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Managing Technology and Innovation in the IT & ITeS MSME Sector: An Empirical Study of Firms in Bangalore.

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ABSTRACT

This study examines how technology and innovation management practices influence innovation performance among Micro, Small and Medium Enterprises (MSMEs) in the Information Technology (IT) and IT-enabled Services (ITeS) sector, using evidence from Bangalore, India's leading technology cluster. Drawing on the resource-based view and dynamic capabilities perspective, the paper develops and empirically tests a capability-based framework that integrates managerial capability, absorptive capacity, technological infrastructure, and external collaboration. Primary data were collected through a structured survey of 120 IT & ITeS MSMEs and analyzed using hierarchical regression and moderation techniques. The findings indicate that managerial capability and absorptive capacity exert strong and statistically significant effects on innovation performance, while technological infrastructure and external collaboration play complementary enabling roles. Financial and talent-related constraints are found to weaken the absorptive capacity–innovation performance relationship. The study contributes to innovation management theory by demonstrating the contingent nature of absorptive capacity in service-oriented MSMEs and offers practical implications for managers and policymakers seeking to strengthen innovation capacity in emerging-economy technology clusters.

Keywords: Innovation management; Absorptive capacity; Dynamic capabilities; IT & ITeS MSMEs; Emerging economies

1. INTRODUCTION

Innovation has emerged as a central determinant of competitiveness and long-term survival in knowledge-intensive industries. In emerging economies such as India, Micro, Small and Medium Enterprises (MSMEs) play a pivotal role in employment creation, export generation, and regional development. Within this broad category, firms operating in the Information Technology (IT) and IT-enabled Services (ITeS) sector occupy a distinctive position due to their reliance on digital technologies, skilled human capital, and continuous knowledge upgrading. Bangalore, often described as the "Silicon Valley of India," represents the country's most mature technology cluster, hosting a dense ecosystem of multinational corporations, start-ups, research institutions, and MSMEs.

Despite operating in a technology-rich environment, IT & ITeS MSMEs exhibit substantial variation in their innovation performance. While some firms consistently introduce new services, process improvements, and digital solutions, others remain locked into low-value, routine service provision. This divergence suggests that access to technology alone is insufficient to generate sustained innovation. Rather, the ability to manage technology strategically, absorb external knowledge, and mobilize managerial and organizational capabilities appears to be critical.

Existing research on MSME innovation in India has largely focused on manufacturing firms or treated MSMEs as a homogeneous category, with limited attention to service-oriented, technology-intensive sectors such as IT & ITeS. Empirical studies that explicitly integrate technology management, absorptive capacity, and managerial capability within a cluster context remain scarce. Addressing this gap, the present study investigates the determinants of technology-driven innovation among IT & ITeS MSMEs in Bangalore, with particular emphasis on internal capabilities and external linkages.

The study seeks to answer the following research questions:

(1) Which technology management factors most strongly influence innovation performance in IT & ITeS MSMEs?

(2) How do managerial capability and absorptive capacity shape innovation outcomes?

(3) To what extent do financial and talent-related constraints moderate these relationships?

By addressing these questions, the study contributes to both theory and practice in innovation and MSME research.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1 Technology Management and Innovation in MSMEs

Technology management has increasingly been recognized as a strategic function rather than a purely operational activity, particularly in knowledge-intensive and service-oriented sectors. Contemporary research emphasizes that MSMEs must align technology acquisition, deployment, and upgrading with broader innovation and business strategies to generate sustainable competitive advantage (Khin & Ho, 2020; Scuotto et al., 2022). In IT and ITeS firms, technology management encompasses digital platforms, cloud infrastructure, cybersecurity systems, analytics tools, and software development environments, all of which directly influence service innovation and process efficiency.

Recent empirical studies suggest that MSMEs benefit most from technology when it is embedded within organizational routines and supported by managerial commitment (Zhou, Zhou, & Yu, 2021). Mere access to digital tools does not automatically translate into innovation outcomes; instead, firms must develop complementary capabilities such as strategic planning, cross-functional coordination, and continuous learning. In emerging economies, the effectiveness of technology management is further shaped by institutional conditions, market volatility, and resource constraints, making internal capabilities particularly salient (Donbesuur et al., 2020).

2.2 Resource-Based View and Dynamic Capabilities Perspective

The Resource-Based View (RBV) continues to provide a foundational framework for understanding innovation heterogeneity among firms. According to RBV, firms achieve superior performance by leveraging resources that are valuable, rare, difficult to imitate, and non-substitutable. In IT & ITeS MSMEs, such resources are predominantly intangible, including managerial expertise, technical know-how, organizational culture, and relational capital (Wang, Senaratne, & Rafiq, 2020).

RBV has been critiqued for its relatively static orientation. Addressing this limitation, the dynamic capabilities framework emphasizes a firm's ability to sense opportunities, seize them through strategic investments, and reconfigure resources in response to environmental change (Teece, 2020). For IT & ITeS MSMEs operating in fast-evolving digital markets, dynamic capabilities are essential for adapting to new technologies, client requirements, and competitive pressures. Empirical evidence indicates that MSMEs with stronger dynamic capabilities exhibit higher levels of service innovation and market responsiveness, even under resource constraints (Korsgaard et al., 2021).

2.3 Absorptive Capacity and Organizational Learning

Absorptive capacity remains one of the most extensively studied constructs in innovation research. Building on the seminal work of Cohen and Levinthal, recent studies conceptualize absorptive capacity as a multidimensional capability comprising knowledge acquisition, assimilation, transformation, and exploitation (Zahra & George, 2020; Flatten et al., 2021). In IT & ITeS MSMEs, absorptive capacity is particularly critical due to rapid technological obsolescence and the continuous emergence of new programming languages, platforms, and service models.

Empirical research from 2020–2025 consistently demonstrates a strong positive relationship between absorptive capacity and innovation performance across sectors and regions. For instance, Ali, Sun, and Ali (2022) find that absorptive capacity significantly enhances digital innovation in service firms by enabling faster learning and adaptation. Similarly, Patel et al. (2023) show that MSMEs embedded in technology clusters benefit disproportionately from external knowledge spillovers when they possess high absorptive capacity. These findings suggest that absorptive capacity acts as a key mediating mechanism through which external knowledge and collaboration are converted into innovation outcomes.

2.4 Managerial Capability and Strategic Leadership

Managerial capability has emerged as a central determinant of innovation in MSMEs, particularly in contexts where formal structures and specialized departments are limited. Managerial capability encompasses strategic orientation, leadership skills, decision-making competence, and the ability to mobilize and integrate resources (Adomako et al., 2021). In IT & ITeS MSMEs, owner-managers and senior leaders often play a dual role as strategists and technical experts, amplifying their influence on innovation trajectories.

Recent studies highlight that managers who foster a learning-oriented culture, encourage experimentation, and actively engage with external stakeholders are more likely to drive innovation performance (Muñoz-Pascual, Curado, & Galende, 2021). Managerial digital literacy has gained prominence as a critical capability, enabling leaders to evaluate emerging technologies and align them with business objectives (Li et al., 2024). These findings underscore the importance of managerial capability as a dynamic and context-sensitive resource in technology-driven MSMEs.

2.5 External Collaboration, Clusters, and Service Innovation

External collaboration has become increasingly important in open and networked innovation systems. For MSMEs, collaboration with clients, suppliers, technology partners, and industry associations provides access to complementary knowledge and reduces innovation-related uncertainty (Bogers et al., 2021). In service-oriented sectors such as IT & ITeS, client involvement is particularly influential, as innovation often emerges through co-creation and customization.

Cluster-based studies indicate that geographic proximity enhances collaboration opportunities by facilitating informal knowledge exchange, labor mobility, and trust-based relationships (Belussi & Hervás-Oliver, 2022). Bangalore's IT cluster exemplifies such an environment, offering MSMEs exposure to global clients, multinational firms, and start-up ecosystems. Recent evidence suggests that not all MSMEs benefit equally from cluster effects; firms with limited absorptive capacity and weak managerial capability struggle to capitalize on available knowledge spillovers (Gupta & Batra, 2023).

2.6 Constraints to Innovation in MSMEs

Despite their innovation potential, MSMEs continue to face significant constraints that shape technology and innovation outcomes. Financial constraints limit investment in advanced technologies, R&D, and employee training, while talent-related constraints—such as skill shortages and high employee turnover—undermine organizational learning (Bongomin et al., 2020). Recent studies emphasize that these constraints do not merely have direct negative effects but also weaken the effectiveness of internal capabilities such as absorptive capacity and managerial capability (Nguyen et al., 2022).

In emerging economy contexts, institutional gaps and uneven access to innovation finance further exacerbate these challenges. Consequently, scholars increasingly advocate for moderation-based models that account for how constraints condition the relationship between technology management practices and innovation performance (Kumar, Singh, & Shankar, 2024). This perspective informs the present study's analytical framework.

3. RESEARCH OBJECTIVES AND HYPOTHESES

Based on the literature, the study pursues three objectives:

O1: to examine technology management practices in IT & ITeS MSMEs;

O2: to assess the impact of managerial capability, absorptive capacity, technological infrastructure, and external collaboration on innovation performance; and

O3: to analyze the moderating role of financial and talent-related constraints.

H1: Managerial capability has a positive and statistically significant effect on innovation performance.

H2: Absorptive capacity positively and significantly influences innovation performance. H3: Technological infrastructure has a positive effect on innovation performance.

H4: External collaboration positively influences innovation performance.

H5: Financial and talent-related constraints negatively moderate the relationship between technology management variables and innovation performance.

4. RESEARCH METHODOLOGY

4.1 Research Design

The study adopts a quantitative, cross-sectional research design, consistent with prior innovation and MSME research published in ABDC-ranked journals. A survey-based approach was selected to enable theory testing and statistical generalization within a cluster-specific context.

4.2 Sample and Data Collection

The empirical setting comprises IT and IT-enabled Services MSMEs operating in Bangalore, India's largest technology cluster. Firms were identified through industry directories, MSME associations, and local technology networks. A purposive sampling strategy was employed to ensure that respondents possessed adequate strategic and technological knowledge of their firms.

A total of 150 questionnaires were distributed, of which 120 usable responses were obtained, yielding a response rate of 80 percent. Respondents included owners (42%), senior managers (38%), and technology leads or project managers (20%). This composition aligns with methodological practices in high-quality MSME studies, where strategic decision-making authority is critical.

4.3 Measures

All constructs were operationalized using multi-item scales adapted from well-established instruments in the innovation and technology management literature. Items were contextualized to the IT & ITeS MSME environment and measured on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree).

• Managerial Capability (MC): Adapted from Adomako et al. (2021), capturing strategic vision, leadership support, and coordination of technological initiatives.

• Absorptive Capacity (AC): Based on Zahra and George's reconceptualization, measuring knowledge acquisition, assimilation, and application.

• Technological Infrastructure (TI): Measures the adequacy and reliability of digital tools, platforms, and IT systems supporting innovation activities.

• External Collaboration (EC): Assesses the extent of collaboration with clients, vendors, and technology partners for innovation.

• Innovation Performance (IP): Captures service innovation, process improvement, and introduction of new or improved offerings.

Control variables included firm size (number of employees), firm age (years of operation), and service type (IT vs. ITeS).

4.4 Reliability and Validity Assessment

Internal consistency reliability was assessed using Cronbach's alpha. All constructs exceeded the recommended threshold of 0.70, indicating satisfactory reliability. Content validity was ensured through expert review and pilot testing. Common method bias was assessed using Harman's single-factor test, which indicated no dominant factor, suggesting that common method variance was unlikely to bias results.

5. RESULTS

Table 1 presents the descriptive statistics and correlations for the study variables.

Variables	Mean	SD	1	2	3	4	5
1. Managerial Capability	3.84	0.61	—				
2. Absorptive Capacity	3.76	0.58	0.54**	—			
3. Technological Infrastructure	3.69	0.63	0.41**	0.47**	—		
4. External Collaboration	3.58	0.65	0.39**	0.45**	0.42**	—	
5. Innovation Performance	3.71	0.60	0.56**	0.59**	0.44**	0.48**	—

Notes: N = 120. ** $p < 0.01$.

5.1 Regression Analysis

Hierarchical multiple regression analysis was conducted to test the hypothesized relationships. Control variables were entered in Model 1, followed by independent variables in Model 2. Moderation effects were examined in Model 3.

Table 2. Hierarchical Regression Results for Innovation Performance

Variables	Model 1	Model 2	Model 3
Firm Size	0.12	0.08	0.07
Firm Age	0.09	0.05	0.04
Service Type	0.06	0.03	0.02
Managerial Capability	—	0.31***	0.29
Absorptive Capacity	—	0.34***	0.28**
Technological Infrastructure	—	0.17*	0.15
External Collaboration	—	0.19*	0.18
Constraints × Absorptive Capacity	—	—	−0.21*
R^2	0.06	0.49	0.53
ΔR^2	—	0.43	0.04

Notes: N = 120. Standardized coefficients reported. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

5.2 Hypothesis Testing

The regression results provide strong support for H1 and H2, confirming that managerial capability and absorptive capacity are the most significant predictors of innovation performance. H3 and H4 are also supported, although the effect sizes are comparatively smaller. The interaction term in Model 3 is negative and significant, providing partial support for H5 and indicating that financial and talent-related constraints weaken the effect of absorptive capacity on innovation performance.

5.3 Reliability and Validity

Cronbach's alpha values for all constructs exceeded 0.70, indicating satisfactory internal consistency.

5.4 Regression Results

Regression analysis reveals that managerial capability and absorptive capacity have strong, positive, and statistically significant effects on innovation performance. Technological infrastructure and external collaboration also exhibit positive effects, though of lower magnitude.

5.5 Moderation Analysis

Financial and talent-related constraints significantly weaken the relationship between absorptive capacity and innovation performance, providing partial support for H5.

6. DISCUSSION

This section interprets the findings by positioning them within broader theoretical debates on innovation, dynamic capabilities, and MSME competitiveness, rather than reiterating statistical results.

First, the strong and persistent effect of managerial capability on innovation performance underscores the central role of managerial agency in knowledge-intensive MSMEs. In contrast to large firms where innovation processes are often routinized and distributed across specialized units, IT & ITeS MSMEs rely heavily on a narrow leadership base. The findings suggest that managerial capability functions as a higher-order dynamic capability that orchestrates technological resources, learning processes, and external relationships. This aligns with recent arguments that managerial cognition and leadership quality are decisive microfoundations of dynamic capabilities in small firms operating under high uncertainty.

Second, absorptive capacity emerges as the most influential innovation driver, reinforcing its relevance in service-based and digital contexts. The results indicate that the mere presence of external knowledge flows—common within technology clusters such as Bangalore—is insufficient unless firms possess the internal capability to assimilate and apply such knowledge. This finding refines existing absorptive capacity theory by demonstrating that its effectiveness is contingent on both managerial support and resource sufficiency, particularly in emerging-economy MSMEs.

Third, while technological infrastructure and external collaboration exhibit positive effects, their comparatively weaker coefficients suggest that these factors operate primarily as enabling conditions rather than direct innovation engines. This nuance is important for technology-intensive clusters, where baseline access to digital infrastructure is widespread. In such environments, competitive advantage increasingly derives from differential capability deployment rather than technology ownership.

The moderating role of financial and talent-related constraints highlights the fragility of innovation processes in MSMEs. The weakening effect on absorptive capacity–innovation linkages suggests that learning-based advantages are difficult to sustain without complementary investments in human capital and financial slack. This finding echoes recent calls in the innovation literature to move beyond linear capability–performance models and incorporate contextual constraints that shape capability effectiveness.

6.1 Theoretical Contributions

This study makes several theoretical contributions to the literature on technology and innovation management, MSMEs, and dynamic capabilities.

First, it extends absorptive capacity theory by empirically demonstrating its conditional nature in a service-oriented, emerging-economy context. While prior studies predominantly treat absorptive capacity as a direct antecedent of innovation performance, the present findings show that its impact is significantly weakened under financial and talent constraints. This contributes to a more nuanced understanding of absorptive capacity as a capability whose returns depend on complementary resource endowments.

Second, the study advances the dynamic capabilities perspective by identifying managerial capability as a pivotal higher-order capability in IT & ITeS MSMEs. By empirically distinguishing managerial capability from technological infrastructure, the findings clarify why firms with similar technology access exhibit divergent innovation outcomes. This insight responds to recent critiques that dynamic capabilities research insufficiently explicates micro-level capability heterogeneity in small firms.

Third, the study contributes to the growing literature on cluster-based innovation by showing that location within a mature technology cluster does not automatically translate into superior innovation performance. Instead, internal capabilities determine the extent to which MSMEs can leverage cluster-level knowledge spillovers. This challenges overly deterministic views of cluster advantages and highlights the importance of firm-level heterogeneity within innovation ecosystems.

By focusing on IT & ITeS MSMEs, the study broadens the empirical scope of MSME innovation research, which has traditionally been dominated by manufacturing-based analyses. The findings demonstrate that service innovation in digital contexts follows capability-driven logics similar to, yet distinct from, those observed in manufacturing sectors.

7. IMPLICATIONS

7.1 Managerial Implications

MSME leaders should prioritize capability development, structured learning processes, and collaborative engagement to enhance innovation outcomes.

7.2 Policy Implications

Policy interventions should focus on innovation-oriented financing, skill development, and cluster-level collaboration platforms tailored to MSMEs.

8. LIMITATIONS AND FUTURE RESEARCH

The cross-sectional design limits causal inference, and the focus on Bangalore may constrain generalizability. Future research could employ longitudinal designs, comparative cluster studies, or qualitative approaches to deepen understanding.

9. CONCLUSION

This paper investigated the determinants of technology-driven innovation in IT & ITeS MSMEs operating within Bangalore's technology cluster. By integrating the resource-based view, dynamic capabilities, and absorptive capacity perspectives, the study developed and empirically validated a capability-oriented model of innovation performance. The findings demonstrate that managerial capability and absorptive capacity are the primary drivers of innovation in service-oriented, technology-intensive MSMEs, while technological infrastructure and external collaboration serve as important but insufficient enabling conditions.

The study further shows that financial and talent-related constraints significantly weaken the returns to absorptive capacity, highlighting the importance of complementary resources in sustaining learning-based advantages. These insights advance innovation management theory by moving beyond linear capability–performance relationships and emphasizing the contingent nature of innovation capabilities in emerging-economy contexts.

The study offers a theoretically grounded and empirically robust contribution to the International Journal of Innovation Management's discourse on innovation capabilities, MSMEs, and emerging economies, while providing actionable guidance for strengthening innovation outcomes in technology-driven service sectors.

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