

Enhancing Sustainable Market Competitiveness through Innovation, Service Optimization, and Brand Management: The Mediating Role of Differentiation in Beijing's Printing Industry

Peng Li¹ and Srochinee Siri wattana²

Suan Sunandha Rajabhat University, Thailand

Email: srochinee.si@ssru.ac.th²

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Abstract

This research combines both quantitative and qualitative methods, research design, and research environment for investigating the influence of technological innovation capability, service system optimization, and brand management on sustainable market competitiveness in Beijing printing enterprises, with a focus on the mediating role of enterprise competitive differentiation capability. Research Objectives: (1) To evaluate current levels of technological innovation capability, service system optimization, brand management, and enterprise differential competitive capability among Beijing printing enterprises through descriptive statistics and benchmarking analysis. (2) To examine the mediating role of enterprise differential competitive capability in the relationships between technological innovation capability, service system optimization, brand management, and sustainable market competitiveness using structural equation modeling (SEM). (3) To validate an integrated SEM model for enhancing sustainable market competitiveness of Beijing printing enterprises through technological innovation capability, service system optimization, brand management, and enterprise differential competitive capability. Literature Review use: Resource - Based Theory, Institutional Theory. Enterprise Sustainable Development Theory, Technological Innovation Capability, Technological Innovation Capability and their Dimensions. Definition of Service System Optimization: And Definition of Brand Management.

This study shows that technological innovation capability, service system optimization, and brand management each play crucial roles in enhancing sustainable market competitiveness in Beijing's printing industry. Across all three areas, enterprise differentiation capability serves as the key mediating mechanism that transforms these capabilities into competitive advantages. Technological innovation contributes not only through efficiency and quality improvements but also through environmental gains that strengthen green differentiation. Service system optimization enhances competitiveness via operational coordination, stronger customer

relationships, and sustainability benefits, producing durable, capability-embedded differentiation. Brand management acts as a strategic asset by signaling credibility and sustainability, helping firms secure price premiums and client loyalty. Differentiation emerges as a dynamic capability rather than a simple strategic choice, converting diverse organizational resources into market advantages. The effectiveness of these mechanisms depends on industry context, enterprise size, and market segment. The study also shows that technology, service, and brand capabilities each support different dimensions of sustainability, requiring balanced development. Overall, sustainable competitiveness in traditional industries hinges on integrating technological, service, and brand capabilities and aligning them with firm strengths and market conditions.

Keywords: Brand Management, Sustainable Market Competitiveness, Innovation Service Optimization

Introduction

In the era of accelerated global economic integration and intensifying market competition, enterprises encounter unprecedented challenges and opportunities on their path to sustainable development. With the continuous progress of information technology and the rapid evolution of business models, traditional competitive strategies are undergoing profound transformations (Li, 2024). Technological innovation capability, service system optimization, and brand management have emerged as pivotal factors driving enterprise development, potentially determining their market positions and developmental trajectories (Wang & Chen, 2023). As China's political, cultural, and international exchange hub, Beijing hosts enterprises across diverse industries that significantly contribute to the city's economic vitality and industrial structure optimization (Liu, 2022). Nevertheless, enterprises in Beijing, especially those in traditional industries like printing, face severe challenges in achieving sustainable development due to stringent environmental regulations, rising labor costs, and fierce market competition. The urgent question is how these enterprises can effectively cultivate differential competitive advantages to achieve sustainable development (Zhao & Wu, 2023). In the current context of digital transformation and environmental policy tightening, printing enterprises face unprecedented theoretical challenges regarding the mechanisms through which strategic capabilities influence sustainable market competitiveness. While technological innovation, service system optimization, and brand management are recognized as critical factors, the mediating role of enterprise competitive differentiation capability in these relationships remains theoretically unclear and empirically unverified.

Current research on technological innovation in traditional industries presents contradictory findings regarding implementation effectiveness. Although technological innovation

is increasingly recognized as vital, enterprises face integration challenges with existing systems and workflows (Liu & Zhang, 2023). The talent shortage and capital constraints further complicate this relationship (Wang & Li, 2023; Chen & Zhao, 2023). However, research on technological innovation in traditional industries shows inconsistent findings, especially regarding the effectiveness of implementation. Although innovation is widely recognized as essential, enterprises struggle to integrate new technologies with existing systems, and issues such as talent shortages and capital limitations further hinder progress. A major theoretical gap remains in understanding how these implementation barriers influence the link between technological innovation and sustainable competitiveness through differentiation capability. Similar contradictions appear in studies on service system optimization. While service improvements can enhance competitiveness by boosting customer satisfaction and loyalty, they may also increase operational complexity or create misalignment between service and production. This highlights the need for clearer theories explaining when service optimization strengthens or weakens competitive differentiation. In brand management research, the mediating role of differentiation capability is still insufficiently explored. Although strong brand management contributes to competitiveness, the mechanisms linking brand assets to differentiation remain unclear, as do interactions between differentiation capability and other organizational capabilities. The absence of systematic assessment frameworks for differentiation capabilities creates theoretical gaps in understanding capability development and deployment (Wang & Li, 2023; Chen & Zhao, 2023). Overall Research Problem: The core research problem is the absence of a comprehensive theoretical framework explaining how technological innovation contributes to sustainable market competitiveness through differentiation capability, particularly under implementation constraints and addressing the inconsistencies surrounding service optimization and brand asset translation.

Research Objectives

1. To evaluate current levels of technological innovation capability, service system optimization, brand management, and enterprise differential competitive capability among Beijing printing enterprises through descriptive statistics and benchmarking analysis.
2. To examine the mediating role of enterprise differential competitive capability in the relationships between technological innovation capability, service system optimization, brand management, and sustainable market competitiveness using structural equation modeling (SEM).
3. To validate an integrated SEM model for enhancing sustainable market competitiveness of Beijing printing enterprises through technological innovation capability, service system optimization, brand management, and enterprise differential competitive capability.

Literature Review

Resource - Based Theory

Based on Resource-Based Theory, Beijing printing enterprises can gain sustainable competitive advantage through unique, valuable, and hard-to-imitate resources specifically technological innovation capabilities and optimized service systems. Technological innovation, such as advanced digital printing, high-resolution color management, and eco-friendly materials, enables product differentiation by improving quality, speed, customization, and sustainability. These capabilities are rare because they require significant financial investment and technical expertise. Service system optimization is another key resource. Comprehensive services including pre-press consulting, efficient order handling, and post-press support enhance customer satisfaction and loyalty in Beijing's competitive printing market. Integrated "one-stop" service models are difficult for competitors to replicate due to required organizational structures and specialized human capital. Both technological and service capabilities benefit from firm-specific experience and knowledge, which further strengthens their inimitability. Thus, together, these resources form a solid foundation for sustainable competitive advantage among Beijing printing enterprises.

Institutional Theory

Institutional Theory emphasizes the role of formal and informal institutions in shaping organizational behavior (DiMaggio & Powell, 1983). Brand management in Beijing printing enterprises can be seen as a reflection of the firm's institutional building. A strong brand is not only a symbol of product quality but also an indicator of the enterprise's compliance with industry norms, social values, and its overall institutional environment. Brands that are well - managed and recognized in the market are more likely to gain the trust of customers, suppliers, and other stakeholders. This trust is crucial for the long - term success of the enterprise, as it can lead to increased business opportunities, better supplier relationships, and enhanced access to resources. In addition, a positive brand image can act as a signal of the enterprise's internal institutional strength, indicating that the enterprise has effective management systems, quality control mechanisms, and a commitment to meeting social and industry expectations (Scott, 2001). Moreover, brand management also involves conforming to informal institutions such as industry best practices and customer expectations. For Beijing printing enterprises, understanding and adapting to the changing aesthetic and service - quality expectations of customers in the local market is essential for brand building.

Enterprise Sustainable Development Theory

Enterprise Sustainable Development Theory highlights the need for organizations to balance economic, environmental, and social aspects to achieve long - term viability (Elkington,

1998). For Beijing printing enterprises, the sustainable market competitiveness ultimately reflects their ability to thrive within the industrial ecosystem over the long run. Economically, sustainable development requires printing enterprises to maintain profitability while continuously innovating and optimizing their operations. In conclusion, the Enterprise Sustainable Development Theory provides a comprehensive framework for Beijing printing enterprises to assess and enhance their sustainable market competitiveness by considering the interplay of economic, environmental, and social factors within the context of the evolving industrial ecosystem in Beijing.

Literature review on Technological Innovation Capability, In the context of Beijing's printing enterprises, technological innovation capability refers to a firm's comprehensive ability to identify, acquire, integrate, and transform technical knowledge and resources into new products, processes, and systems that create sustainable competitive advantage (Chen et al., 2022). Technological Innovation Capability and their Dimensions (1) Printing Process Innovation Dimension. (2) Equipment Technology Innovation Dimension. (3) Material Innovation Dimension. Definition of Service System Optimization: Service Process Automation Dimension, Service Customization Capability Dimension, Service agility Dimension. And Definition of Brand Management. Brand management in the context of Beijing printing enterprises represents a strategic dimension encompassing the systematic creation, development, and maintenance of brand assets to establish distinctive market positioning, foster customer loyalty, and create sustainable competitive advantage (Wang et al., 2023).

Methodology

This research combines both quantitative and qualitative methods, research design, and research environment for investigating the influence of technological innovation capability, service system optimization, and brand management on sustainable market competitiveness in Beijing printing enterprises, with a focus on the mediating role of enterprise competitive differentiation capability. The quantitative research methods are elaborated in two stages. The first stage involves the study population and sample, sampling method scale, data collection approach, the measurement of reliability and validity, pre-test sample selection, and data analysis tools. This study employs a mixed-methods approach that integrates quantitative and qualitative methods, enhanced by triangulation to ensure the robustness and validity of findings. Quantitative Approach:

Data collected through a structured questionnaire from 250 participants in printing enterprises in Beijing. Statistical analysis, including Structural Equation Modeling (SEM), will be used to test relationships between technological innovation capability, service system optimization, brand management, enterprise competitive differentiation capability, and

sustainable market competitiveness. Qualitative Approach: Semi-structured interviews conducted with five printing enterprise managers to explore contextual insights, challenges, and perceived impacts of innovation, service, and brand strategies. Thematic analysis will be used to identify patterns and align qualitative findings with quantitative results. Triangulation: Combined both methods to cross-validate findings for increased reliability and depth. Results from qualitative data will be used to explain and contextualize trends observed in the quantitative analysis.

Sampling Methodology. This section elaborates on the sampling methodology used for the quantitative and qualitative components of the study. A combination of stratified random sampling and purposive sampling techniques was adopted to ensure that the data collected represented diverse perspectives and provided meaningful insights into the research problem. **Population and Sample Size:** The study targets managers, department heads, and strategic decision-makers from printing enterprises in Beijing who are directly involved in technological innovation, service system development, brand management, or strategic planning. These individuals provide critical insights into the relationships between organizational capabilities, differentiation strategies, and sustainable market competitiveness. 250 respondents from Beijing printing enterprises. **Feasibility Analysis Timeline Feasibility:** All fieldwork and analysis completed in eight months, following a phased schedule and pilot validation. **Resource Feasibility:** Budget was ample for tools, incentives, and licenses. The team offered bilingual expertise and both statistical and qualitative skills.

Access Feasibility: Established collaborations and industry partnerships secured sufficient participant access. **Technical Support:** All required software for analysis was in place from project inception.

Results

This study used quantitative and qualitative research phases conducted to examine the mechanisms through which technological innovation capability, service system optimization, and brand management contribute to the sustainable market competitiveness of Beijing's printing enterprises. In line with the proposed research framework, particular attention is given to the mediating role of enterprise differential competitive capability. By integrating statistical testing and in-depth qualitative exploration, the chapter aims to provide a comprehensive account of how strategic capabilities are translated into long-term competitive advantage in a dynamic and highly competitive industrial environment. In the quantitative stage, data were obtained from 751 valid questionnaires distributed across diverse clusters of the printing industry in Beijing, including Haidian, Chaoyang, Fengtai, Shunyi, Dongcheng, and Xicheng districts. The responses were analyzed using SmartPLS 4.0, which enabled the evaluation of measurement reliability, construct

validity, and structural relationships among the latent variables. The results demonstrated statistically significant effects of technological innovation capability, service system optimization, and brand management on sustainable market competitiveness. Furthermore, enterprise differential competitive capability was confirmed as a key mediator in these relationships, reinforcing the theoretical proposition that differentiation serves as a critical pathway linking core strategic resources to sustainable outcomes (Barney, 1991; Porter, 2008). In the qualitative stage, semi-structured interviews were conducted with senior executives, department managers, and innovation team members from representative enterprises within Beijing's printing sector. The interview data were analyzed using Nvivo 12.0, employing thematic coding and visualization techniques to capture managerial perspectives and contextualize the survey findings. The qualitative insights not only validated the statistical results but also enriched the understanding of how differentiation strategies are implemented in practice.

Quantitative Analysis 1. Study Participants: This study employed a quantitative research design utilizing the reliable online survey platform WENJUANXING for questionnaire distribution and collection during July-August 2025. The target population comprised printing enterprises across Beijing's core industrial distribution areas. This multi-level sampling approach ensures comprehensive representation of strategic and operational perspectives within the printing industry ecosystem (Creswell, 2009). The questionnaire instrument, developed through rigorous literature analysis and adaptation, comprised five core constructs: respondent information, Technological Innovation Capability, Service System Optimization, Brand Management, Sustainable Market Competitiveness, and Enterprise Differential Competitive Capability. From an initial collection of 769 questionnaires, systematic data screening procedures eliminated responses with excessively short completion times and uniform response patterns, yielding 751 valid questionnaires (response validity rate: 97.66%). This high validity rate exceeds the recommended threshold for structural equation modeling studies and demonstrates robust data quality for subsequent PLS-SEM analysis (Sarstedt et al., 2021). The structural model encompasses five primary latent variables, each operationalized through specific dimensions to capture the multifaceted nature of organizational capabilities and competitive outcomes in Beijing's printing industry. Table 4.1 presents the comprehensive framework of variables, their constituent dimensions, and corresponding abbreviations utilized throughout the PLS-SEM analysis.

2. Descriptive Statistics. Descriptive Statistics Result: The demographic analysis of the survey respondents (N = 751) indicates a broad distribution across organizational positions, firm sizes, districts, and years of establishment. Among participants, 18.9% were senior managers, 29.0% department heads, and 41.5% core innovation team members, ensuring that perspectives from both strategic and operational levels were well represented. Geographically, the sample covered Beijing's major industrial clusters, with the

highest concentration in Chaoyang District (25.0%), followed by Fengtai (19.3%) and Haidian (16.5%). In terms of firm size, the majority of respondents were from medium-sized enterprises with 201-500 employees (37.2%) and 501-1000 employees (24.8%), which reflects the dominant scale of printing enterprises in Beijing's industrial ecosystem (NBSC, 2023). Regarding industry type and organizational maturity, 25.3% of participants were engaged in packaging printing, followed by publishing printing (24.9%) and commercial service printing (19.3%). Nearly one-third of firms had been established for 11-20 years (33.3%), and another 26.2% for 21-30 years, highlighting the maturity and stability of the sector. The respondents also demonstrated substantial professional experience, with 41.7% reporting over 10 years of work experience. Collectively, these distributions suggest that the sample is representative of the structural characteristics of Beijing's printing industry, strengthening the external validity of the findings (Hair et al., 2021).

The structural model analysis confirmed that all six hypotheses were supported, demonstrating the robustness of the proposed research framework. Innovation capability, service optimization, and brand management were found to have significant and positive effects on sustainable market competitiveness, with path coefficients of 0.248, 0.185, and 0.225, respectively. These findings align with prior studies emphasizing the critical role of innovation, service efficiency, and brand management in shaping competitive advantage. Furthermore, the mediating role of differentiation capability was validated. Specifically, innovation capability, service optimization, and brand management influenced sustainable market competitiveness indirectly through differentiation capability, with statistically significant indirect effects ($p < 0.001$). This result highlights the importance of differentiation as a mechanism through which core strategic capabilities translate into long-term competitive outcomes. Overall, the findings demonstrate that Beijing's printing enterprises can enhance sustainable market competitiveness by leveraging innovation, service, and brand strategies, particularly when coupled with differentiation.

Conclusion

This study emphasizes the critical roles of technological innovation capability, service system optimization, and brand management in determining sustainable market competitiveness, with particular attention to the mediating effect of enterprise differential competitive capability. The findings validate all six hypotheses while revealing novel mechanisms specific to Beijing's printing industry that extend broader theoretical frameworks. 1. Technological Innovation and Competitiveness. Technological innovation significantly enhances sustainable competitiveness. Beyond known benefits such as efficiency and quality, the study identifies an overlooked mechanism: environmental sustainability gains (e.g., waste reduction), which offer both cost advantages and green differentiation. Mediation results show that innovation impacts

competitiveness mainly through differentiation rather than efficiency. This challenges traditional assumptions and introduces the concept of “strategic technology signaling,” where technology strengthens market positioning rather than merely improving operations.

2. Service System Optimization. Service optimization positively influences competitiveness through multiple pathways: operational synchronization, relationship embeddedness, and sustainability-related efficiency. These mechanisms demonstrate that service value in manufacturing extends beyond customer satisfaction to economic and environmental benefits. Differentiation again plays a major mediating role—service-based differentiation proves more enduring than technology-based differentiation. This leads to the concept of “capability-embedded differentiation,” where unique organizational processes, not discrete service features, create sustainable competitive advantages.

3. Brand Management as a Strategic Asset. Brand management significantly contributes to competitiveness in B2B manufacturing by signaling credibility, sustainability, innovation, and stability. Brands enable price premiums and client retention, especially during market disruptions. The strong mediation effect shows that brands influence competitiveness primarily by strengthening differentiation, suggesting that B2B brand strategy should focus on positioning rather than traditional awareness metrics.

4. Differentiation as the Core Competitive Mechanism. Differentiation capability consistently mediates the effects of technology, service, and brand capabilities, emerging as the study’s central theoretical contribution. Differentiation functions not just as a strategic choice but as a dynamic capability that transforms diverse organizational resources into competitive advantages. Different enterprise types achieve stronger differentiation through different capability sources, showing the importance of aligning differentiation strategies with core strengths. The study further identifies synergy among technological, service, and brand capabilities.

5. Industry Context and Contingencies. Contextual factors in Beijing’s printing industry—policy emphasis on green transition, strong competition, digitalization, and sophisticated clients—shape how differentiation mechanisms operate. Effective approaches vary by market segment (offset, digital, packaging). Smaller firms, despite resource limitations, can achieve strong differentiation through specialization or niche brand positioning.

6. Intersection with Sustainability. The study shows that different differentiation sources contribute unevenly to economic, environmental, and social sustainability: Technology → economic + environmental sustainability. Services → economic + social sustainability. Brands → economic + social sustainability

Comprehensive sustainability requires balanced development across all three capability areas.

7. Overall Contributions. The study contributes to theory by showing that: Capabilities create competitive value mainly through differentiation rather than direct operational gains. Differentiation should be viewed as a strategic capability, not merely a strategic choice.

Technological, service, and brand capabilities work synergistically to strengthen competitiveness. Effective differentiation strategies require alignment with industry context and enterprise characteristics. Practical implication: Sustainable competitiveness in traditional industries depends on developing integrated technological, service, and brand capabilities aligned with market positioning and tailored to specific competitive environments.

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