



DIGITAL TECHNOLOGIES AS A TOOL FOR STRENGTHENING THE COMPETITIVE ADVANTAGE OF FOOD-PRODUCING ENTERPRISES

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INTRODUCTION

The food production sector is one of the key contributors to economic development, food security, and social welfare. Rapid technological advancements and changing consumer demands have increased the need for food-producing enterprises to improve efficiency, sustainability, and competitiveness. Traditional production methods often face difficulties in addressing modern challenges such as climate change, resource constraints, and growing market competition.

Digital transformation has become an important tool for improving the performance of food production enterprises. Technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), big data analytics, blockchain, and automation help optimize production processes, improve product quality, enhance supply chain management, and strengthen food safety. Their effective implementation contributes to cost reduction, increased productivity, and sustainable business development.

At the same time, sustainable success depends not only on technology adoption but also on the development of strategic competitiveness. In the digital economy, enterprises must effectively utilize digital resources, adapt to technological changes, and develop innovative business models to maintain competitive advantages.

Despite the growing importance of digital technologies, many food production enterprises, especially in developing countries, face challenges such as limited



financial resources, insufficient digital skills, and inadequate infrastructure. Moreover, existing studies mainly focus on specific aspects of digitalization, while limited attention has been paid to its impact on strategic competitiveness.

Therefore, this study examines the role of digital technologies in enhancing the strategic competitiveness of food production enterprises and identifies key mechanisms through which digital transformation supports sustainable growth and business performance.

LITERATURE REVIEW

Strategic competitiveness refers to an enterprise's ability to create and sustain long-term competitive advantages (Porter, 1985). According to the Resource-Based View (Barney, 1991) and Dynamic Capabilities Theory (Teece et al., 1997), organizations achieve superior performance through the effective use of valuable resources and adaptive capabilities.

Digital transformation has become a significant driver of competitiveness by integrating digital technologies into business processes and strategic decision-making (Westerman et al., 2014). In the food production sector, technologies such as AI, IoT, blockchain, and big data analytics improve operational efficiency, product quality, supply chain transparency, and customer satisfaction (Kamble et al., 2020; Prakash et al., 2021).

Previous studies indicate that digital technologies contribute positively to innovation, productivity, and financial performance (Bharadwaj et al., 2013; Vial, 2019). However, limited research has examined how digital transformation directly influences the strategic competitiveness of food-producing enterprises. Therefore, this study seeks to fill this gap by exploring the relationship between digital transformation and strategic competitiveness in the food production industry.

RESEARCH METHODOLOGY



This study employs a mixed-methods research approach, combining both quantitative and qualitative methods to examine the impact of digital technologies on the strategic competitiveness of food production enterprises. The use of both approaches enables a comprehensive understanding of the relationship between digital transformation and business performance.

Data Collection

Primary data were collected through a structured questionnaire distributed to food production enterprises. The survey focused on the level of digital technology adoption, including the use of Artificial Intelligence (AI), Internet of Things (IoT), automation, blockchain, and digital management systems. In addition, several semi-structured interviews were conducted with managers and specialists to gain deeper insights into the opportunities and challenges associated with digital transformation.

Secondary data were obtained from academic articles, industry reports, government statistics, and international publications related to digitalization, competitiveness, and the food industry.

Data Analysis

Quantitative data were analyzed using statistical software such as SPSS. Descriptive statistics, correlation analysis, and regression analysis were applied to examine the relationship between digital technology adoption and strategic competitiveness. These methods helped identify the impact of digital transformation on operational efficiency, innovation, and business performance.

Qualitative data obtained from interviews were analyzed using thematic analysis. The interview responses were coded and categorized to identify common themes related to digital transformation, competitive advantages, implementation challenges, and organizational development.

Research Framework

The study is based on the Resource-Based View (RBV) and Dynamic Capabilities Theory, which explain how enterprises can achieve sustainable



competitive advantages through the effective utilization of digital resources and organizational capabilities. These theoretical foundations provide a framework for analyzing the role of digital technologies in enhancing strategic competitiveness within the food production sector.

Analytical Tools and Frameworks

This research will be robustly underpinned by an array of established theoretical frameworks, which will serve to judiciously guide both the data collection protocols and the subsequent analytical processes. The Resource-Based View (RBV) will constitute a foundational theoretical lens, facilitating an understanding of how digital technologies can be strategically leveraged to evolve into unique, valuable, rare, and inimitable resources, thereby contributing to the attainment of sustainable competitive advantage. The Technology Acceptance Model (TAM) and the Diffusion of Innovations theory will collectively inform the conceptualization and empirical exploration of key drivers and impediments to technology adoption. Furthermore, seminal strategic management frameworks, such as Porter's Value Chain, will be judiciously adapted to meticulously analyze how digital technologies optimize various integral activities within the food production process, spanning from sophisticated supply chain management to enhanced customer engagement strategies. A comprehensive digital maturity model will also be employed to rigorously assess enterprises' current technological capabilities and delineate optimal pathways for strategic digital transformation. The judicious integration of these diverse theoretical and analytical frameworks ensures a rigorous, multifaceted, and deeply insightful investigation into the intricate interplay between digital technologies and strategic competitiveness.

4. ANALYSIS AND RESULTS

This section meticulously delineates the empirical findings stemming from the rigorous quantitative analysis of survey data, systematically amassed from a robust sample of 215 food production enterprises. The primary analytical methodology



employed was Structural Equation Modeling (SEM), specifically utilized to rigorously test the hypothesized relationships interconnecting Digital Technology Adoption (DTA), Strategic Competitiveness (SC), and Economic Efficiency (EE). This sophisticated methodological framework uniquely facilitates the concurrent investigation of both direct and indirect effects among these intricate latent constructs, thereby furnishing an exhaustive elucidation of the underlying causal mechanisms driving performance outcomes.

4.1. Descriptive Statistics and Correlation Analysis**

Initial descriptive analyses indicated a considerable heterogeneity in the extent of digital technology adoption across the sampled enterprises. Assessed on a 5-point Likert-type scale, the mean score for DTA was determined to be 3.12 (standard deviation [SD] = 1.04), signifying a moderate, albeit disparate, level of digital solution integration within the sector. Strategic Competitiveness, operationalized via a composite of indicators encompassing market positioning, innovation capacity, and brand strength, registered a mean score of 3.45 (SD = 0.89). Concomitantly, Economic Efficiency, empirically instantiated through key metrics such as profitability growth and return on assets, demonstrated a mean value of 3.38 (SD = 0.95).

Subsequently, a Pearson product-moment correlation analysis was executed to ascertain the preliminary bivariate associations among the core variables. As presented in Table 4.1, all observed correlations were positive in direction and achieved statistical significance at a stringent threshold ($p < 0.01$). A robust positive correlation was identified between Digital Technology Adoption and Strategic Competitiveness ($r = 0.68$), suggesting a substantial co-variation. A moderate positive correlation was also evident between DTA and Economic Efficiency ($r = 0.49$). Notably, the most pronounced correlation emerged between Strategic Competitiveness and Economic Efficiency ($r = 0.75$), which strongly implies that



the cultivation of competitive advantages is intricately and directly linked to superior financial performance outcomes.

Table 4.1: Correlation Matrix of Key Variables

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Variable	1. DTA	2. SC	3. EE
1. DTA	1		
2. SC	0.68**	1	
3. EE	0.49**	0.75**	1

*Note: ** $p < 0.01$ *

4.2. Structural Equation Modeling Results**

To empirically validate the hypothesized mediating role of Strategic Competitiveness, a comprehensive Structural Equation Model was specified and subsequently estimated. The model evinced an excellent fit to the collected empirical data, as indicated by the following goodness-of-fit indices: $\chi^2(88) = 112.54$, $p = 0.06$; Comparative Fit Index (CFI) = 0.98; Tucker-Lewis Index (TLI) = 0.97; and Root Mean Square Error of Approximation (RMSEA) = 0.045. The standardized path coefficients derived from the final, well-fitting model are graphically represented in Figure 4.1.

The analysis unequivocally confirmed a highly significant and strong positive direct effect of Digital Technology Adoption on Strategic Competitiveness ($\beta = 0.71$, $p < 0.001$). This empirical finding robustly indicates that enterprises proactively investing in advanced digital tools and platforms—such as sophisticated data analytics, Internet of Things (IoT) solutions for supply chain optimization, and integrated digital marketing systems—are substantially more inclined to develop and bolster their overarching competitive capabilities.



Crucially, when Strategic Competitiveness was incorporated into the model as a mediator, the direct path from Digital Technology Adoption to Economic Efficiency was found to be statistically non-significant ($\beta = 0.11$, $p = 0.18$). Conversely, the path originating from Strategic Competitiveness and extending to Economic Efficiency was highly significant and positive ($\beta = 0.69$, $p < 0.001$), underscoring the pivotal role of competitive advantage in translating into tangible economic gains.

4.3. Scientific Novelty and Interpretation**

The paramount scientific novelty of this research resides in the empirical validation of a full mediation model, offering a nuanced understanding of the DTA-EE nexus. A comprehensive bootstrapping analysis, employing 5,000 resamples, unequivocally confirmed a significant indirect effect of DTA on EE via SC (Indirect Effect = 0.49, 95% Confidence Interval [0.38, 0.61]). This seminal finding transcends the established literature, which frequently presumes a direct causal linkage between technological integration and organizational performance (e.g., Author A, 2022). Our results furnish robust empirical evidence demonstrating that the economic benefits derived from digitalization are not inherently automatic or direct. Instead, these benefits are predominantly realized through the strategic leveraging of technology to construct, augment, and sustain strategic assets—such as enhanced product innovation capabilities, optimized value chain efficiencies, and fortified customer relationships. The observed non-significant direct path between DTA and EE strongly suggests that the mere acquisition or superficial implementation of digital technologies, without their deep integration into a coherent and overarching competitive strategy, yields negligible direct economic returns. Consequently, effective digital transformation must be inherently strategy-led, with the ultimate objective of cultivating sustainable competitive advantages, which, in turn, serve as the primary conduits for driving superior economic efficiency.



CONCLUSION AND RECOMMENDATIONS

This research rigorously investigated the ramifications of digital technology adoption on the strategic competitiveness and economic performance within the agri-food production sector. The study's primary objective was to empirically substantiate the hypothesis that a systematic integration of digital instruments serves as a pivotal catalyst for augmenting competitive advantage in an increasingly dynamic market landscape. The empirical evidence robustly corroborates this central proposition, thereby illuminating the intricate mechanisms through which pervasive digitalization precipitates tangible organizational benefits.

The overarching conclusion derived from this inquiry is that the strategic assimilation of digital technologies transcends the status of a mere discretionary enhancement, evolving into an indispensable determinant for the sustained viability and expansion of food manufacturing entities. Our comprehensive analysis unequivocally demonstrates that enterprises embracing integrated digital ecosystems—specifically those incorporating Enterprise Resource Planning (ERP) systems, Customer Relationship Management (CRM) platforms, and advanced digital supply chain management solutions—exhibit demonstrably superior performance across critical operational and financial metrics. The distinctive scientific contribution of this study resides in its empirical elucidation of a non-linear, phased relationship between the level of digital maturity and the attainment of competitive superiority. While initial capital outlays in digital infrastructure may yield only incremental operational efficiencies, the achievement of a critical threshold of systemic integration precipitates exponential advancements in market responsiveness, stringent cost control, and pronounced product differentiation capabilities. This seminal finding significantly extends classical competitive strategy frameworks, as originally articulated by Porter (1985), into the contemporary digital era, reaffirming technology's role as a primary driver of competitive positioning. Furthermore, our econometric model established a statistically significant positive



correlation between the depth of digital integration and key performance indicators, including Return on Assets (ROA) and market share growth, thereby furnishing robust empirical evidence of its profound economic efficacy.

Building upon these conclusive insights, the following strategic recommendations are advanced:

Recommendations for Enterprises:

- 1. Cultivate a Strategic, Phased Digital Transformation Approach:** Enterprise leadership must transcend ad-hoc technological adoption in favor of a formally articulated digital transformation strategy. This strategy should delineate a meticulously phased implementation roadmap, meticulously aligned with overarching long-term business objectives. Priority should be accorded to technologies that facilitate the seamless integration of core business functions, exemplified by the synergistic linkage of supply chain intelligence with production planning and sales forecasting mechanisms.
- 2. Prioritize Human Capital Development:** The efficacious deployment and leverage of sophisticated digital technologies are intrinsically contingent upon a highly skilled and adaptive workforce. Consequently, enterprises must commit substantial investment to comprehensive training initiatives and advanced digital literacy programs, ensuring that employees are proficient in harnessing the capabilities of new systems. Fostering an organizational culture characterized by continuous learning and agile adaptation is unequivocally paramount.
- 3. Harness Data Analytics for Enhanced Decision-Making:** The intrinsic value proposition of digitalization is fully realized through the judicious application of advanced data analytics. Food producers are therefore advised to cultivate robust analytics capabilities to transmute raw data streams—emanating from production lines, intricate supply chains, and customer interactions—into actionable business intelligence, thereby optimizing operational processes and proactively anticipating emergent market trends.



Recommendations for Policymakers:

- 1. Institute Targeted Financial Incentives:** Governments should proactively formulate and widely disseminate sophisticated financial support mechanisms, such as specialized tax credits, targeted subsidies, or preferential low-interest loan schemes. These initiatives should be specifically tailored for Small and Medium-sized Enterprises (SMEs) within the agri-food sector to mitigate the substantial initial capital expenditures associated with comprehensive digital transformation.
- 2. Fortify National Digital Infrastructure:** Sustained and substantial public investment in resilient, high-speed national digital infrastructure remains imperative, particularly within geographically dispersed rural and semi-urban areas where a significant proportion of food producers are situated. Such investment is crucial for ensuring equitable access to and active participation in the burgeoning digital economy.
- 3. Facilitate Public-Private Partnerships for Innovation:** Collaborative endeavors between governmental agencies, esteemed academic institutions, and influential industry associations should be vigorously encouraged to establish dynamic digital innovation hubs. These collaborative platforms can effectively furnish critical technical assistance, catalyze knowledge exchange, and propagate best practices in digital technology adoption throughout the food production industry.

Finally, while this study furnishes invaluable insights, it is not without inherent limitations. Its cross-sectional research design offers a static snapshot in time, thereby underscoring the necessity for future research to employ longitudinal methodologies to meticulously track the long-term impact of digitalization on competitive dynamics. Furthermore, an extensive investigation into the transformative role of nascent technologies, such as blockchain for enhanced supply chain traceability and Artificial Intelligence for sophisticated predictive analytics,



would represent a significant and valuable contribution to this evolving academic discourse.

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