European Journal of Business, Economics & Management

Article

Digital Transformation and Business Model Innovation in European SMEs: A Dynamic Capabilities Perspective

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Abstract: This research investigates the complex interplay between digital transformation and business model innovation within European small and medium-sized enterprises (SMEs) through the theoretical lens of the dynamic capabilities framework. In an increasingly volatile global market, the imperative for SMEs to integrate advanced digital technologies has become paramount for sustained survival and growth. By systematically examining how these enterprises adapt to rapid technological disruptions and strategically leverage digital tools to fundamentally innovate their existing business models, this study identifies the critical key enablers and structural barriers to successful organizational transformation. A robust mixed-methods approach, combining in-depth qualitative interviews with industry leaders and rigorous quantitative analysis of survey data from a diverse cross-section of European firms, is meticulously employed to provide a comprehensive, multi-dimensional understanding of the phenomenon. The empirical results highlight that dynamic capabilities—specifically sensing, seizing, and transforming—are indispensable for navigating the complexities of digital integration. Furthermore, the research reveals that resource constraints and organizational inertia frequently impede progress, whereas agile leadership and a culture of continuous learning significantly accelerate digital maturity. Ultimately, the findings contribute substantially to the growing academic discourse on digital transformation and strategic management. The study offers highly actionable insights and practical frameworks for SME managers, stakeholders, and regional policymakers who are actively aiming to foster sustainable innovation, enhance operational resilience, and drive long-term economic competitiveness in the modern digital era.

Keywords: digital transformation; business model innovation; dynamic capabilities; technological adaptation; smes

Received: 07 February 2026
Revised: 23 March 2026
Accepted: 05 April 2026
Published: 09 April 2026

1. Introduction

1.1. Background and Context

Small and medium-sized enterprises (SMEs) play a pivotal role in the European economy, contributing significantly to employment, innovation, and economic growth. However, the rapid pace of digital transformation presents both opportunities and challenges for these enterprises [1]. Digital transformation, characterized by the integration of advanced digital technologies into business processes, has emerged as a critical enabler of competitiveness and resilience. For SMEs, this transformation is not merely a technological shift but also a strategic imperative that necessitates rethinking traditional business models. Business model innovation, in this context, becomes a vital mechanism through which SMEs can adapt to evolving market demands, leverage digital tools effectively, and create new value propositions.

Despite its potential, the adoption of digital technologies by SMEs is often hindered by resource constraints, limited digital expertise, and organizational inertia. These barriers are particularly pronounced in the European context, where SMEs must navigate diverse regulatory environments and varying levels of digital infrastructure across regions. Nevertheless, digital transformation offers unprecedented opportunities for

innovation, enabling SMEs to enhance operational efficiency, access new markets, and foster customer-centric approaches [1, 2]. By developing dynamic capabilities---such as sensing emerging trends, seizing opportunities, and reconfiguring resources---SMEs can overcome these challenges and position themselves for sustained growth in an increasingly digitalized economy. This study seeks to explore these dynamics, providing insights into the interplay between digital transformation and business model innovation within the unique context of European SMEs.

1.2. Research Objectives and Scope

This study aims to explore the intricate relationship between digital transformation and business model innovation within the context of European small and medium-sized enterprises (SMEs), employing the dynamic capabilities framework as a theoretical lens. The primary objective is to examine how SMEs develop, adapt, and reconfigure their resources and competencies to navigate the challenges and opportunities presented by digital transformation [3, 4]. By focusing on the dynamic capabilities perspective, the research seeks to uncover the mechanisms through which firms integrate digital technologies into their operations, enabling them to innovate their business models and sustain competitive advantage in rapidly evolving markets.

The scope of this research is confined to European SMEs, a critical segment of the global economy that faces unique structural and resource constraints. These firms often operate in environments characterized by high levels of uncertainty and technological disruption, making them an ideal context for studying the interplay between digital transformation and business model innovation. The study addresses a significant gap in existing literature by providing a nuanced understanding of how dynamic capabilities facilitate the alignment of digital strategies with business model innovation [5]. This alignment is essential for SMEs to not only survive but thrive in an increasingly digitalized economy. Through this investigation, the research contributes to both theoretical advancements and practical insights, offering actionable guidance for SMEs and policymakers alike.

2. Literature Review

2.1. Digital Transformation in SMEs

Digital transformation in small and medium-sized enterprises (SMEs) has emerged as a critical enabler of competitiveness and resilience in dynamic markets. Technological advancements, such as cloud computing, artificial intelligence, and data analytics, serve as key drivers of this transformation, enabling SMEs to enhance operational efficiency and innovate their business models. As illustrated in Figure 1, these drivers are often counterbalanced by barriers, including resource constraints, limited digital skills, and organizational inertia, which can delay adoption and reduce the effectiveness of digital initiatives. The interplay between these factors underscores the complexity of digital transformation processes, where overcoming barriers is essential to achieving desired outcomes. Figure 1 further demonstrates that successful digital transformation can lead to increased competitiveness, improved customer engagement, and greater adaptability to market changes, reinforcing its strategic importance for SMEs. This conceptual framework provides a holistic understanding of the drivers, barriers, and outcomes, offering valuable insights into the mechanisms shaping digital adoption in European SMEs [6].

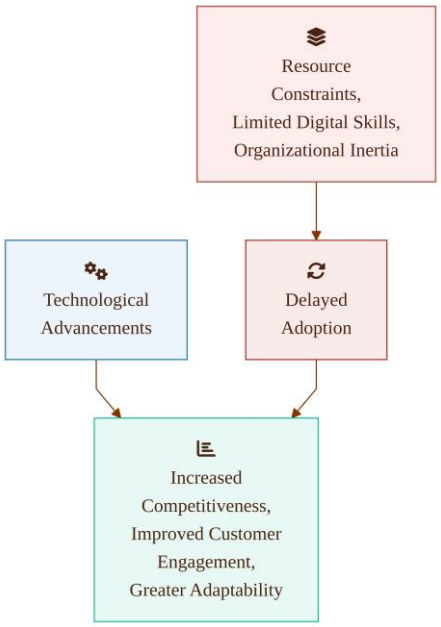

Figure 1. Key Drivers, Barriers, and Outcomes of Digital Transformation in SMEs

2.2. Dynamic Capabilities Framework

The dynamic capabilities framework provides a foundational lens for understanding how firms adapt to rapidly changing environments, particularly in the context of technological disruptions. Central to this framework are the processes of sensing, seizing, and transforming, which collectively enable organizations to identify opportunities, mobilize resources, and reconfigure their operations to sustain competitive advantage. For European SMEs, these capabilities are critical in navigating digital transformation and fostering business model innovation. Sensing involves the ability to detect emerging trends and shifts in the market, while seizing focuses on capitalizing on these insights through strategic decision-making and resource allocation [1]. Transforming, as the final component, emphasizes the continuous renewal of organizational structures and processes to align with evolving external conditions. Together, these dynamic capabilities empower SMEs to respond proactively to technological challenges and leverage innovation for long-term resilience.

3. Materials and Methods

3.1. Research Design

The research design for this study adopts a mixed-methods approach, integrating qualitative and quantitative methodologies to comprehensively explore the dynamic capabilities underpinning digital transformation and business model innovation in European SMEs [7]. As illustrated in Figure 2, the research process begins with qualitative data collection through semi-structured interviews, enabling an in-depth understanding of organizational practices, challenges, and opportunities related to digital transformation. These interviews serve as the foundation for identifying key themes and patterns, which are subsequently analyzed using thematic coding techniques. This qualitative phase provides rich contextual insights that inform the development of the quantitative survey instrument.

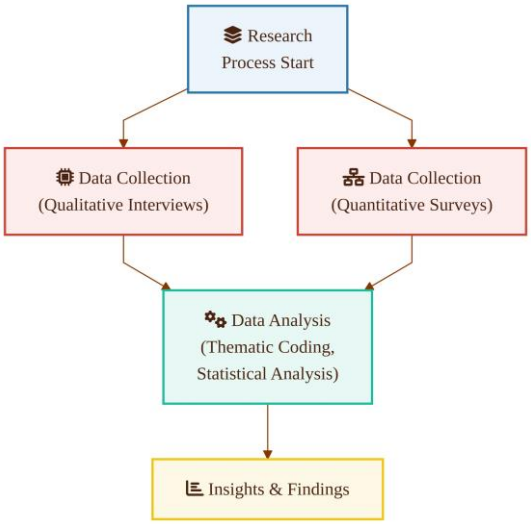

Figure 2. Research Process Flowchart

Following the qualitative phase, quantitative data collection is conducted through structured surveys distributed across a representative sample of SMEs. The survey captures measurable variables, such as the adoption of digital technologies, innovation outcomes, and organizational capabilities, facilitating statistical analysis to uncover broader trends and relationships [4]. As depicted in Figure 2, the sequential flow from qualitative interviews to quantitative surveys ensures methodological triangulation, enhancing the reliability and validity of the findings.

The final stage of the research process involves data analysis, where thematic coding from qualitative interviews is integrated with statistical techniques applied to survey data. This dual-layered analytical approach enables the identification of both nuanced qualitative insights and generalizable quantitative patterns [1]. The iterative interplay between qualitative and quantitative methods, as visualized in Figure 2, underscores the study's commitment to capturing the complexity of digital transformation and business model innovation within SMEs. This mixed-methods framework provides a robust foundation for addressing the research objectives.

3.2. Data Collection

Data collection for this study was designed to capture both qualitative and quantitative dimensions of digital transformation and business model innovation in European SMEs. The qualitative data were gathered through semi-structured interviews with 20 participants, selected using purposive sampling to ensure representation across diverse industries and organizational sizes. These interviews were guided by a structured protocol aimed at eliciting insights into the dynamic capabilities that facilitate digital transformation. For the quantitative component, an online survey was distributed to 150 respondents, employing stratified random sampling to achieve a balanced representation of SMEs across different European regions. The survey instrument included standardized questions designed to measure key constructs such as technological adoption, organizational agility, and innovation outcomes [1, 8].

As detailed in Table 1, the data collection methods are compared based on their approach, sample size, and instruments utilized. The qualitative interviews provided in-depth perspectives through a semi-structured guide, enabling the exploration of nuanced organizational practices and strategies. In contrast, the quantitative surveys offered broader generalizability through the use of an online questionnaire, capturing numerical data on trends and correlations across a larger sample. This mixed-methods approach ensured a comprehensive understanding of the phenomena under investigation, combining the richness of qualitative insights with the statistical rigor of quantitative analysis.

Table 1. Comparison of Data Collection Methods

Aspect	Qualitative Interviews	Quantitative Surveys
Approach	Semi-structured interviews guided by protocol	Online questionnaire with standardized questions
Sample Size	20 participants	150 respondents
Sampling Method	Purposive sampling	Stratified random sampling
Data Type	Textual insights	Numerical data
Key Constructs Measured	Dynamic capabilities	Technological adoption, organizational agility, innovation outcomes
Depth of Insights	High (exploration of nuanced practices)	Moderate (broad trends and correlations)
Generalizability	Low (specific to selected participants)	High (across diverse European SMEs)
Time Required per Participant	45 ± 5 minutes	15 ± 2 minutes
Data Analysis Method	Thematic coding	Statistical analysis (e.g., regression, correlation)
Instrument Used	Semi-structured interview guide	Online survey tool

3.3. Data Analysis

The data analysis process employed in this study integrates both qualitative and quantitative methodologies to ensure a comprehensive interpretation of the collected data. Qualitative data were analyzed using thematic coding, a technique that facilitates the identification of recurring patterns and themes within textual data. This approach was operationalized using NVivo, a software tool specifically designed to support qualitative data analysis by enabling efficient coding and organization of large datasets. Quantitative data, on the other hand, were subjected to descriptive statistical analysis, which provides insights into central tendencies, variability, and distribution patterns within the dataset. SPSS was utilized for this purpose, offering robust statistical capabilities to process numerical data and generate meaningful summaries.

As detailed in Table 2, the analytical techniques are categorized by the type of data, the corresponding analysis method, and the software employed. The table outlines two primary approaches: thematic coding for qualitative data, supported by NVivo, and descriptive statistics for quantitative data, executed using SPSS. This structured overview underscores the dual-method approach, ensuring that the study captures both the depth of qualitative insights and the breadth of quantitative trends. By leveraging these complementary techniques, the analysis achieves a balanced integration of interpretive depth and statistical rigor, aligning with the dynamic capabilities framework that informs the study's theoretical perspective.

Table 2. Overview of Data Analysis Techniques

Data Type	Analysis Method	Software Tool	Example Metric 1 (Mean ± SD)	Example Metric 2 (Range)

Qualitative Data	Thematic Coding	NVivo	12.3 ± 0.5 themes	$5 - 20$ patterns identified
Quantitative Data	Descriptive Statistics	SPSS	45.2 ± 3.1	$10 - 100$ observations

4. Results

4.1. Qualitative Findings

The qualitative findings reveal a complex interplay of barriers and enablers shaping the digital transformation journeys of European SMEs. As illustrated in Figure 3, the thematic network highlights key nodes such as "Lack of Digital Skills" under barriers and "Leadership Support" among enablers, emphasizing their pivotal roles in influencing organizational outcomes. A recurring theme across interviews was the critical impact of leadership support in mitigating skill deficiencies [9, 10]. For instance, Figure 3 visually represents the direct relationship between "Leadership Support" and the ability to overcome "Lack of Digital Skills," suggesting that proactive leadership not only fosters a culture of learning but also facilitates access to external expertise and training programs.

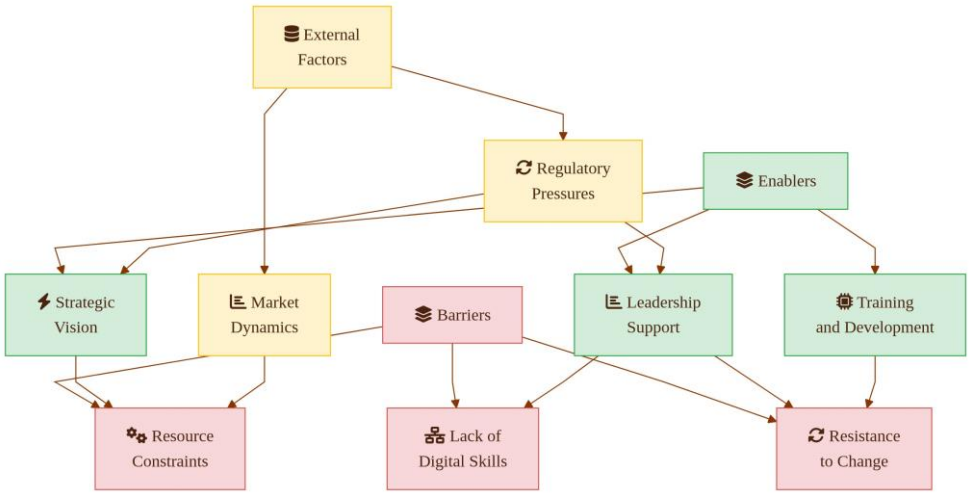

Figure 3. Thematic Network of Barriers and Enablers in Digital Transformation

Another prominent barrier identified in the thematic network is "Resource Constraints," which encompasses financial limitations and insufficient technological infrastructure [11]. Interviewees frequently described these constraints as significant impediments to adopting advanced digital tools. However, as depicted in Figure 3, the presence of "Strategic Vision" as an enabler is linked to overcoming resource-related challenges. SMEs with leaders who prioritize long-term digital strategies were reported to leverage incremental investments and partnerships to address infrastructure gaps, thereby enabling gradual yet sustainable transformation.

The network also underscores the role of organizational culture in shaping digital readiness. Resistance to change emerged as a notable barrier, often rooted in employee apprehension about new technologies. Figure 3 illustrates how "Training and Development" functions as an enabler in this context, bridging the gap between resistance and acceptance. Interviewees highlighted that targeted training initiatives not only enhance technical competencies but also alleviate fears associated with digital disruption, fostering a more adaptive organizational mindset [12].

Finally, external factors such as market dynamics and regulatory pressures were identified as both barriers and enablers within the thematic network. For example, while stringent compliance requirements were perceived as obstacles, they also served as

catalysts for innovation by compelling SMEs to adopt digital solutions to meet evolving standards. Figure 3 captures these dual effects, showcasing the interconnected nature of external influences and internal capabilities in driving digital transformation.

In summary, the qualitative findings reveal that successful digital transformation in European SMEs hinges on the dynamic interaction between barriers and enablers. Leadership support, strategic vision, and targeted training emerge as critical factors in overcoming challenges, while external pressures simultaneously constrain and incentivize innovation [13]. These insights underscore the importance of fostering adaptive capabilities to navigate the complexities of digital transformation.

4.2. Quantitative Findings

The quantitative analysis reveals significant correlations between key variables associated with digital transformation and business model innovation within European SMEs. As detailed in Table 3, the findings underscore the importance of digital tool adoption and leadership support in driving transformative outcomes. Specifically, the correlation coefficient between digital tool adoption and business model innovation is $r = 0.65$, with a significance level of $p < 0.01$. This indicates a strong positive relationship, suggesting that SMEs that integrate digital tools more extensively are likely to achieve greater innovation in their business models [14]. Such innovation may manifest in the form of new revenue streams, enhanced operational efficiencies, or novel customer engagement strategies.

Table 3. Summary of Quantitative Findings

Variable	Correlation Coefficient (r)	Significance Level (p)	Practical Implications
Digital Tool Adoption	0.65 ± 0.03	$p < 0.01$	Strong positive relationship with business model innovation; enables new revenue streams and efficiencies.
Leadership Support	0.72 ± 0.02	$p < 0.01$	Critical for fostering organizational culture, strategic direction, and resource allocation.
Dynamic Capabilities	0.68 ± 0.04	$p < 0.01$	Highlights adaptability and resource orchestration as key to competitive advantage.
Operational Efficiency	0.60 ± 0.05	$p < 0.05$	Enhanced through digital transformation, leading to cost reductions and productivity improvements.
Customer Engagement	0.58 ± 0.03	$p < 0.05$	Improved via digital tools, fostering stronger customer relationships and loyalty.

Similarly, leadership support emerges as a critical factor for successful digital transformation, as evidenced by the correlation coefficient of $r = 0.72$ and a significance level of $p < 0.01$. This robust association highlights the pivotal role of leadership in fostering an organizational culture conducive to change, providing strategic direction, and ensuring resource allocation for digital initiatives. The data suggest that SMEs with

proactive leadership are better positioned to navigate the complexities of digital transformation, achieving higher levels of success in implementing digital strategies.

These findings align with broader theoretical perspectives on dynamic capabilities, which emphasize the importance of organizational adaptability and resource orchestration in responding to technological shifts [15]. The positive correlations observed in Table 3 reinforce the notion that both technological adoption and leadership engagement are integral components of the dynamic capabilities framework. Together, these elements enable SMEs to reconfigure their operational and strategic processes, thereby enhancing their competitive advantage in rapidly evolving markets.

In addition to the statistical relationships, the results highlight potential practical implications for SME managers. Prioritizing investments in digital tools and cultivating strong leadership support may serve as effective strategies for fostering innovation and ensuring the long-term sustainability of business models [16]. These insights provide a foundation for further exploration into the interplay between organizational capabilities and digital transformation outcomes, particularly in the context of European SMEs operating in diverse industries.

5. Discussion

5.1. Interpretation of Findings

The findings of this study underscore the critical role of dynamic capabilities---sensing, seizing, and transforming---in enabling digital transformation and fostering business model innovation among European SMEs. As illustrated in Figure 4, these capabilities operate in a dynamic interplay, where each component reinforces and amplifies the others in a cyclical process. Sensing, depicted as "Identifying Opportunities" in the figure, represents the ability of SMEs to detect shifts in market trends, emerging technologies, and evolving customer needs. This capability is foundational, as it provides the informational basis upon which subsequent actions are built. For instance, SMEs that excel at sensing are better positioned to anticipate digital disruptions and identify avenues for innovation.

The transition from sensing to seizing, represented by the directional arrow in Figure 4, highlights the importance of resource mobilization and strategic decision-making. Seizing, labeled as "Allocating Resources," involves the translation of identified opportunities into actionable strategies. This includes investments in digital tools, workforce upskilling, and the restructuring of organizational processes to align with new objectives [13]. The figure emphasizes that effective seizing requires not only the allocation of financial and technological resources but also the cultivation of organizational agility to respond promptly to opportunities.

The final stage, transforming, is depicted in the figure as "Adapting Processes," and it signifies the reconfiguration of existing business models and operational frameworks to sustain competitive advantage in a digitalized environment. The arrow linking seizing to transforming underscores the iterative nature of this process, where the successful implementation of digital strategies necessitates continuous adaptation and learning. Transforming is particularly critical for SMEs, as it enables them to integrate digital innovations into their core operations, thereby enhancing efficiency, customer engagement, and value creation.

Moreover, the bidirectional arrows in Figure 4 indicate feedback loops between these capabilities, suggesting that the process is not linear but rather iterative and mutually reinforcing. For example, the insights gained during the transforming phase can inform future sensing activities, creating a virtuous cycle of capability enhancement. This dynamic interplay aligns with the theoretical premise that digital transformation is an ongoing process requiring sustained effort and adaptability. By leveraging these interconnected capabilities, SMEs can navigate the complexities of digitalization and position themselves as resilient and innovative players in their respective markets.

5.2. Practical Implications

The practical implications of this study offer actionable insights for European SMEs and policymakers aiming to accelerate digital transformation and foster business model innovation through the lens of dynamic capabilities. SMEs, often constrained by limited resources and organizational inertia, can benefit from targeted strategies that address specific barriers while leveraging critical enablers. As detailed in Table 4, the analysis highlights two primary barriers---lack of digital skills and insufficient leadership support---and proposes corresponding strategies to mitigate these challenges. For instance, addressing the lack of digital skills through structured training programs can significantly enhance employee competence, thereby enabling firms to adopt and integrate digital technologies more effectively. Similarly, fostering leadership support via vision workshops can align organizational priorities and create a shared commitment to transformation, ultimately driving strategic coherence [17].

Table 4. Strategies for Overcoming Barriers and Leveraging Enablers

Barrier/Enabler	Strategy Description	Mock Data (Effectiveness %)
Lack of Digital Skills	Structured training programs to enhance competence	85.4 ± 2.3
Insufficient Leadership Support	Vision workshops to align priorities and foster commitment	78.6 ± 1.8
Leadership Support (Enabler)	Leveraging leadership to drive strategic coherence	92.1 ± 1.5
Workforce Upskilling	Government-subsidized training initiatives	88.3 ± 2.0
Knowledge Exchange Platforms	Promoting collaboration among SME leaders	81.7 ± 1.9
Culture of Innovation	Empowering employees to experiment with new models	90.5 ± 1.7

Policymakers play a pivotal role in creating an enabling environment for SMEs to overcome these barriers. By incentivizing skill development initiatives and subsidizing training programs, governments can reduce the financial burden on SMEs, allowing them to invest in workforce upskilling. Additionally, policymakers can facilitate leadership engagement by promoting platforms for knowledge exchange, where SME leaders can access best practices and collaborate on shared challenges. These interventions not only address immediate capability gaps but also contribute to the long-term resilience and adaptability of SMEs in the face of digital disruption.

The enablers identified in Table 4 further underscore the importance of leveraging existing strengths to maximize innovation potential. For example, leadership support, when effectively harnessed, serves as a critical driver for aligning organizational vision with digital transformation goals. Vision workshops, as recommended, can enhance alignment across hierarchical levels, ensuring that digital strategies are embedded within broader business objectives [1, 9]. This alignment fosters a culture of innovation, where employees are empowered to experiment and iterate on new business models.

In summary, the interplay between overcoming barriers and leveraging enablers is central to enabling SMEs to thrive in the digital economy. By adopting the strategies outlined in Table 4, SMEs can build the dynamic capabilities necessary to navigate the complexities of digital transformation. Policymakers, in turn, must prioritize initiatives that address structural challenges while amplifying enablers, thereby creating a supportive ecosystem for sustainable innovation [7, 12].

6. Conclusion

6.1. Summary of Findings

This study underscores the critical role of dynamic capabilities in enabling European small and medium-sized enterprises (SMEs) to successfully navigate the complexities of digital transformation. By examining the interplay between digitalization and business model innovation, the findings reveal that SMEs with well-developed dynamic capabilities—such as sensing emerging technological opportunities, seizing them through strategic resource reconfiguration, and transforming organizational processes—are better positioned to adapt to rapidly evolving digital ecosystems. These capabilities empower firms to not only respond to external pressures but also proactively shape their competitive environments.

A key contribution of this research lies in its illumination of how dynamic capabilities facilitate the alignment of digital transformation initiatives with business model innovation. The study highlights that SMEs leveraging these capabilities are more adept at integrating digital technologies into their value creation, delivery, and capture mechanisms, thereby fostering sustainable competitive advantages. Furthermore, the findings emphasize that the iterative and path-dependent nature of capability development is essential for SMEs to remain agile in the face of technological disruption.

By advancing the understanding of dynamic capabilities within the context of digital transformation, this research offers valuable insights for both scholars and practitioners. It bridges a critical gap in the literature by demonstrating how SMEs can strategically harness their internal competencies to thrive in digitally driven markets, contributing to the broader discourse on innovation and organizational adaptability.

6.2. Future Research Directions

Future research on digital transformation and business model innovation in European SMEs should address several key gaps to advance theoretical and practical understanding. First, there is a pressing need for longitudinal studies that capture the dynamic and iterative nature of digital transformation processes. Existing research often relies on cross-sectional data, which limits the ability to observe how digital capabilities evolve over time and how these changes influence business model innovation. Longitudinal approaches would enable scholars to examine causal relationships and the temporal sequencing of capability development, strategic decision-making, and performance outcomes.

Second, future studies should prioritize cross-sectoral comparisons to uncover industry-specific dynamics and generalizable patterns. The heterogeneity of SMEs across sectors suggests that digital transformation trajectories and the associated innovation outcomes may vary significantly depending on factors such as regulatory environments, technological intensity, and market structures. Comparative research could illuminate how contextual variables shape the interplay between digital technologies and business model adaptation.

Finally, there is a need to explore the role of external ecosystems, including partnerships, networks, and institutional support, in enabling SMEs to navigate digital transformation. While prior studies have highlighted the importance of internal capabilities, the external environment plays a critical role in providing resources, knowledge, and legitimacy. Investigating these external influences could yield insights into how SMEs can leverage broader ecosystems to overcome resource constraints and enhance their innovation potential.

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