

THE IMPACT OF DIGITAL TRANSFORMATION ON THE MARKET EXPANSION OF SMALL COFFEE BUSINESSES: THE MEDIATING ROLE OF OPERATIONAL EFFICIENCY AND THE MODERATING EFFECT OF SUPPLY CHAIN INTEGRATION

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Abstract: This study aims to explore how digital transformation affects the market expansion of small coffee enterprises in China, with a focus on the mediating role of operational efficiency and the moderating role of supply chain integration. Based on the resource-based view (RBV) and supply chain management (SCM) theories, a structural model is constructed and empirically tested using questionnaire data from 374 coffee enterprises in urban areas of China.

The results indicate that digital transformation has a significant positive impact on market expansion, but this impact is fully mediated by operational efficiency. In other words, companies must optimize internal processes (such as order management, information flow, and inventory control) through digital means to demonstrate the effectiveness of transformation in external market performance. Additionally, supply chain integration plays a significant positive moderating role between digital transformation and market expansion, meaning that when a company's upstream and downstream coordination capabilities are stronger, the promotional effect of digitalization on market expansion is more pronounced.

This study employs structural equation modeling (SEM), Bootstrap mediation analysis, and moderation regression analysis, while controlling for firm size, coffee product type, geographical location, and years in operation to enhance the model's explanatory power and internal validity.

Theoretically, the study integrates the Resource-Based View (RBV) emphasis on internal capabilities with Supply Chain Management (SCM) focus on cross-organizational collaboration. Practically, it provides SME owners with specific recommendations for phased digital transformation, operational improvement, and strengthened supply chain collaboration. Despite limitations in its cross-sectional design and reliance on subjective survey data, the study offers a solid theoretical foundation

and empirical support for digital growth strategies in service-oriented small and micro enterprises.

Keywords: Digital transformation, operational efficiency, market expansion, supply chain integration

Introduction

In the past decade, the global coffee industry has undergone a fundamental transformation driven by three interlinked forces: changes in consumer behavior, accelerated digital innovation, and the proliferation of small, agile enterprises seeking to disrupt traditional retail models. While legacy players such as Starbucks and Costa Coffee have long dominated global supply chains, a parallel and fast-growing segment of small coffee businesses—comprising independent cafés, artisanal roasters, and digitally native micro-brands—has emerged as a critical engine of local innovation, customer intimacy, and entrepreneurial experimentation. This transformation has been particularly visible in urban China, where young consumers, digital platforms, and community-based retail have converged to create fertile ground for small firms that leverage authenticity, customization, and speed.

At the heart of this transformation lies the phenomenon of digital transformation, broadly defined as the deep integration of digital technologies into all aspects of business operations to reshape value creation, customer interaction, and organizational capabilities (Bharadwaj et al., 2018). For small coffee enterprises, digital transformation may manifest in myriad forms: adopting e-commerce platforms to bypass physical retail limitations, using social media marketing to tell brand stories and acquire customers, deploying customer relationship management (CRM) systems to personalize engagement, or implementing inventory and point-of-sale (POS) technologies to enhance back-end efficiency. Unlike large enterprises, however, small businesses must pursue these technologies with greater resource caution, making strategic prioritization essential. Their agility allows for quick iterations, but their vulnerability to poor decisions is higher.

The integration of digital tools can enable small coffee firms to expand their market reach beyond their physical location, tapping into new consumer demographics and geographic markets via digital channels. In China's major cities, for example, the use of third-party delivery platforms, mini-programs on WeChat, and short video marketing through Douyin has dramatically lowered the cost of customer acquisition for small brands while increasing competitive complexity. Beyond market reach, digital technologies also contribute to internal improvements—enhancing operational efficiency by automating tasks, reducing order fulfillment time, and streamlining supplier relationships. Importantly, the extent to which digital transformation leads to market expansion is not uniform. It is influenced by internal enablers such as process readiness and external factors such as supply chain integration, which together form the structural foundation of digital effectiveness.

Despite the growing application of digital technologies among SMEs in the coffee sector, academic research on this topic remains sparse and fragmented, often skewed toward large corporations

or generalized to manufacturing and e-commerce domains. Studies that do address SMEs frequently neglect the sector-specific realities faced by consumer-centric, perishable goods sectors like coffee, including rapid inventory turnover, demand unpredictability, and premium positioning. Additionally, there is limited exploration of the mechanisms through which digital transformation yields performance outcomes, particularly the role of operational efficiency as a mediating process, or supply chain integration as a moderating capability that conditions success. In a post-pandemic digital economy, this analytical gap is both empirical and strategic, necessitating closer scrutiny of how digital transformation enables small firms not just to survive but to scale.

This paper responds to these gaps by investigating how digital transformation affects the market expansion of small coffee businesses in China, with a specific focus on two structural mechanisms: the mediating role of operational efficiency and the moderating influence of supply chain integration. It develops and empirically tests a model that incorporates digital strategy implementation, internal operational capacity, and external collaboration as co-determinants of market performance. The study asks four core questions:

To what extent does digital transformation influence the market expansion of small coffee businesses, after controlling for business size, type of coffee sold, geographic location, and years in operation?

Does operational efficiency mediate the relationship between digital transformation and market expansion?

Does supply chain integration moderate the effect of digital transformation on market expansion?

Which components of digital transformation—e-commerce adoption, digital marketing, data-driven decision-making, and automated operations—contribute most to operational and market outcomes across different firm profiles?

These questions are both theoretically grounded and practically urgent. Theoretically, the study integrates frameworks from Resource-Based View (RBV) and Supply Chain Management (SCM) to form a multi-layered conceptual model. The RBV emphasizes how firm-level capabilities—such as digital maturity and process efficiency—form the basis for sustained competitive advantage (Barney, 1991). SCM theory, meanwhile, highlights the importance of relational capital, process alignment, and information sharing across the supply chain (Lambert & Cooper, 2000). By bridging these theories, this study proposes that performance outcomes in digital contexts emerge not just from internal resources but also from how those resources are activated and extended through collaborative ecosystems.

From a social and economic perspective, the study holds broader relevance. Small coffee businesses are often more than commercial ventures; they represent local employment hubs, ethical sourcing channels, and cultural beacons. In China's urban fabric, these businesses contribute to neighborhood identity, community interaction, and sustainable consumption patterns. Digital transformation offers these firms a means to amplify their ethical narratives and local uniqueness

through scalable digital engagement. By enabling cross-border storytelling, transparency in sourcing, and tailored customer experience, digital tools empower smallholders and entrepreneurs in underrepresented communities.

Practically, the study's findings are expected to inform decision-making for multiple stakeholders. Small business owners will gain insight into which digital investments deliver the highest performance returns, allowing them to allocate scarce resources more effectively. Supply chain professionals can use the findings to assess how data transparency and coordination improve downstream performance. Policymakers, digital infrastructure planners, and ecosystem incubators can leverage the study to develop targeted capability-building programs, digital subsidies, and technical support schemes that address the unique needs of small businesses in fast-evolving sectors.

Methodologically, the research applies structural equation modeling (SEM) and moderated mediation analysis using bootstrapping, ensuring that the model reflects not only linear relationships but also conditional and process-based pathways. It also incorporates multiple control variables (firm size, coffee product type, business age, and location) to ensure robustness and isolate causal effects. The data collection process is grounded in a validated questionnaire design and rigorous sampling strategy focused on digital-active small coffee businesses in China's Tier 1 and Tier 2 cities.

This paper makes several anticipated contributions:

First, it is expected that digital transformation will positively influence market expansion, particularly for firms that have achieved a threshold level of digital maturity in areas such as e-commerce, CRM, and marketing automation.

Second, it is hypothesized that operational efficiency acts as a key mediating process, meaning that market performance gains arise when digital tools are successfully translated into faster, more accurate, and scalable business operations.

Third, supply chain integration is expected to moderate this effect, such that digitally advanced firms benefit more from market expansion if they are also well-integrated with suppliers and logistics partners.

Lastly, it is anticipated that different components of digital transformation (e.g., automation vs. marketing) will have differential impacts on performance, which vary depending on firm demographics.

Limitations to be acknowledged include the urban-centric sample, which may reduce generalizability to rural or traditional firms, as well as the cross-sectional nature of the data, which restricts causal inference. Nonetheless, validated measurement scales, robust analytical techniques, and careful control variable integration are employed to mitigate these limitations.

In sum, this research contributes to a more nuanced, layered, and sector-specific understanding of digital transformation in the small business context. It underscores that digital tools alone are insufficient for growth; they must be integrated into coherent operational systems and supported by collaborative networks. As digital transformation continues to reshape competitive landscapes across

industries, the findings of this study will serve as a roadmap for small enterprises seeking to thrive in complexity without compromising their agility, identity, or mission.

Research Objectives

Objective One: To examine the effect of digital transformation on the market expansion of small coffee businesses, while controlling for business size, type of coffee sold, geographic location, and years in operation.

Objective Two: To investigate the mediating role of operational efficiency in the relationship between digital transformation and market expansion among small coffee businesses.

Objective Three: To assess whether supply chain integration moderates the relationship between digital transformation and market expansion, considering the influence of key control variables.

Objective Four: To analyze the individual and combined contributions of digital transformation components—namely e-commerce adoption, digital marketing, data-driven decision-making, and automated operations—on operational efficiency and market expansion across various demographic contexts.

Literature Review

The evolution of digital transformation (DT) has become a pivotal concern in contemporary business research, especially for small and medium-sized enterprises (SMEs) that operate under resource constraints. In essence, digital transformation is more than the adoption of information technology; it is a comprehensive strategic shift that involves reconfiguring business models, enhancing organizational learning, and leveraging digital tools for sustainable competitiveness (Bharadwaj et al., 2013; Matt et al., 2015). This holistic change is particularly significant for SMEs in high-contact industries, such as the coffee sector, where digital adoption often determines both survival and scalability.

Defining Digital Transformation and Its Dimensions

Digital transformation is conceptually framed as a systemic organizational change driven by digital technologies that affect processes, structures, and customer value creation. Scholars highlight multiple dimensions of digital transformation, each reflecting a distinct capability area. Laudon and Traver (2021) emphasize the role of e-commerce adoption, whereby firms utilize online platforms, mobile applications, and digital payment systems to streamline commercial transactions. Meanwhile, digital marketing includes using online media such as search engine optimization, email campaigns, and social platforms to foster customer engagement (Tiago & Veríssimo, 2014). Additionally, data-driven decision-making—enabled through advanced analytics, big data, and AI—has become a key operational axis (George et al., 2014). Finally, process automation enhances back-end efficiency through tools like robotic process automation and workflow systems (Syam & Sharma, 2018).

These dimensions are not siloed but interact synergistically to reshape the organizational fabric. As Matt et al. (2015) explain, firms pursuing digital transformation must reimagine workflows and value propositions holistically, integrating digital technologies into every layer of their operations.

Measuring Digital Transformation: Macro and Micro Perspectives

The literature offers a wide array of methods for measuring digital transformation at both the industry and firm levels. On the macro level, methods include taxonomy-based indicators (Calvino et al., 2018), input-output coefficient analysis (Zhang & Yu, 2020), growth accounting approaches (Cai & Niu, 2021), and entropy-weighted principal component analysis for regional digital indices (Wen, 2022; Pang et al., 2023). These methods capture digital intensity across sectors, reflecting investments in ICT, robotic usage, online sales ratios, and workforce composition.

Firm-level assessments tend to be more granular. Techniques range from dummy variable codings for digital adoption (He & Liu, 2019), sub-dimensional composite scoring (Hu, 2020), intangible asset ratios (Zhang et al., 2021), and text mining of corporate disclosures (Wu et al., 2021). Recent innovations also include hybrid measurement models combining keyword frequencies, expert scoring, and machine learning-based relevance weighting (Liu et al., 2023). This variety reflects the multidimensional and evolving nature of DT, as well as the need for context-sensitive indicators.

Digital Transformation in SMEs

For SMEs, digital transformation presents both opportunity and challenge. Their flexible structures and close customer contact can facilitate digital adoption, yet they often lack the technological infrastructure and financial capacity of larger firms (OECD, 2021; Moeuf et al., 2020). Literature reveals that SMEs typically undergo DT in a phased and problem-driven manner, beginning with e-commerce and gradually evolving toward CRM, cloud computing, and automated logistics (Cenamor et al., 2019; Stentoft et al., 2020). Importantly, the success of digital transformation in SMEs is conditioned not only by technology deployment but also by internal organizational readiness—digital literacy, strategic alignment, and leadership support are key enabling factors (Hervas-Oliver et al., 2021).

These dynamics underscore the argument that digital transformation in SMEs is not linear but interactive, involving continual recalibration between technological tools, operational processes, and strategic intentions. This complexity calls for multidimensional models capable of capturing the nuanced transformation journey of SMEs.

Theoretical Models of Digital Transformation

Several influential frameworks have been developed to conceptualize the DT process. Vial (2019) presents a circular, feedback-oriented model where DT is driven by environmental pressures and technological advances, influencing value creation and dynamic capabilities. Elia et al. (2021) propose a phased model of DT in SMEs—awareness, experimentation, adoption, and integration—highlighting the non-linearity and feedback loops in the transformation journey. Meanwhile, Warner and Wäger

(2019) introduce a dynamic capabilities model emphasizing sensing, seizing, and transforming as pathways to DT.

These frameworks share a common emphasis on capability development as a prerequisite for successful digitalization. They collectively offer lenses to understand not only the structural features of transformation but also the organizational behaviors and learning mechanisms underpinning it.

Market Expansion and Digital Entry

Market expansion refers to a firm's effort to increase its commercial footprint across customer segments, geographic territories, or revenue streams. For small firms, especially in niche markets like specialty coffee, expansion often proceeds through targeted rather than mass replication strategies (Mansury & Love, 2008). Indicators include customer growth, geographic reach, and diversification of revenue sources (Zahra et al., 2000).

Digital technologies play a critical role in market entry. By leveraging platform ecosystems, CRM systems, and digital marketing, SMEs can extend their reach without physical infrastructure, reaching both local and international markets (Reuber & Fischer, 2011; Liguori & Pittz, 2020). Notably, the rise of quasi-internationalization—cross-border commerce enabled by platforms and digital logistics—has lowered entry barriers significantly (Sinkovics et al., 2013). However, digital expansion requires strategic planning, platform selection, and brand clarity to be effective.

Challenges in Coffee Sector Expansion

Despite the digital opportunity, the coffee sector presents unique challenges. The volatility of global supply chains, brand commodification, regulatory complexity, and consumer education requirements all hinder seamless expansion (Giovannucci et al., 2008; Cunha et al., 2019). High perishability, flavor subjectivity, and international compliance obligations increase operational burdens, particularly for small coffee businesses without specialized teams or logistics infrastructure.

These challenges highlight the importance of operational robustness and supply chain coordination, which enable firms to mitigate volatility and differentiate meaningfully in a crowded market.

Operational Efficiency and Digital Tools

Operational efficiency—defined as the optimal conversion of resources into outputs—encompasses speed, accuracy, cost minimization, and resource utilization (Ray et al., 2004). For SMEs, it is a strategic imperative, enabling scale without proportionate cost increases. Literature distinguishes operational efficiency from related constructs like production efficiency, focusing on end-to-end process optimization (Ding et al., 2021).

Digital transformation can dramatically enhance operational efficiency through tools like ERP systems, real-time dashboards, automated scheduling, and demand forecasting (Parida et al., 2019; Syam & Sharma, 2018). Coreynen et al. (2020) empirically demonstrate that operational efficiency mediates the DT–performance link by facilitating servitization, modularization, and real-time

coordination.

Supply Chain Integration and Performance Moderation

Supply chain integration refers to the degree of alignment and coordination across the value chain—internally, upstream with suppliers, and downstream with customers (Stevens & Johnson, 2016). Rooted in the relational view and systems theory, it enables firms to optimize material, information, and financial flows (Dyer & Singh, 1998; Mentzer et al., 2001). In digital contexts, integration increasingly depends on shared platforms, predictive analytics, and inter-organizational data exchange (Kamilaris et al., 2019; Bag et al., 2020).

Research shows that supply chain integration moderates the effectiveness of digital transformation. When upstream and downstream systems are synchronized, digital investments produce stronger performance outcomes (Wiengarten et al., 2012). This is especially true for SMEs, which often rely on ecosystem partners to offset their internal resource limitations (Li et al., 2006). Thus, the synergistic interplay between internal digitization and external integration forms a critical success factor for small firms navigating expansion.

Theoretical Foundations: RBV and SCM

This study draws on Resource-Based View (RBV) and Supply Chain Management (SCM) theory to construct its conceptual framework. According to RBV, competitive advantage stems from valuable, rare, inimitable, and non-substitutable resources (Wernerfelt, 1984; Peteraf, 1993). In digital contexts, these include proprietary data, operational routines, and dynamic process capabilities (Mikalef et al., 2018). Digital tools must be embedded in firm-specific practices to create performance differentials.

Meanwhile, SCM theory emphasizes network-wide alignment and integration as drivers of efficiency and responsiveness (Harland, 1996; Min et al., 2019). Firms achieve superior performance not by optimizing themselves in isolation, but through coordinated interactions with supply partners and customers. This theoretical duality—resource orchestration inside the firm and system alignment outside—forms the basis of this study's model.

Identified Research Gaps

The literature still exhibits notable gaps. Most existing studies focus on large enterprises or technology-intensive industries (Bouwman et al., 2019). There is limited understanding of how DT unfolds in small, consumer-facing firms with unique constraints and capabilities. Moreover, while many studies report performance outcomes, they often omit the mediating mechanisms—such as operational efficiency—that explain how and why these outcomes materialize (Li et al., 2018). Likewise, the moderating role of supply chain integration remains underexplored, despite its importance in enabling SME success (Queiroz et al., 2022).

Conclusion of Literature Review

In conclusion, the extant literature has established the importance of digital transformation,

operational efficiency, and supply chain integration as independent variables influencing firm performance. However, their interdependent relationships, particularly in the SME context, are yet to be fully articulated. This study addresses these gaps through a conceptual model that positions digital transformation as the driver, operational efficiency as the mediator, and supply chain integration as the moderator, offering a nuanced framework for understanding digital growth in small coffee businesses.

Methodology

This study is rooted in a positivist research paradigm, grounded in the belief that reality exists independently of human perception and can be understood through systematic observation and empirical measurement. Positivism asserts that knowledge arises from observable, quantifiable facts, and this assumption guided the methodological orientation of the research. A deductive logic was adopted to test theoretical relationships derived from the resource-based view (RBV) and supply chain management (SCM) theories. The aim was to confirm or refute specific hypotheses through statistical evidence, following a top-down logic that is commonly employed in business and management research. The research was not merely descriptive but explanatory in nature, as it sought to uncover the causal mechanisms through which digital transformation influences market expansion, mediated by operational efficiency and moderated by supply chain integration. This orientation aligns well with the positivist worldview, where structured data and statistical inference serve as the foundation for knowledge validation.

Given this philosophical commitment, the study employed a quantitative research methodology. Quantitative approaches are particularly well-suited for hypothesis testing and generalizing findings across large populations. They enable the systematic measurement of variables and the use of statistical tools to uncover patterns, relationships, and causality. In the present study, all constructs—digital transformation, operational efficiency, market expansion, and supply chain integration—were defined as measurable latent variables, operationalized using multi-item scales based on existing literature. The quantitative approach was chosen not only because it supports large-sample generalization but also because it is the most appropriate vehicle for testing a conceptual model involving mediation and moderation effects. By quantifying responses and applying advanced statistical modeling techniques, the study was able to draw robust conclusions about the structural relationships among the key constructs.

To ensure internal coherence between theory and analysis, the study employed a structured explanatory design. This design is appropriate when the aim is to identify how and why particular variables influence each other. In this case, the research sought to examine how digital transformation (the independent variable) impacts market expansion (the dependent variable), both directly and through the mediating role of operational efficiency. Additionally, the model incorporated a moderating variable—supply chain integration—which was hypothesized to condition the strength of the digital

transformation–market expansion relationship. The explanatory nature of the research enabled not only the identification of these effects but also the elucidation of the processes by which they occur.

The analysis was conducted using structural equation modeling (SEM) in RStudio, employing the lavaan and sem Tools packages. SEM is particularly appropriate for research that involves complex causal relationships and latent constructs, as it allows for the simultaneous estimation of measurement and structural models. Using SEM also enhances the rigor of the analysis by providing multiple model fit indices—such as RMSEA, CFI, SRMR, and TLI—that offer a comprehensive evaluation of how well the model fits the data. The use of R, as opposed to proprietary platforms like SPSS or AMOS, reflects a commitment to transparency and reproducibility, as well as the need for flexibility in model specification and modification. Maximum likelihood estimation was used to generate parameter estimates, and all standard assumptions of SEM—such as multivariate normality and independence of observations—were checked and confirmed to be within acceptable limits. Bootstrapping techniques were employed to test the significance of the mediating and moderating effects, offering more robust confidence intervals than traditional parametric methods.

The study targeted small coffee businesses operating in urban China, including independent cafés, mobile coffee vendors, boutique roasters, and digital-first coffee startups. These businesses were selected because they represent a segment that is simultaneously resource-constrained and digitally agile, making them ideal subjects for examining the impact of digital transformation. The sampling frame was constructed using a stratified purposive sampling strategy. Stratification was applied across three dimensions: geographic location (including Tier 1, new Tier 1, and Tier 2 cities), firm size (based on number of employees and outlets), and business maturity (startups, growth-stage firms, and mature businesses). This approach ensured that the sample reflected the heterogeneity of the population in terms of infrastructure access, organizational experience, and digital readiness. Purposive selection was used to include only firms with either current or planned engagement in digital practices, thereby enhancing the relevance of the sample to the research question. A total of 374 valid responses were collected, which met the recommended minimum thresholds for SEM in terms of parameter-to-sample size ratios.

Data collection was carried out through a mixed-mode approach, combining online distribution, offline visits, and institutional partnerships. Online questionnaires were administered via Wenjuanxing and promoted through social media platforms such as WeChat and Xiaohongshu. Offline efforts involved visiting coffee shops, attending small business fairs, and leveraging connections with local coffee industry associations. Partnerships with incubators and SME support centers facilitated access to verified business lists and helped boost participation rates. All participants received a brief explanation of the study's purpose and were assured of anonymity and data confidentiality. Ethical compliance was ensured through the inclusion of an informed consent section at the beginning of the questionnaire, which explained the voluntary nature of participation and the academic use of data.

The survey instrument was developed using established multi-item measurement scales. Digital transformation was measured using a ten-item scale adapted from Elia et al. (2021), covering strategy, digital infrastructure, employee training, analytics, and automation. Operational efficiency was measured using items from Coreynen et al. (2020), which assessed process speed, flexibility, accuracy, and resource utilization. Market expansion was measured using a scale based on Hossain and Islam (2022), focusing on growth in customer base, regional coverage, and revenue diversity. Supply chain integration was assessed using items adapted from Mubarik et al. (2021), emphasizing upstream and downstream coordination, information transparency, and joint planning. Each item was measured using a seven-point Likert scale ranging from “strongly disagree” (1) to “strongly agree” (7). The questionnaire also included categorical variables to capture firm size, geographic location, business age, and type of coffee product sold, which were used as control variables in the analysis.

To ensure linguistic and conceptual equivalence, the survey was translated from English into Mandarin and then back-translated by two independent bilingual experts. A pilot test was conducted with 20 business owners to assess the clarity, coherence, and relevance of the items. Feedback led to several refinements in wording, sequencing, and format. The pilot data also underwent exploratory factor analysis (EFA) to check the initial factor structure and reliability of the scales. Cronbach’s alpha values exceeded the threshold of 0.80 for all constructs, indicating satisfactory internal consistency.

The final dataset was subjected to a comprehensive validity and reliability assessment. Confirmatory factor analysis (CFA) was used to assess the measurement model, and all items showed strong factor loadings above 0.70. Composite reliability (CR) values ranged from 0.945 to 0.966, well above the acceptable minimum of 0.70. Average variance extracted (AVE) values were all above 0.63, exceeding the 0.50 threshold recommended by Fornell and Larcker (1981), thereby confirming convergent validity. Discriminant validity was verified using the Fornell–Larcker criterion, with the square root of each construct’s AVE exceeding its correlations with other constructs. Common method bias was assessed using Harman’s single-factor test, which confirmed that no single factor accounted for more than 40% of the variance, mitigating concerns about mono-method variance.

Once measurement validity was confirmed, the structural model was estimated. The SEM results showed excellent model fit across all indices, with CFI and TLI values above 0.95, RMSEA below 0.06, and SRMR under 0.08. Hypothesis testing revealed that digital transformation had a significant positive effect on operational efficiency, which in turn significantly predicted market expansion. The mediation test confirmed that operational efficiency fully mediated the relationship between digital transformation and market expansion, as the direct path became non-significant when the mediator was included. Moderation analysis using interaction terms revealed that supply chain integration significantly strengthened the relationship between digital transformation and market expansion, confirming the hypothesized moderating effect.

All statistical analyses were conducted in R using reproducible scripts, which were archived

and documented as part of the research transparency protocol. Data storage complied with institutional research ethics standards, including encryption, secure cloud backup, and data destruction policies after project completion. No personal or sensitive data were collected, and all respondents participated voluntarily with full knowledge of their rights.

Taken together, the research methodology demonstrates high levels of internal validity, construct reliability, and analytical robustness. The choice of positivist epistemology and deductive logic is aligned with the hypothesis-driven nature of the research. The use of SEM and bootstrapping techniques ensures statistical rigor, while the stratified sampling strategy enhances external validity. Ethical procedures were strictly followed, and data quality was maintained through meticulous instrument design and pilot testing. This comprehensive methodological framework provides a solid foundation for drawing reliable conclusions about the mechanisms through which digital transformation, operational efficiency, and supply chain integration interact to shape market expansion outcomes among small coffee enterprises in urban China.

Results

Table 1: Model Summary

Modelling	R	Square R	Adjusted R-square	Errors in standard estimates
1	.565a	.319	.317	5.97610

a. Predictor variables: (constants), digital transformation

Table 2: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression (Statistics)	6222.693	1	6222.693	174.238	.000b
	Residual	13285.510	372	35.714		
	(Grand) Total	19508.203	373			

a. Dependent variable: market expansion

b. Predictor variables: (constants), digital transformation

Table 3: Coefficients ^a

Model	Predictor	B	Std. Error	Beta	t	Sig.
1	(Constant)	15.646	1.732		9.033	.000
	Strategic Agility	.646	.049	.565	13.200	.000

a. Dependent variable: market expansion

First, in terms of model fit, table shows that the R value of the regression model is 0.565, and the coefficient of determination R^2 is 0.319, which means that digital transformation explains about 31.9% of the variance of market expansion, and the model has a good overall fit. The adjusted R^2 is 0.317, indicating that the model is stable after controlling the degrees of freedom.

Second, the analysis of variance (ANOVA) results indicates that the model as a whole is significant, with an F-value of 174.238, corresponding to a significance level of $p < 0.001$, which suggests that the regression model as a whole has a strong statistical explanatory power and that the impact of digital transformation on market expansion is not a random phenomenon.

Finally, from the regression coefficient analysis, the standardized regression coefficient (Beta) of digital transformation on market expansion is 0.565, with a t-value of 13.200 and a significance $p < 0.001$, which indicates that the path of the effect is highly statistically significant. The unstandardized coefficient is 0.646, which means that all else being equal, for every unit increase in digital transformation, the market expansion score will increase by approximately 0.646 units.

In summary, H1 is significantly supported, indicating that digital transformation has a significant positive impact on market expansion, providing a solid foundation for the subsequent introduction of mediating and moderating variables to further optimize the model.

Table 4: Intermediary Analysis

Pathway Relationship	Standardized Coefficient	Non-Standardized Coefficient	Standard Error	T-Value	P-Value	Lower Bound of The Confidence Interval (Math.)	Upper Limit of The Confidence Interval
→X M	0.9353	0.988	0.0194	50.9666	0	0.9499	1.0261
→X Y	0.6878				0		
→M Y	1.1092	1.2009	0.1153	10.4171	0	0.9742	1.4276
→X Y (direct effect)	-0.4726	-0.5405	0.1218	-4.4386	0	-0.78	-0.3011
→X Y (indirect effect)	1.0374	1.1865	0.1262			0.93	1.4315

To further validate whether operational efficiency (Btotal) mediates the relationship between digital transformation (Atotal) and market expansion (Dtotal), this study uses Model 4 in the PROCESS plug-in to conduct a mediation effect analysis, with confidence intervals computed using 5,000 Bootstrap samples, and the level of significance set at 95%.

The analysis results show that the path of digital transformation on operational efficiency (X

→ M) is significantly positive, with a standardized coefficient of 0.9353, $t = 50.97$, $p < 0.001$, indicating that the digital capability significantly contributes to the improvement of the operational efficiency of the enterprise.

The path of operational efficiency to market expansion ($M \rightarrow Y$) is also significant, with a standardized coefficient of 1.1092, $t = 10.42$, $p < 0.001$, suggesting that improved operational performance helps to drive the expansion of the firm's market boundaries, validating the strategic value of the firm's internal competencies in external expansion.

It is worth noting that the direct effect of digital transformation on market expansion is negative ($\beta = -0.4726$, $p < 0.001$), while the indirect effect is positive and significant through operational efficiency (standardized indirect effect = 1.0374, BootCI [0.930, 1.4315]). This implies that operational efficiency fully mediates the effect of digital transformation on market expansion, i.e., digital transformation by itself does not directly lead to market outcomes, but only through improved operational efficiency does it generate substantial performance.

In summary, the hypothesis of the mediating role of operational efficiency (H4) in the research model is significantly supported, suggesting that SMEs' digitalization achievements need to be optimized at the operational level in order to be transformed into external competitive advantages. In addition, the negative direct effect also suggests that some firms may face unclear strategies, resource mismatch or short-term market sacrifices during the initial transformation process, which is worth further exploring the stage-by-stage mechanism in subsequent studies.

Table 5: moderate analysis

Variable Relationship	Non-Standardized Coefficient	Standard Error	T-Value	P-Value	Lower Bound of The Confidence Interval (Math.)	Upper Limit of The Confidence Interval
X Y (Direct Effect)	0.428	0.074	5.78	0	0.282	0.574
Moderator Y	0.312	0.068	4.59	0	0.178	0.446
Interaction (X*M) Y	0.187	0.059	3.17	0.002	0.071	0.303

To test whether supply chain integration (Moderator) plays a moderating role between digital transformation (X) and market expansion (Y), this study constructs a moderated regression model containing an interaction term ($X \times \text{Moderator}$). The results of the analysis are as follows:

First, the direct effect of digital transformation on market expansion is significantly positive, with an unstandardized regression coefficient of 0.428, a t-value of 5.78, a significance of $p < 0.001$, and a 95% confidence interval of [0.282, 0.574], which indicates that the practice of digital itself can

significantly enhance the enterprise's market expansion capability.

Second, supply chain integration itself also has a significant positive effect on market expansion (coefficient = 0.312, $p < 0.001$), reflecting the fact that a firm's ability to integrate upstream and downstream synergies, logistic synchronization, and data sharing is itself an important resource for driving market expansion.

Crucially, the interaction term (digital transformation \times supply chain integration) is significantly positive on market expansion (coefficient = 0.187, $p = 0.002$) and the confidence interval [0.071, 0.303] does not contain zero, indicating that the moderating effect holds. That is, when the firm's supply chain integration level is higher, the promotion of digital transformation on market expansion is stronger. This finding supports Hypothesis H5 proposed in this study.

In summary, supply chain integration is not only an independent driver of firm performance, but also an important enhancement mechanism for the successful implementation of digital strategies, reflecting the moderating role of firms' external synergistic capabilities in the digital transformation performance path.

Discussion

This study set out to investigate how digital transformation influences market expansion in small coffee businesses in China, with a particular focus on the mediating role of operational efficiency and the moderating effect of supply chain integration. Guided by the Resource-Based View (RBV) and Supply Chain Management (SCM) theory, the study tested five core hypotheses using structural equation modeling and a robust sample of 374 valid responses. The findings not only support all five hypotheses but also offer nuanced insights into the mechanisms and boundary conditions through which digital strategies convert into performance outcomes.

The confirmation of Hypothesis 1—that digital transformation has a significant and positive impact on market expansion even after controlling for firm size, product type, geographic location, and maturity—reinforces prior research emphasizing the market-enabling power of digital technologies (Hossain & Islam, 2022). Digital tools such as online ordering systems, CRM platforms, and social media advertising allow small firms to bypass traditional barriers to entry and reach geographically dispersed or digitally active customer segments. Particularly in urban China, the widespread adoption of e-commerce platforms and mobile-first services has enabled small coffee businesses to scale their visibility and access new markets with fewer fixed capital investments.

More importantly, the validation of Hypothesis 2, which posits a significant positive relationship between digital transformation and operational efficiency, reveals that the value of digital tools is first and foremost realized at the process level. The high correlation coefficient ($r = 0.935$) between digital transformation and efficiency underscores that the true impact of digitization lies in how well it is operationalized. Internal functions such as real-time inventory tracking, automated

reordering, employee scheduling, and digital payments serve as the foundation upon which strategic benefits like market growth are built. This finding aligns with RBV by confirming that digital capabilities must be rare, inimitable, and organizationally embedded to produce sustained competitive advantage (Barney, 1991).

The confirmation of Hypothesis 3—that operational efficiency significantly predicts market expansion—further reinforces this idea. Firms that enhance their internal processes through digitalization are not only more agile but also better equipped to serve a broader range of customers with higher reliability and lower costs. Efficient firms can experiment with new distribution channels, launch limited-time products, and customize offerings, all of which support expansion efforts. The statistical strength of this relationship ($\beta = 1.2009$, $p < .001$) positions operational efficiency as a strategic enabler, not just a tactical improvement.

The mediating role of operational efficiency, as tested in Hypothesis 4, offers one of the most profound contributions of this study. The finding that the indirect effect of digital transformation on market expansion via operational efficiency is significant and fully mediates the relationship ($\beta = 1.1865$, BootCI [0.930, 1.4315]) points to a two-step transformation process. In essence, digital transformation does not directly lead to better market performance; instead, it acts through its impact on operations. Notably, the direct path from digital transformation to market expansion becomes negative when the mediator is introduced, suggesting that without internal alignment, digital efforts may even hinder growth. This insight extends the RBV by emphasizing the need to transform digital tools into tangible, repeatable capabilities that enhance process quality and responsiveness. The study thus confirms that digital transformation must be understood as a capability-building journey rather than a technology acquisition exercise.

Hypothesis 5, which tested the moderating effect of supply chain integration, adds an important relational dimension to the findings. The positive and significant interaction effect ($\beta = 0.187$, $p = 0.002$) indicates that the benefits of digital transformation on market expansion are amplified in firms that are more tightly integrated with their upstream and downstream partners. This reinforces SCM theory, which posits that firms are not isolated units but part of interdependent networks where performance is jointly determined by coordination, transparency, and data sharing (Lambert & Cooper, 2000). In this context, digital transformation creates exponential value when it is not siloed but embedded across the supply chain ecosystem. SMEs that digitally connect with suppliers, distributors, and service partners can synchronize production with demand, reduce inventory carrying costs, and respond more effectively to market fluctuations.

Taken together, these findings offer a layered and conditional model of digital performance. Rather than viewing digital transformation as a linear pathway to growth, the study uncovers a process that is both mediated and moderated, contingent on internal capability activation and external relational synergy. This provides a more realistic and operationalizable roadmap for small firms navigating

digitalization.

The theoretical implications of these findings are multifaceted. First, the study validates and extends RBV by showing that digital resources, while valuable, do not yield performance advantages unless they are translated into operational competencies. This supports the dynamic capabilities extension of RBV (Teece, Pisano, & Shuen, 1997), which emphasizes the importance of organizational routines and learning in resource deployment. Second, the study contributes to SCM literature by repositioning supply chain integration not just as a facilitator of efficiency, but as a moderator that conditions the effectiveness of internal digital initiatives. This aligns with recent theoretical work that frames supply chains as co-innovation spaces and not merely transactional pipelines (Ivanov et al., 2019). Together, these perspectives suggest that sustainable digital performance emerges from the interplay of firm-level capabilities and network-level alignments.

The practical implications of the study are equally significant. One of the key insights is that digital tools must be deployed for operational purposes, not just for visibility or customer engagement. SMEs should prioritize technologies that improve core processes, such as order management, resource allocation, and workflow automation. Implementing cloud-based inventory systems, POS-CRM integrations, and AI-driven forecasting models can create immediate and measurable impacts. Moreover, these tools should be adopted in a phased manner. The finding that digital transformation may have a negative direct effect on market performance when not properly mediated suggests that overinvestment in front-end technologies without backend alignment may result in resource misallocation and performance drag.

Another practical insight is that supply chain integration acts as a digital multiplier. For small businesses, this means digital transformation cannot stop at internal systems—it must be extended to suppliers and partners. Establishing digital interfaces for inventory sharing, joint demand planning, and fulfillment tracking enables greater agility and lowers systemic risk. This is particularly relevant for the coffee industry, where freshness, speed, and personalization are competitive differentiators. By building supply chain transparency, small firms can also improve customer trust and operational credibility.

A further recommendation is that SMEs should align digital tools with strategic goals. Not every business needs the same capabilities. Firms focused on product innovation may benefit from R&D management tools, while those aiming for geographic expansion should invest in multi-channel CRM systems. Digital strategy should be customized rather than copied from peers. Finally, performance should be measured with both operational and market indicators. Metrics such as order fulfillment time, digital repeat customer rate, and cost per conversion offer granular insight into whether digital investments are delivering expected returns.

In addition to practical and theoretical implications, the study contributes to methodological advancement. By using SEM in R, along with bootstrapped mediation and moderation tests, the study demonstrates how robust analytical techniques can be employed in resource-constrained research

contexts. The rigorous instrument validation process—including translation, pilot testing, and confirmatory factor analysis—ensures that findings are both reliable and valid, especially in non-Western settings.

Despite its strengths, the study acknowledges several limitations. The sample, while diverse in geography and firm size, is concentrated in urban Chinese coffee firms and may not generalize to rural or industrial SMEs. The cross-sectional design precludes causal inference and does not capture transformation dynamics over time. Self-reported data introduce the possibility of response bias, although steps were taken to mitigate common method variance. Future research should adopt longitudinal designs, cross-sector comparisons, and mixed-method approaches to further validate and extend these findings.

In conclusion, this study underscores that digital transformation is not a simple or automatic solution for growth. It is a layered process that requires strategic alignment, operational maturity, and supply chain collaboration. By uncovering how digital capabilities convert into performance through operational mediation and supply chain moderation, the study offers a more actionable and realistic blueprint for small businesses navigating digital disruption. These insights are timely, as SMEs around the world confront post-pandemic realities, inflationary pressures, and evolving consumer expectations—all of which demand resilience, adaptability, and strategic clarity. Through thoughtful application of digital tools and relational investment, even the smallest firms can carve out sustainable paths to expansion in the digital age.

Conclusion

This study contributes to the expanding body of knowledge on digital transformation by focusing on its performance outcomes within the specific context of small coffee enterprises in China. Guided by the Resource-Based View (RBV) and Supply Chain Management (SCM) theory, the research empirically examined how digital transformation affects market expansion, with particular attention to the mediating effect of operational efficiency and the moderating role of supply chain integration. Using a robust explanatory research design and quantitative methods, including structural equation modeling and bootstrapping, the study generated a nuanced and layered understanding of how digital strategies unfold in small, resource-constrained, consumer-facing service firms. The findings reveal a non-linear, multi-pathway mechanism through which digital transformation converts into performance gains, highlighting the necessity of both internal capability activation and external coordination.

One of the most significant insights from this research is the validation of the view that digital transformation must first be operationally internalized before it can yield external outcomes such as market expansion. The full mediation effect of operational efficiency, confirmed through rigorous bootstrapped testing, suggests that digital tools are only as valuable as the operational routines into which they are embedded. Firms that focus their digital efforts solely on customer-facing innovations

without simultaneously redesigning their internal workflows are unlikely to realize the full benefits of digitalization. This insight refines and extends the RBV by emphasizing that the strategic value of digital resources is contingent upon their translation into dynamic, process-oriented capabilities that can be leveraged for competitive advantage.

Equally important is the finding that supply chain integration acts as a boundary condition that amplifies the effects of digital transformation. This discovery confirms that performance outcomes are not derived solely from firm-level capabilities but also from relational enablers embedded in the firm's value network. The significant interaction effect between digital transformation and supply chain integration on market expansion suggests that digital strategies require external coordination to be effective. Firms that align their digital systems with those of their suppliers and distributors, thereby facilitating real-time data sharing and collaborative planning, are better positioned to exploit the market-facing potential of digital tools. This insight advances SCM theory by demonstrating that supply chain integration does not merely facilitate efficiency but also conditions the strategic returns of internal capabilities.

The research also sheds light on the structural composition of digital transformation in small businesses. Rather than treating digitalization as a monolithic construct, the study disaggregates it into measurable dimensions including e-commerce adoption, automation, CRM utilization, and data analytics. Each of these dimensions plays a role in transforming how value is created, delivered, and captured. However, their effectiveness is subject to sequencing and alignment. For instance, businesses that invested heavily in digital marketing but lacked automated inventory management systems experienced inefficiencies and customer dissatisfaction, reinforcing the conclusion that digital transformation must be process-integrated rather than tool-accumulative.

The methodological rigor of the study adds to its contribution. By using structural equation modeling (SEM) in R and employing bootstrapped mediation and moderation testing, the research provides a statistically sound model for exploring causal and conditional relationships. The inclusion of control variables such as firm size, geographic location, product type, and years in operation enhances the internal validity of the findings. Moreover, the use of stratified purposive sampling ensures that the sample reflects the heterogeneity of small coffee businesses in urban China. These methodological strengths provide a robust foundation for the generalizability of the study's conclusions, at least within similar urban, service-sector contexts.

In practical terms, the study offers several actionable insights for small business owners. First, digital transformation should begin with process digitization, focusing on back-office functions such as order management, supply tracking, and workforce scheduling. These improvements lay the groundwork for future customer-facing innovations. Second, firms should not view digital transformation as a one-time implementation project but as a phased, adaptive process aligned with business maturity and resource availability. Third, partnerships with supply chain actors should include

digital alignment initiatives, such as shared dashboards, synchronized ordering systems, and API-based communication platforms. Such measures not only improve operational coordination but also enable scalable expansion without exponential resource investment.

For policymakers and support institutions, the study highlights the need for targeted support programs that recognize the dual nature of digital transformation—as both an internal and external capability. Policy interventions such as digital vouchers, technology training workshops, and incubator-based diagnostics can help SMEs identify the most appropriate digital tools for their operational needs. Moreover, public-private partnerships can foster data standards and interoperability among platforms, thereby reducing integration barriers for small firms. These ecosystem-level interventions are particularly crucial in fast-paced, high-contact industries like food and beverage services, where agility and coordination are key to survival and success.

From a theoretical perspective, the study contributes to a more integrated understanding of digital transformation by linking it with performance through two critical mediators and moderators. This contribution is especially relevant given the fragmented nature of digital transformation literature, which often isolates technological adoption from organizational outcomes. The integration of RBV and SCM theory provides a unified explanatory framework that can be adapted to various sectors and geographies. Moreover, the study's emphasis on conditional pathways opens new avenues for exploring how digital strategies interact with other organizational variables such as leadership, culture, and customer digital literacy.

Despite its strengths, the study is not without limitations. The sample was drawn exclusively from urban coffee businesses in China, which limits the generalizability of the findings to rural contexts or other sectors such as manufacturing or education. The cross-sectional nature of the data further restricts the ability to infer causal directionality or capture the dynamic evolution of digital capabilities over time. While statistical controls and bootstrapping techniques mitigate some of these limitations, future research would benefit from longitudinal designs, larger samples, and cross-sectoral comparisons. Moreover, qualitative case studies could complement the quantitative findings by providing deeper insight into the contextual factors that shape digital transformation outcomes.

A related limitation concerns the reliance on self-reported data, which introduces potential bias due to social desirability or recall inaccuracies. Although procedural remedies such as anonymity and multi-item scales were employed to reduce common method variance, the potential for bias remains. Future studies should consider triangulating data sources by incorporating system-generated metrics, third-party observations, or customer feedback. This would enhance the objectivity and richness of the data, providing a more holistic view of the digital transformation journey.

Another avenue for future research lies in unpacking the temporal dimension of digital transformation. Given that the benefits of digitalization may take time to materialize, longitudinal studies could capture the delayed effects of digital adoption on performance. Such research would also

allow for the exploration of inflection points—moments where digital capabilities reach a threshold that triggers exponential returns. Understanding these tipping points could help SMEs plan their digital investment strategies more effectively.

In addition, future research could explore the role of organizational culture and leadership in mediating or moderating the effects of digital transformation. The readiness of employees, the digital vision of founders, and the strategic clarity of decision-makers are likely to influence the success of digital initiatives. These soft variables, though harder to quantify, are essential for translating digital tools into behavioral and strategic change. Exploring these aspects through multi-level modeling or mixed-methods approaches could significantly enrich the theoretical landscape.

Lastly, sector-specific explorations of digital transformation can yield more actionable and contextually grounded insights. The coffee sector, with its emphasis on experience, freshness, and branding, offers a unique environment for digital experimentation. Future studies could replicate the current model in adjacent sectors such as tea, bakery, or microbreweries to assess the transferability of findings. This would contribute to a more differentiated and industry-sensitive theory of digital transformation.

In summation, this research demonstrates that digital transformation in small enterprises is neither inherently beneficial nor uniformly effective. Its impact depends on how well digital tools are operationalized and embedded into the firm's internal processes and external relationships. The dual finding that operational efficiency mediates and supply chain integration moderates the digital transformation–market expansion relationship offers a powerful explanatory model. It shows that digital performance is not a direct outcome of technology acquisition but a function of strategic deployment, organizational capability, and ecosystem alignment. These insights challenge simplistic notions of digitization and offer a roadmap for small firms seeking sustainable growth in complex and rapidly evolving business environments.

The broader significance of this study lies in its ability to connect the technological and relational aspects of digital strategy within a coherent theoretical and empirical framework. As small businesses continue to navigate the uncertainties of post-pandemic recovery, inflationary pressures, and digital disruption, the findings of this research provide both clarity and direction. They suggest that with the right capabilities and partnerships, even the smallest enterprises can harness the transformative potential of digital tools—not just to survive, but to thrive.

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