



The Impact of Digital Transformation on the Innovation Performance of SME through Employees' Digital Capabilities: The Moderating Effect of Digital Transformation Leadership

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ABSTRACT

In the digital age, small and medium-sized enterprises (SMEs) face significant challenges and opportunities in adopting digital transformation (DT) to enhance their innovation performance. This study investigates the critical role of employee digital capabilities and digital transformational leadership (DTL) in driving innovation within SMEs. By leveraging a theoretical framework that integrates digital adoption, digital drive, and digital culture, this paper explores how these factors influence innovation performance. Using Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze survey data from SMEs, the findings reveal that employee digital capabilities significantly mediate the relationship between digital transformation and innovation performance. Furthermore, digital transformational leadership is found to moderate this relationship, amplifying the positive effects of employee digital capabilities on innovation. The study contributes to the literature by highlighting the interconnectedness of digital transformation, leadership, and employee competencies in fostering innovation in SMEs. The results underscore the importance of strategic leadership and employee skill development in navigating digital transformation processes. Implications for managers and policymakers are discussed, particularly in the context of fostering a digital culture and enhancing organizational agility through leadership and employee capabilities.

Keywords: Digital Transformation, Employee Digital Capabilities, Digital Transformational Leadership, Innovation Performance, Small and Medium Enterprises, Digital Adoption

JEL Classifications: O32, L25, M15, M54, D02, O33

1. INTRODUCTION

Small- and medium-sized enterprises (SMEs) play a vital role in the economies of developing nations and contribute to their overall development. In Jordan, SMEs are essential for promoting economic growth by providing employment opportunities and reducing regional economic disparities while promoting sustainable development across rural and underdeveloped areas of the country (Yousef, 2024). However, SMEs repeatedly face resource constraints, limited access to technology, resource constraints, government financial support, and a lack of expertise compared to giant organizations (Al-Weshah et al., 2022). These challenges create problems for SMEs in adopting digital

technologies successfully. This research focuses on providing practical insights and recommendations to benefit SMEs and help them successfully navigate the digital landscape. This research helps fill a gap in the existing literature by providing an in-depth framework that connects these variables and offers insights into their combined influence on innovation performance.

Theoretically, there needs to be more existing literature regarding understanding the complex relationships between digital transformation (DT), digital transformation leadership, employee digital capabilities, and innovation performance. In the view of the resource-based view (RBV) and dynamic capabilities theory, this study enriches the literature by analyzing the link between

elements of digital transformation, such as digital adoption, digital drive, and digital culture, digital transformation leadership, and employee digital capabilities. This research also fills the literature gap by extending research on all variables in the existing literature because more research still needs to be done on these collective variables. These variables have been investigated separately. Still, there is an absence of systematic analyses that combine these variables and investigate how they influence the innovation performance of SMEs operating in Jordan, as in developing Asian countries. Lastly, this research was motivated by the practical relevance of supporting SMEs in adopting DT and the theoretical significance of bridging a research gap by studying the correlations between these factors. Furthermore, it offers significant insights that help develop strategies, policies, and practices to support innovation and digital growth in small and medium-sized firms.

The recent evolution of the business landscape and the increasing prevalence of digital technology due to COVID-19 have led to many SMEs embracing DT (Egala et al., 2024). The new wave of technology has greatly shifted the entire world of business, creating new prospects along with problems for SMEs like cybersecurity risks, digital skills gaps, and the financial investment required for adoption (Phukan, 2025). Digital transformation for SMEs goes beyond just adopting new technologies; it also involves altering business models, processes, and mindsets, which is a critical enabler of SME innovation (Hongyun et al., 2025). It helps SMEs enhance operations and customer experiences to remain competitive (Kao et al., 2024; Phukan, 2025).

While identifying the research gap, it is crucial to establish practical and theoretical motivations to understand the unique context of SMEs and their distinct challenges. This study sheds light on the relationship between digital transformation (DT), digital transformation leadership, employee digital capabilities, and innovation performance in this sector. These constructs are particularly relevant as SMEs often face resource constraints, limited technological expertise, and organizational rigidity, which differentiate them from larger firms in their digital transformation journey. Hassan et al. (2024) believe that more in-depth research is needed to determine the strategic position of digitalization in the innovation of SMEs. To guide this investigation, the Dynamic Capabilities Theory (DCT) provides a valuable theoretical framework for analyzing how SMEs can develop, integrate, and reconfigure their organizational and digital resources to achieve sustainable competitive advantage in a rapidly changing digital environment like Jordan. Building on this theoretical lens, this study conceptualizes DT through three integrated dimensions: digital adoption, digital drive, and digital culture (Wang and Zhang, 2025). While many prior studies have examined DT from a singular perspective, focusing either on technological implementation or strategic leadership (Li et al., 2018; Baden-Fuller and Teece, 2020), a growing body of research highlights the need for a multidimensional understanding of digital transformation that captures both the technological and human-centric aspects of change.

DCT needs more specific gaps, like employees' digital capabilities in the context of developing countries. Employees' digital

capabilities play a significant role in shaping product and service innovation as well as process digitalisation (Proksch et al., 2024). More specifically, there is a pressing need to better understand how employees' digital competencies influence the relationship between DT and innovation performance in SMEs operating within these environments. Moreover, digital transformation leadership has been suggested to influence the relationship between employees' digital competencies and innovation performance in SMEs, highlighting the strategic importance of human capital in the digital era. Moreover, digital transformation leadership has been suggested to influence the relationship between employees' digital capabilities and innovation performance in SMEs, indicating that effective leadership is essential for translating digital skills into meaningful innovative outcomes.

This research focuses on analyzing new methods and tools for assessing the impact of employees' digital capabilities and innovation performance, and understanding the DT elements influencing such capabilities. Gyamerah et al. (2025) claim that employees' digital capabilities, which can lead to DT outcomes such as innovation, are neglected in the SMEs context. SMEs should consider investing in employees' digital capabilities and digital transformation leadership to enhance DTs and innovation in SMEs (Cetindamar et al., 2021; Gyamerah et al., 2025; Phukan, 2025). These results have changed the dilemma of only relying on digital technologies for innovation. This study investigates the relationship between DT in terms of digital adoption, digital drive, and digital culture, and innovation performance, and innovation performance and the mediating and moderating impacts of employee digital capabilities and digital transformation leadership, respectively. This paper has examined these factors deeply in the context of developing nations and is deeply invested in the perception of managers, CEOs, and executives about adopting new technologies in different sectors of SMEs. This study addresses these research questions:

- RQ1. How does digital transformation (in terms of digital adoption, digital drive, and digital culture) correlate with employee digital capabilities and innovation performance?
- RQ2. How do employee digital capabilities affect performance Innovation?
- RQ3. How do employee digital capabilities mediate the relationship between digital transformation (in terms of digital adoption, digital drive, and digital culture) and innovation performance?
- RQ4. How does digital transformation leadership moderate the relationship between digital transformation (in terms of digital adoption, digital drive, and digital culture) and performance innovation?

2. THEORY AND HYPOTHESES DEVELOPMENT

We employ dynamic capability theory to develop a conceptual framework to investigate the relationship between DT and innovation performance through employees' digital capabilities. The existing literature utilises this theory to explore different facets of DT (Gyamerah et al., 2025; Shao et al., 2025). However, a limited literature exists regarding the application of this theory to

examine how transformational leaders inspire the creation of digital capabilities and a strategy to drive DT. This gap is particularly evident in the context of SMEs in developing countries. Hence, we seek to address this theoretical gap.

2.1. Dynamic Capabilities Theory (DCT)

Dynamic capabilities theory (DCT) offers a robust framework for understanding how firms can adapt and innovate in rapidly changing environments, providing a strategic edge in competitive markets (Baden-Fuller and Teece, 2020). This study applied DCT to the digital transformation of SMEs. While the literature on DT is still emerging in its exploration of the mechanisms that allow firms to leverage digital technologies for strategic renewal (Vial, 2019), evidence highlights the critical role of three key dynamic capabilities (sense, seize, and reconfiguration) in facilitating a firm's DT in SMEs (Shao et al., 2025). Wang and Zhang (2025) adopt a systems theory perspective to explore the interplay between digital adoption, digital drive, and digital culture, demonstrating that these elements form an integrated system that collectively drives innovation performance in SMEs. Together, these dimensions offer a holistic view of digital transformation in organizations. By integrating this classic theory, this study investigates how digital transformation influences the innovation performance of Small and Medium Enterprises (SMEs), with a focus on the mediating role of employees' digital capabilities. Digital transformation refers to the integration of digital technologies into business processes, fundamentally changing operations and business models to improve efficiency and value creation (Kao et al., 2024; Vial, 2019). When digital tools are combined with organizational capabilities such as skilled employees and an innovative culture, they become inimitable assets that foster long-term success (Phukan, 2025). This research also examines how digital leadership fosters an environment where employees can continuously renew and leverage their digital skills to adapt to a rapidly evolving digital landscape. By integrating DCT with digital leadership, this study provides a deeper understanding of how organizations can harness their internal resources, specifically employee capabilities gain a competitive edge and drive sustainable digital transformation.

2.2. Digital Transformation

DT is a crucial driver of modern economic change, though it is frequently misunderstood as merely automating processes without modifying underlying business operations (Kahveci, 2025). It has the potential to radically reshape an organization's value creation process by altering its culture, mindset, and business framework (Kao et al., 2024). As a complex and multifaceted process, DT affects all facets of an organization and is vital for long-term survival and competitiveness (Phukan, 2025).

Moreover, as the business environment evolves rapidly and becomes more complex under digital transformation, it presents significant challenges to employees (Parker and Grote, 2022). Many enterprises recognize that the main barrier to successful DT is the lack of talent, prompting them to invest in digital training and develop new skill sets, particularly for blue-collar workers (Liu et al., 2024). By converting digital resources into digital

capabilities, organizations can gain a competitive edge, which is critical in today's fast-paced digital landscape (Kao et al., 2024).

DT represents an organizational response to the ever-evolving technological and business landscape, enabling companies to use digital technologies to enhance operations, improve customer experiences, and remain competitive (Kao et al., 2024). It requires a willingness to change, the digitization of business processes, and the simplification of existing workflows while developing new processes essential for business restructuring. This ensures that digital transformation is not a one-time event but an ongoing organizational evolution (Kahveci, 2025).

Following Vial (2019, p. 118), digital transformation can be viewed as "a process where digital technologies create disruptions triggering strategic responses from organizations that seek to alter their value creation paths while managing the structural changes and organizational barriers that affect the positive and negative outcomes of this process." In business contexts, it often involves the adoption of artificial intelligence, blockchain, cloud computing, social media, and big data in response to the fast-changing market landscape (Liu et al., 2024).

This study conceptualizes digital transformation through three integrated dimensions: Digital Adoption, Digital Drive, and Digital Culture, as shown in Table 1. While many prior studies have examined transformation from a singular perspective, such as technological implementation or strategic leadership (Li et al., 2018; Baden-Fuller and Teece, 2020), a growing body of literature emphasizes the need for a multidimensional view.

Furthermore, Seppänen et al. (2025) emphasized that digital transformation involves not only the adoption of technology but also a comprehensive reassessment of management functions, practices, and operational roles. Zhang and Wang (2024) argued that enterprise digital transformation enables organizations to achieve breakthrough improvements by optimizing business models and enhancing customer experience. Shao et al. (2025) identified three core elements of digital transformation in SMEs: (1) digital infrastructure as the foundation for transformation strategies; (2) profound changes in employee skills, management styles, business models, and value chains; and (3) potential positive and negative impacts arising from implementation. This paper, therefore, considers DT as encompassing economic, environmental, socio-cultural, personal, and technological dimensions.

2.3. Digital Transformation and Innovation Performance

DT has become a critical driver of innovation performance in SMEs, acting as a catalyst for enhancing their competitive edge in increasingly digital markets. Numerous studies have confirmed that digital transformation positively impacts innovation at both the process and product levels (Hongyun et al., 2025). As SMEs embrace digital technologies, they achieve more dynamic and flexible business models, which in turn lead to significant improvements in innovation outcomes (Hassan et al., 2024). For instance, a comprehensive study of 1,100 SMEs in Germany

Table 1: Subdimensions of digital transformation and their role in innovation performance in SMEs

Subdimension	Description	Role in innovation	Key references
Digital Adoption	Refers to the integration and implementation of digital technologies within SMEs.	Provides the technological infrastructure needed for product development, process optimization, and increased productivity. Key to enabling innovation.	Li et al. (2018); Hassan et al. (2024); Ashaari et al. (2025); Wang and Zhang (2025)
Digital Drive	Focuses on the strategic initiatives and motivations behind adopting digital technologies.	Ensures alignment of digital tools with the firm's growth strategy, facilitating better decision-making, problem-solving, and innovation.	Ashaari et al. (2025); Proksch et al. (2024); Gyamerah et al. (2025); Wang and Zhang (2025)
Digital Culture	Refers to the organizational mindset and behaviors that support digital transformation and innovation.	Creates an environment that encourages innovation through collaboration, knowledge-sharing, and proactive engagement with new digital tools.	Andriani et al. (2025); Martínez-Caro et al. (2020); Theng et al. (2021); Wang and Zhang (2025)

indicated that digital diffusion, when coupled with absorptive capacity, significantly enhances innovation performance (Hassan et al., 2024). This finding aligns with previous research by Andriani et al. (2025), which emphasized the role of a robust digital culture in amplifying the positive effects of digital leadership on employee performance, enabling SMEs to better capitalize on emerging digital opportunities.

Additionally, Sawaeen and Aburumman (2025) explored how digital leadership, when combined with a strong innovation culture, significantly alters the impact on innovation outcomes. This finding underscores the intertwined nature of leadership and organizational culture, highlighting that digital leadership alone is not sufficient to drive innovation unless it is supported by a conducive culture for innovation. These insights reinforce the need for SMEs to not only invest in digital technologies but also foster a strong digital leadership and innovation culture to fully realize the potential of digital transformation. The existing literature suggests a complex, multi-dimensional relationship between digital transformation and innovation performance, influenced by factors such as digital adoption, digital drive, and digital culture (Kahveci, 2025; Gyamerah et al., 2025). As such, it is hypothesized that SMEs with a higher degree of digital adoption, drive, and culture will experience greater innovation performance. These hypotheses are proposed as follows:

H₁: Digital transformation (in terms of digital adoption, digital drive, and digital culture) has a positive effect on the innovation performance of SMEs.

In line with this, the strategic role of digital transformation and leadership should be further explored, particularly in terms of its mediating and moderating effects on the overall innovation capabilities of SMEs (Shao et al., 2025; Liu et al., 2024). For example, recent studies emphasize the role of digital leadership and digital capabilities as key enablers in enhancing innovation outcomes (Gyamerah et al., 2025). Thus, it is critical to investigate how the synergy between digital transformation, leadership, and culture influences not just technological outcomes but also organizational performance and resilience in a fast-evolving digital landscape.

2.4. Digital Transformation and Employee Digital Capabilities

DT involves the integration of digital technologies into business processes, which fundamentally alters business models,

operations, and organizational cultures (Kao et al., 2024). Digital transformation enables firms to enhance their competitive advantage by fostering new capabilities, improving operations, and delivering better customer experiences (Hongyun et al., 2025; Phukan, 2025). However, for SMEs, the effective adoption of digital technologies requires the development of employee digital capabilities, which include the ability to use digital tools and adapt to evolving technological landscapes (Blanka et al., 2022). As digital transformation reshapes organizational structures, employees must adapt by acquiring new digital skills and competencies (Gyamerah et al., 2025). Research by Liu et al. (2024) and Proksch et al. (2024) has shown that SMEs need to focus on building employees' digital capabilities, as these are crucial for leveraging new technologies. Digital tools alone do not guarantee innovation without the necessary human capabilities to utilize them effectively (Shao et al., 2025). Therefore, it is hypothesized that digital transformation initiatives positively affect the development of employee digital capabilities in SMEs. H₂: Digital transformation (in terms of digital adoption, digital drive, and digital culture) has a positive effect on the development of employee digital capabilities in SMEs.

Building on DCT, it is essential that the digital transformation process not only focuses on technological change but also on the human aspect of innovation, including employees' digital competencies (Phukan, 2025). As SMEs undergo digital transformation, employees with improved digital skills will be better positioned to drive innovation in products and processes (Proksch et al., 2024; Gyamerah et al., 2025).

2.5. Employee Digital Capabilities and Innovation Performance

The role of employee digital capabilities is increasingly recognized as a fundamental driver of organizational innovation, especially in the context of digital transformation (DT). Digital capabilities are often defined as the ability of employees to effectively use digital tools and technologies to perform tasks, collaborate, and contribute to organizational processes. These capabilities extend beyond basic technical skills to include cognitive and process-based competencies that enable employees to adapt to the evolving digital landscape (Gyamerah et al., 2025; Blanka et al., 2022).

As businesses undergo digital transformation, employees' digital capabilities are pivotal to integrating new technologies and optimizing digital workflows. The ability of employees to embrace

digital tools, including mobile and social media platforms, is critical in enhancing organizational agility, fostering innovation, and improving competitive advantage (Cetindamar et al., 2021; Zhang et al., 2024). Proksch et al. (2024) found that the digital competencies of employees influenced product and service innovation as well as process digitalisation. Although much of the current literature highlights the role of technologies such as cloud computing and AI in business transformation, the focus on employee-driven digital skills remains limited (Gyamerah et al., 2025). This gap presents an opportunity to explore the dynamic relationship between employee digital capabilities and innovation performance, particularly within SMEs.

DT influences not only the technical skills of employees but also their cognitive and adaptive competencies, which are crucial for driving innovation (Budiarti and Firmansyah, 2024). As organizations face an increasingly complex and fast-paced digital environment, employees with higher digital literacy and adaptive skills are more likely to contribute to strategic innovation efforts. For SMEs, this is particularly relevant since the success of digital transformation often depends on the ability of employees to integrate digital technologies with existing business models, operations, and customer engagement processes (Shao et al., 2025). Moreover, a workforce equipped with digital competencies enables SMEs to maintain their competitive edge by fostering creativity and new business practices that lead to innovation.

However, the relationship between digital capabilities and innovation performance is not solely positive. DT can also introduce significant challenges for employees, such as job insecurity, stress, and reduced well-being (Liu et al., 2024). The dual perspectives of positive and negative outcomes related to DT suggest that the impact of digital capabilities on innovation performance is complex and multifaceted. These perspectives are often discussed separately, with limited integration of the potential interplay between positive and negative outcomes, leaving an incomplete understanding of how digital transformation affects employee innovation performance.

The existing literature also reveals a gap in research regarding the nuanced ways in which digital capabilities contribute to innovation in SMEs, particularly in non-strategic, ad hoc scenarios (Kohli and Melville, 2019). Although a substantial body of research emphasizes the role of digital skills in driving innovation (Scuotto et al., 2021), it remains unclear how these capabilities translate into measurable innovation outcomes, such as product development, service innovation, and process improvements. Therefore, a more holistic view of the relationship between digital capabilities and innovation performance is essential. This study builds upon these insights and hypothesizes the following:

H₃: Employee digital capabilities have a positive effect on innovation performance in SMEs.

This hypothesis is grounded in the understanding that employee digital capabilities not only facilitate the integration of digital technologies within the organization but also empower employees to innovate and adapt to changes, thus driving organizational growth and competitive advantage. By investigating this

relationship, this research aims to contribute to the growing body of knowledge on digital transformation and employee innovation, particularly in the context of SMEs.

2.6. The Mediating Effect of Employee Digital Capabilities

DT has been widely recognized as a key driver of innovation performance, especially when complemented by strong research and development (R&D) capabilities. Liang and Li (2022) emphasized that DT's impact on innovation performance is notably stronger when mediated by R&D capabilities. A systematic review by Hausberg et al. (2019) of 1,054 research papers revealed significant research streams related to DT, focusing on the roles of technology, organizations, and individuals. They posited that digital technologies are pivotal in enhancing business performance (Hongyun et al., 2025). Yet, a major research gap remains regarding the influence of employee digital capabilities on innovation performance within SMEs.

DT promotes a shift in organizational processes, requiring the adoption of digital tools, platforms, and communication channels that directly influence the firm's innovation capacity. According to Martínez-Caro et al. (2020), employee digital capabilities represent a critical resource in successfully navigating DT and fostering innovation within SMEs. DT involves not just the adoption of new technologies, but also a fundamental transformation in how firms interact with customers, manage operations, and engage in R&D (Vial, 2019). This transformation is highly dependent on employees who possess strong problem-solving skills, openness to change, and the ability to tackle digital challenges (Butschan et al., 2019). As such, employee digital capabilities are essential in mediating the relationship between DT and innovation performance in SMEs (Gyamerah et al., 2025).

Despite growing attention on digital transformation, the mediating role of employee digital capabilities remains insufficiently explored. While studies indicate that employee digital capabilities act as mediators between digital leadership and organizational DT (Gyamerah et al., 2025) and between organizational agility and successful DT implementation in SMEs (Zhang et al., 2024), the underlying mechanisms of how these capabilities facilitate innovation performance are not fully understood. Thus, investigating the mediating role of employee digital capabilities is crucial to bridging this research gap.

Sawaeen and Aburumman (2025) highlighted the mediating role of digital capabilities in the relationship between digital leadership and innovation performance within SMEs. This suggests that enhancing employee digital capabilities is not just beneficial but essential for improving innovation outcomes. Digital capabilities, which encompass a range of fundamental skills, knowledge, attitudes, and awareness about digital technologies, contribute directly to innovation processes (Kahveci, 2025). However, digital capabilities also transcend individual employee skills, incorporating organizational knowledge, expertise, and the ability to leverage digital technologies efficiently across various organizational layers (Proksch et al., 2024).

Recent research has established that digital technologies positively influence innovation performance in SMEs (Hassan et al., 2024; Hongyun et al., 2024). Specifically, the mediating role of employee digital capabilities has been substantiated, with studies showing that digital transformation elements such as digital adoption, drive, and culture facilitate innovation through employee competencies (Wang and Zhang, 2025; Gyamerah et al., 2025). This insight underscores the importance of employee digital capabilities as a driver of innovation performance. Firms that are more digitally capable can harness DT more effectively, yielding significant benefits in terms of innovation and organizational competitiveness (Romero and Mammadov, 2025). Therefore, we hypothesize the following relationships:

H₄: Employee digital capabilities mediate the relationship between digital transformation (in terms of digital adoption, digital drive, and digital culture) and innovation performance in SMEs.

2.7. The Moderating Effect of Digital Transformational Leadership

The moderating effect of digital transformational leadership (DTL) has emerged as a powerful mechanism for facilitating successful DT in SMEs, particularly by fostering the development of employee digital capabilities and enhancing innovation performance. In today's rapidly evolving digital environment, SME leaders who prioritize digital transformation and employee digital capabilities are better equipped to navigate the complexities and challenges associated with digital adoption. This, in turn, boosts organizational agility and enhances innovation outcomes (Kahveci, 2025; Liu, 2025; Lyu, 2024). However, there remains a need for further exploration into the specific ways in which digital transformational leadership influences innovation performance in SMEs (Ren et al., 2023; Gyamerah et al., 2025).

DTL plays a pivotal role in shaping employee digital capabilities by adopting inspiring and visionary leadership styles that encourage employees to embrace new digital tools and approaches. Research has shown that digital leadership is closely linked to enhanced IT capabilities, which are foundational to developing new business models and driving innovation (Gyamerah et al., 2025). Notably, studies have found that DTL significantly impacts innovation capabilities by promoting knowledge sharing, fostering creativity, and supporting the adoption of digital tools (Odai et al., 2025). This suggests that the impact of employee digital capabilities on innovation performance is strengthened under the influence of effective digital transformational leadership.

The effectiveness of digital transformational leadership in SMEs is becoming increasingly critical for organizations striving to remain competitive in an era of digital disruption. By leveraging data analytics and digital capabilities, DTL allows organizations to make better decisions, innovate faster, and respond to market changes more efficiently. Sawaeen and Aburumman (2025) further argue that digital transformational leadership enhances SMEs' innovation performance by creating a conducive environment for innovation. Leaders who effectively harness the digital capabilities of their employees are more likely to introduce successful product and service innovations, thereby improving the overall

competitiveness and performance of their organizations in the digital age (Hoang and Hien, 2024; Zhu, 2024).

Moreover, digital transformational leadership can enhance the digital capabilities of employees by fostering a culture of continuous learning and adaptation. Leaders who are committed to developing employees' digital skills and encouraging innovative thinking contribute directly to organizational success in a highly competitive digital landscape. In this context, employee digital capabilities play a crucial role in translating technological adoption into tangible innovation outcomes. When supported by effective digital leadership, these capabilities are leveraged to drive both incremental and radical innovations, contributing significantly to the organization's competitive edge.

Digital leadership itself is a nuanced concept, defined as the ability to "successfully do the right thing for the digital strategy of enterprises and their business ecosystems" (Ren et al., 2023). Unlike traditional leadership, digital leadership involves a greater focus on adaptability, decision-making in a digital context, and fostering an environment that promotes both technological proficiency and organizational agility. While traditional leadership may center on directing and guiding employees toward achieving set goals, digital leadership requires a more dynamic and forward-looking approach. Leaders in digital contexts must continuously update their knowledge and make decisions with a heightened awareness of the broader technological landscape (Ren et al., 2023).

Dynamic capability theory provides a robust theoretical framework to understand how organizations can continuously adapt, reconfigure, and build both internal and external capabilities in response to rapidly changing digital environments (Teece, 2014a). In the context of DT, DTL serves as a dynamic capability that aligns digital strategies with broader organizational goals, guiding firms through the complexities of the digital landscape (Kohli and Melville, 2019). Effective digital leadership enables organizations to address barriers such as resource constraints, skill gaps, and technological challenges, while fostering the digital capabilities necessary to implement successful digital transformation strategies (Meier et al., 2022; Romero and Mammadov, 2025).

Therefore, the moderating role of digital transformational leadership is central to understanding how employee digital capabilities impact innovation performance within SMEs. The evidence suggests that when SME leaders effectively manage digital transformation, they amplify the innovation potential of their employees, creating a more agile, responsive, and competitive organization. We hypothesize that:

H₅: Digital transformational leadership moderates the relationship between digital transformation (in terms of digital adoption, digital drive, and digital culture) and innovation performance in SMEs.

2.7. Conceptual Framework

In today's rapidly evolving digital landscape, organizations face constant pressure to innovate and remain competitive. The success of SMEs in this digital age depends on their ability to

leverage DT, develop employee digital capabilities, and foster effective leadership that can guide these changes. This study presents a conceptual framework that integrates six key variables, each representing a critical facet of SME digital transformation and innovation. These variables are: digital transformation, employee digital capabilities, digital transformational leadership, and innovation performance. Together, they capture the primary trends and challenges that SMEs encounter in their digital journey (Figure 1).

2.7.1. Overview of variables and their interconnectedness

As the foundation of this framework, DT encompasses the strategic integration of digital technologies into all aspects of business operations. SMEs' ability to effectively execute digital transformation is central to their survival and growth in the digital age. DT shapes not only how businesses operate internally but also how they interact with customers, suppliers, and other stakeholders. The success of DT initiatives depends heavily on the development of internal capabilities, particularly employee digital capabilities and strong digital transformational leadership.

Digital adoption refers to the extent to which an organization embraces and integrates digital tools, platforms, and systems into its operations. It is a crucial factor influencing how SMEs adapt to digital changes and leverage new technologies for business improvement. Effective digital adoption accelerates the implementation of DT strategies and the development of employee digital capabilities, ultimately boosting innovation performance.

Digital drive focuses on the strategic initiatives and motivations behind adopting digital technologies within an organization. It ensures that digital tools are aligned with the firm's overall growth strategy, helping to facilitate more informed decision-making, effective problem-solving, and continuous innovation. By integrating digital solutions into the business processes, firms can enhance operational efficiency and remain competitive in an increasingly digital landscape. The emphasis is on using technology not just for automation but to drive strategic outcomes and innovation performance.

Digital culture represents the organizational mindset and values that support digital transformation. It includes the readiness and openness of employees to embrace new digital technologies, the

organization's attitude toward continuous learning, and its ability to foster collaboration and innovation in a digital environment. A strong digital culture reinforces the other elements of the framework by ensuring that employees are not only equipped with digital skills but also motivated to apply them creatively.

Employee digital capabilities refer to employees' skills, knowledge, attitudes, and behaviors that enable them to use digital technologies effectively. Employees with strong digital capabilities contribute significantly to the success of digital initiatives, as they play a pivotal role in implementing digital tools, managing digital processes, and innovating within their respective roles. Therefore, enhancing employee digital capabilities is a key driver of innovation performance in SMEs.

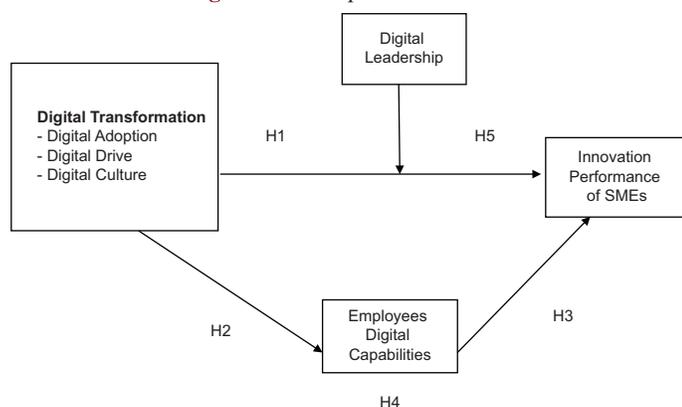
Digital Transformational Leadership (DTL): The role of digital transformational leadership is essential in steering SMEs through the complexities of DT. Leaders who adopt a digital transformational style inspire, motivate, and guide their teams through digital changes. By creating a supportive environment that encourages the development of digital skills, DTL fosters employee engagement, innovation, and organizational agility. Moreover, DTL plays a moderating role in the relationship between digital capabilities and innovation performance, amplifying the effect of digital initiatives on organizational outcomes.

Innovation Performance: The ultimate goal of the framework is to enhance innovation performance, which refers to an SME's ability to create new products, services, processes, or business models that improve its market position and competitiveness. In this context, innovation performance is viewed as the outcome of the successful integration of digital transformation, the enhancement of employee digital capabilities, and the enabling role of digital transformational leadership. Together, these factors contribute to SMEs' ability to innovate effectively in the digital era.

2.7.2. Motivation behind variable selection and interconnectedness

The selection of these six variables is grounded in the increasing recognition that digital transformation is not just a technological shift but a multifaceted process that requires changes in leadership, culture, and employee capabilities. Each variable is interdependent, forming a dynamic system where the presence or absence of one element can influence the success of others. For example, digital transformational leadership acts as both a catalyst for digital adoption and a moderator that amplifies the effect of employee digital capabilities on innovation performance. Similarly, digital culture fosters an environment that supports the ongoing development of digital skills, making it a crucial enabler of DT and innovation. The interconnectedness of these elements suggests that SMEs cannot focus on just one aspect of digital transformation in isolation. Instead, they must adopt an integrated approach where leadership, employee development, digital tools, and culture are aligned to drive innovation. This study seeks to enhance the understanding of how these elements work together to define and achieve innovation performance in the digital age. By exploring these relationships, the study aims to provide actionable

Figure 1: Conceptual Framework



insights into how SMEs can optimize their digital transformation strategies for sustained innovation and competitiveness.

3. METHODS

3.1. Research Samples and Data Collection

The main objective of this study is to analyze the relationship between digital transformation and innovation performance through employees' digital competencies. This paper also examines the role of digital transformational leadership in moderating the relationship between employees' digital competencies and innovation performance in SMEs. The study adopted a quantitative approach, consistent with the research objectives and scope. Data were collected by distributing online questionnaires. The questionnaire was reviewed by academic experts to ensure its reliability and ease of understanding by the respondents (Appendix). A pilot test was conducted to validate the questionnaire, involving 30 respondents. The respondents included SME owners, CEOs/CFOs, executive managers, and managers in Jordan. This study used a non-probability sampling strategy known as convenience sampling. The service and manufacturing sectors were chosen as focus sectors due to the inherent challenges they face in leveraging current digital technologies to enhance SME performance. Approximately 500 questionnaires were distributed between November and December 2025. To collect the data, the researchers selected business owners, CEOs/CFOs, executive managers, and managers because they are responsible for developing, making, and implementing digital strategies and decisions, thus providing the most accurate data on the use of digital technology (Hongyun et al., 2025).

3.2. Variables and Measurement

This study has four primary variables, including digital transformation based on three sub-dimension variables, one mediator, one moderator, and one dependent variable. Digital competencies of employees are defined as the level of competence team members possess to utilise digital technology gained from their prior digital and technical knowledge (Proksch et al., 2024). Measurement of EMDC consisted of four items adapted from the scale developed by Gyamerah et al.(2025) and also Proksch et al. (2024).

DTL is conceptualised as a leadership approach that guides organisations through the complexities of DT by leveraging technology to innovate, improve processes, and enhance business outcomes while fostering a culture of adaptability, innovation, and continuous learning among employees (Kane et al., 2019). This construct was measured with six items using a scale developed by Gyamerah et al.(2025).

DI has three subdimensions (digital adoption, digital drive, and digital culture) and is measured by validated scales developed by Wang and Zhang (2025), who examined digital transformation and innovation performance in SMEs through a systems perspective. Each construct was measured using four items that captured strategic, technological, and cultural aspects of digital transformation.

Similarly, innovation performance was measured using four items that assess both the quantity and quality of innovation outcomes, including new products, services, and workflow improvements. These items were slightly reworded to fit the present study's context without altering their original meaning (Wang and Zhang, 2025).

3.3. Data Analysis

Because of the intricacy of the theoretical model proposed, involving over one construct and intricate interactions at both the construct as well as the individual levels, Partial Least Squares Structural Equation Modeling (PLS-SEM) is selected as the method of choice for statistical analysis. PLS-SEM has been discovered to be very tolerant and effective in dealing with complex models involving over one variable and relationship, and thus an ideal tool for this research (Hair et al., 2019).

PLS-SEM is most suitable when research involves exploratory models or predictive modeling to determine causal relationships between more than one independent and dependent variable. This is best aligned with the study's greatest purpose, which is to determine the relationships among various constructs in the newly created framework. In PLS-SEM, this study aims to examine the strength of the direction of the relationship between constructs and shed some light on the causal mechanisms of observed results.

One of the biggest strengths of PLS-SEM is that it can estimate complex models using small and medium sample sizes without sacrificing statistical power (Hair et al., 2021). This is particularly significant for SMEs, where data availability may be constrained. PLS-SEM also supports non-normality of distribution of data, which is common in business and management research, and does not place strong assumptions on data distribution (Hair et al., 2019).

With PLS-SEM, the measurement model (checking for valid relationships between the indicators and the corresponding constructs) and structural model (testing causal relations among the constructs) can be probed by this study. The method also enables one to probe intervening variables' relationships with exogenous variables as well as endogenous variables, which provides an overview of how digital transformation, employee digital capabilities, and digital transformational leadership influence the innovation performance in SMEs.

Overall, PLS-SEM is appropriate for this study's aim, providing a strong and effective means of testing the hypothesized relationships and evaluating how well the theoretical framework at hand is empirically supported. Its ability to deal with complicated models, small samples, and non-normal distributions gives it the robustness required to test the intricacies involved in digital transformation in SMEs.

4. RESULTS

4.1. Measurement Model Assessment

Initially, indicator reliability, internal consistency reliability, and convergent validity were evaluated, respectively, by the

standardized indicator loadings (Hair et al., 2022). Table 2 and Figure 2 indicate the values of the outer loadings of the items corresponding to each of the constructs. It shows that the minimum value of the outer loading belongs to EMDC3, which is 0.744 and still greater than the threshold of 0.7; hence, it can be said that the indicator reliability is met (Hair et al., 2022; Chin, 1998). Moreover, the item DA4 had low loading, hence the item was removed.

Table 2: Outer loadings

Construct	Item	Loading
Digital Adoption (DA)	DA1	0.915
	DA2	0.956
	DA3	0.961
Digital Culture (DC)	DC1	0.908
	DC2	0.947
	DC3	0.923
	DC4	0.940
Digital Drive (DD)	DD1	0.860
	DD2	0.908
	DD3	0.887
	DD4	0.896
Digital Transformation Leadership (DTL)	DTL1	0.893
	DTL2	0.893
	DTL3	0.895
	DTL4	0.887
	DTL5	0.900
	DTL6	0.898
Employee Digital Capabilities (EMDC)	EMDC1	0.919
	EMDC2	0.934
	EMDC3	0.744
	EMDC4	0.919
Innovation Performance (IP)	IP1	0.894
	IP2	0.907
	IP3	0.860
	IP4	0.857
	IP5	0.752

Table 3 indicates that all the constructs' values of composite reliability are well above the threshold value of 0.7, hence maintaining the internal consistency (Nunnally and Bernstein, 1994; Hair et al., 2022). Moreover, the results of AVE are presented to test the convergent validity. The values under the column AVE are all above the suggested threshold of 0.5, hence assuring the convergent validity (Fornell and Larcker, 1981; Hair et al., 2022).

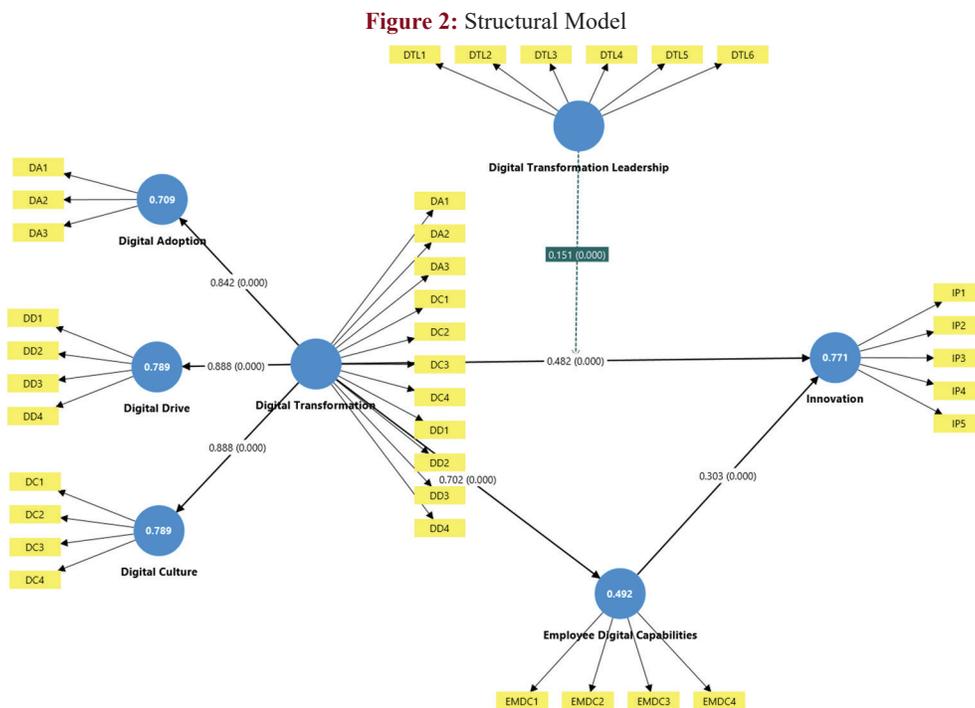
To examine the discriminant validity of the construct, the HTMT is provided in the table above. The result shows that almost all the values are under 0.85, which shows that they are well maintaining the discriminant validity. As shown in Table 4, however, only one value is above 0.85 but still under 0.9, which is also acceptable (Hair et al, 2021). In conclusion, it can be said that there exists an acceptable level of discriminant validity of the construct.

The PLS-SEM model shows borderline fit. As shown in Table 5, SRMR is 0.095 for the estimated model (ideally <0.08, sometimes <0.10 is acceptable).

4.2. Structural Model Assessment

The bootstrapping method is used to run the structural model, which shows the path coefficient with the p-values of the relationships. It can be noticed is the figure below that the model not only includes the Independent and dependent variables but also the mediator and moderator, as shown in Figure 3.

To test the hypotheses, we adopted the bootstrap approach with 5,000 resamples. The results in Table 6 indicate that the relationship between digital transformation and innovation performance is also positive, with the beta coefficient of 0.482, P < 0.05, hence indicating the significant impact of digital transformation on innovation performance, in support of H₁. In the same way, the impact of digital



transformation on employee digital capabilities has a positive beta of 0.702 with a significant $P = 0.00$, in support of H_2 . The relationship between employee digital capabilities and innovation performance is also positive and significant, with a beta equal to 0.303 and a $P < 0.05$, in support of H_3 . For H_4 , the results of the mediated impact of digital transformation on Innovation performance through employee digital capabilities showed a positive 0.142, and the $P < 0.05$, which indicates a significant mediated relationship.

Furthermore, Table 6 also shows a moderated relationship where digital transformation leadership significantly moderates

Table 3: Construct reliability and validity

Construct	α	CR	AVE
Digital Adoption	0.939	0.940	0.891
Digital Culture	0.948	0.948	0.864
Digital Drive	0.910	0.911	0.788
Digital Transformation Leadership	0.950	0.950	0.800
Employee Digital Capabilities	0.903	0.914	0.779
Innovation Performance	0.907	0.912	0.732

Table 4: Discriminant validity-HTMT

Construct	DA	DC	DD	DTL	EMDC	IP
Digital Adoption						
Digital Culture	0.653					
Digital Drive	0.711	0.714				
Digital Transformation Leadership	0.270	0.399	0.299			
Employee Digital Capabilities	0.653	0.625	0.707	0.283		
Innovation Performance	0.753	0.745	0.871	0.401	0.804	

Table 5: Fit indices

Fit index	Saturated model	Estimated model
SRMR	0.090	0.095

the relationship between digital transformation and innovation performance, with a beta equal to 0.151 and a $P < 0.05$ in support of H_5 . Overall, the hypotheses show that there are a total of five hypotheses in the given model, where all hypotheses were found to be supported as all P-values are well below the threshold value of 0.05, hence showing the strong and significant relationships.

5. DISCUSSION

This study focused on understanding the relationships between digital transformation, employee digital capabilities, and innovation performance in SME managers in Jordan. It also examined how key factors such as employee competencies and digital transformational leadership mediate and moderate these relationships. The results support all five hypotheses formulated in the study and provide important insights into how digital transformation can enhance innovation outcomes, especially when combined with employee digital capability development and leadership support.

The results of this study demonstrate a significant positive impact of digital transformation on innovation performance. This finding supports previous research indicating that when SMEs adopt digital technologies, they strengthen their competitiveness by improving product and process innovation (Hongyun et al., 2025; Hassan et al., 2024). The positive relationship revealed by this study highlights the importance of digital transformation as a catalyst for innovation, particularly for SMEs, which often face pressure to maintain their agility and competitiveness in a rapidly changing digital environment. Digital transformation is not simply about integrating new technologies; it also fosters more dynamic and flexible business models, contributing to improved innovation outcomes (Hassan et al., 2024). Therefore, SMEs that invest in digital tools and technologies have better opportunities for innovation, adaptation, and growth.

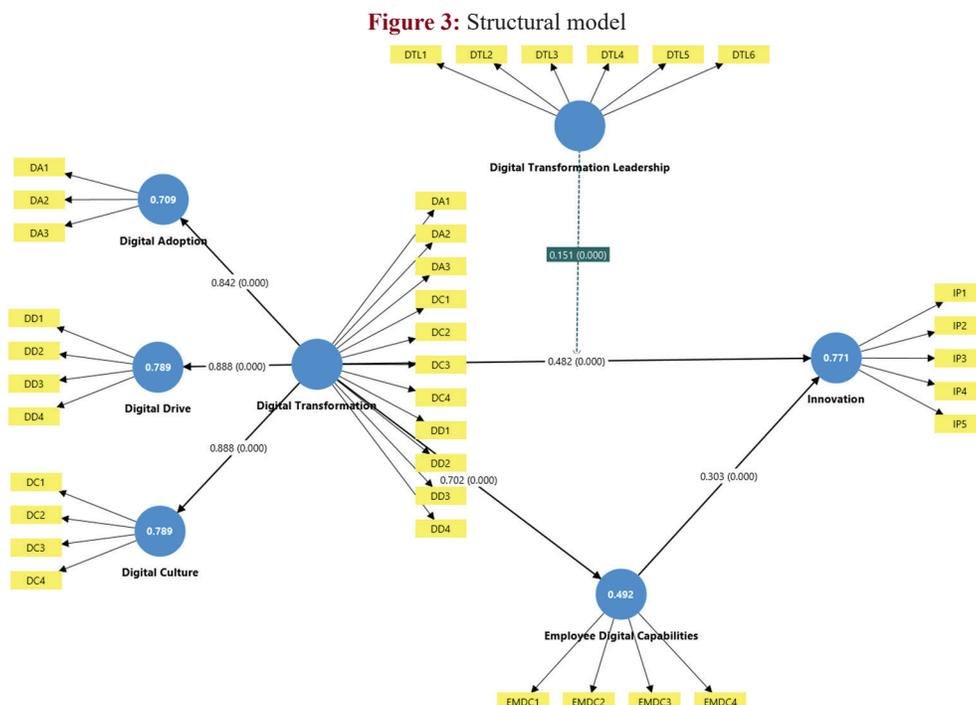


Table 6: Structural model results

Hypothesis	Path	Coefficient	T stats	P-values
H ₁	Digital Transformation -> Innovation Performance	0.482	11.873	0.000
H ₂	Digital Transformation -> Employee Digital Capabilities	0.702	26.318	0.000
H ₃	Employee Digital Capabilities -> Innovation	0.303	8.383	0.000
H ₄	Digital Transformation Leadership -> Employee Digital Capabilities -> Innovation Performance	0.142	5.175	0.001
H ₅	Digital Transformation Leadership x Digital Transformation -> Innovation Performance	0.151	6.202	0.000

This study supports the hypothesis that digital transformation has a positive impact on employees' digital skills development, which in turn positively affects innovation performance. These findings are consistent with previous research highlighting the importance of employees' digital skills in driving innovation (Gyamerah et al., 2025; Blanka et al., 2022). Within SMEs, employees' digital skills encompassing everything from technical capabilities to cognitive adaptive skills are essential for integrating new digital tools and increasing organizational agility. This finding reinforces the idea that for SMEs, it is not enough to simply adopt digital technologies; it is also crucial to equip employees with the skills to use these tools effectively (Shao et al., 2025). Furthermore, this research highlights the critical interplay between employees' digital skills and innovation performance, indicating that an organization's capacity for innovation increases significantly when employees possess the necessary skills to adapt to and leverage evolving digital technologies (Proksch et al., 2024). Employees who can effectively utilize digital tools not only enhance operational efficiency but also contribute to the development of innovative products and services, giving SMEs a competitive edge in the market.

The study demonstrated a significant impact of employee digital capabilities on the relationship between digital transformation and innovation performance. This finding adds another dimension to our understanding of how digital transformation impacts SMEs, suggesting that simply using digital technologies is insufficient to achieve innovation results. Developing employees' digital skills is essential to translating digital transformation efforts into tangible innovation performance. This finding aligns with research by Martínez-Caro et al. (2020) and Vial (2019), which emphasizes the importance of the human element in the digital transformation process. Employees with strong digital skills can use digital tools more effectively, enabling organizations to innovate more efficiently. This study highlights the role of digital skills as a means of linking digital transformation to improved innovation outcomes.

Finally, the results support the hypothesis that digital transformational leadership influences the relationship between digital transformation and innovation performance. This finding aligns with the work of Sawaeen and Aburumman (2025), who argue that digital leadership plays a pivotal role in creating an

environment conducive to innovation. Digital transformation leaders encourage employees to adopt new digital tools and processes, thereby enhancing their digital skills and fostering innovation (Gyamerah et al., 2025). Furthermore, digital leadership is essential for ensuring an organizational culture that supports innovation, as leaders must establish a vision for digital transformation and unite employees around it. The effects observed in this study indicate that digital leadership can significantly enhance the impact of digital transformation on innovation performance by fostering an organizational culture that encourages creativity, knowledge sharing, and the adoption of new technologies (Ren et al., 2023).

6. CONCLUSION

In conclusion, this study provides strong evidence that digital transformation has a significant positive impact on innovation performance. This relationship is further supported by enhancing employee digital capabilities and having effective digital leadership. SMEs hoping to improve their innovation outcomes must prioritize both the technological and human aspects of their digital transformation process. This includes creating an environment that encourages employee learning and digital skills development, as well as ensuring strong leadership to guide the organization through the complexities of digital transformation. By taking these steps, SMEs can enhance their chances of success in the digital economy and foster sustainable innovation in the future.

6.1. Implications for Theory and Practice

These findings offer multiple theoretical and practical advantages to the literature on digital transformation and innovation in SMEs. This study expands our understanding of the mechanisms driving innovation in the digital age by emphasizing the enhanced mediating roles of employees' digital capabilities and leadership in digital transformation. While previous research has emphasized the direct link between digital transformation and innovation, this study demonstrates that employees and leadership play a vital role in strengthening this relationship. Furthermore, the study contributes to the growing understanding of how digital transformation impacts SMEs, particularly regarding how digital tools can be used to enhance innovation at both the employee and organizational levels.

These findings underscore the importance for SME managers to recognize the value of investing in digital technologies, with a strong emphasis on developing employees' digital skills and fostering a culture of effective digital leadership. By doing so, SMEs can ensure that their digital transformation efforts lead to significant improvements in innovation performance. Managers should focus on providing targeted training and development programs to enhance employees' digital skills and ensure that digital leadership effectively contributes to managing the digital transformation process within the organization.

6.2. Future Research

In future research, it will be important to examine the sustainable impacts of digital transformation on innovation within SMEs, particularly across different sectors and regions, to understand

the generalizability of these findings. Furthermore, future studies could explore the challenges and difficulties SMEs may face in fostering digital skills among their employees, and how these obstacles might affect the overall success of digital transformation programs.

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APPENDIX

Appendix Table 1: Digital transformation leadership (DTL)

Item code	Item statement
DTL1	Our leaders inspire all members with the digital transformation plans/strategy for our organisation
DTL2	Our leaders articulate a clear vision and develop strategies to harness digital technologies for competitive advantage
DTL3	Our leaders motivate team members to work together for the same digital transformation goals
DTL4	Our leaders encourage all members to achieve digital transformation goals for our organisation
DTL5	Leaders in my organisation act by considering the digital transformation beliefs of all members
DTL6	Our leaders stimulate all members to think about digital transformation ideas

Appendix Table 2: Employee digital capabilities (EMDC)

Item code	Item statement
EMDC1	We offer different trainings (courses, literature, coaching) to improve the digital expertise of our team members
EMDC2	Digital skills are an important selection criterion in recruiting new team members
EMDC3	Our team members use all digital services and products we offer
EMDC4	Our team has the necessary skills to further digitalise our company

Appendix Table 3: DT elements

Construct	Item code	Item statement
Digital Adoption	DA1	Our firm recognizes the importance of adopting digital technology
	DA2	Our firm is in the early stages of implementing digital technology
	DA3	Our firm has created a comprehensive strategy for digital technology integration
	DA4	Our firm has launched a digitalization program
Digital Drive	DD1	Our firm is committed to driving digital technology to support the firm's growth
	DD2	Our firm drives digital technology to facilitate decision-making processes
	DD3	Our firm drives digital technology to enhance communication and collaboration efficiency
	DD4	Our firm drives digital technology to devise innovative strategies
Digital Culture	DC1	Our firm embraces a culture of innovation based on digital technology
	DC2	Our firm encourages a culture of change for digitalization
	DC3	Our firm actively promotes its digital strategy
	DC4	Our firm is open to suggestions from employees on digitalization
Innovation Performance	IP1	In recent years, our firm has seen an increase in the percentage of new products or services
	IP2	In recent years, our firm has seen new products or services increase
	IP3	In recent years, our firm has seen an increase in the number of innovations introduced into our workflow
	IP4	In recent years, the quality of new products or services introduced by our firm has improved

Appendix Table 4: Innovation performance

Construct	Item code	Item statement
Innovation Performance	IP1	In recent years, our firm has seen an increase in the percentage of new products or services
	IP2	In recent years, our firm has seen new products or services increase
	IP3	In recent years, our firm has seen an increase in the number of innovations introduced into our workflow
	IP4	In recent years, the quality of new products or services introduced by our firm has improved