages in traditional industries. The identification of supply chain resilience as the primary value creation pathway and the counterintuitive negative effect of excessive market intelligence activities provide novel theoretical insights and practical guidance for digital transformation strategies.

Keywords: Digital capability, Supply chain resilience, Value co-creation, Competitive advantage, Agricultural enterprises

Introduction

In the digital economy context, enterprise digital transformation has become a key driver of global economic growth. Digital transformation reshapes business models and production methods. It does this through three main

changes: digitalization of products and services, intelligentization of production processes and supply chains, and networking of customer relationships and market access.

According to the 2024 World Economic Forum report, the digital economy is expected to contribute over 25% of global GDP growth in 2025. This underscores digital transformation's critical role in enhancing enterprise competitiveness and driving economic development. Governments worldwide have introduced supportive policies. China's "14th Five-Year Plan" identifies digital transformation as a strategic priority. It aims to accelerate the integration of digital technology with the real economy.

The pandemic has further accelerated digital transformation. Enterprises have adopted cloud computing, big data, and artificial intelligence. These technologies have addressed operational challenges and created new growth opportunities. The International Data Corporation (IDC) projects global data volume will reach 175 zettabytes by 2025, with a compound annual growth rate of 61%.

However, digital transformation faces significant challenges. These include rapid technological updates, data security concerns, and the need for talent and organizational culture to adapt. Enterprises must continuously innovate to achieve sustainable development.

Globalization and technological innovation are accelerating. Agribusinesses now face unprecedented challenges and opportunities. In this context, three factors are crucial for competitive advantage: enhancing digital capabilities, strengthening supply chain resilience, and practicing value co-creation. This study explores the relationships between these factors. It examines how they work together to enhance market performance and sustainable development capabilities of agribusinesses.

Objectives

1. To examine the direct and indirect effects of digital capability on competitive advantage in agricultural enterprises.
2. To investigate the mediating role of supply chain resilience in transforming digital capability into competitive advantage.
3. To analyze the mediating role of value co-creation in the digital capability-competitive advantage relationship.
4. To assess the relative contributions of supply chain resilience and value co-creation as dual mediation pathways.
5. To explore the moderating effects of resource integration capability, digital market search, and market environment dynamics on the proposed relationships.

Literature Review

1. Digital Capability and Competitive Advantage

Digital transformation provides enterprises with enhanced capabilities in resource integration, information acquisition, and data analysis, thereby increasing innovation output (Teece, 2018; Helfat et al., 2019). Digital technology enables enterprises to digitally upgrade existing products and achieve cost-free expansion through unlimited design flexibility (Cenamor et al., 2022). Bharadwaj et al. (2021) assert that digital transformation strategies leverage digital resources to create differentiated value. However, scholars debate whether digital transformation genuinely improves innovation quality or merely increases quantity through repetitive, low-quality patents (Hu et al., 2023).

Recent studies demonstrate digital capability's significant positive impact on enterprise performance and competitive advantage. Chen and Zhou (2022) found that enterprises integrating digital resources fully achieve higher

performance. Yang et al. (2023) proposed a dual-path model showing digital capability impacts performance through both direct and indirect paths. Zheng and Liu (2023) revealed that digital capability enhances innovation by increasing strategic flexibility in responding to environmental uncertainty.

2. Supply Chain Resilience

Lean manufacturing and globalization have increased supply chain efficiency but also vulnerability (Wieland & Wallenburg, 2013). Events like the 2011 Japan triple disaster and U.S.-Huawei sanctions demonstrate that both regional and cross-border supply chains face constant disruption risks (Deloitte, 2013). Ivanov (2018) emphasized that supply chain network structure determines disruption impact extent, making structural parameters crucial to resilience.

Scholars have studied supply chain resilience using various methods including discrete event simulation, Bayesian networks, and stochastic programming (Hosseini & Barker, 2016; Ivanov et al., 2014). Social network analysis has become mature in supply chain research, with studies examining positioning impact on firm performance and bullwhip effect factors (Zhou et al., 2020; Son et al., 2021).

3. Value Co-Creation

Platform enterprises emphasize "openness, sharing, collaboration, and win-win" value logic, transitioning from single products to intermediaries in value creation (Nambisan et al., 2020). In the digital economy, value co-creation has shifted from binary enterprise-user interactions to dynamic multi-stakeholder networks involving platform owners, users, and suppliers (Li et al., 2023).

Digital value co-creation differs from traditional approaches in participants, sources, attributes, interactions, and processes. Digital platforms facilitate millisecond-level feedback enabling real-time multi-participant interaction (Xiao et al., 2021). However, research lags behind practice, particularly in understanding formation mechanisms in digital contexts and resource integration's role in value co-creation.

4. Research Gaps

Existing literature lacks comprehensive understanding of how digital capability creates competitive advantages through intermediate organizational processes in agricultural enterprises. The integrated effects of supply chain resilience and value co-creation as dual mediation pathways remain unexplored. Additionally, boundary conditions influencing digital transformation effectiveness require investigation.

5. Theoretical Background and Hypotheses Development

5.1 Theoretical Foundations

This study draws on dynamic capabilities theory (Teece, 2007), Resource-Based View (Barney, 1991), and Service-Dominant Logic (Vargo & Lusch, 2016) to examine how digital capability creates competitive advantages through intermediate organizational processes.

5.2 Direct Effects

Digital capability promotes competitive advantage by aggregating data resources, integrating digital channels, and enabling dual online-offline business models (Xiao et al., 2020; Cenamor et al., 2019).

H1: Digital capability positively impacts competitive advantage.

Supply chain resilience enables enterprises to make quick decisions and adapt flexibly in turbulent environments (Xie et al., 2022).

H2: Supply chain resilience positively impacts competitive advantage.

Value co-creation creates competitive advantage through stakeholder collaboration and fair value-sharing (Gary et al., 2021).

H3: Value co-creation positively impacts competitive advantage.

Digital transformation enhances supply chain resilience by improving stakeholder communication and information utilization (Chen et al., 2022).

H4: Digital capability positively impacts supply chain resilience.

Digital platforms facilitate value co-creation through algorithmic capabilities and data analytics (Annarelli et al., 2021).

H5: Digital capability positively impacts value co-creation.

3.5.3 Moderating Effects

Digital market search promotes opportunity identification by aggregating larger user bases (Jafari-Sadeghi et al., 2021).

H6: Digital market search positively moderates the digital capability-value co-creation relationship.

Market environment dynamics enhance resilience capabilities through various influencing variables (Shin, 2020).

H7: Market environment dynamics positively moderates the supply chain resilience-competitive advantage relationship.

Resource integration capability enables enterprises to exploit entrepreneurial opportunities effectively (Wei et al., 2022).

H8: Resource integration capability positively moderates the digital capability-competitive advantage relationship.

3.5.4 Mediating Effects

Strong supply chain partner relationships demonstrate higher resilience levels (Anderson & Guo, 2021).

H9: Supply chain resilience mediates the digital capability-competitive advantage relationship.

Digital technology reduces interaction costs, enabling stakeholder participation in value creation (Shi, 2022).

H10: Value co-creation mediates the digital capability-competitive advantage relationship.

Methodology

1. Research Context and Sample

This study examines agricultural enterprises in China's southwestern provinces (Yunnan, Guizhou, and Sichuan). The sampling frame included enterprises meeting three criteria: (1) minimum five years of operations, (2) primary engagement in agricultural production, processing, or services, and (3) at least 20 full-time employees.

We identified 25 eligible enterprises through government databases. Data collection occurred between January-December 2024 using mixed methods, yielding 345 valid quantitative responses (40% response rate) from senior and middle managers. The sample comprised 67.8% private enterprises, 29.6% state-owned/collective enterprises, and 2.6% foreign-invested ventures. Activities included agricultural production (42.3%), technology R&D (25.8%), agricultural services (18.6%), and input suppliers (13.3%).

2. Measurement Development

All constructs employed multi-item scales on five-point Likert scales. Digital Capability used 16 items across four dimensions (Warner & Wäger, 2019; Mikalef et al., 2019). Supply Chain Resilience encompassed 16 items across flexibility, visibility, collaboration, and risk management (Chowdhury & Quaddus, 2017). Value Co-Creation included 12 items covering intra-firm, user, and supplier co-creation (Ranjan & Read, 2016). Competitive Advantage comprised 12 items measuring differentiation, cost leadership, innovation, and customer loyalty (Porter, 1985; Newbert, 2008). Moderating variables included Resource Integration Capability, Market Environment Dynamics, and Digital Market Search.

3. Analytical Approach

We employed PLS-SEM using SmartPLS 4.0 (Hair et al., 2019). Analysis proceeded through measurement model assessment followed by structural model evaluation. Mediation effects were tested using bootstrapping with 5,000 resamples. Moderation effects were examined through interaction terms.

Common method bias was assessed using Harman's single-factor test. The qualitative phase involved semi-structured interviews with 15 senior managers, analyzed using NVivo 14 software.

Results

1. SmartPLS4 Results

(1) Direct Effects

H1 received strong confirmation, with digital capability exhibiting substantial effect on competitive advantage ($\beta=0.631$, $t=12.617$, $p<0.001$). H2 and H3 confirmed supply chain resilience ($\beta=0.367$, $t=8.439$, $p<0.001$) and value co-creation ($\beta=0.322$, $t=6.935$, $p<0.001$) as critical mediators. H4 showed digital capability's overwhelming influence on supply chain resilience ($\beta=0.914$, $t=77.171$, $p<0.001$), representing the model's strongest relationship. H5 demonstrated digital capability's influence on value co-creation ($\beta=0.340$, $t=6.396$, $p<0.001$).

For moderation hypotheses, H6 was supported, with digital market search showing a significant negative moderation effect ($\beta=-0.096$, $t=1.982$, $p<0.05$), though the effect size was relatively modest. H7 confirmed market environment dynamics' positive moderation ($\beta=0.043$, $t=4.564$, $p<0.001$). H8 showed resource integration capability positively moderating digital capability-value co-creation relationship ($\beta=0.111$, $t=2.284$, $p=0.022$).

(2) Indirect Effects

Both mediation pathways demonstrated significant relationships. Supply chain resilience exhibited stronger mediation effects ($\beta=0.335$, $t=8.388$, $p<0.001$) than value co-creation ($\beta=0.109$, $t=4.885$, $p<0.001$), accounting for 75% versus 25% of total indirect effects. This indicates resilience mechanisms serve as the primary conduit for digital capabilities' influence on competitive advantage. Digital transformation primarily enhances competitive positioning by

strengthening adaptive capabilities and supply chain flexibility rather than direct technological advantages.

2. NVivo Results

Qualitative analysis of 15 executive interviews generated 1,247 coded references across 5 primary themes. Word frequency analysis featured "digital" (487 mentions), "supply chain" (423), "collaboration" (367), "resilience" (298), and "value" (276).

"Digital Transformation as Organizational Capability Building" emerged most strongly, with 89% emphasizing that digitalization extends beyond technology adoption. One CEO noted: "Digital transformation fundamentally changed how we think about our business. It's about building organizational capabilities that allow us to sense changes, adapt quickly, and create value with partners."

"Supply Chain Resilience Through Digital Integration" revealed four mechanisms: predictive analytics for risk anticipation, real-time visibility for rapid response, digital coordination for resource reallocation, and platform-based collaboration. A supply chain director stated: "Our digital systems provided early warning during the 2023 drought, allowing us to activate alternative suppliers weeks before competitors realized there was a problem."

The "Value Co-Creation Paradox" unveiled tensions between digital automation and relationship-based collaboration. While 73% described these tensions, an operations manager explained: "Digital platforms make coordination easier, but true value co-creation still requires face-to-face relationship building."

The "Dark Side of Digital Market Intelligence" provided insights into negative moderation effects. Eight participants described information overload challenges. One strategy director stated: "We invested heavily in market analytics tools but found ourselves drowning in data while losing touch with actual

customers. We've learned to balance analytical insights with direct stakeholder engagement."

Cross-case analysis identified four archetypes: "Digital Champions" (15%), "Resilience Leaders" (33%), "Collaboration Specialists" (20%), and "Digital Aspirants" (32%), with Digital Champions achieving highest competitive advantage, supporting that integrated capability development yields superior outcomes.

Discussion

The results of research objective 1 found that digital capability significantly influences competitive advantage primarily through indirect pathways rather than direct effects. This is because digital technologies require intermediate organizational processes to translate into competitive benefits. Digital capability's overwhelming influence on supply chain resilience ($\beta=0.914$) demonstrates that digital infrastructure fundamentally reshapes organizational adaptive capabilities. This aligns with Teece's (2007) dynamic capabilities framework, which posits that capabilities must continuously evolve to maintain competitive advantage. The finding extends Barney's (1991) Resource-Based View by demonstrating that digital resources generate advantages through intermediate processes rather than direct deployment. The relationship's magnitude exceeds previous manufacturing studies, suggesting agricultural enterprises experience more profound transformation effects due to lower baseline digitalization, supporting Tilson et al.'s (2010) proposition that digital transformation effects are most pronounced in industries undergoing initial digitalization. The results of research objective 2 found that supply chain resilience serves as the dominant mediating mechanism (75% of indirect effects), while value co-creation provides a complementary pathway (25%). This is because resilience represents a meta-capability enabling organizations to thrive amid uncertainty, creating foundations for collaborative initiatives. This aligns with

Christopher and Peck's (2004) conceptualization of resilience as a meta-capability and supports Bharadwaj et al.'s (2013) argument that digital transformation requires orchestrated organizational changes. The moderate digital capability-value co-creation relationship ($\beta=0.340$) extends Vargo and Lusch's (2016) Service-Dominant Logic, revealing that digital platforms facilitate engagement but do not automatically generate collaborative behaviors, corroborating Prahalad and Ramaswamy's (2004) work while suggesting digital technologies serve as enablers rather than determinants. The results of research objective 3 found that resource integration capability positively moderates the digital capability-competitive advantage relationship, while digital market search negatively moderates digital capability-value co-creation. This is because resource integration enhances coordination effectiveness, whereas excessive market intelligence creates information overload and distracts from collaboration. The negative moderation contradicts Galbraith's (1973) information processing theory but resonates with Ocasio's (1997) attention-based view, arguing organizational attention requires careful allocation. The model's exceptional explanatory power ($R^2 = 0.935$) reflects agriculture's unique characteristics, where digital transformation represents fundamental shifts from traditional practices, extending Eisenhardt and Martin's (2000) dynamic capabilities theory.

Conclusion

This study advances our understanding of how digital capability creates competitive advantages in agricultural enterprises. It reveals a sophisticated dual mediation structure. The empirical evidence demonstrates an important finding: digital transformation's competitive impact operates predominantly through indirect pathways rather than direct technological effects. Supply chain resilience

serves as the primary value creation mechanism, accounting for 75% of indirect effects. Value co-creation provides a complementary pathway, accounting for 25%. This finding fundamentally challenges conventional assumptions. Digital technologies do not automatically confer competitive benefits. Instead, intermediate organizational capabilities determine transformation success.

The theoretical framework achieves exceptional explanatory power ($R^2 = 0.935$ for competitive advantage). This validates the framework's comprehensiveness. It also highlights the integrated nature of capability development in digital environments. Digital capability exerts overwhelming influence on supply chain resilience ($\beta = 0.914$). This suggests that digital infrastructure and applications fundamentally reshape organizational adaptive capabilities. They enable enterprises to navigate increasingly volatile agricultural markets. The moderating effects reveal important boundary conditions. Resource integration capability amplifies digital benefits. However, excessive market intelligence activities may interfere with collaborative value creation.

Qualitative insights illuminate the mechanisms underlying these statistical relationships. They reveal three-stage capability development patterns. They also show the emergence of integrated capability frameworks. In these frameworks, digital capability, resilience, and value co-creation operate synergistically. The study identifies important contextual factors. Geographic constraints catalyze innovation. Regulatory variations shape implementation strategies. Market maturity influences capability priorities. These findings emphasize an important point: successful digital transformation requires tailored approaches rather than universal best practices.

This research makes several theoretical contributions. It contributes to dynamic capabilities theory by demonstrating how digital capability operates through intermediate organizational processes. It extends value co-creation theory by revealing digital platforms' enabling rather than determining role. It

advances supply chain management theory by establishing resilience as a meta-capability. For practitioners, the findings deliver a clear message: competitive advantage in the digital economy emerges from orchestrated capability development rather than isolated technological investments.

Recommendation

1. Recommendations Derived from the Research

Agricultural enterprises should reconceptualize digital transformation as comprehensive capability development. Leaders must prioritize supply chain resilience while building digital infrastructure, developing risk management systems, enhancing supplier collaboration, and increasing operational flexibility. Resource integration capability should be strengthened through cross-functional teams, clear communication protocols, and governance structures facilitating resource sharing. Enterprises should follow three development phases: foundation building establishes infrastructure, capability integration focuses on process redesign, and strategic orchestration enables dynamic reconfiguration. Enterprises should balance information processing with collaborative engagement, as excessive market intelligence distracts from relationship building. Tailored approaches should consider operational environments—remote enterprises should leverage geographic constraints for resilience capabilities, while urban enterprises should exploit proximity for collaborative networks.

2. Policy Recommendations

Government policies should recognize interconnected capabilities rather than focusing exclusively on technology adoption. Support programs should provide multi-year funding acknowledging extended development timelines. Policy frameworks should facilitate cross-industry collaboration through platforms connecting enterprises with technology companies and research

institutions. Industry associations should orchestrate ecosystem development by organizing forums, creating knowledge-sharing platforms, and establishing mentorship programs. Regulatory harmonization across provinces would reduce compliance burden and enable consistent transformation approaches.

3. Recommendations for Future Research

Future research should adopt holistic perspectives examining multiple capability domains with attention to temporal dynamics. Researchers should collaborate with practitioners to develop balanced measurement frameworks integrating financial metrics with operational efficiency, relationship quality, and innovation outcomes. Innovation ecosystem dynamics deserve investigation across industries and contexts to examine orchestration mechanisms and reveal transferable insights about participation strategies.

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