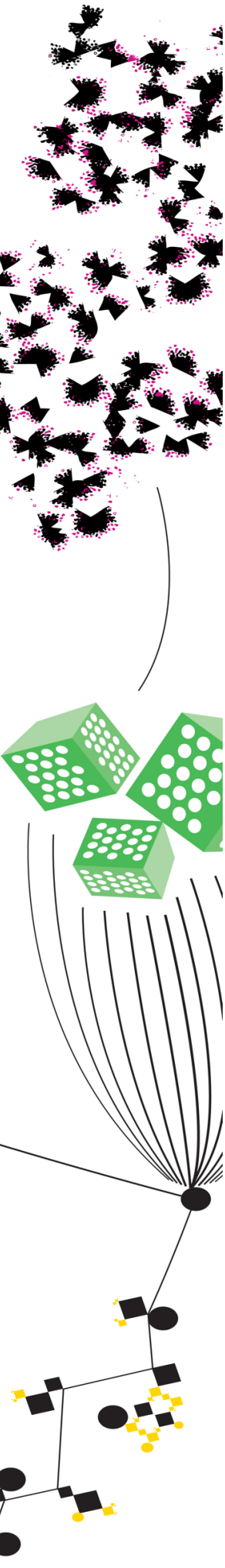

Exploring Digital Leadership Competencies and Their Impact on Digital Transformation Maturity: A Study of German Retail SMEs

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Abstract

In today's rapidly digitizing business environment, small and medium-sized enterprises (SMEs) in the retail sector face increasing pressure to adopt digital transformation strategies to stay competitive. Despite the recognized importance of leadership in guiding this transformation, little is known about the specific digital leadership competencies that enable successful digital transformation, particularly in the context of German retail SMEs. This exploratory study seeks to address this gap by investigating the relationship between digital leadership competencies and digital transformation maturity. Drawing on a detailed literature review, six key leadership competencies—tech-savviness, digital strategy, agility, networking, innovation, and empowerment—are identified as potential drivers of digital transformation maturity. The research adopts a quantitative approach, collecting data from a sample of German retail SMEs to examine how these competencies influence the level of digital maturity within the organizations. The analysis employs exploratory data techniques and correlation analysis to identify significant patterns between leadership practices and transformation success. The findings suggest that specific competencies, particularly tech-savviness and empowerment, are strongly associated with higher levels of digital transformation maturity. These insights provide valuable theoretical contributions to digital leadership while offering practical recommendations for SME leaders to develop and refine these competencies to drive successful digital transformation. The study concludes by outlining areas for future research, emphasizing the need for further exploration of leadership dynamics in the context of digital transformation and providing actionable strategies for leaders in retail SMEs to enhance their digital readiness.

Keywords: Digital Transformation, Digital Transformation Maturity, Digital Leadership, Leadership Competencies, Retail SMEs, Exploratory Study

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1 Introduction

In today´s rapidly evolving digital landscape, the retail industry is experiencing a profound transformation, driven by the rapid expansion of e-commerce, technological innovation, and shifting customer expectations (Palmié et al., 2022). For small and medium-sized enterprises (SMEs) in the retail sector, embracing digital transformation is not just an option but a necessity to remain competitive (Shankar et al., 2021). SMEs, which form the backbone of many economies, including Germany, must adapt to digital trends to maintain market relevance and growth potential.

Digital transformation offers significant opportunities for growth, innovation, and operation efficiency, but it also poses distinct challenges, particularly for SMEs. Unlike large corporations, SMEs often need more resources, expertise, and organizational flexibility, making it challenging to navigate these changes effectively (Kilimis et al., 2019; Petzolt et al., 2022; Pfister & Lehmann, 2022). Despite these challenges, SMEs must adapt to the digital shift to compete with larger corporations and e-commerce giants.

Leadership is crucial in this context, facilitating successful digital transformation efforts. Leaders in SMEs must steer their organizations through technological disruption while managing the unique constraints and characteristics of smaller businesses. Despite its critical importance, the specific competencies and strategies leaders in German retail SMEs must develop to implement digital transformation successfully still need to be explored (Trenerry et al., 2021). Most existing research focuses on more large corporations, leaving a gap in understanding how SMEs, which comprise over 99% of all companies in Germany, can thrive in a rapidly digitizing market (Pfister & Lehmann, 2021). This study seeks to address this gap by exploring the intersection of digital transformation and leadership within the specific context of German retail SMEs. Given the complexity and novelty of digital transformation in this sector, an exploratory approach is well-suited for uncovering the nuanced leadership practices that enable successful digital transitions. The research aims to identify critical digital leadership competencies that correlate with higher levels of digital transformation maturity, thereby providing practical insights into how these competencies are developed and implemented.

Despite the increasing emphasis on digital transformation and digital leadership in the retail industry, there still needs to be significant gaps in our understanding of how these concepts apply to retail SMEs. These gaps are particularly concerning, given SMEs' vital role in economic growth and employment. To ensure the survival and success of SMEs in the digital age, it is crucial to explore how digital transformation and digital leadership function within the unique context of retail SMEs. One critical research gap is the limited understanding of digital transformation within the retail SME sector (Mostaghel et al., 2022; Pinto et al., 2023; Shankar et al., 2021). While considerable research exists on digital transformation in larger retail organizations, more is needed to know how SMEs adapt to the digital environment. This gap is particularly pressing, as SMEs often need help implementing digital technologies due to their limited resources and capabilities (Kilimis et al., 2019; Petzolt et al., 2022; Pfister & Lehmann, 2022). Another significant gap is the need for more research on digital leadership tailored explicitly to retail SMEs (Adhiatma et al., 2023). While digital leadership has been explored in other contexts, such as large organizations and the tech industry, little attention has been given to how it can be effectively applied within retail SMEs. This gap is crucial, as SMEs may require different leadership approaches and face distinct challenges compared to larger organizations in developing and executing digital strategies.

While digital transformation has been extensively researched in the context of large retail organizations, more is needed to know how SMEs adapt to the digital landscape. This gap is concerning because SMEs are critical in driving economic growth and employment, especially in Germany’s retail sector (Mostaghel et al., 2022; Pinto et al., 2023; Shankar et al., 2021). The barriers to digital adoption in SMEs, such as limited financial resources and technological expertise, are well-documented, but there is a lack of focused research on how leadership can mitigate these challenges (Kilimis et al., 2019;

Petzolt et al., 2022; Pfister & Lehmann, 2022). Moreover, effective digital leadership strategies in larger organizations may not directly apply to SMEs, which often require more flexible and adaptive approaches.

One critical gap in the literature is the need for more understanding of digital leadership tailored to retail SMEs' unique needs and constraints. While studies have examined digital leadership in broader contexts, such as large corporations and the technology industry, there needs to be more guidance for leaders in retail SMEs on effectively leading digital initiatives (Adhiatma et al., 2023). These organizations may face distinct challenges, such as smaller teams, flatter hierarchies, and closer relationships with their local customer base, necessitating different leadership approaches.

Given these gaps, this study takes an exploratory approach to understand better the intersection of digital transformation and digital leadership in retail SMEs. The primary objective of this research is to investigate the relationship between digital leadership competencies and the degree of digital transformation maturity achieved by retail SMEs in Germany. The central research question guiding this study is: **What is the relationship between digital leadership competencies and digital transformation maturity in retail SMEs in Germany?**

The exploratory nature of this research is significant as it seeks to uncover new insights and build a foundational understanding of these little known areas. Academically, this study aims to bridge existing research gaps by contributing to the broader literature on digital transformation and leadership, particularly within retail SMEs. By addressing these gaps, this research will enrich theoretical frameworks and enhance our understanding of how digital leadership competencies drive successful digital transformation in retail SMEs.

From a practical perspective, this research will provide valuable guidance for retail SME owners and managers. The study will offer insights to inform digital leadership development initiatives and help SMEs effectively navigate their digital transformation journeys by identifying the competencies that most strongly influence digital transformation maturity. The findings will serve as a roadmap for SME leaders, enabling them to recognize and cultivate the competencies essential for guiding their organizations through the complexities of digital transformation. Finally, retail SMEs in Germany stand to benefit from this research by gaining evidence-based insights that can shape their digital strategies. In a competitive digital marketplace, understanding which digital leadership competencies are most critical can influence strategic decisions, resource allocation, and overall approaches to digital transformation. Ultimately, the study's findings may have broader implications for the economic growth and competitiveness of the retail sector in Germany, supporting SMEs in their digital transformation efforts and contributing to the sector's overall vitality and sustainability.

This paper is organized into several sections. Section 2 provides the theoretical background, introducing key concepts such as digital transformation and digital leadership and their relevance to German retail SMEs. Section 3 focuses on proposition development, presenting propositions on how specific leadership competencies might be related to digital transformation maturity. Section 4 outlines the research methodology, including design, sample selection, and data analysis. Section 5 presents the results, followed by Section 6, which discusses the findings in relation to existing literature. Finally, Section 7 offers conclusions, summarizing key insights and proposing areas for future research.

2 Theoretical Background

This chapter will explore the theoretical background, setting the foundation for the study by reviewing existing research and key concepts related to digital transformation and digital leadership. This review is critical for understanding how the forthcoming propositions are framed and why these specific competencies are emphasized in the research.

2.1 Digital Transformation

The first part of the theoretical background introduces digital transformation, which has received significant attention from scholars and practitioners due to its profound impact on industries, companies, and societal development (Fernandez-Vidal et al., 2022). Understanding this concept is essential as it forms the basis of this study's investigation into leadership in the digital age.

Digital transformation is essential in strategic IS research and practical implementation (Vial, 2019). In today's rapidly evolving digital landscape, understanding and embracing digital transformation has become imperative for organizations aiming to remain competitive and adapt to the ongoing advancements in digital technologies (Vial, 2019).

Although digital transformation has attracted considerable attention from scholars and practitioners, there has yet to be a consensus on its definition (Zhang et al., 2022). Scholars have presented different views on how to define digital transformation. Some view it as a strategy, business model, process, or tool (Zhang et al., 2022). One common understanding of digital transformation includes the profound changes in society and industries through digital technologies (Zhang et al., 2022). It is not solely about adopting digital technologies but also about finding ways to innovate with these technologies by devising strategies that embrace the implications of digital transformation and drive better operational performance (Fernandez-Vidal et al., 2022; Vial, 2019).

According to Leso et al. (2022) and Verhoef et al. (2021), digital transformation entails using digital technologies to create a business model that generates increased customer value beyond essential digitalization initiatives that concentrate solely on organizational processes and tasks. The impact of digital transformation extends beyond technology; it necessitates strategic renewal and detailed change, including the updating or creating of business models, methods, structures, and cultural approaches to enhance customer value (Leso et al., 2022). Digital transformation can lead to wide-ranging organizational implications as it modifies the core business model of a company through the integration of digital technology (Verhoef et al., 2021). Furthermore, AlNuaimi et al. (2022) describe digital transformation as a tool for adapting business processes, organizational aspects, and cultures in response to evolving market demands driven by digital technologies. Three key elements characterize this transformation. First, it involves the reevaluation and redefinition of firm boundaries. Second, it entails engaging community input and reducing property rights by opening products and services. Lastly, digital transformation involves reshaping both organizational and product identities (AlNuaimi et al., 2022).

According to Buck et al. (2021), Leso et al. (2022), Trenerry et al. (2021), and Verhoef et al. (2021), digital transformation can be understood as a process consisting of three distinct phases: digitization, digitalization, and digital transformation. While management scholars often use these terms interchangeably, they cover different types of technology utilization and carry different levels of complexity, with implications for value creation, technology management, business strategy, and organizational culture (Leso et al., 2022).

Firstly, digitization refers to the foundational process of converting analog information into digital formats. This initial step enables organizations to process, store, and manage data more efficiently (Buck et al., 2021; Trenerry et al., 2021). Examples of digitization include transitioning from paper-based record-keeping to digital databases or automating internal administrative processes using

software. Although digitization enhances the efficiency of existing methods, it does not typically affect the underlying business model or value-creation activities (Verhoef et al., 2021).

Secondly, digitalization takes the process further by integrating digital technologies into core business processes to optimize and enhance operations (Trenerry et al., 2021). Digitalization involves using IT to streamline communication channels, automate supply chains, and improve customer interactions, creating added value and improving operational efficiency (Verhoef et al., 2021). It enables organizations to explore new opportunities by leveraging technology to optimize existing processes, such as developing mobile platforms to engage customers or creating data-driven marketing strategies. Significantly, digitalization drives change in isolated processes and across various aspects of the organization, including culture and work environments, making it a transformative step (Buck et al., 2021).

Thirdly, digital transformation is considered the most advanced and complex phase, transcending mere process optimization to encompass strategic renewal and innovation (Verhoef et al., 2021). Digital transformation reshapes business models, alters value creation, and redefines how organizations engage with customers, partners, and stakeholders. It involves embedding digital capabilities into every facet of the organization, from product development and customer experience to supply chain management and leadership culture (Buck et al., 2021). For instance, companies may deploy advanced analytics to predict market trends, use artificial intelligence (AI) to personalize customer interactions or adopt blockchain for secure and transparent transactions. The ultimate goal of digital transformation is not simply to embrace technology but to create new business models that drive sustainable competitive advantage and growth (Leso et al., 2022).

Overall, digital transformation is a complex process beyond mere technology adoption, as indicated by several scholars (Henderikx & Stoffers, 2022; Horvath & Szabo, 2019; Vial, 2019; Zhang et al., 2022). It involves reshaping various aspects of an organization, including its vision, strategy, structure, processes, capabilities, and culture, in response to the dynamic digital business environment (Vial, 2019). Its primary purpose is to create value across multiple dimensions – improving operational efficiency, enhancing customer experiences, driving innovation, and enabling strategic differentiation (Zhang et al., 2022). Companies that successfully undergo digital transformation often gain significant competitive advantages. They can streamline their operations, reduce costs, and offer personalized products and services that meet the evolving needs of their customers (Vial, 2019).

Moreover, digital transformation extends beyond product and process enhancements to influence the supply chain and organizational structure (Horvath & Szabo, 2019). It impacts how companies interact with stakeholders, enter new markets, and develop strategic partnerships. As a result, companies that embrace digital transformation are often better positioned to navigate market disruptions, capitalize on emerging trends, and ensure long-term sustainability in an increasingly digital world.

Digital transformation is ultimately a disruptive change process facilitated by innovative digital technologies and the strategic utilization of essential resources and capabilities (Gong & Ribiere, 2021). It aims to radically improve organizations, business networks, industries, and society (Gong & Ribiere, 2021). By adopting emerging technologies and leveraging them effectively, organizations can enhance internal processes, meet customer needs, and ultimately gain a competitive advantage, leading to fundamental shifts in their operations and value creation (Henderikx & Stoffers, 2022).

2.1.1 Digital Transformation Maturity

Having introduced digital transformation, it is essential to consider organizations' maturity in adopting and integrating digital technologies. This subsection will discuss the notion of digital transformation maturity, which will later be used to assess the progress of retail SMEs in Germany. Understanding maturity levels helps clarify the varying stages of transformation and their implications for leadership practices.

Maturity models provide structured frameworks for evaluating progress, often focusing on critical areas such as technology, strategy, culture, and customer experience (Petzolt et al., 2022; Schallmo & Williams, 2021). These frameworks help organizations identify where they stand on the digital continuum, enabling informed decisions about future transformation strategies.

The concept of digital transformation maturity, closely related to the broader idea of digital maturity, has been extensively discussed by researchers (Petzolt et al., 2022; Pinto et al., 2023; Rossmann, 2019; Schallmo & Williams, 2021; Zaoui & Souissi, 2022). Digital maturity refers to the stage a company reaches in its digital transformation process, reflecting its operations advancements and the skills it has developed to navigate the digital landscape (Zaoui & Souissi, 2022). Achieving digital maturity requires an organization to integrate digital tools involving employees, processes, communication, and technology (Pinto et al., 2023).

Assessing digital maturity is challenging due to digital transformation's complexity and wide-ranging implications. Various maturity models have been developed to address this, focusing on different dimensions and levels of digital transformation. These models, as outlined by Schallmo and Williams (2021), break down digital maturity into several dimensions—each evaluated independently—such as technology integration, strategic alignment, and cultural adaptation. Petzolt et al. (2022) further emphasize that these maturity models represent a foreseeable path, progressing from initial experimentation with digital tools to the desired level of integration and transformation. Achieving full digital maturity is a long-term process that requires continual adaptation to the changing digital landscape. As Pinto et al. (2023) note, this process extends beyond adopting digital technologies—it involves fostering a digital culture where digital practices and innovations permeate the organization. Becoming digitally mature has wide-reaching benefits, influencing operational efficiency and competitiveness, innovation, customer experience, risk management, and strategic decision-making (Pinto et al., 2023).

2.1.2 Digital Transformation in German SMEs

With an understanding of digital transformation maturity, the focus shifts to German SMEs, a critical sector of the economy. This subsection explores the challenges and opportunities these firms face when undergoing digital transformation, highlighting why these unique factors must be considered when discussing leadership competencies.

Small and medium-sized enterprises (SMEs) are essential contributors to the economy in various countries, including Germany, as they drive innovation, create employment opportunities, and foster economic growth (Pfister & Lehmann, 2021). SMEs represent over 99% of all European companies, emphasizing their significance in the business landscape (Pfister & Lehmann, 2021). According to Destatis (2023), SMEs are classified as micro-enterprises, small enterprises, and medium-sized enterprises based on the number of employees and annual turnover. To be categorized as an SME, a business should have less than 250 employees, including full-time and part-time owners and partners, and its yearly revenue should not surpass 50 million EUR (Destatis, 2023). The classification further specifies micro-enterprises as having up to 9 employees and a turnover of 2 million EUR, small enterprises with up to 49 employees and a turnover of 10 million EUR, and medium-sized enterprises with up to 249 employees and 50 million EUR. Enterprises that exceed these thresholds in terms of employment or turnover are considered large enterprises (Destatis, 2023).

The COVID-19 pandemic had a notable impact on digital transformation in Germany. According to KfW (2023), the completion rate of digitalization projects in German SMEs increased to 33% from 2018 to 2020, indicating a moderate push toward digitalization. This figure is remarkable, considering the decline from 40% to 30% in the previous survey (KfW, 2023). In 2020 alone, German SMEs invested EUR 20 billion in digitalization, marking a significant 16% increase compared to last year (KfW, 2023). These findings were reinforced throughout the pandemic, with a growing disparity between SMEs reporting increased digitalization activities and those reducing or discontinuing them due to the pandemic, reaching 31 points by autumn 2021 (KfW, 2023).

Despite these developments, it is essential to acknowledge that not all SMEs fully embrace digitalization. As of autumn 2021, 25% of German enterprises reported no digitalization activities, and 6% reduced or completely discontinued their digitalization efforts (KfW, 2023). The average expenditure on digitalization remains relatively low and has even experienced a slight decline compared to 2019 (KfW, 2023). This mixed picture suggests that digitalization has yet to become a standard practice, even in the face of the coronavirus pandemic (KfW, 2023).

Digital transformation has been steadily gaining traction across diverse industrial sectors. Germany initiated its journey toward digitalization with the advent of the fourth industrial revolution, commonly known as Industry 4.0 (Kilimis et al., 2019). However, the pace of transformation remains slow for SMEs in Germany, highlighting the need for coordinated efforts to drive digitalization in this segment of the economy (Kilimis et al., 2019). Driving digital transformation in German SMEs is extremely important, as the successful adoption of digital technologies can yield numerous benefits for these companies. Digitalization can enhance operational efficiency, streamline processes, and optimize resource allocation (BMWi, 2021). Moreover, embracing digitalization opens new avenues for SMEs to reach customers and expand their markets through online platforms, data-driven services, and innovative business models (BMWi, 2021).

A country's economic growth is closely linked to the development of its SME field (Pfister & Lehmann, 2021). The government can unlock its full potential by empowering German SMEs to embrace digital transformation, driving innovation, creating employment opportunities, and fostering technological progress (Pfister & Lehmann, 2021). Moreover, digitalization in retail and hospitality has picked up pace, requiring SMEs to adapt and enhance competitiveness (BMWi, 2021).

However, German SMEs need help adopting digital technologies and fully capitalizing on their benefits. These challenges include limited personnel capacity, skills, and funding resources, hindering effective adoption and utilization of digital technologies (Pfister & Lehmann, 2021). Additionally, a knowledge gap concerning digital competencies and know-how prevents the successful implementation of new technologies (Kilimis et al., 2019). Internal resistance to digital transformation within SMEs due to informal and less formalized organizational structures further poses obstacles to implementation (Petzolt et al., 2022). Limited knowledge and understanding of technology in the business environment, difficulty forming collaborations, and difficulty accessing shared knowledge are also challenges SMEs face (Chonsawat & Sopadang, 2020; Petzolt et al., 2022). Addressing these challenges requires a holistic approach that includes building digital competencies, providing guidance and orientation, promoting a positive attitude toward technology adoption, and fostering collaborations and alliances (Pfister & Lehmann, 2021). Supporting SMEs in realizing the additional value and benefits of digital transformation is crucial.

Several essential requirements must be considered to drive digital transformation in German SMEs. Firstly, the strategic direction of an organization relies heavily on the personality and skills of the leader, making it vital for them to formulate and implement a digital strategy systematically (Petzolt et al., 2022). Secondly, SMEs often require greater involvement of external partners to access expertise and resources for effective digital transformation (Petzolt et al., 2022). Moreover, awareness of monitoring new digital technologies and their relevance to the industry and competition is essential (Petzolt et al., 2022). Creating an open error culture, establishing innovative workplaces, facilitating knowledge exchange through digital technologies, and embracing a new work and learning culture is crucial for a successful digital transformation (Daheim et al., 2017; Petzolt et al., 2022). Additionally, top management's role in driving digital transformation, developing a detailed strategy, and demonstrating digital competency is vital (Daheim et al., 2017).

In conclusion, digital transformation is critical for German SMEs to remain competitive in the evolving business landscape. Overcoming challenges and embracing digital technologies can unlock significant benefits, driving innovation, creating employment opportunities, and fostering economic growth. A detailed approach, including building digital competencies, providing guidance, promoting a positive

attitude, and fostering collaborations, is necessary to support SMEs in their digital transformation journey.

2.1.3 Digital Transformation of SMEs in the Retail Sector

The focus narrows further to examine digital transformation in SMEs' retail sector. Given the unique pressures retail businesses face, this subsection explores the intersection of sector-specific challenges and digital transformation needs, laying the groundwork for the study's exploration of leadership strategies tailored to this sector.

The retail industry has undergone a dramatic transformation in recent years, driven by the rise of digital technologies (Cakir et al., 2021; Palmié et al., 2022; Pinto et al., 2023). This digital revolution has led to "Digital Retail," a hybrid approach combining traditional brick-and-mortar stores with online elements (Cakir et al., 2021). Today's customers expect a seamless, omnichannel experience throughout their shopping journey, seamlessly switching between online and physical touchpoints (Cakir et al., 2021). Historically, retail has been considered a low-tech industry (Palmié et al., 2022). However, advancements in digitalization have brought about significant changes in the retail market over the past few years (Palmié et al., 2022). The COVID-19 pandemic further accelerated this process (Cakir et al., 2021; Mostaghel et al., 2022; Ogunjimi et al., 2021; Palmié et al., 2022; Pinto et al., 2023; Shankar et al., 2021; Stieninger et al., 2019), forcing retailers to rapidly adopt online ordering, click-and-collect services, and even robot-assisted operations to adapt to lockdowns and social distancing (Jiang & Stylos, 2021; Shankar et al., 2021; Statista, 2022).

Global retail technology investments have experienced remarkable growth, reaching a value of US$200 billion, and are projected to increase to US$225 billion by 2022 (Cakir et al., 2021). This rapid expansion can be attributed to the emergence of various retail technologies (see Table 1) that have revolutionized customer-retailer interactions. Among these technologies, self-checkout/automated checkout systems have streamlined the payment process, while innovative mirror technology has provided customers with immersive shopping experiences (Alexander & Kent, 2022; Hauser et al., 2019; Ogunjimi et al., 2021; Pantano & Vannucci, 2019; Pratas et al., 2022). Smart shelves have enhanced inventory management, digital signage has delivered dynamic multimedia content, and mobile payment options have offered convenient and secure payment methods (Alexander & Kent, 2022; Pantano & Vannucci, 2019; Pratas et al., 2022). These technologies, powered by Artificial Intelligence (AI), mobile technologies, augmented reality, virtual reality, and the Internet of Things (IoT), have reshaped how customers engage with retailers, leading to significant advancements in the retail industry (Cakir et al., 2021).

Table 1 Retail Technologies.

Retail technology	Description	Benefit	Reference
Self-checkout/ Automated Checkout Systems	Self-checkout or automated checkout systems enable shoppers to scan, bag, and pay for products without the need to interact with a cashier. These systems utilize portable scanners or customers' mobile phones to scan items as they shop. When leaving the store, the payment process is triggered automatically. Self-checkout systems can be centralized at store exits or decentralized, with customers carrying handheld devices or using their own mobile phones.	Improves in-store productivity by reducing the need for cashier assistance. Reduces queue lengths at payment counters, allowing for faster transactions. Enhances the overall customer experience by providing a convenient and streamlined checkout process.	Alexander and Kent (2022); Hauser et al. (2019); Pantano and Vannucci (2019); Pratas et al. (2022)
Smart mirror	Smart mirror fashion technology (SMFT) revolutionizes the retail experience, particularly in the fashion, cosmetics, and groceries sectors. SMFT incorporates algorithms, cameras, electronic displays, and sensors behind a two-way mirror to create an interactive and immersive shopping experience. Customers can view themselves in a 360-degree panoramic augmented fashion, try on virtual clothing, and receive personalized recommendations.	Enables virtual try-on, allowing customers to visualize how clothing items would look on them without physically trying them on. Provides personalized recommendations based on customer preferences and body measurements. Reduces queues by facilitating offline and online clothing selections.	Alexander and Kent (2022); Ogunjimi et al. (2021); Pantano and Vannucci (2019); Pratas et al. (2022)

Retail technology	Description	Benefit	Reference
Smart shelves	Smart shelves utilize RFID technology and weight sensors to automatically track inventory levels, manage stock-outs, and prevent thefts in retail stores. These shelves can interact with customers' smartphones, providing real-time price updates, personalized offers, and directing customers to the location of desired products.	Improves inventory management by ensuring accurate tracking of stock levels and preventing out-of-stock situations. Enhances customer engagement by delivering real-time price updates and personalized offers. Creates personalized shopping experiences by guiding customers to the location of desired products.	Pratas et al. (2022)
Digital signage	Digital signage offers retailers the ability to deliver dynamic multimedia content in public spaces. This technology allows for rapid and easy updates of information, making it ideal for promoting new items, promotions, and seasonal offers. Digital displays placed strategically within stores, such as entrance doors, shop windows, and fridge doors, attract customers, especially younger and male demographics.	Allows for rapid and easy updates of information, ensuring timely promotion of new items and offers. Attracts customers, particularly younger and male demographics, through eye-catching multimedia content. Increases awareness of promotions and seasonal offers.	Alexander and Kent (2022); Pantano and Vannucci (2019); Pratas et al. (2022)

Retail technology	Description	Benefit	Reference
Mobile payment	Mobile payment solutions enable customers to make purchases through their mobile devices or using biometric characteristics for verification. These methods, such as Apple Pay, Google Pay, and Samsung Pay, offer convenience, security, and speed compared to traditional payment methods. Retailers can generate revenue and build customer loyalty by accommodating various forms of mobile payment and value-added services (mobile wallets, gift cards, cryptocurrencies).	Provides convenient and contactless payment options, eliminating the need for physical cash or cards. Enhances security through biometric verification and encryption technologies. Speeds up transaction times, reducing wait times at payment counters. Increases customer loyalty by offering additional value-added services, such as mobile wallets and rewards programs.	Alexander and Kent (2022); Pantano and Vannucci (2019); Pratas et al. (2022)
Click-and-collect	Click-and-collect (C&C) is a retail strategy that combines online and offline channels, allowing customers to order products online and pick them up at a physical store or designated pickup point. C&C enhances customer convenience, increases customer base, and positively impacts online spending. It is a valuable tool for retailers to integrate physical and virtual retail channels, driving consumer satisfaction, loyalty, and purchase intentions.	Enhances convenience by providing flexible delivery options and eliminating shipping costs. Increases customer base by attracting online shoppers who prefer in-store pickups. Boosts online spending as customers often browse additional items during pickup.	Alexander and Kent (2022); Pantano and Vannucci (2019); Vyt et al. (2022)

Several factors have encouraged the need for digital transformation in retail SMEs. Firstly, consumer behavior has experienced drastic changes, particularly with a notable shift towards digital channels (Cakir et al., 2021). This shift has prompted retailers to reassess their strategies and operations to align with their customers' evolving preferences and demands. Essentially, as consumers increasingly engage with digital platforms for shopping, retailers must adapt to meet these changing expectations (Cakir et al., 2021). Secondly, the rise of e-commerce and digital retailers has intensified competition within the retail industry (Palmié et al., 2022). This competition extends beyond just pricing, with digital players offering new services that reshape customer relationships, behaviors, and expectations regarding the quality of retail services. To remain competitive and safeguard their market shares, traditional retailers must reevaluate and potentially redesign their business models (Hauser et al., 2019). Finally, the COVID-19 pandemic stimulated digital transformation within retail SMEs (Ogunjimi et al., 2021). The

restrictions imposed during the pandemic, such as lockdowns and social distancing measures, forced retailers to swiftly adopt technology-driven solutions to maintain operations and effectively serve their customers (Ogunjimi et al., 2021). This accelerated integration of digital tools and platforms led to an increased reliance on online shopping and increased demand for enhanced digital service experiences (Mostaghel et al., 2022; Shankar et al., 2021).

While the necessity for digital transformation is evident, retail SMEs face particular challenges (Ogunjimi et al., 2021; Palmié et al., 2022; Statista, 2022; Stieninger et al., 2019). One significant key challenge is the industry´s digital legacy. Compared to sectors such as information and communication technologies, vehicle construction, and electrical engineering, retail has historically been slower to embrace digital tools (Statista, 2022). This can leave SMEs struggling to keep pace with the rapid advancements and implement the necessary technologies (Stieninger et al., 2019). Furthermore, shifting from traditional, brick-and-mortar business models to digital or omnichannel ones requires a significant redesign (Palmié et al., 2022; Stieninger et al., 2019). SMEs must update existing strategies, systems, and even their approach to service quality to deliver seamless customer experiences across online and offline touchpoints. This transformation can be complex and resource-intensive (Ogunjimi et al., 2021). The competitive landscape adds another layer of difficulty. E-commerce giants have set a high bar, forcing SMEs to innovate and offer new services that compete with online giants' convenience and reach. This pressure to constantly adapt and differentiate can be challenging for smaller retailers (Hauser et al., 2019).

In conclusion, retail SMEs are forced to undergo digital transformation due to the ongoing changes in the retail industry (Cakir et al., 2021; Palmié et al., 2022; Pinto et al., 2023). Integrating digital technologies is crucial to meet customer demands, compete with online retailers, and navigate the challenges brought about by the COVID-19 pandemic (Hauser et al., 2019; Ogunjimi et al., 2021; Shankar et al., 2021). For example, “Fräulein,” a physical fashion and interior store, successfully transformed digitally by enhancing its online presence and integrating e-commerce tools (see Figure 1). This shift allowed “Fräulein" to compete with online businesses while maintaining its unique in-store experience, demonstrating how traditional SMEs can thrive in the digital age. To successfully embark on this transformation journey, businesses must embrace digital innovation, revise their strategies, and change their products and delivery systems to deliver exceptional service experiences (Hauser et al., 2019; Ogunjimi et al., 2021). By leveraging the potential of digital solutions and adapting to the changing landscape, retail SMEs can position themselves for long-term success in the digital era.

Figure 1 Case Example of a German Retail SME Undergoing Digital Transformation

Fräulein: Fashion and Interior meets Technology.

Fräulein, a physical fashion and interior store, has significantly impacted the retail landscape in Rheinland, Germany, through the seamless integration of traditional and digital realms, enabling it to compete effectively against online market leaders. Fräuleins operates three physical stores in Rheinland, offering a wide range of products, including clothing, shoes, bags, accessories, and home décor accessories. Despite the competition from well-established online platforms that offer a wide range of products at competitive prices, Fräulein has crafted a unique strategy that capitalizes on the strengths of both the physical and digital realms.

One of the critical aspects of Fräulein's success is its active presence on social media platforms, particularly Instagram and Facebook. Each week, the store showcases its latest products in captivating video content. These videos display individual clothing items and demonstrate how different pieces can be combined to create fashionable outfits. Customers watching these videos can ask questions directly in the comments section or via WhatsApp. Fräulein has embraced digital engagement to the fullest extent by offering individual and personalized consultations to customers through these platforms. This helps build a stronger connection with customers and allows for a more interactive and informative shopping experience. Integrating social media and in-store experience is a crucial feature of Fräulein's success. The short videos serve as an effective bait to attract customers to their physical stores. Once in-store, customers can try on the outfits they have seen in the videos, providing an immersive experience that is hard to replicate online.

Fräulein has also implemented a digital inventory control system that efficiently manages stock levels across all their stores. This innovative system ensures that customers can always find the products they desire. Suppose a particular item is out of stock at one store. In that case, the system can quickly check the availability at the other two locations and arrange delivery to the customer's preferred store or home. In addition to offering in-store and inter-store services, Fräulein has made shopping even more convenient by allowing customers to order some products directly through their Instagram and Facebook shops. This means that, even when customers scroll through their social media feeds, they can make purchases with a simple click.

Fräulein's success story is an exemplary model for other retailers looking to thrive in an increasingly digital retail landscape. By embracing the power of social media, enhancing the in-store experience, and efficiently managing its inventory through digital technologies, Fräulein has not only competed with online giants but also created a unique and successful niche for itself in the ever-evolving world of fashion and interior retail.

Note. This case example is adopted and translated from BMWi (2022).

2.2 Leadership in Digital Transformation

After laying the groundwork for understanding digital transformation, the discussion now transitions to leadership's role in this context. This section will examine the evolving concept of leadership, particularly regarding digital competencies and their impact on transformation efforts.

Over the past five years, more academic literature has focused on digital transformation and leadership (AlNuaimi et al., 2022; Bartsch et al., 2021; Cortellazzo et al., 2019; Fernandez-Vidal et al., 2022; Henderikx & Stoffers, 2022; Leso et al., 2022; McCarthy et al.; Philip et al., 2023; Porfirio et al., 2021; Schiuma et al., 2022; Tuerk, 2023; Weber, Krehl, et al., 2022; Zulu & Khosrowshahi, 2021). While earlier studies have primarily examined strategic leadership challenges in digital transformation, it has become evident that such challenges extend beyond top management to affect all levels of an organization (Henderikx & Stoffers, 2022). A fresh understanding of leadership is required to navigate

the ongoing digitalization process and the emergence of a new digital organization (Henderikx & Stoffers, 2022). This is further supported by research by Weber, Buttgen, et al. (2022), which indicates that digital transformation presents paradoxical challenges to leadership and fundamentally changes leadership behavior. Digital transformation involves a company-wide shift triggered by digital technologies, leading to changes in business operations, value creation, and organizational structure (Fernandez-Vidal et al., 2022; Weber, Buttgen, et al., 2022). It requires a shift in thinking and behavior and significantly impacts leaders' and employees' roles, skills, and capabilities (Schiuma et al., 2022).

To succeed in digital transformation, companies must adopt flexible and agile structures and reassess their talent management practices due to the fundamental transformation of the workforce (Fernandez-Vidal et al., 2022). In addition, leaders have a critical role in determining the strategic direction of digital transformation and guiding organizational and operational changes arising from adopting new digital technologies (Fernandez-Vidal et al., 2022). Moreover, the literature on change management recognizes leadership as a primary facilitator of digital transformation that enables organizations to achieve positive performance outcomes (Philip et al., 2023). In contrast, research on leadership development acknowledges that organizations must have creative, strategic thinking to comprehend and utilize new technologies, allowing exceptional leaders to emerge in unconventional scenarios. Therefore, leaders must possess suitable transformational leadership skills to drive the changes required by digital transformation (Philip et al., 2023).

The extant literature suggests that leaders require the capacity to comprehend the implications of existing or emerging digital technologies to identify opportunities and challenges and subsequently adjust the company's strategy accordingly (Henderikx & Stoffers, 2022; Philip et al., 2023; Schiuma et al., 2022; Tuerk, 2023; Weber, Krehl, et al., 2022; Zulu & Khosrowshahi, 2021). In particular, Fernandez-Vidal et al. (2022) posit that leaders must possess a profound understanding of the potential implications of new technologies for their business and industry, coupled with the ability to adapt swiftly and effectively to changing circumstances. Henderikx and Stoffers (2022) assert that leaders must be equipped with the skills to recognize technological trends and competently utilize technological resources. Leaders must acknowledge their limitations and actively pursue knowledge in areas lacking expertise. (Henderikx & Stoffers, 2022).

Several additional studies have indicated that leadership-related factors, such as strategy, culture, and talent development, hold greater importance in digital transformation than technological aspects (Fernandez-Vidal et al., 2022; Henderikx & Stoffers, 2022; Schiuma et al., 2022; Trenerry et al., 2021; Weber, Krehl, et al., 2022). Trenerry et al. (2021) emphasize the critical role of leadership in shaping digital transformation processes and outcomes within teams and organizations. Leadership entails motivating and influencing individuals to collaborate toward shared goals and is widely acknowledged as a critical element in organizational functioning and employee performance (Trenerry et al., 2021). Adopting and implementing new technologies can disrupt existing practices and encounter resistance, necessitating leaders to enhance their skills and assume new responsibilities (Trenerry et al., 2021). This includes fostering positive digital cultures, motivating employees to embrace transformation and acquire new skills, and attracting digital experts. The ongoing interplay between leadership and technology emphasizes the need for leaders to consistently adapt and evolve to address the challenges of digitalization and transformation. (Trenerry et al., 2021). These findings are consistent with the assertions of Fernandez-Vidal et al. (2022), who contend that managers are also responsible for fostering an appropriate cultural environment that promotes emotional well-being and job satisfaction, thus stimulating entrepreneurship and intellectual capital generation. Furthermore, Schiuma et al. (2022) emphasize the importance of leadership style in making decisions within complex contexts and nurturing a transformative digital culture throughout the organization (Schiuma et al., 2022). Overall, Zulu and Khosrowshahi (2021) asserts that digital transformation is not solely contingent upon technological expertise but instead on the perception of leaders, managers, and employees to embrace the change process and integrate the organization's systems with new digital technologies.

2.2.1 Digital Leadership

Building upon the general discussion of leadership, the focus now shifts to digital leadership, a concept that merges traditional leadership qualities with digital savviness. This section will review the competencies that define successful digital leaders and how these are instrumental in driving digital transformation, particularly in the context of SMEs.

Today's organizations are facing significant challenges in the dynamic digital environment (Zulu & Khosrowshahi, 2021). The growing demand for digital products and services, the emergence of digital platforms, and the ever-connected customers necessitate substantial organizational transformation to maintain competitiveness and relevance (Zulu & Khosrowshahi, 2021). Digital transformation offers opportunities for innovation, but its success relies on effective leadership that supports the change management process (Zulu & Khosrowshahi, 2021). Consequently, digital leadership has emerged, building upon traditional human resources studies while exploring new directions. Different eras have demanded different leadership styles shaped by technological advancements (Erhan et al., 2022; Schiuma et al., 2022; Tuerk, 2023; Weber, Krehl, et al., 2022; Zulu & Khosrowshahi, 2021). In the digital economy, digitalization has fundamentally altered leadership styles, competencies, and skills, presenting leaders with new challenges that require adaptation and the enhancement of digital knowledge (Zhu et al., 2021). Digital leadership has been proposed as the most appropriate leadership style to address the increasingly complex and evolving digital landscape demands (Zhu et al., 2021).

Overall, researchers have provided different interpretations of digital leadership, considering factors such as digital technology, digitalization, innovative behavior, and the specific context in which it is applied (Benitez et al., 2022; Erhan et al., 2022; Schiuma et al., 2022; Tuerk, 2023; Weber, Krehl, et al., 2022; Zulu & Khosrowshahi, 2021). Digital leadership is generally defined as individuals utilizing digital technologies to enhance organizational value. These individuals combine their leadership skills with digital expertise. This concept has led to the emergence of “digital leaders,” a term scholars use to describe leaders or managers who possess the necessary knowledge to guide their teams or organizations through digital transformation, ultimately creating value (Benitez et al., 2022; Erhan et al., 2022; Matricano et al., 2022; Philip et al., 2023; Tuerk, 2023). According to Erhan et al. (2022), digital leaders consistently oversee digital transformation processes and employ diverse leadership approaches to gain strategic advantages and promote competitiveness. Philip et al. (2023) and Tuerk (2023) further supported this view, stating that digital leadership contains elements of conventional leadership styles, including transformational, transactional, and authentic leadership, manifesting in the digital leader’s vision, governance, decision-making, and people management.

Numerous studies also emphasize the importance of digital leadership in ensuring the success of digital business transformation (Benitez et al., 2022; Erhan et al., 2022; Matricano et al., 2022; Schiuma et al., 2022; Weber, Krehl, et al., 2022; Zhu et al., 2021; Zulu & Khosrowshahi, 2021). Matricano et al. (2022) propose two primary objectives for digital transformation success: firstly, having a clear vision of the organization's future considering emerging technologies and evolving market dynamics, and secondly, actively working towards achieving these objectives while guiding the change in organizational culture. To effectively accomplish these objectives, digital leaders must focus on several key areas (Matricano et al., 2022). They should cultivate a continuous learning and experimentation culture, where failure is viewed as an opportunity for growth and improvement (Matricano et al., 2022). Additionally, digital leaders must facilitate change by identifying areas that require transformation and guiding the organization throughout the change implementation process (Matricano et al., 2022). A cross-sectional Delphi study rated visionary thinking, agility, understanding the value of data, data-driven decision-making, knowledge of strategy, and accepting change as the top six competencies for managing digital transformation (Philip et al., 2023).

Furthermore, digital leaders must act as coaches, encouraging employees to critically examine current practices and processes, which are vital in promoting active and proactive participation among the workforce and leading networks that facilitate collaboration and communication within the organization (Matricano et al., 2022). Benitez et al. (2022) conducted a study that supports these notions and

highlights additional characteristics of digital leaders. Their research states that digital leaders possess a transformative vision and a forward-looking perspective (Benitez et al., 2022). They exhibit a change-oriented and adaptable mindset, allowing them to drive cultural change even in turbulent environments (Benitez et al., 2022). These leaders are responsible for effectively communicating and selling the vision internally and externally, selecting and retaining the right team members, and making strategic organizational changes (Benitez et al., 2022). In addition to these traits, digital leaders demonstrate strong business acumen and possess digital skills. They are naturally enthusiastic and integrative, making them well-suited to lead integration efforts as they are closely connected to the frontline of the transformation (Benitez et al., 2022).

Moreover, Matricano et al. (2022) emphasized the importance of digital leaders' focus on customers, who are always at the core of any digital business transformation. Digital leaders must be attentive to customer needs and preferences, continuously seeking ways to enhance the customer experience. In a recent study conducted by Benitez et al. (2022), digital leaders were classified as individuals who possess both IT leadership skills with strong business acumen (referred to as "business-savvy") and business leadership skills with practical digital expertise (referred to as "IT-savvy"). This suggests that digital leadership encompasses a range of competencies, including digital, market, business, and strategic leadership skills. These competencies are crucial in driving the digital transformation of organizations and creating value (Benitez et al., 2022).

Some of these studies concluded that digital leaders must be open to collaborations and partnerships with external entities like vendors, startups, and other organizations to discover fresh ideas and growth opportunities (Matricano et al., 2022; Schiuma et al., 2022; Weber, Krehl, et al., 2022; Zhu et al., 2021). By focusing on these essential aspects, digital leaders can guide their organizations through the ever-changing realm of digital transformation, positioning themselves for success in the digital era. According to Zhu et al. (2021), digital leadership displays distinct traits such as creativity, profound knowledge, vital networking and collaboration abilities, and committed participation through a visionary approach. Additionally, Erhan et al. (2022), Schiuma et al. (2022), and Weber, Krehl, et al. (2022) highlighted the essential characteristics required for being a digital leader, which comprises a blend of agility, inclusiveness, networking, and openness in leadership. The agile traits help identify crucial issues and diverse scenarios, while participative traits leverage the knowledge of employees, recognizing that leaders cannot possess all knowledge within an organization (Erhan et al., 2022). Moreover, networking and open characteristics showcase the digital leaders' constructive response to criticism and their efforts in fostering employee networks (Erhan et al., 2022).

3 Proposition Development

Building on the theoretical foundation of digital leadership, this section introduces key propositions to explore the relationship between digital leadership competencies and digital transformation maturity in retail SMEs. Rather than testing predefined hypotheses, these propositions guide the study's investigation to uncover the patterns and connections between specific competencies and digital transformation outcomes, offering more profound insights into leadership's role in this context.

A concept matrix (Table 2) was developed to build the propositions, synthesizing relevant literature on digital leadership competencies. This matrix highlights the most commonly discussed competencies across critical studies. Based on this analysis, six key competencies have emerged as the most relevant for digital leadership in driving digital transformation:

1. Tech-savviness
2. Digital strategy
3. Agility

4. Networking
5. Innovation
6. Empowerment

These competencies were identified from more than ten critical academic articles and are consistently regarded as essential drivers of digital transformation in SMEs. The following sections briefly explain each competency, supported by theoretical insights from the literature, and formulate corresponding propositions to guide further exploration.

Table 2 Concept Matrix Synthesizing Relevant Literature on Digital Leadership Competencies

Digital Leadership Competency	Reference																	
	Adhiatma et al. (2023)	AlNuaimi et al. (2022)	Benitez et al. (2022)	Cortellazzo et al. (2019)	Eberl and Drews (2021)	Erhan et al. (2022)	Fernandez-Vidal et al. (2022)	Guzmán et al. (2020)	Henderikx and Stoffers (2022)	Kane et al. (2018)	Kane et al. (2019)	Klein (2020)	Magesa and Jonathan (2022)	Matricano et al. (2022)	McCarthy et al. (2022)	Philip et al. (2023)	Schiuma et al. (2022)	Weber, Krehl, et al. (2022)
Tech-savviness		X	X	X		X	X		X		X	X	X		X	X		X
Digital strategy		X	X	X				X	X	X	X	X	X	X	X	X	X	X
Agility	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X
Learning orientation					X	X		X			X	X	X	X			X	X
Networking			X	X	X	X	X	X	X	X		X	X	X	X		X	X
Innovation			X	X	X	X		X	X	X	X	X			X		X	X
Empowerment		X		X	X	X		X	X	X		X	X	X				X
Mentoring/ Coaching				X	X				X			X		X			X	X
Social intelligence							X	X				X	X				X	
Ethics		X															X	

3.1 Tech-Savviness

The first competency discussed in this paper is tech-savviness, which refers to a leader's ability to comprehend and effectively navigate the digital landscape, including a broad understanding of digital technologies, tools, and trends, enabling informed decision-making and strategic use of digital resources. Numerous scholars have highly regarded this competency, highlighting its crucial role in today's rapidly evolving digital world. It has been a central topic of discussion in 12 out of 18 articles. Within these 12 research perspectives, it becomes evident that tech-savviness is not merely a technical skill but a multifaceted competency that extends beyond the boundaries of traditional leadership.

Scholars agree that leaders must remain technologically aware, tracking emerging trends to identify opportunities for innovation and potential disruptions. This awareness is essential for leaders to adapt and make informed decisions that drive digital transformation (AlNuaimi et al., 2022; Fernandez-Vidal et al., 2022; Weber, Krehl, et al., 2022). Leaders who stay ahead of digital trends are better equipped to navigate the challenges of a dynamic digital landscape.

Furthermore, leaders must proactively respond to the relentless march of digitalization. This involves adjusting strategies to align with digital trends and seizing opportunities for growth while mitigating risks. Proactive leaders, as highlighted by Benitez et al. (2022), Fernandez-Vidal et al. (2022), and Weber, Krehl, et al. (2022), can steer their organizations toward thriving in the digital age, demonstrating the urgency and dynamism of the digital landscape.

The demand for IT knowledge and skills has not just increased; it has grown significantly. Leaders must now understand IT systems and technological advancements and guide digital transformation. This indicates the evolving nature of leadership requirements, as highlighted by Cortellazzo et al. (2019) and McCarthy et al. (2022). The concept of digital intelligence, which includes technical, IT, and digital cultural skills, is now more critical than ever for modern leadership, as emphasized by Klein (2020). Another essential aspect of tech-savviness is the strategic application of digital technologies. Leaders who excel in this area enhance organizational competitiveness and drive successful digital transformations (Fernandez-Vidal et al., 2022; Kane et al., 2019; Matricano et al., 2022).

Finally, data literacy and data-driven decision-making are fundamental in the digital era. Leaders must be able to interpret and leverage data to inform strategic decisions (Klein, 2020; Magesa & Jonathan, 2022; Philip et al., 2023). Fostering a data-driven culture and utilizing digital tools for effective data management are also key responsibilities of modern leaders (McCarthy et al., 2022).

In conclusion, tech-savviness is vital for leaders to navigate the complexities of the digital era. Leaders with this competency are well-positioned to identify opportunities, address disruptions, make informed decisions, and leverage digital technologies and data to drive successful digital transformations.

> **Proposition 1:** Tech-savviness, defined as the leader's ability to understand, utilize, and adapt to digital tools, technologies, and data, may be associated with higher levels of digital transformation maturity in retail SMEs. Leaders using digital technologies can more effectively guide their organizations through technological advancements, fostering data-driven decision-making and innovative strategies.

3.2 Digital Strategy

Next, the paper examines the competency of digital strategy, defined as the leader's ability to establish a well-defined and future-oriented strategy for how an organization intends to use digital technologies to attain its long-term goals and objectives. It involves creating a roadmap that aligns digital initiatives with the overall business strategy and ensures that technology investments contribute to the organization's success. This competency is widely recognized by scholars in the field of digital leadership. It has been a central topic of discussion in 14 out of 18 articles on the subject. Notably, it is

the second most common competency explored among these articles, highlighting its pivotal role in driving organizational success in today's digital landscape.

Several studies highlight the importance of having a clear vision to guide an organization through digital transformation (AlNuaimi et al., 2022; Guzmán et al., 2020; Kane et al., 2018; Philip et al., 2023). A forward-looking perspective is equally crucial, enabling leaders to anticipate future trends and challenges, fostering innovation and adaptability (Benitez et al., 2020; Kane et al., 2019; Henderikx & Stoffers, 2022; Klein, 2020).

Another vital aspect is maintaining alignment between digital initiatives and the organization's core mission (Cortellazzo et al., 2019; Matricano et al., 2022; Weber, Krehl et al., 2022). Leaders must ensure that digital efforts support the organization's fundamental goals without causing disruptions. Furthermore, leaders are expected to inspire and motivate their teams, as an enthusiastic digital vision drives creativity and commitment (Klein, 2020; Magesa & Jonathan, 2022).

Strategic planning and roadmaps are essential components of digital strategy. Accurate planning ensures that organizations navigate digital transformation in a structured and practical manner (Magesa & Jonathan, 2022; Matricano et al., 2022). Additionally, effective communication of the digital vision is crucial for building support and mobilizing teams toward shared goals (McCarthy et al., 2022; Schiuma et al., 2022).

In summary, leaders with a clear vision, forward-thinking approach, alignment with core values, and strong communication skills are better positioned to guide their organizations through successful digital transformations, fostering innovation and sustainable growth.

> **Proposition 2:** A well-defined digital strategy, where leaders formulate a forward-looking plan for leveraging digital technologies, is likely to be associated with higher levels of digital transformation maturity in retail SMEs. Leaders with a clear digital vision ensure that organizational goals and technology investments align with long-term objectives.

3.3 Agility

The third competency discussed in this study is agility, which is the ability to quickly adapt and respond to changing digital landscapes, technologies, and market conditions. It involves a flexible and dynamic approach to decision-making, allowing leaders to seize opportunities and navigate challenges in the fast-paced digital environment. This competency holds significant importance in digital leadership, as recognized by numerous scholars. In 16 of 18 scholarly articles dedicated to digital leadership competencies, agility emerges as the most frequently discussed and emphasized competency. This underlines its central role in effectively navigating today's rapidly changing digital environment. In the following discussion, we will look deeper into the significance of agility in digital leadership and explore how it impacts organizational success in the digital era.

A key theme across the literature is adaptability. Scholars highlight that agility equips leaders to anticipate changes, maintain preparedness, and facilitate swift, precise responses to challenges and opportunities (Adhiatma et al., 2023; AlNuaimi et al., 2022; Eberl & Drews, 2021). Leaders must pivot strategies in uncertain, complex environments and ensure their organizations remain competitive (Fernandez-Vidal et al., 2022).

Agile leadership is also crucial for managing change and problem-solving. Leaders excel in navigating ambiguity and making quick, decisive decisions, even without complete information (Cortellazzo et al., 2019; Fernandez-Vidal et al., 2022; Kane et al., 2019; Magesa & Jonathan, 2022; McCarthy et al., 2022; Schiuma et al., 2022). This ability to tolerate uncertainty and foster creative problem-solving is essential for effective digital transformation. By highlighting the significance of agility in managing change and problem-solving, leaders can feel more resilient and adaptable in digital disruption.

Responsiveness to digital trends and technologies is another critical component of agility. Leaders must stay attuned to external changes, adapting strategies to maintain competitiveness and innovation (Guzmán et al., 2020; Hendrikx & Stoffers, 2022). Agile leaders also prioritize customer-centricity, ensuring collaboration and innovation are aligned with enhancing the customer experience and identifying new avenues for growth (Matricano et al., 2022). Open-mindedness and innovation further define agile leaders as they continually update their knowledge and embrace new perspectives (Kane et al., 2018; Klein, 2020). This mindset ensures that leaders can adapt to evolving environments and drive organizational innovation.

Finally, creating empowering work environments is vital for fostering agility. These settings enable teams to collaborate, adapt to new business models, and cohesively develop digital transformation strategies (Weber, Krehl et al., 2022).

In summary, agility encompasses adaptability, change management, responsiveness to trends, customer-centricity, open-mindedness, decisiveness, and empowering work settings. These competencies are essential for leaders to drive successful digital transformation, overcome the challenges of the digital age, and seize opportunities for growth and innovation.

> **Proposition 3:** Agility, or the ability to quickly adapt to changing circumstances and technologies, may be associated with increased digital transformation maturity in retail SMEs. Leaders who exhibit agility can navigate the volatile digital landscape, implementing changes swiftly to seize opportunities and address challenges.

3.4 Networking

Following agility, the paper turns to the competency of networking. This competency is defined as the ability of a digital leader to establish and nurture valuable relationships with internal and external stakeholders, fostering collaboration, knowledge sharing, and partnerships to drive digital initiatives and organizational growth. Scholars and experts in the field of leadership have recognized the significance of this competency, with 14 out of 18 articles specifically discussing it. It is the second most explored competency in these articles, parallel to the digital strategy competency.

One critical aspect of networking is fostering a collaborative culture within organizations. Leaders play a pivotal role in creating environments where collaboration and effective communication flourish, enabling innovation and agile network structures (Benitez et al., 2022; Eberl & Drews, 2021). Building strong internal and external networks is also crucial. Leaders who effectively leverage these connections gain a competitive edge in the digital landscape (Cortellazzo et al., 2019; Erhan et al., 2022; Matricano et al., 2022).

Adaptation to new organizational structures is another significant element of networking. Digital transformation often requires novel ways of working, and leaders with vital networking and communication skills are better equipped to manage these transitions (Fernandez-Vidal et al., 2022; Henderikx & Stoffers, 2022).

Customer-centric collaboration is emphasized as well. Leaders must focus on partnerships that enhance the customer experience and align digital transformation efforts with customer needs, driving value creation and business success (McCarthy et al., 2022; Matricano et al., 2022). Addressing organizational barriers to collaboration is equally important. Leaders who dismantle silos and encourage cooperation create environments conducive to successful digital initiatives (Kane et al., 2019).

Networking intelligence is another critical skill. Leaders who can quickly build and coordinate teams across boundaries, distribute tasks effectively, and collaborate within ecosystems are better positioned to seize opportunities in the digital landscape (Klein, 2020). Additionally, cross-disciplinary networks provide access to crucial information, enabling informed decision-making and problem-solving (Weber, Krehl et al., 2022).

In summary, networking competency in digital leadership involves building solid networks, fostering collaboration, addressing barriers, focusing on customer-centricity, and leveraging interdisciplinary connections to drive successful digital transformation.

> **Proposition 4:** Networking, which refers to a leader's capacity to build internal and external relationships, may be associated with higher levels of digital transformation maturity in retail SMEs. Effective networking facilitates collaboration, knowledge sharing, and access to external resources that can drive innovation.

3.5 Innovation

The discussion then shifts to innovation, a competency described as the ability and willingness to explore new ideas, technologies, and approaches while fostering a culture that encourages experimentation and continuous improvement to drive digital transformation and creative problem-solving. This competency has attracted substantial attention from scholars in digital leadership and transformation. A detailed literature analysis found that this competency has been extensively discussed and studied in 12 out of 18 relevant articles.

Digital leaders must possess ambidexterity, risk-taking, and innovation skills to balance creativity with efficiency. They guide organizations through uncertainties while promoting a culture of innovation (Benitez et al., 2022; Cortellazzo et al., 2019; Erhan et al., 2022; McCarthy et al., 2022). Leaders act as architects of digital innovation, creating solutions that transform processes and propel organizations into the digital age (McCarthy et al., 2022).

Embedding a culture of innovation is vital. Leaders should prioritize modern technologies, encourage risk-taking, and tolerate experimentation and learning from failure (Eberl & Drews, 2021; Schiuma et al., 2022). This empowers employees to participate actively in innovation, accelerating digital transformation and enabling organizations to adapt quickly to evolving landscapes. Fostering an environment conducive to experimentation is crucial. Leaders must advocate for innovation, lead by example, and provide resources that enable teams to explore new technologies and strategies (Guzmán et al., 2020; Kane et al., 2018; Kane et al., 2019; Henderikx & Stoffers, 2022). A forward-thinking, entrepreneurial mindset is also essential for envisioning a future integrated with innovative practices, extending beyond organizational boundaries (Klein, 2020).

Leaders act as catalysts for change, inspiring enthusiasm and creativity through innovative ideas, ultimately driving digital transformation (Weber, Krehl, et al., 2022). By championing innovation, they help organizations adopt new technologies and strategies for lasting success.

In summary, innovation competency is critical for digital leaders, as it enables them to foster a culture of creativity, encourage experimentation, and lead successful digital transformations in an evolving digital landscape.

> **Proposition 5:** Innovation, the leader’s ability to foster a culture of creativity, experimentation, and risk-taking, may be associated with higher levels of digital transformation maturity. Leaders who encourage continuous improvement and exploration of new ideas are more likely to guide their organizations through successful digital transformations.

3.6 Empowerment

Finally, this paper addresses the competency of empowerment, which involves granting individuals the authority, autonomy, and resources to make decisions and take ownership of their work within a digital context. This competency has gained considerable attention from scholars, as evidenced by its discussion in 11 scholarly articles. In contrast to the remaining five competencies, empowerment may have received somewhat less scholarly focus, but it remains sufficiently significant to warrant a closer examination and deeper exploration.

Leaders who delegate power and involve teams in decision-making foster a sense of ownership and commitment among employees (AlNuaimi et al., 2023; Erhan et al., 2022). Engaging teams in a participatory manner inspires innovation and enhances collaboration. Inclusive leadership, which values diverse opinions and two-way communication, encourages creative solutions and better decision-making, which is crucial for digital transformation (Henderikx & Stoffers, 2022; Magesa & Jonathan, 2022). Empowered employees actively contribute to digital initiatives and feel a sense of purpose, driving organizational success (Matricano et al., 2022; Weber, Krehl et al., 2022).

Studies also emphasize autonomy and knowledge sharing as key to empowerment (Cortellazzo et al., 2019; Eberl & Drews, 2021). When employees can make decisions and access the necessary knowledge, they become more adaptable and innovative, essential in the fast-evolving digital landscape. Empowering teams to experiment and learn fosters adaptability and drives transformation efforts.

Openness and transparency are additional elements of empowerment. Transparent communication builds trust and encourages open dialogue, which enhances collaboration and innovation (Klein, 2020; Guzmán et al., 2020). Leaders who embrace new ideas and perspectives empower their teams to think differently and adapt to changing market conditions (Kane et al., 2018).

In summary, empowerment in digital leadership fosters a culture of collaboration, innovation, and adaptability. By distributing power, encouraging diverse thinking, and promoting transparency, leaders equip their teams to navigate digital challenges effectively, contributing to organizational success.

> **Proposition 6:** Empowerment, characterized by delegating authority and providing resources to team members, may be associated with higher digital transformation maturity. Leaders who cultivate a culture of autonomy and trust enable employees to take initiative and contribute to the digital transformation process.

4 Methodology

This section details the methodology used in this research, enabling a systematic exploration of the relationship between digital leadership competencies and digital transformation maturity. The chapter begins by outlining the research design, followed by sample selection, measurement of variables, data collection procedures, and data analysis methods. This structure ensures clarity and a logical flow in explaining the steps taken to answer the research question.

4.1 Research Design

The research design adopted for this study was carefully selected to align with the research objectives and the exploratory nature of the investigation. A quantitative approach was chosen to statistically analyze the relationship between digital leadership competencies and digital transformation maturity. By using structured surveys to collect data from a broad sample of retail SMEs, the study can generate generalizable and data-driven insights. This research aims to measure and statistically analyze the relationship between critical digital leadership competencies and digital transformation outcomes. An exploratory design was chosen as the most appropriate approach for this study, given the limited

existing research on the relationship between digital leadership and transformation maturity in the retail SME sector. Exploratory research is ideal when examining little known areas, as it identifies new patterns, relationships, and insights without relying on predefined hypotheses. This design helps uncover nuances in the role of leadership competencies that may not yet be fully understood within this specific context.

The data collection process uses standardized questions and Likert scales to consistently measure abstract constructs such as leadership traits and transformation maturity, providing robust, data-driven conclusions for the study. Furthermore, the ability to analyze these relationships statistically ensures that the findings are rigorous and can inform practical leadership development strategies for digital transformation. This approach enhances the study's replicability, allowing future researchers to expand on or verify the results in different contexts. A web-based survey, developed in collaboration with Nino Raben, a co-researcher, serves as the foundation for data collection. The survey, designed and administered through the Qualtrics platform, gathers quantitative data on business leaders' opinions and self-reported experiences, specifically those within the German retail sector and the broader SME landscape. This strategic targeting of a representative sample allows the study to generalize the findings to the broader population of German SMEs.

The survey collects data on two key aspects. The first section explores digital leadership competencies. Leaders from participating SMEs will be asked to self-report their proficiency in specific competencies relevant to successful digital transformation within the German retail sector. This self-reported data will be collected using standardized questions with a five-point Likert scale, mirroring the approach used in the maturity level assessment. This section design allows for a direct comparison between the self-reported leadership skills and the achieved level of digital transformation within each SME.

The second section assesses the digital transformation maturity of participating SMEs. A standardized questionnaire with closed-ended items measured on a five-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5), is used for this purpose. This approach offers several advantages. First, it allows participants to express varying degrees of agreement, fostering richer and more nuanced data than a binary response format. Second, the five-point scale facilitates a more accurate representation of the underlying distribution of responses within the sample. This, in turn, enhances the generalizability of the study's findings by ensuring they represent the broader population of German retail SMEs.

A detailed literature review was conducted beforehand to ensure the survey focused on the most relevant aspects of digital leadership and digital transformation within the German retail SME context. This review process involved examining existing research on digital leadership and digital transformation. By carefully selecting the digital leadership competencies and digital transformation maturity to be assessed based on this research, the study can ensure it measures the factors most critical to successful digital transformation in this context.

Additionally, the survey instrument will be pilot-tested with a small sample group to ensure clarity, comprehensiveness, and ease of use before widespread distribution. This pilot testing allows for identifying and adjusting any potential issues with the survey instrument, such as unclear wording, missing questions, or difficulty in navigation. By ensuring that the survey is clear, detailed, and easy to use, the study can maximize the accuracy and reliability of the collected data.

For the data analysis, SPSS will analyze the relationship between digital leadership competencies and digital transformation maturity in German SMEs while examining the impact of control variables like age, gender, company size, decision-making role, and job position. The analysis will start with exploratory data analysis and descriptive statistics to understand variable characteristics. Correlation analysis and categorical techniques will be used to explore and quantify the relationships between variables, including Pearson or Spearman correlations, Chi-Square Test of Independence, Cross-Tabulation, and Cramér’s V. This detailed approach aims to reveal how digital leadership competencies

correlate with digital transformation maturity and how control variables influence these relationships, providing insights to guide strategies for improving digital leadership and transformation in SMEs.

4.2 Selection and Sample Respondents

Following the explanation of the research design, attention is now directed to the selection and sampling of respondents. This section describes how the targeted sampling process ensures that the data collected is both representative and relevant to the population of German retail SMEs. Next, the criteria used to define and include the appropriate respondents will be outlined, ensuring a focused examination of the core research variables.

This study explores the relationship between digital leadership competencies and digital transformation maturity within the German retail SME sector. The sample consisted of business leaders from German retail SMEs. This group was specifically chosen because of their pivotal role in implementing digital transformation strategies, making them the most relevant participants for evaluating how digital leadership competencies impact the digital transformation maturity of their organizations.

The participating organizations adhered to the EU definition to qualify as SMEs, requiring fewer than 250 employees and an annual revenue under €50 million. The study included CEOs, owners, managing directors, and managers directly overseeing digital transformation initiatives. These individuals were selected for their strategic roles and decision-making authority within their organizations, ensuring that the data reflects insights from those directly involved in driving digital transformation.

A snowball sampling technique was used to recruit participants, leveraging professional networks on platforms such as LinkedIn. Snowball sampling is a non-probability sampling method where existing study participants recruit future participants from among their professional acquaintances. This technique was particularly effective for reaching business leaders, a group often challenging to access using traditional sampling methods. Additionally, snowball sampling enabled the study to achieve a more diverse and representative sample across various retail SMEs by extending the recruitment through personal and professional networks (Goodman, 1961).

By focusing on retail SMEs in Germany, the study maintains precision and relevance, isolating the effects of digital leadership competencies within this specific industry and geographical context. These considerations ensure that the findings directly apply to the targeted population of business leaders in German retail SMEs involved in digital transformation.

4.3 Measurement

Once the selection of respondents has been explained, the focus shifts to how the variables in the study are measured. This section provides a detailed overview of the measurement approach used to assess the critical variables in this study. It explains how the independent variables, representing digital leadership competencies, and the dependent variable, digital transformation maturity, are quantified. In addition, it outlines the control variables introduced—company size, annual turnover, industry sector, geographical location, decision-making role, job position, age, and gender—to account for any confounding effects on the relationships between digital leadership competencies and digital transformation maturity. Measurement scales for both the independent and dependent variables are derived from established literature on digital leadership and digital transformation. Although validation of measurement items is standard practice, this study, due to time constraints, utilizes a detailed set of items for each construct to ensure robustness in the preliminary analysis.

4.3.1 Independent Variable

This subsection explains how each digital leadership competency is operationalized and measured using validated items from the literature. The study employed a multi-dimensional approach to assess six key

digital leadership competencies: tech-savviness, digital strategy, agility, networking, innovation, and empowerment. These competencies are critical for driving digital transformation within organizations. To ensure the reliability and validity of the measures, items were adapted from previously validated scales in the literature.

Each competency was assessed using a five-point Likert scale, allowing participants to express their level of agreement or disagreement with each statement, ranging from "strongly disagree" (1) to "strongly agree" (5). This consistent and precise method facilitated rigorous statistical analysis by quantifying participant responses.

For example, eight items were adopted from established scales to assess tech-savviness (Berbel-Vera et al., 2022; Munsamy et al., 2023; Weber, Krehl, et al., 2022). Tech-savviness is a critical component of digital leadership, and these items were selected to assess the participant's level of knowledge and competency in this area. Seven items adapted from the scales were used to measure digital strategy, another vital aspect of digital leadership (AlNuaimi et al., 2022; Niemand et al., 2021). This construct evaluated the participants' ability to formulate and communicate a clear digital vision and strategic direction for their organizations.

In line with the study conducted by Troise et al. (2022), agility was measured using a six-item construct. Agility, a critical competency in the digital leadership landscape, was assessed to determine the participants' capacity to adapt and respond effectively to rapidly changing digital environments. Furthermore, innovation was classified using a seven-item scale adapted from Berbel-Vera et al. (2022) and Weber, Krehl, et al. (2022). This construct sought to assess the participants' inclination towards fostering innovation and experimentation within their organizations, a characteristic often associated with successful digital leaders.

Networking was assessed using a six-item scale provided by Mharapara et al. (2019) and Weber, Krehl, et al. (2022). This construct aimed to measure the participant's ability to establish and nurture meaningful connections and collaborations within the digital ecosystem. Finally, the empowerment construct was operationalized with six items, which were adapted from the research of Arnhold et al. (2000) and Amundsen and Martinsen (2014). This construct sought to evaluate the participants' capacity to empower and motivate their teams, thereby driving digital transformation within their organizations.

These competencies reflect the multifaceted nature of digital leadership, which is essential for driving digital transformation in organizations. Table A1 provides detailed descriptions of the measures used.

4.3.2 Dependent Variable

After addressing the independent variable, the focus will turn to the dependent variable, digital transformation maturity. This subsection outlines how digital transformation within SMEs is assessed, ensuring that it captures varying maturity levels across the sampled organizations. This construct is defined by developing measurement items based on existing literature, focusing on the framework proposed by Weritz et al. (2024), which views digital transformation maturity through the lens of digital transformation success. Detailed descriptions of the measures used can be found in Table A2. A five-point Likert scale was employed to ensure consistent and precise data collection. Participants utilized this scale to express their level of agreement or disagreement with each statement, ranging from “strongly disagree” (1) to “strongly agree” (5). The Likert scale facilitated the quantification of participant responses, enabling rigorous statistical analysis.

The model proposed by Weritz et al. (2024) offers a robust framework for assessing the effectiveness of digital transformation initiatives within organizations. It emphasizes the importance of organizational shifts towards a digital-first orientation, integrating digital technologies into operational processes, developing empowered talent equipped with digital competencies, and effectively utilizing data and collaboration tools. Accordingly, four primary dimensions are identified within the construct of digital transformation success, each offering critical insights into an organization's digital maturity.

Firstly, the dimension of the digital-first mindset reflects how strongly an organization prioritizes digital thinking and innovation across all departments (Weritz et al., 2024). It comprises a set of four measurement items tailored to assess the prevalence and effectiveness of digital-first attitudes within the organizational culture. Secondly, the dimension of digitized practices and operations focuses on the extent to which traditional operational practices have been digitized and optimized for efficiency and effectiveness (Weritz et al., 2024). Four measurement items evaluate the extent of digital integration across various operational processes.

The third dimension is empowered talent. Central to any successful digital transformation endeavor is empowering personnel to leverage digital tools and insights effectively (Weritz et al., 2024). This dimension, measured by three items, explores the organization's efforts to equip its workforce with the necessary skills and resources to thrive in a digital environment. Finally, the dimension of data access and collaboration tools highlights the importance of data utilization and collaborative platforms in facilitating organizational agility and competitiveness (Weritz et al., 2024). Four measurement items assess the organization's infrastructure and mechanisms for data access, sharing, and collaborative decision-making. By operationalizing digital transformation maturity through these distinct dimensions, this study aims to provide a more detailed and nuanced understanding of an organization’s current state and progress in its digital transformation journey.

Utilizing these established constructs and validated items from prior research allowed for a rigorous and structured assessment, contributing to the overall validity and reliability of the study's findings.

4.3.3 Control Variable

Lastly, the role of control variables is considered. These variables are introduced to account for potential confounding effects and to ensure that the relationships between digital leadership competencies and digital transformation maturity are accurately examined. The upcoming section on data collection will elaborate on how these control variables are integrated into the analysis.

Several control variables—company size, annual turnover, industry sector, geographical location, decision-making role, job position, age, and gender—are incorporated to enhance the study's internal validity. Company size is controlled to ensure the focus remains on Small and Medium Enterprises (SMEs). This is determined by the number of employees, with a specific criterion of fewer than 250. Annual turnover is also considered, with SMEs capped at €50 million to align with typical SME definitions.

The industry sector is included to maintain a focus on the retail context, allowing the study to isolate the effects of digital leadership competencies within this specific industry. Geographical location is controlled to restrict the scope to the German retail sector, ensuring the findings are relevant to this regional context.

The decision-making role captures the level of involvement participants have in digital transformation initiatives, ranging from minimal input to primary decision-makers. This variable is crucial for understanding how the extent of participation might influence the effectiveness of digital leadership competencies. Job position reflects the hierarchical level or role within the organization, as different positions may have varying degrees of influence over digital transformation efforts. This helps isolate the impact of digital leadership competencies from the effects associated with different organizational roles.

Lastly, age and gender are included to account for their potential impact on the relationship between digital leadership competencies and digital transformation maturity. Age may affect familiarity with and attitudes toward digital technologies, influencing leadership effectiveness. Gender may shape leadership styles and decision-making approaches, affecting the application and perception of digital leadership competencies.

4.4 Data Collection

With the key variables and their measurements established, attention now moves to the data collection process. This section outlines the tools and platforms for gathering data, ensuring consistency and reliability.

Data for this study was collected through a standardized survey instrument, which was distributed online using the Qualtrics platform. The choice of this platform ensured ease of access and completion for participants. The survey was designed to be accessible to business leaders across different regions of Germany, allowing respondents to complete the survey at their convenience. The survey was presented in English and German, allowing participants to choose their preferred language, thereby ensuring a broader reach.

Before full distribution, the survey underwent a pilot test with a small sample to refine the wording of the survey items and ensure that the target population understood the Likert scale. This step helped enhance the responses' reliability and improve the quality of the collected data.

The survey remained open for five weeks to accommodate the busy schedules of business leaders. Weekly reminders were sent to encourage participation. The snowball sampling technique increased the sample size by inviting respondents to share the survey with their professional networks. To protect participants' privacy, anonymity was guaranteed to increase the response rate and encourage candid answers.

The survey was distributed through various channels to reach a geographically representative sample. These included professional networking platforms such as LinkedIn, the research platform SurveyCircle, and other social media channels. A specific focus was placed on business leaders actively involved in digital transformation initiatives within the German retail sector's small and medium-sized enterprises (SMEs).

4.5 Data Analysis

Finally, the data analysis procedures are described, setting the stage for understanding how the collected data will be interpreted. In this research, SPSS will be employed as the statistical software to analyze the data and to explore the relationship between digital leadership competencies and digital transformation maturity within German small and medium-sized enterprises (SMEs). The primary objective is to determine how digital leadership competencies correlate with the level of digital transformation maturity across these organizations. Additionally, the analysis will investigate how much control variables, including age, gender, company size, decision-making role, and job position, influence this relationship.

To achieve this, the research will begin with an exploratory data analysis to understand the distribution and characteristics of the variables involved. Descriptive statistics will provide an overview of the data, allowing more detailed analyses.

The relationship between digital leadership competencies and digital transformation maturity will be analyzed using correlation and categorical analysis techniques. Correlation analysis will determine the strength and direction of the relationship between these variables, with Pearson or Spearman correlation coefficients applied based on the data distribution. Categorical analysis will be conducted using the Chi-Square Test of Independence to assess whether there is a statistically significant association between the categories derived from the independent and dependent variables. This analysis will help understand how different levels of one variable relate to varying levels of another. Additionally, Cross-Tabulation and Cramér's V will be used to more precisely explore the relationships between categorical variables. Cross-tabulation will provide a detailed view of the frequency of different category combinations, helping to visualize data distribution across these categories. Cramér's V will quantify the strength of these associations, offering a clearer understanding of the intensity of the relationships.

Moreover, the influence of control variables, such as age, gender, company size, decision-making role, and job position, will be further examined using the aforementioned categorical analysis techniques. This exploration aims to determine whether these demographic or organizational factors enhance or diminish the effectiveness of digital leadership in driving digital transformation, thereby providing a more detailed understanding of the dynamics at play.

This multi-faceted analysis will provide a nuanced understanding of the dynamics at play, offering valuable insights into how different factors contribute to or hinder digital transformation within German SMEs. The findings are expected to guide the development of targeted strategies for enhancing digital leadership and accelerating digital transformation in various organizational settings.

5 Results

The study's results will now be presented, focusing on the findings derived from the data analysis. A total of 92 responses were collected, with 37 respondents indicating that their businesses belong to the retail sector—the primary focus of this study. Given this sample size, the analysis begins with an exploratory data analysis to summarize the distribution and characteristics of the variables, laying the groundwork for more advanced techniques. It then proceeds in two main directions: first, by exploring the relationships between variables through correlation analysis, and second, by examining associations between categories derived from these variables.

5.1 Exploratory Data Analysis

Before conducting the correlation and categorical analyses, an overview of the descriptive statistics is necessary. Exploratory Data Analysis (EDA) was performed to understand the dataset, including control, independent and dependent variables. EDA helps identify patterns, outliers, and data distribution, ensuring the dataset is suitable for further statistical tests. This process provides valuable insights into the sample's characteristics and their perceptions of leadership competencies and digital transformation maturity.

5.1.1 Control Variables

In this section, the control variables—gender, age, job position, company size, and decision-making role—were analyzed to create a detailed demographic and organizational profile of the respondents. Understanding these variables is crucial because they may influence the relationship between leadership competencies and digital transformation by moderating or confounding the results.

The gender distribution revealed that 64.9% of respondents were female, while 35.1% were male, highlighting a significant female representation within the sample (see Table B2). Regarding company size, most respondents (54.1%) came from small organizations with 10-49 employees (see Table B3). Medium-sized companies, with 50-249 employees, accounted for 32.4%, and micro-organizations (1-9 employees) made up 13.5%. With a slight skew toward larger companies, this distribution reflects the diversity of organizational contexts (see Table B1).

The data showed an almost equal split regarding decision-making roles, with 48.6% of respondents serving as the primary decision-makers in their organizations and another 48.6% participating in the decision-making team (see Table B4). Only a small proportion (2.7%) were not directly involved in decision-making, indicating that most respondents play critical roles in shaping their organizations' strategies.

When examining job positions, nearly half of the respondents (48.6%) held top-level management roles, including positions such as Owners, CEOs, and Senior Executives, demonstrating a strong leadership presence in the sample (see Table B5). Mid-level management positions comprised 21.6%, first-line

management roles accounted for 18.9%, and Team Leaders represented 10.8%, concentrating on higher management positions.

In terms of age, the respondents were pretty balanced across age groups. The largest group (32.4%) was aged 25-34, followed by 27% in the 35-44 and 45-54 age ranges (see Table B6). Younger respondents (18-24) and older individuals (55-64) were less represented, comprising 5.4% and 8.1%, respectively, with the average age skewing slightly toward younger and middle-aged respondents (see Tables B1 & B6).

Overall, the data presents a diverse and engaged sample with a strong female representation, significant involvement in decision-making, and a substantial proportion of respondents in top management roles. Most participants come from small and medium-sized organizations, offering valuable insights into their critical roles within their companies.

5.1.2 Independent and Dependent Variables

Next, the key independent variables (digital leadership competencies) and the dependent variable (digital transformation maturity) were explored. This is important to establish a baseline understanding of how respondents rate their competencies and the state of digital transformation within their organizations.

The descriptive statistics (see Table B7) reveal that networking is the highest-rated factor, with a mean score of 4.24 and a relatively low standard deviation of 0.46. This suggests that respondents consistently rated their ability to foster and maintain professional relationships highly, reflecting the importance of networking in facilitating resource exchange and collaboration during digital transformation efforts. Conversely, tech-savviness was the lowest-rated variable with a mean score of 3.13, suggesting it is seen as less prevalent or developed among the respondents. This variable also exhibited higher response variability, as indicated by a standard deviation of 0.84, reflecting diverse perceptions of tech-savviness.

Empowerment was also rated highly, with a mean score of 4.10 and the lowest standard deviation among the competencies (0.45), indicating that respondents consistently viewed themselves as effective in empowering their teams. Digital strategy had a mean score of 3.46. Still, it exhibited significant negative skewness (-1.01), suggesting that while the average rating was moderate, a notable proportion of respondents gave higher ratings, indicating generally positive perceptions of their organization's digital strategy.

Agility also had a relatively high mean score of 4.00, with a slight left skewness (-0.49), suggesting that respondents generally felt confident in their ability to adapt to changes. Digital transformation displayed the most variability among the respondents, with a standard deviation of 0.92 and a mean score of 3.24, pointing to diverse experiences and views regarding digital transformation efforts.

In summary, the analysis revealed that respondents strongly emphasized competencies such as networking and empowerment. At the same time, tech-savviness was viewed as a weaker area. Additionally, the variability in digital transformation maturity highlights the differing stages of digital transformation among the organizations represented in the sample.

5.2 Correlation Analysis

Following the exploratory data analysis, the correlation analysis will be presented. This section aims to quantify the relationships between the variables, offering insight into how the identified digital leadership competencies correlate with digital transformation maturity.

5.2.1 Between control and dependent variables

This subsection will focus on the relationships between the control variables—company size, job position, decision-making role, gender, and age—and the dependent variable, digital transformation maturity. Understanding these connections helps contextualize the study's primary findings.

A one-way ANOVA was used to compare the means of different groups and determine if significant differences exist in their levels of digital transformation maturity (Pallant, 2010). The assumptions necessary for a valid ANOVA were assessed, and alternative tests were employed when required (see appendix for details).

The analysis of the control variables yielded several key findings related to digital transformation maturity. Due to a violation of the homogeneity of variances for the company size variable, a non-parametric Kruskal-Wallis test was conducted. The results indicated significant differences between groups ($H = 12.112$, $p = 0.002$), suggesting that company size significantly influences digital transformation maturity. Larger companies, which often have greater resources and infrastructure, tend to exhibit higher levels of digital maturity. This suggests that company size might moderate the relationship between leadership competencies and digital transformation success.

For the decision-making role and job position variables, one-way ANOVA results indicated significant differences between groups, p-values of 0.046 and 0.009, respectively (see Tables B42 and B43). These findings suggest that individuals in different decision-making roles and job positions experience varying levels of digital transformation maturity within their organizations. In contrast, no significant differences were found for age ($p = 0.822$) and gender ($p = 0.142$), indicating that these demographic factors do not significantly influence digital transformation maturity. These results suggest that personal characteristics such as age or gender do not moderate the relationship between leadership competencies and digital transformation, reinforcing that organizational and role-based factors play a more critical role.

These results suggest that company size, decision-making role, and job position significantly influence digital transformation maturity. At the same time, age and gender do not significantly impact digital transformation efforts.

5.2.2 Between independent and dependent variables

Next, the correlation between the independent variables, digital leadership competencies, and the dependent variable, digital transformation maturity, will be explored. This analysis is crucial for addressing the core research question of this study. It is particularly relevant because it identifies which leadership competencies have the strongest impact on digital transformation efforts. By understanding these relationships, organizations can gain actionable insights into the most critical competencies for guiding digital transformation.

Pearson’s correlation was applied to most variables to measure the strength and direction of the associations between the independent leadership competencies and the dependent variable, digital transformation maturity. This method provides a clear picture of how different competencies influence the success of digital transformation initiatives. The assumptions required for Pearson’s correlation were verified (see Appendix B for detailed assumption checks), ensuring the appropriateness of the analysis for the dataset. Due to deviations from normality for the digital strategy variable, Spearman’s correlation was employed for that competency.

The correlation analysis identified several significant relationships between Digital Transformation and the independent variables (see Table B9). Tech-savviness exhibited the strongest positive correlation with digital transformation ($r = .804$, $p < .001$), emphasizing the crucial role that technological competency plays in driving digital transformation within organizations. This was followed closely by empowerment ($r = .687$, $p < .001$) and networking ($r = .686$, $p < .001$), both of which demonstrated

strong positive correlations. These findings suggest that empowering employees and building robust internal and external networks are critical factors in the success of digital transformation efforts.

Innovation also showed a significant positive correlation with Digital Transformation ($r = .620$, $p < .001$), emphasizing the importance of fostering a culture of innovation to support digital transformation initiatives. Agility ($r = .625$, $p < .001$) displayed a similarly strong positive correlation, indicating that organizational flexibility and responsiveness are essential to facilitating effective digital transformation.

Due to the normality concerns related to digital strategy, Spearman's correlation was applied (see Table B10). The analysis revealed a strong positive correlation between digital strategy and Digital Transformation ($rs = .694$, $p < .001$), suggesting that a well-defined digital strategy is integral to successful transformation, even when deviations from normality are present in the data.

In conclusion, tech-savviness, empowerment, and networking emerged as the top competencies most strongly correlated with digital transformation maturity. While digital strategy, agility, and innovation also play significant roles, their impact is slightly less pronounced but still crucial for successful transformation efforts.

5.3 Categorical Analysis

Once significant relationships have been identified through the correlation analysis, a more detailed examination is conducted to explore how varying levels of digital leadership competencies are associated with digital transformation maturity through categorical analysis.

5.3.1 Between independent and dependent variables without the influence of the control variables

An initial categorical analysis is conducted without considering the control variables to clarify the relationship between leadership competencies and digital maturity. This analysis is relevant because it allows to explore how different levels of digital leadership competencies relate to varying degrees of digital transformation maturity, providing a more transparent, more nuanced understanding of these relationships. By categorizing continuous variables into distinct groups (Low, Medium, and High), we can identify patterns or trends that may not be immediately apparent in continuous data. The independent variables—innovation, empowerment, digital strategy, agility, networking, and tech-savviness—and the dependent variable, digital transformation maturity, were categorized into three levels: Low (1 to 2.34), Medium (2.34 to 3.67), and High (3.67 to 5). This categorization helps reveal different competency levels associated with organizational digital maturity.

The Chi-Square Test of Independence was employed to test for statistically significant associations between the categories. This test is critical in understanding whether the differences between competency levels and digital transformation maturity are meaningful or due to chance. Additionally, cross-tabulation was used to visualize the distribution of respondents across these categories, and Cramér's V was calculated to quantify the strength of these associations (Pallant, 2010). This approach is essential because it provides actionable insights into how various levels of leadership competencies impact digital transformation. By identifying which competencies are most influential at different maturity levels, the findings can guide leadership development efforts and help organizations target the areas most critical for advancing their digital transformation. The key findings for each leadership competency are presented in the following sections, highlighting the specific associations with digital transformation maturity.

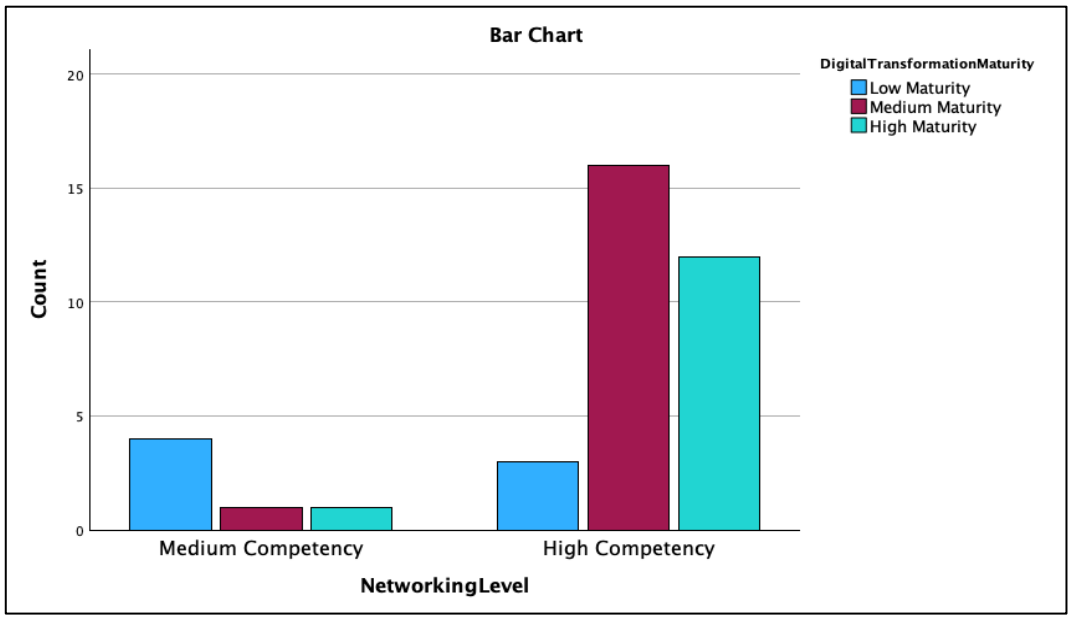
Networking Competency Level

The analysis revealed a clear relationship between networking competency and digital transformation maturity. Individuals with higher networking competency were more likely to achieve higher levels of

digital maturity (see Figure 7). Specifically, 94.1% of respondents with high networking competency reached medium maturity, and 92.3% achieved high maturity. In contrast, 57.1% of those with medium networking competency fell into the low maturity category, with only 5.9% reaching medium maturity and 7.7% achieving high maturity (Table B11). Statistical analysis supports this finding. Cramér's V value of 0.537 indicates a moderate association between networking competency and digital transformation maturity, with a significant p-value of 0.005. The Pearson Chi-Square value of 10.661 ($p = 0.005$) further reinforces this relationship (Tables B12 and B13).

In conclusion, strong networking competency is closely linked to higher digital transformation maturity. Fostering this skill within organizations could significantly enhance their digital transformation efforts.

Figure 7 Networking Competency Level vs Digital Transformation Maturity

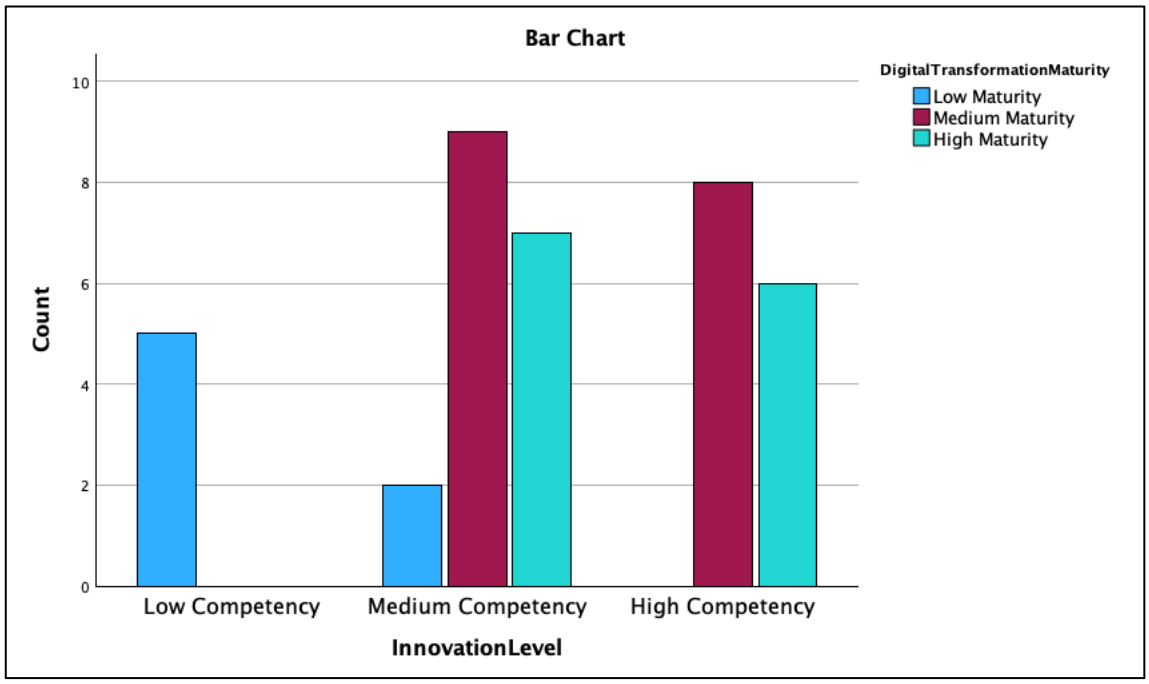


Innovation Competency Level

The analysis shows a clear relationship between innovation competency and digital transformation maturity. As Figure 7 shows, respondents with higher innovation competency were predominantly found in the medium and high maturity categories, while those with low innovation competency were mainly in the low maturity category. Notably, no respondents with high innovation competency fell into the low maturity group. Cross-tabulation data (Table B14) reveals that 71.4% of respondents with low innovation competency are in the low maturity category, with none reaching medium or high maturity. In contrast, those with medium innovation competency are distributed across low (28.6%), medium (52.9%), and high maturity (53.8%). Respondents with high innovation competency are mainly in the medium (47.1%) and high maturity (46.2%) categories. Cramér's V value of 0.586 indicates a moderate association between innovation competency and digital transformation maturity, with a significance level of <0.001 (Table B16). The Chi-Square test further supports this with a Pearson Chi-Square value of 25.413 ($p < 0.001$), confirming the statistical significance of the relationship (Table B15).

In conclusion, higher innovation competency is strongly associated with advanced digital transformation maturity. This highlights the importance of fostering innovation within organizations to drive digital transformation success.

Figure 8 Innovation Competency Level vs Digital Transformation Maturity



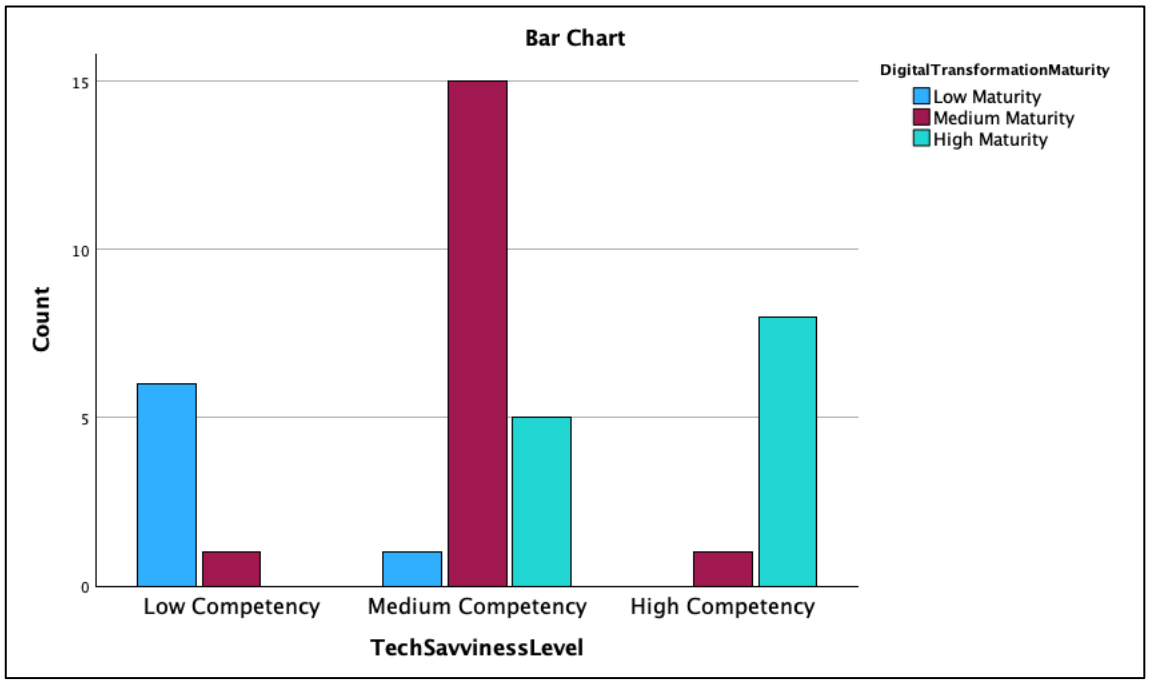
Tech-savviness Competency Level

The analysis highlights a strong relationship between tech-savviness and digital transformation maturity. Individuals with higher levels of tech-savviness tend to achieve greater digital maturity, as shown in Figure 9. Respondents with low tech-savviness were primarily in the low maturity category, while those with medium and high tech-savviness were more frequently in the medium and high maturity categories. Notably, none of the respondents with high tech-savviness were in the low maturity group. Cross-tabulation data (Table B17) supports this pattern, showing that 85.7% of respondents with low tech-savviness fell into the low maturity category, with only 5.9% reaching medium maturity.

In contrast, 88.2% of those with medium tech-savviness were in the medium maturity category, and 38.5% reached high maturity. Among respondents with high tech-savviness, 61.5% were in the high maturity category, with no representation in low maturity. The strength of this association is confirmed by a Cramér's V value of 0.716, indicating a strong association between tech-savviness and digital transformation maturity, with a statistically significant p-value of less than 0.001 (Table B19). The Chi-Square test also shows a significant relationship, with a Pearson Chi-Square value of 37.935 ($p < 0.001$, Table B18).

In summary, tech-savviness is strongly associated with higher digital transformation maturity. Organizations aiming to enhance digital transformation should prioritize the development of tech-savviness within their workforce to achieve higher maturity levels and optimize their transformation efforts.

Figure 9 Tech-savviness Competency Level vs Digital Transformation Maturity

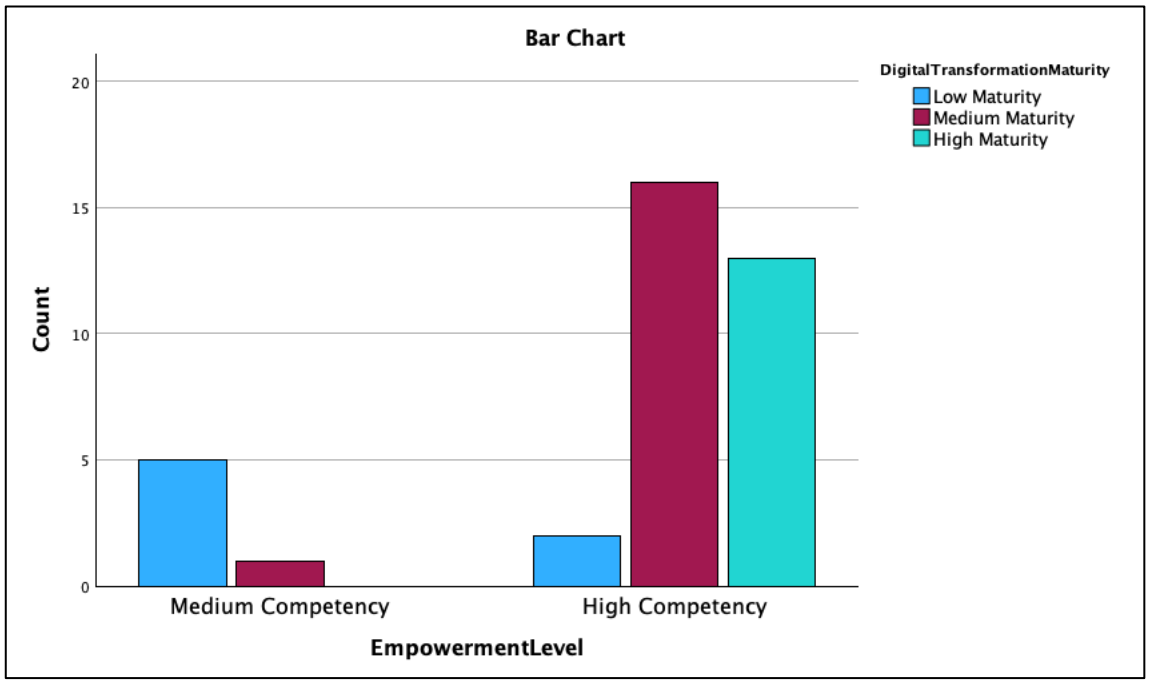


Empowerment Competency Level

The analysis shows a strong relationship between empowerment competency and digital transformation maturity. Individuals with higher empowerment competency are more likely to achieve higher maturity levels, while those with medium competency are primarily found in the low maturity category (see Figure 10). Cross-tabulation data (Table B20) confirms this trend: 71.4% of respondents with medium empowerment competency are in the low maturity category, with only 5.9% in medium maturity and none in high maturity. In contrast, 94.1% of those with high empowerment competency fall into the medium maturity group, and 100% reach high maturity. Statistical tests further support this association. Cramér's V value of 0.727 indicates a strong association between empowerment competency and digital transformation maturity, with a highly significant p-value of <0.001 (Table B22). The Pearson Chi-Square value of 19.558 ($p < 0.001$) also confirms the significance of this relationship (Table B21).

In summary, higher empowerment competency is strongly linked to greater digital transformation maturity. Organizations aiming to enhance their digital transformation efforts should focus on fostering empowerment, which is crucial in driving successful digital initiatives.

Figure 10 Empowerment Competency Level vs Digital Transformation Maturity

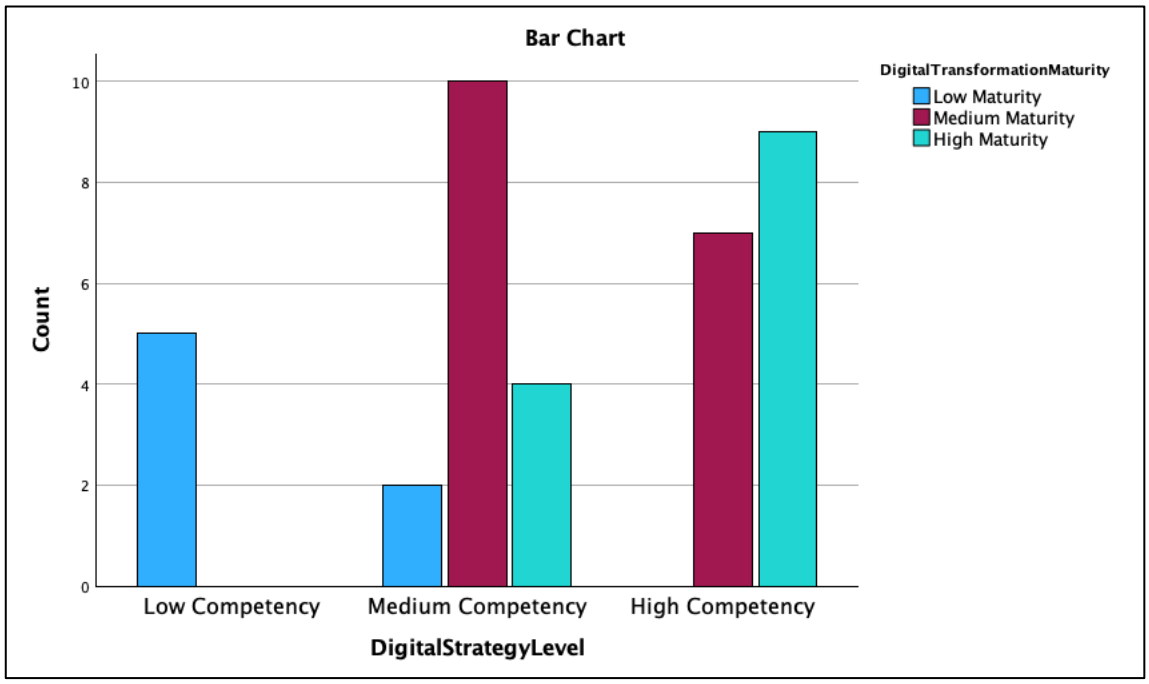


Digital Strategy Competency Level

The analysis shows a clear relationship between digital strategy competency and digital transformation maturity. Respondents with low digital strategy competency are predominantly in the low maturity category, with none achieving medium or high maturity. In contrast, those with medium competency are more frequently in the medium or high maturity categories, while respondents with high competency are only represented in medium and high maturity, with no individuals in the low maturity group. Cross-tabulation data (Table B23) further clarifies this relationship: 71.4% of those with low competency are in the low maturity category, while none reach medium or high maturity. For those with medium competency, 58.8% fall into medium maturity and 30.8% into high maturity. Among those with high competency, 69.2% are in the high maturity category, and 41.2% are in the medium, with no representation in low maturity. Cramér's V value of 0.618 indicates a strong association between digital strategy competency and digital transformation maturity, with a significance level of <0.001 (Table B25). The Pearson Chi-Square value of 28.273 ($p < 0.001$) confirms the statistical significance of this relationship (Table B24).

In summary, higher levels of digital strategy competency are strongly associated with greater digital transformation maturity. This highlights the importance of developing digital strategy capabilities to achieve advanced digital maturity and transformation outcomes.

Figure 11 Digital strategy Competency Level vs Digital transformation maturity

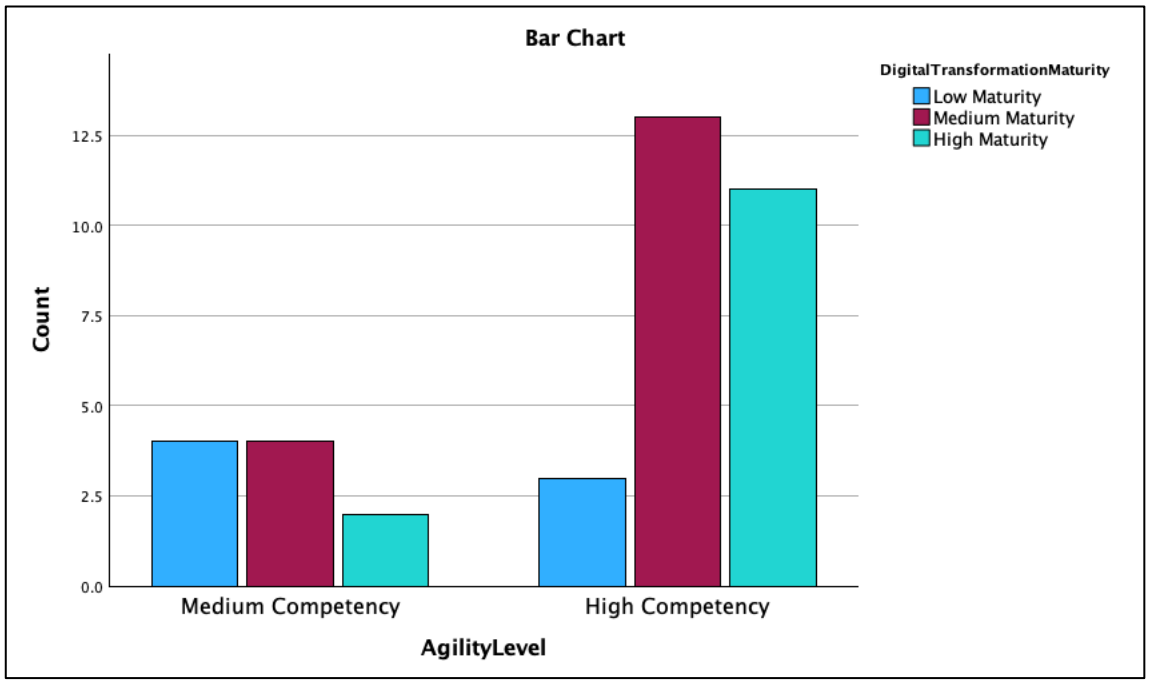


Agility Competency Level

The analysis shows a general trend where higher agility competency is associated with greater digital transformation maturity. Individuals with medium agility competency are distributed across low, medium, and high maturity categories, concentrating on low maturity. In contrast, those with high agility competency are predominantly in the medium and high maturity categories. Cross-tabulation data (Table B26) indicates that 57.1% of respondents with medium agility competency fall into the low maturity category, while 42.9% of those with high agility competency are in low maturity. Additionally, 76.5% of those with high agility competency are in medium maturity, and 84.6% are in high maturity, suggesting a positive relationship between agility and digital maturity. However, statistical analysis does not confirm a significant relationship. Cramér's V value of 0.338 suggests a weak association, and the Chi-Square test ($p = 0.121$) indicates that the relationship between agility competency and digital transformation maturity is not statistically significant (Table B27-B28).

In conclusion, while there is a trend suggesting that higher agility competency is associated with greater digital maturity, this relationship is not statistically significant. Agility may contribute to digital transformation but should be considered alongside other competencies that substantially impact digital transformation maturity.

Figure 12 Agility Competency Level vs Digital Transformation Maturity



In conclusion, empowerment demonstrated the strongest association with digital transformation maturity, highlighting its crucial role in driving successful transformation efforts. Tech-savviness closely followed, emphasizing the importance of technological proficiency in achieving digital maturity. Digital strategy also played a key role, showing that a clear and well-defined strategic direction is essential. Innovation and networking were moderately strong, reinforcing the need for fostering creativity and building strong relationships. Lastly, agility showed the weakest association, suggesting that while flexibility is beneficial, it is less critical than other competencies.

5.3.2 Between independent and dependent variables with the influence of the control variables

Finally, the analysis will incorporate control variables to determine how these factors influence the relationships between leadership competencies and digital transformation maturity. This step is essential for a nuanced understanding of the findings. Building on insights from the initial correlation analysis, which highlighted the significant relationship between company size, job position, decision-making role, and digital transformation, this analysis employs categorical techniques, such as Cross-Tabulation, to investigate how varying levels of each control variable influence the link between digital leadership competencies and digital transformation maturity.

Company Size

The Cross-tabulation data (Tables B44-B49) reveals that digital leadership competencies significantly influence digital transformation maturity across different company sizes. In micro-enterprises (1-9 employees), low competency levels in networking, agility, digital strategy, empowerment, tech-savviness, and innovation are predominantly associated with low digital transformation maturity.

However, those few with high competencies in these areas can achieve higher maturity levels. Small enterprises (10-49 employees) generally display medium digital transformation maturity when they have medium to high competencies in these areas, with a notable increase in high maturity when competencies like networking, agility, digital strategy, empowerment, tech-savviness, and innovation are strong. Medium-sized enterprises (50-249 employees) show a clear trend where high competencies

across all these leadership areas strongly correlate with high digital transformation maturity, indicating that robust digital leadership becomes more critical in achieving advanced digital maturity as companies grow.

Job Position

The Cross-tabulation data (Tables B50-B55) across various digital leadership competencies (networking, agility, digital strategy, empowerment, tech-savviness, and innovation) and job positions reveal critical digital transformation maturity trends. Top-level management with high competency levels in networking, agility, digital strategy, empowerment, tech-savviness, and innovation are generally more likely to achieve medium to high digital transformation maturity. Mid-level management with high competency levels also tends to achieve higher maturity, particularly in networking, agility, and digital strategy. While benefiting from high competency in these digital leadership areas, first-line management and team leaders show more variability, with some remaining at lower maturity levels despite medium competency. High competency in these leadership areas correlates with higher digital transformation maturity across most job positions. Still, the most vital relationships are observed in mid-level and top-level management roles.

Decision-Making Role

The Cross-tabulation analysis (see Table B56-B61) across decision-making roles and digital leadership competencies (networking, agility, digital strategy, empowerment, tech-savviness, and innovation) reveals several key trends in digital transformation maturity. For primary decision-makers, higher competency levels across all competencies consistently lead to medium and high digital transformation maturity, with most high competency groups achieving high maturity, particularly in agility, digital strategy, and innovation. For individuals in the decision-making team, medium and high competency levels generally result in medium to high maturity, with high maturity more common when competency levels are higher, especially in tech-savviness, innovation, and empowerment. Those not involved in the decision-making process show more limited variability, with some medium competencies reaching medium maturity but no significant results in achieving high maturity. The findings indicate that primary decision-makers with high competency across these leadership skills are most likely to achieve high digital transformation maturity. At the same time, those in supporting roles benefit from higher competencies but are less likely to reach the highest maturity levels.

6 Discussion

This discussion interprets the findings on digital leadership competencies' role in advancing German retail SMEs' digital transformation maturity. By examining the relationships between competencies such as tech-savviness, digital strategy, agility, networking, innovation, and empowerment with digital transformation, this section assesses how the results correspond with or challenge existing theories and evaluates the study’s propositions. The broader implications for theoretical frameworks and practical applications are also considered, and the research limitations will be presented.

The research explored the relationship between digital leadership competencies and digital transformation maturity within German retail SMEs, identifying which competencies are most critical for successful transformation. This study focused on six key competencies: tech-savviness, digital strategy, empowerment, networking, innovation, and agility. The findings suggest significant correlations between several leadership competencies and digital transformation maturity, providing valuable insights for both theory and practice.

Tech-savviness was strongly correlated with digital transformation maturity ($r = .804$, $p < .001$, Cramér's $V = 0.716$, $p < .001$), highlighting the importance of technological proficiency in successfully navigating the digital landscape. This finding supports the proposition that leaders with high levels of

tech-savviness are better equipped to guide their organizations through digital changes (Kane et al., 2018; Klein, 2020). The significant correlation between tech-savviness and transformation outcomes aligns with previous research, suggesting that leaders with a deep understanding of digital tools and trends are more effective in adapting their organizations to technological advancements (Weber Krehl et al., 2022). Given the fast-paced nature of digital innovation, tech-savviness is not just a technical skill but a strategic asset that enhances leadership decision-making (Fernandez-Vidal et al., 2022).

Digital strategy was another competency that strongly correlated with transformation maturity ($r = .694$, $p < .001$, Cramér's $V = 0.618$, $p < .001$). Leaders who develop and implement clear digital strategies are more likely to drive their organizations toward higher digital maturity (Benitez et al., 2022). This supports the proposition that a well-defined digital strategy aligns organizational goals with technological investments, ensuring sustained digital growth. While the correlation was slightly lower than tech-savviness, the results highlight the essential role of strategic thinking in navigating complex digital environments (Matricano et al., 2022). However, the slightly weaker performance in categorical analysis compared to other competencies may suggest that digital strategy alone is not sufficient—its effectiveness might depend on complementary competencies such as empowerment and networking.

Empowerment emerged as the most influential competency in both the correlation results and categorical analysis ($r = .687$, $p < .001$, Cramér's $V = 0.727$, $p < .001$), supporting the proposition that leaders who empower their employees can significantly impact digital transformation outcomes (Erhan et al., 2022; McCarthy et al., 2022). This result resonates with research emphasizing the importance of distributed leadership, where giving employees autonomy and decision-making power fosters innovation and engagement during transformation efforts (Schiuma et al., 2022). The strong correlation between empowerment and transformation maturity may be explained by the fact that digital transformation requires not only top-down leadership but also active participation from all levels of the organization (Kane et al., 2019). This competency's impact might also be amplified by its ability to integrate with other competencies like networking and innovation.

Networking showed a moderate correlation with digital transformation maturity ($r = .686$, $p < .001$, Cramér's $V = 0.537$, $p < .005$), supporting the idea that leaders who establish and maintain strong relationships, both internally and externally, facilitate the knowledge sharing and collaboration needed for successful digital transformation (Benitez et al., 2022). While networking was less influential than empowerment or tech-savviness, the data indicates that effective leaders who leverage networks can drive innovation and efficiency, reinforcing earlier findings by Kane et al. (2019). This competency's role in creating cross-functional teams and external partnerships may be valuable in complex digital ecosystems where collaboration is vital (Cortellazzo et al., 2019). However, the moderate strength of this correlation suggests that networking alone may not be a primary driver but a supportive mechanism for transformation.

Innovation, which was moderately correlated with digital transformation ($r = .620$, $p < .001$, Cramér's $V = 0.586$, $p < .001$), also supports the proposition that fostering a culture of experimentation and creativity is essential for digital success (Schiuma et al., 2022). Leaders who encourage risk-taking and continuous improvement play a crucial role in adapting their organizations to the rapidly changing digital environment (McCarthy et al., 2022). However, the slightly lower correlation compared to tech-savviness or empowerment suggests that innovation, while important, may rely heavily on a supportive culture and leadership that encourages creativity. These findings align with previous studies emphasizing the need to balance innovation and operational efficiency to sustain digital growth (Klein, 2020).

Finally, agility demonstrated the weakest correlation with digital transformation maturity, both in the correlation and categorical analyses ($r = .625$, $p < .001$, Cramér's $V = 0.338$, $p < .121$), somewhat contradicting the proposition that flexibility and adaptability are critical drivers of digital transformation (Matricano et al., 2022). While agility is often considered a key leadership trait in dynamic digital environments (Benitez et al., 2022), the weaker results suggest it may be less significant in isolation. Instead, agility might be more effective when combined with strategic vision or tech-savviness, as these

competencies enable leaders to make informed, flexible decisions. The lower correlation could also indicate that agility's impact depends on the specific context or the phase of digital transformation the organization is in, as flexibility may be more important during certain stages than others.

Control variables also played an essential role in moderating these relationships. Company size consistently influenced the impact of competencies, with medium-sized enterprises showing higher digital maturity across most leadership skills compared to smaller organizations. This suggests that larger SMEs may have more resources or infrastructure to leverage digital leadership competencies effectively. Job position and decision-making roles also had significant effects, with top-level managers and primary decision-makers showing more excellent digital transformation outcomes when they exhibited high competency in tech-savviness, digital strategy, and empowerment. These insights stress the importance of leadership hierarchy and organizational structure in shaping the success of digital transformation initiatives.

Unexpected results, such as the relatively weak role of agility, could be explained by the more structured nature of digital transformation in SMEs, where clear strategies and technical proficiency take precedence over flexibility. This contrasts with larger organizations, where agility might play a more significant role due to the complexity and scale of digital initiatives (Weber Krehl et al., 2022). An alternative explanation is that agility could be more critical in crisis-driven or high-uncertainty contexts. In contrast, SMEs may require stability and clear direction, making strategy and empowerment more valuable.

In summary, the findings largely support the initial propositions, with empowerment and tech-savviness emerging as the most influential competencies for driving digital transformation maturity. These competencies were consistently associated with higher digital maturity, particularly in medium-sized organizations and among top-level managers. Digital strategy, innovation, and networking also played significant roles, albeit slightly lesser, indicating that strategic foresight, fostering innovation, and building strong relationships are crucial but may require integration with other competencies to maximize their impact. Agility, while still beneficial, appeared to have the weakest influence, suggesting that flexibility may not be as critical as other leadership traits in the context of SMEs. The moderation effects of company size, job position, and decision-making roles highlight the importance of organizational structure and resources in determining the success of digital transformation initiatives. Overall, the results align with existing literature and provide practical insights for leaders aiming to enhance their organization's digital transformation efforts, emphasizing the need to combine leadership competencies and organizational factors for successful outcomes.

6.1 Limitations

Before delving into the study's broader implications, addressing the limitations that may have influenced the findings is essential. A critical evaluation of these constraints will provide a more apparent context for interpreting the results and highlight areas that require cautious interpretation or future research. First, the research relied on self-reported data from business leaders in German retail SMEs. This approach may introduce bias, as respondents might overestimate their digital leadership competencies or their organizations' digital transformation maturity. The subjective nature of self-assessment limits the objectivity of the findings. It suggests that future research could benefit from incorporating objective metrics or third-party evaluations to corroborate these self-reported measures.

Second, the study focused on six critical digital leadership competencies—tech-savviness, digital strategy, agility, networking, innovation, and empowerment. While these competencies are essential, they may not fully capture the breadth of leadership capabilities necessary for digital transformation. Other potentially relevant competencies, such as social intelligence, mentoring/coaching or ethics, were not included. This limited scope could mean that significant aspects of digital leadership were overlooked, potentially affecting the comprehensiveness of the findings.

Third, the use of structured surveys, though valuable for quantitative analysis, may have restricted the depth and accuracy of participant responses. The fixed-choice format may lead to response bias, as participants might provide socially desirable answers rather than entirely accurate representations of their experiences. Moreover, surveys might not capture the complexity of leadership practices in a dynamic business environment, and future research could integrate more flexible qualitative methods to provide richer insights.

Fourth, the study's focus on retail SMEs in Germany limits the generalizability of the findings to other sectors or geographical regions. Retail SMEs may face unique challenges and opportunities in their digital transformation journeys that do not reflect other industries. Therefore, the findings may not be fully transferable to other sectors or SMEs operating in different cultural or economic contexts. Comparative studies across industries or countries would provide a broader understanding of the role of digital leadership in digital transformation.

Fifth, the study's cross-sectional design captures the relationships between digital leadership competencies and digital transformation maturity at a single point in time. This temporal limitation prevents analyzing changes or developments in leadership competencies and digital maturity over time. Longitudinal studies would offer more dynamic insights into how leadership practices evolve and influence digital transformation outcomes over time.

Finally, the study's reliance on a quantitative approach, while valuable for identifying statistical relationships, needs more depth that could be gained from qualitative methods. Interviews or case studies provide richer context and a deeper understanding of how specific leadership behaviors influence digital transformation processes in practice. Future research should consider integrating qualitative approaches to offer more nuanced insights into the mechanisms behind these relationships. These limitations highlight the need for further research to validate and expand upon the findings of this study.

6.2 Theoretical Contributions

Despite the limitations, this study offers meaningful theoretical contributions. The study makes a significant theoretical contribution by empirically validating key digital leadership competencies—such as tech-savviness, digital strategy, empowerment, innovation, networking, and agility—and demonstrating how these competencies are critical drivers of digital transformation maturity. The strong correlations between these competencies and digital maturity reinforce and extend existing theories related to digital leadership and digital transformation, particularly within the insufficiently examined context of SMEs. By focusing on the retail SME sector, this research bridges a critical gap in the literature, which has primarily centered on larger organizations.

Identifying tech-savviness as the most significant driver of digital transformation maturity validates existing theoretical assertions regarding the centrality of technological competence in digital leadership. Similarly, the importance of digital strategy and empowerment further reinforces established theories. However, the study extends the theoretical framework of digital leadership by highlighting the differential impact of these competencies. For example, while tech-savviness and digital strategy were identified as the most critical drivers of digital maturity, agility—though important—was shown to have a less pronounced impact. This nuanced understanding challenges the assumption that all digital leadership competencies contribute equally to digital transformation, suggesting that specific competencies may be more critical depending on the organizational context.

By focusing specifically on the retail SME sector, the study refines leadership models that have been predominantly developed in the context of larger organizations. The findings highlight the unique challenges and competencies needed for digital leadership in SMEs, contributing to a deeper understanding of how leadership practices may need to be adapted for smaller, resource-constrained businesses. This research adds a new dimension to digital leadership theory by uncovering how

leadership competencies can be tailored to the specific challenges of retail SMEs, enhancing the theoretical understanding of digital maturity by directly linking it to these competencies. The study expands the digital maturity model by suggesting that leadership is essential in guiding organizations through digital transformation maturity, particularly in smaller environments like SMEs.

Additionally, the study's exploration of the moderating effects of company size, job position, and decision-making roles provides new insights into how these variables influence the effectiveness of digital leadership competencies. This contributes to the theoretical discourse by emphasizing the importance of organizational context in determining the impact of leadership competencies on digital transformation outcomes. The findings suggest that medium-sized enterprises and leaders in higher decision-making roles benefit more from strong leadership competencies, contributing to a more nuanced understanding of digital transformation in different organizational environments.

6.3 Practical Contributions

Building upon the theoretical contributions, this section will explore the practical implications of the study's findings. By examining the real-world relevance of the identified digital leadership competencies, this section provides actionable insights for SME leaders aiming to enhance their digital transformation efforts, linking theory to practice in meaningful ways. Tech-savviness, digital strategy, and empowerment are the most significant drivers, indicating that leadership development programs should emphasize these skills to facilitate effective digital transformation. By focusing on these specific competencies, SME owners and managers can gain a concrete roadmap to develop the necessary leadership capabilities for successfully navigating digital challenges.

Additionally, the study highlights the importance of networking and innovation competencies, stressing the need to foster a culture of collaboration and creativity within organizations. Building robust networks and encouraging innovative thinking will help retail SMEs address the challenges of digital transformation and enhance their digital maturity. The findings stress the necessity of developing and executing a robust digital strategy. SME leaders must adopt digital tools and craft a detailed, forward-looking digital roadmap that aligns with their organization's goals. This calls for SMEs to invest time and resources in strategic planning to ensure their digital transformation efforts are well-structured and sustainable. The study emphasizes the significance of empowerment and innovation for achieving digital maturity. Empowering employees and fostering a culture of innovation are practical steps SME leaders can take to keep their organizations adaptable and creative in a rapidly evolving digital landscape. This can be operationalized by decentralizing decision-making and encouraging experimentation within the organization. The research also reveals that company size affects the impact of leadership competencies on digital transformation. Medium-sized enterprises demonstrate higher digital maturity than smaller firms, suggesting that digital leadership strategies should be adjusted based on company size. Larger SMEs may have more resources to leverage digital leadership competencies fully, while smaller firms might need more targeted support to build these capabilities.

Finally, the study highlights the critical role of job positions and decision-making roles in driving digital transformation. Leaders in top-level management or key decision-making positions who exhibit high competency in tech-savviness and digital strategy are more likely to achieve greater digital maturity. This insight has practical implications for leadership training programs, which should focus on equipping top-level executives with the competencies required to lead successful digital transformations.

7 Conclusion

The main research question of this thesis sought to determine the relationship between digital leadership competencies and digital transformation maturity within German retail SMEs. The analysis demonstrated that empowerment and tech-savviness were the most influential competencies, highlighting their critical role in enabling successful digital transformation efforts. Additionally, digital strategy, networking, and innovation were found to play important, albeit somewhat secondary, roles in driving transformation. At the same time, agility showed the weakest association, suggesting that, though valuable, adaptability is less central than other competencies in this context.

Control variables also played an essential role in moderating these relationships. Company size consistently influenced the impact of competencies, with medium-sized enterprises showing higher digital maturity across most leadership skills compared to smaller organizations. This suggests that larger SMEs may have more resources or infrastructure to leverage digital leadership competencies effectively. Job position and decision-making roles also had significant effects, with top-level managers and primary decision-makers showing more excellent digital transformation outcomes when they exhibited high competency in tech-savviness, digital strategy, and empowerment. These insights stress the importance of leadership hierarchy and organizational structure in shaping the success of digital transformation initiatives.

However, the conclusions drawn must be tempered by certain empirical limitations. First, while the results indicate plausible associations between competencies like tech-savviness and empowerment with digital transformation maturity, the sample size limits the robustness of these findings. Though representative of German retail SMEs, the sample may not be sufficient to generalize to the broader SME sector. Statistical analysis revealed correlations, but these may not definitively establish causal relationships due to the absence of longitudinal data, which could demonstrate how digital leadership competencies influence transformation outcomes over time.

Moreover, the snowball sampling method may have introduced homogeneity within the sample, leading to potential biases. Respondents may share similar experiences, which affects data diversity and the empirical strength of the findings. As such, the conclusions should be considered plausible but not definitively proven by the data. Further research with a larger and more diverse sample, preferably incorporating longitudinal methods, is necessary to validate these insights.

Despite these challenges, the study provided valuable insights into how specific leadership skills can drive digital maturity in smaller organizations. The research has contributed new knowledge to the field by addressing a gap in the existing literature—namely, the impact of digital leadership competencies in SMEs, which are often overlooked in favor of larger organizations. This study has demonstrated that specific competencies, particularly empowerment and tech-savviness, are pivotal for transformation success in smaller businesses. By doing so, this research has provided a nuanced understanding of how leadership in SMEs must be tailored to address the unique challenges and opportunities of digital transformation, distinguishing it from leadership in larger corporations.

Future Research Directions

Building on this study's findings and limitations, several avenues for future research are proposed to strengthen the empirical robustness of the study. First, future research could explore the cross-cultural applicability of the identified digital leadership competencies. Comparative studies involving SMEs from different countries or regions would provide valuable insights into how cultural and economic factors influence the effectiveness of these competencies in driving digital transformation. This would help determine whether the competencies identified in this study are universally applicable or must be adapted to different contexts.

Second, longitudinal studies are recommended to examine the evolution of digital leadership competencies over time and their long-term impact on digital transformation maturity. Such studies

could provide a dynamic perspective on how leadership styles and competencies need to evolve in response to ongoing technological changes and market developments, offering a more detailed view of the leadership strategies that are most effective in sustaining digital transformation efforts.

Third, expanding the scope of research to include different industry sectors (such as manufacturing, healthcare, or education) beyond retail could offer a broader understanding of how digital leadership competencies vary across industries. For example, comparing the competencies required in high-tech industries with those in more traditional sectors could reveal industry-specific challenges and opportunities in digital transformation.

Another area for future research is exploring the relationship between digital leadership competencies and specific performance outcomes, such as financial performance, customer satisfaction, and innovation rates. Quantitative studies that link leadership competencies directly to measurable outcomes provide more concrete evidence of the value of these competencies to SMEs. Finally, integrating qualitative methods, such as in-depth interviews or case studies, could enrich the understanding of how digital leaders perceive and develop these competencies in real-world settings. Such an approach could uncover leaders' nuanced and context-specific strategies, offering practical insights that are not easily captured through quantitative surveys alone.

In conclusion, this thesis has contributed to understanding the relationship between digital leadership competencies and digital transformation maturity in SMEs. Critically examining these relationships makes it clear that specific leadership skills are essential to driving transformation in smaller businesses. While limitations existed in the scope and methodology, the study has laid a foundation for future research in this area and has provided practical insights for SME leaders. The research journey has underscored the complexity of digital transformation and the importance of effective leadership in navigating this complexity, setting the stage for further exploration and development in this critical field.

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10 Appendix A: Measurement Items

Table A1 Measurement Items of Independent Variables

Dimension	Items (English)	Items (German)	Source
Tech-savviness	1. I understand the drivers of digital transformation. 2. I recognize digital trends at an early stage. 3. I have the skills for data analysis so I can gain insights from both internal and external data sources. 4. I understand data analytics techniques. 5. I focus on data quality issues. 6. I adapt organizational data policies to align with the ongoing digital transformation.	1. Ich verstehe die Treiber der digitalen Transformation. 2. Ich erkenne digitale Trends frühzeitig. 3. Ich verfüge über die Fähigkeiten zur Datenanalyse, sodass ich Erkenntnisse sowohl aus internen als auch externen Quellen gewinnen kann. 4. Ich verstehe Datenanalysetechniken. 5. Ich konzentriere mich auf Fragen der Datenqualität. 6. Ich passe die Datenrichtlinien des Unternehmens an die laufende digitale Transformation an.	Weber, Krehl, et al. (2022) Munsamy et al. (2023) Berbel Vera et al. (2022)

Dimension	Items (English)	Items (German)	Source
Digital strategy	1. I evaluate customer-centeredness using a variety of data to gain insights. 2. I develop digital technologies that can enhance products, customer relationships, and competitive position. 3. I manage digital initiatives within the organization with a long-term and strategic focus. 4. I challenge existing business models to adapt to digital transformation. 5. I ensure alignment between digital technology and our business strategy. 6. I ensure the implementation of digital strategy across all business units. 7. I create a shared vision of the role of digital technology in business strategy. 8. I collaborate with my team to devise plans for integrating digital technology into our business strategy. 9. I articulate a clearly defined digital strategy for the organization. 10. I regularly evaluate and adapt our digital strategy as needed.	1. Ich bewerte die Kundenzentrierung anhand einer Vielzahl von Daten, um Erkenntnisse zu gewinnen. 2. Ich entwickle digitale Technologien, die Produkte, Kundenbeziehungen und Wettbewerbsposition verbessern können. 3. Ich steuere digitale Initiativen innerhalb des Unternehmens mit einem langfristigen und strategischen Fokus. 4. Ich hinterfrage bestehende Geschäftsmodelle hinsichtlich deren Anpassungsfähigkeit an die digitale Transformation. 5. Ich garantiere die Harmonisierung zwischen digitaler Technologie und unserer Geschäftsstrategie. 6. Ich sorge für die Umsetzung der digitalen Strategie in allen Geschäftsbereichen. 7. Ich kreiere eine gemeinsame Vision von der Rolle der digitalen Technologie in der Geschäftsstrategie. 8. Ich arbeite mit meinem Team zusammen, um Pläne für die Integration digitaler Technologie in unsere Geschäftsstrategie zu entwickeln. 9. Ich formuliere eine klar definierte digitale Strategie für die Organisation. 10. Ich evaluiere regelmäßig unsere digitale Strategie und passe sie bei Bedarf an.	AlNuaimi et al. (2022) Niemand et al. (2021) Berbel Vera et al. (2022)

Dimension	Items (English)	Items (German)	Source
Agility	1. I am able to respond rapidly to customers' needs. 2. I am able to adapt our production/service provision rapidly to demand fluctuations. 3. I effectively handle challenges from suppliers and partners. 4. I rapidly implement decisions to face market changes. 5. I actively seek opportunities to innovate and redesign our organization. 6. I see market changes as opportunities for rapid capitalization and growth.	1. Ich bin in der Lage, schnell auf die Bedürfnisse der Kunden zu reagieren. 2. Ich bin in der Lage, unsere Produktion/Dienstleistung schnell an Nachfrageschwankungen anzupassen. 3. Herausforderungen von Lieferanten und Partnern bewältige ich effektiv. 4. Um mich Marktveränderungen zu stellen, setze Ich Entscheidungen schnell um. 5. Ich suche aktiv nach Möglichkeiten zur Innovation und Neugestaltung unserer Organisation. 6. Ich sehe Marktveränderungen als Chancen für schnelle Kapitalisierung und Wachstum.	Troise et al. (2022)

Dimension	Items (English)	Items (German)	Source
Innovation	1. I actively implement innovative ideas in the organization. 2. I get organizational members enthusiastic about innovations in the organization. 3. I use creative problem-solving methods to encourage innovation in the organization. 4. I foster an environment that encourages open communication about errors within the team. 5. I give the freedom and flexibility to experiment intensely with a variety of digital technologies. 6. I balance the focus between operational reliability and experimentation with new capabilities. 7. I facilitate ongoing experimentation with minimal viable products of digital innovations.	1. Ich setze aktiv innovative Ideen im Unternehmen um. 2. Ich begeistere Mitarbeiter für Innovationen im Unternehmen. 3. Ich nutze kreative Problemlösungsmethoden, um Innovationen im Unternehmen zu fördern. 4. Ich fördere ein Umfeld, das eine offene Kommunikation über Fehler im Team fördert. 5. Ich gebe die Freiheit und Flexibilität, intensiv mit einer Vielzahl digitaler Technologien zu experimentieren. 6. Ich lege den Schwerpunkt zwischen Betriebszuverlässigkeit und dem Experimentieren mit neuen Fähigkeiten. 7. Ich ermögliche das kontinuierliche Experimentieren mit minimal realisierbaren Produkten digitaler Innovationen.	Weber, Krehl, et al. (2022) Berbel Vera et al. (2022)

Dimension	Items (English)	Items (German)	Source
Networking	1. I actively build and maintain a wide network of contacts among peers and outsiders. 2. I regularly attend social and professional events to meet people with useful information. 3. I join social networks that include outsiders with useful information. 4. I develop cooperative relations with people who can provide resources and assistance. 5. I keep informed about changes in the political environment and behaviors of competitors and collaborators. 6. I enable working in interdisciplinary teams.	1. Ich baue aktiv ein breites Netzwerk an Kontakten zwischen Kollegen und Außenstehenden auf und pflege es. 2. Ich nehme regelmäßig an gesellschaftlichen und beruflichen Veranstaltungen teil, um Menschen mit nützlichen Informationen kennenzulernen. 3. Ich trete sozialen Netzwerken bei, die Außenstehende mit nützlichen Informationen einbeziehen. 4. Ich baue kooperative Beziehungen zu Menschen auf, die Ressourcen und Unterstützung bereitstellen können. 5. Ich halte mich über Veränderungen im politischen Umfeld und über das Verhalten von Konkurrenten auf dem Laufenden. 6. Ich ermögliche die Arbeit in interdisziplinären Teams.	Weber, Krehl, et al. (2022) Mharapara et al. (2019)

Dimension	Items (English)	Items (German)	Source
Empowerment	1. I actively encourage team members to share ideas and suggestions. 2. I consider my teams' suggestions to make decisions that affect the organization. 3. I give all team members a chance to voice their opinions. 4. I empower team members by giving them authority over relevant issues. 5. I distribute responsibility to my team members. 6. I inspire all members with the digital transformation plans for our organization. 7. I motivate team members to work together for the same digital transformation goals. 8. I delegate power to team members as appropriate.	1. Ich ermutige die Teammitglieder aktiv, Ihre Ideen und Vorschläge zu teilen. 2. Ich berücksichtige die Vorschläge meines Teams, um Entscheidungen zu treffen, die sich auf das Unternehmen auswirken. 3. Ich gebe allen Teammitgliedern die Möglichkeit, ihre Meinung zu äußern. 4. Ich bestärke die Teammitglieder, indem ich ihnen Autorität über relevante Themen gebe. 5. Ich verteile die Verantwortung an die Teammitglieder. 6. Ich inspiriere alle Mitglieder mit den digitalen Transformationsplänen für unsere Organisation. 7. Ich motiviere Teammitglieder, gemeinsam für die gleichen Ziele der digitalen Transformation zu arbeiten. 8. Ich delegiere je nach Bedarf Befugnisse an Teammitglieder.	Arnold et al. (2000) Amundsen and Martinsen (2014) Hassan et al. (2018)

Note. The items have been adapted from established literature on digital leadership, translated into German, and used in the survey.

Table A2 Measurement Items of Dependent Variable

Dimension	Items (English)	Items (German)
Data access & collaboration tools	1. Within our firm we have an increase use of real-time customer and operations data. 2. Within our firm we have an increase use of integrated end-user data. 3. Within our firm we have communication, feedback, and collaboration tools that make it easy to be productive. 4. Within our firm we can access flexible computing power and storage (e.g., through cloud services and external assets).	1. In unserem Unternehmen nutzen wir zunehmend Echtzeit-Kunden- und Betriebsdaten. 2. In unserem Unternehmen nutzen wir zunehmend integrierte Endbenutzerdaten. 3. In unserem Unternehmen verfügen wir über Kommunikations-, Feedback- und Kollaborationstools, die es einfach machen, produktiv zu sein. 4. Innerhalb unseres Unternehmens können wir flexibel auf Rechenleistung und Speicher zugreifen (z. B. über Cloud-Dienste und externe Ressourcen).
Digital-first mindset	1. Within our firm we take advantage of digital solutions wherever possible. 2. Within our firm people naturally think of digital technologies when we consider ways to improve. 3. Within our firm we prioritise digital solutions. 4. Within our firm we openly explore digital opportunities.	1. Innerhalb unseres Unternehmens nutzen wir, wo immer möglich, digitale Lösungen. 2. In unserem Unternehmen denken die Menschen natürlich an digitale Technologien, wenn sie über Verbesserungsmöglichkeiten nachdenken. 3. Innerhalb unseres Unternehmens legen wir Wert auf digitale Lösungen. 4. Innerhalb unseres Unternehmens erkunden wir offen digitale Möglichkeiten.

Dimension	Items (English)	Items (German)
Digitized practices & operations	1. Within our firm our core operational processes are automated and digitised. 2. Within our firm we monitor our operations in real time. 3. Within our firm we employ data-driven decision-making. 4. Within our firm we standardise processes that require human input.	1. In unserem Unternehmen sind unsere Kernbetriebsprozesse automatisiert und digitalisiert. 2. Innerhalb unseres Unternehmens überwachen wir unsere Abläufe in Echtzeit. 3. In unserem Unternehmen setzen wir auf datengestützte Entscheidungsfindung. 4. Innerhalb unseres Unternehmens standardisieren wir Prozesse, die menschlichen Input erfordern.
Empowered talent	1. Within our firm we have experience with new technologies like mobile devices and applications, social media tools and data, big data and advanced analytics, artificial intelligence, machine learning, and internet of things. 2. Within our firm digital skills are widely distributed across. 3. Within our firm we have the skills necessary to conduct digital initiatives.	1. Innerhalb unseres Unternehmens verfügen wir über Erfahrung mit neuen Technologien wie mobilen Geräten und Anwendungen, Social-Media-Tools und -Daten, Big Data und Advanced Analytics, künstlicher Intelligenz, maschinellem Lernen und dem Internet of Things. 2. Innerhalb unseres Unternehmens sind digitale Kompetenzen weit verbreitet. 3. Innerhalb unseres Unternehmens verfügen wir über die notwendigen Fähigkeiten, um digitale Initiativen durchzuführen.

Note. The items have been adopted from Weritz et al. (2024), translated into German, and used in the survey.

11 Appendix B: Statistical Results (SPSS Outputs)

Table B1 Descriptive Statistics of Control Variables

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
NumberEmployees	37	1	3	2.19	.660	-.219	.388
Gender	37	1	2	1.65	.484	-.649	.388
Age	37	2	6	4.00	1.080	.140	.388
JobPosition	37	1	4	1.92	1.064	.754	.388
DecisionMaking	37	1	3	1.54	.558	.341	.388
Valid N (listwise)	37						

Table B2 Frequencies of Gender

	N	%
Male	13	35.1%
Female	24	64.9%

Table B3 Frequencies of Age

	N	%
18 - 24	2	5.4%
25 - 34	12	32.4%
35 - 44	10	27.0%
45 - 54	10	27.0%
55 - 64	3	8.1%

Table B4 Frequencies of Company Size

	N	%
1-9 Employees (Micro)	5	13.5%
10-49 Employees (Small)	20	54.1%
50-249 Employees (Medium)	12	32.4%

Table B5 Frequencies of Job Position

	N	%
Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	18	48.6%
Mid-level Management (e.g., Director, Manager)	8	21.6%
First-line Management (e.g., Assistant Manager, Supervisor)	7	18.9%
Team Leader	4	10.8%

Table B6 Frequencies of Decision-Making Role

	N	%
Yes, I am the primary decision-maker.	18	48.6%
Yes, I am part of the decision-making team.	18	48.6%
No, I am not directly involved in the decision-making process.	1	2.7%

Table B7 Descriptive Statistics of Independent and Dependent Variables

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
IV_Innovation	37	1.71	5.00	3.3050	.77457	-.315	.388
IV_Networking	37	3.17	5.00	4.2387	.45903	-.446	.388
IV_TechSavviness	37	1.33	4.67	3.1261	.84291	-.374	.388
IV_Empowerment	37	3.13	4.88	4.1014	.44667	-.450	.388
IV_DigitalStrategy	37	1.00	4.90	3.4595	.88458	-1.007	.388
IV_Agility	37	3.17	5.00	4.0045	.44702	.490	.388
DV_DigitalTransformation	37	1.27	4.73	3.2360	.91794	-.276	.388
Valid N (listwise)	37						

Assumption Testing for Correlation Analysis Between Independent and Dependent Variables

Assumption 1 stipulates that all variables must be measured at the interval or ratio level, meaning they are continuous (Pallant, 2010). This assumption was met, as all the variables under analysis—*innovation*, *agility*, *digital strategy*, *empowerment*, *tech-savviness*, *networking*, and *digital transformation*—are continuous.

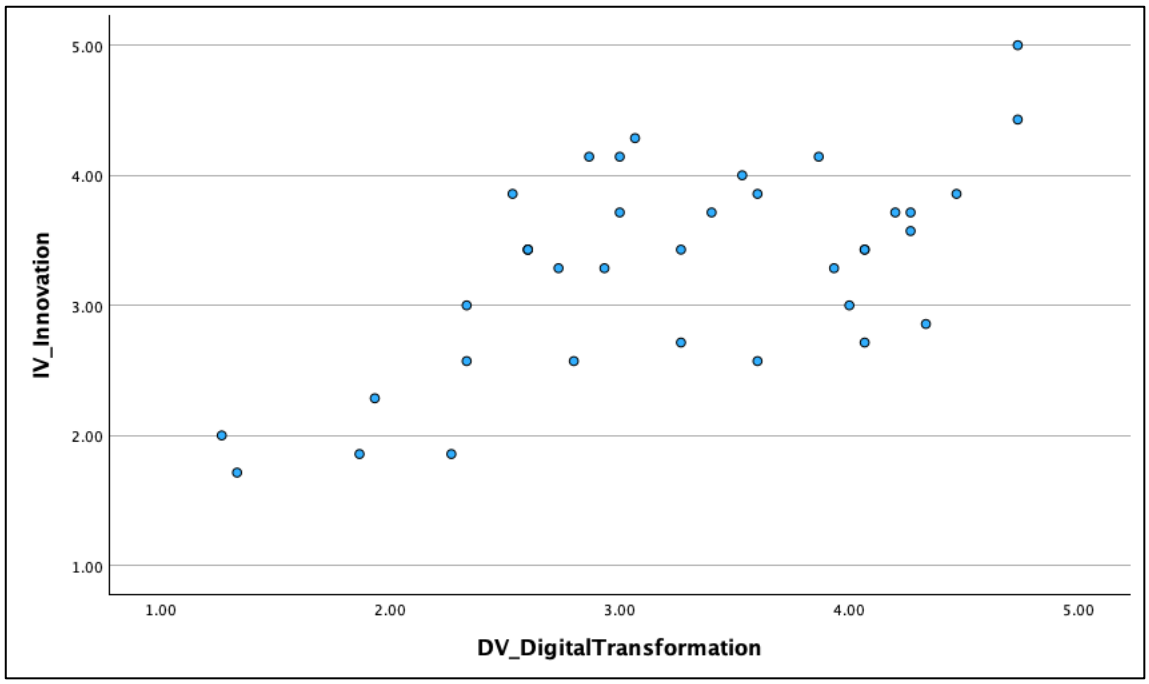
Assumption 2 requires that the relationship between the variables be linear (Pallant, 2010). Scatterplots were used to visually assess this condition for each pair of variables (see Figures B1-B6). The inspection confirmed a positive linear relationship between the independent variables and Digital Transformation. While the strength of the linearity varied—*tech-savviness* and *digital strategy* showed more robust linearity than others—the overall pattern was supported using Pearson's correlation for most variables.

Assumption 3 addresses the need for an absence of significant outliers, as these can heavily skew the results of Pearson's correlation (Pallant, 2010). Boxplots were generated to evaluate the presence of outliers across all variables (see Figures B7-B12). The analysis found no significant outliers for *innovation*, *agility*, *empowerment*, *tech-savviness*, and *networking*, fulfilling this assumption for these variables. However, two potential outliers were identified for *digital strategy*, indicating a slight deviation from this assumption. Despite this, the dataset as a whole supported the assumption that outliers would not significantly impact the analysis.

Assumption 4 requires that the variables be approximately normally distributed (Pallant, 2010). This was tested using the Shapiro-Wilk test (see Table B8). Most variables, including *innovation*, *tech-savviness*, *empowerment*, and *digital transformation*, did not significantly deviate from normality ($p > 0.05$), supporting parametric methods for these variables. In contrast, the *digital strategy* demonstrated significant deviation from normality ($p = 0.025$), with a noticeable left-skewed distribution. This deviation suggests that non-parametric methods or data transformation may be necessary. Slight deviations from normality were also observed for *networking* and *agility*, highlighting the need for cautious interpretation, especially given the small sample size.

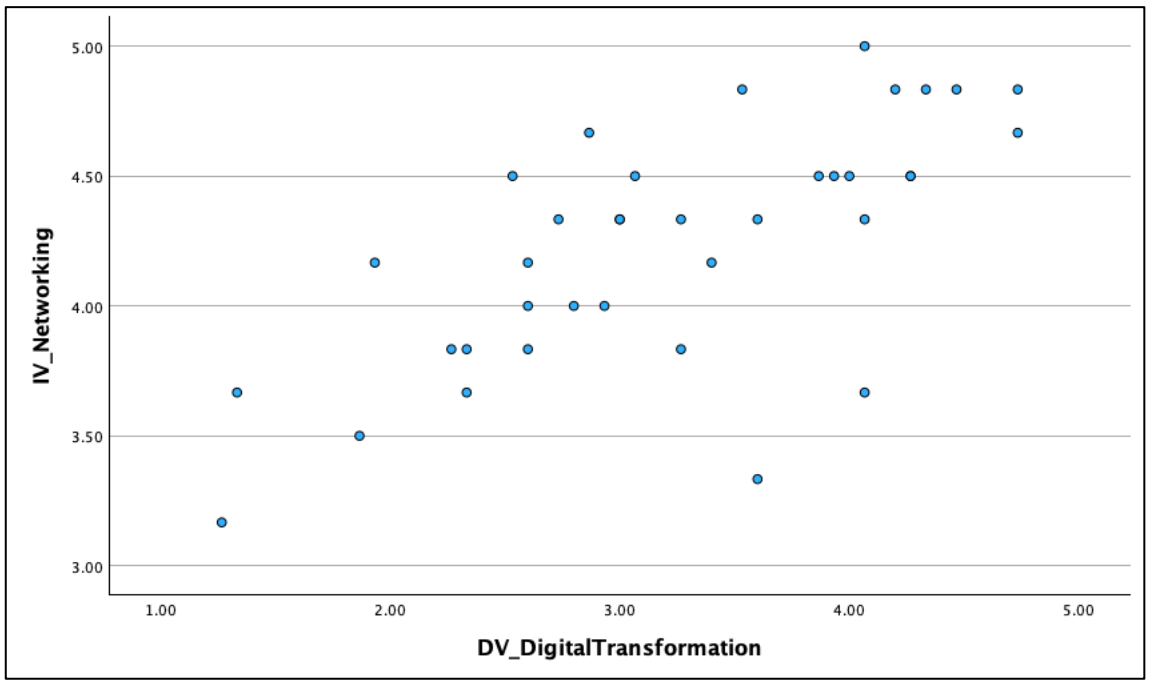
Given that most assumptions were satisfied, Pearson's correlation was applied to all variables except *digital strategy*. Due to concerns regarding normality and the presence of outliers in *digital strategy*, Spearman's correlation was employed for that variable.

Figure B1 Scatterplot of Digital Transformation vs Innovation



Note. This figure illustrates the relationship between Digital Transformation (DV_DigitalTransformation) and Innovation (IV_Innovation). Each point represents a data observation, with the horizontal axis displaying digital transformation levels and the vertical axis representing innovation levels.

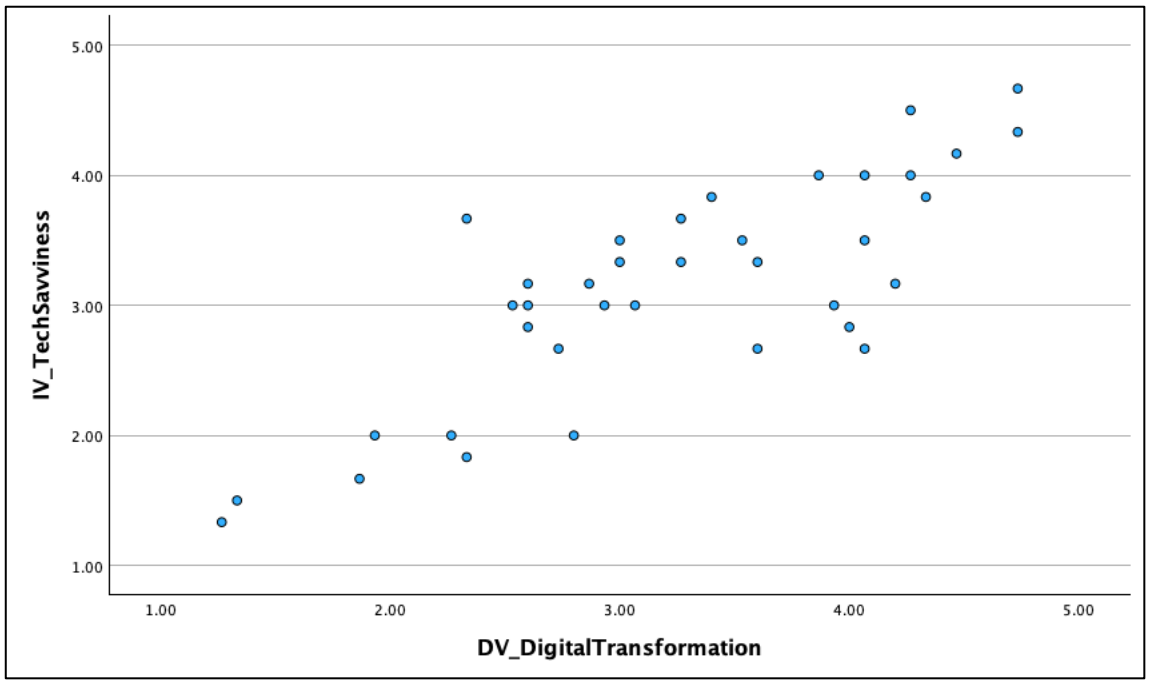
Figure B2 Scatterplot of Digital Transformation vs Networking



Note. This figure illustrates the relationship between Digital Transformation (DV_DigitalTransformation) and Networking (IV_Networking). Each point represents a data

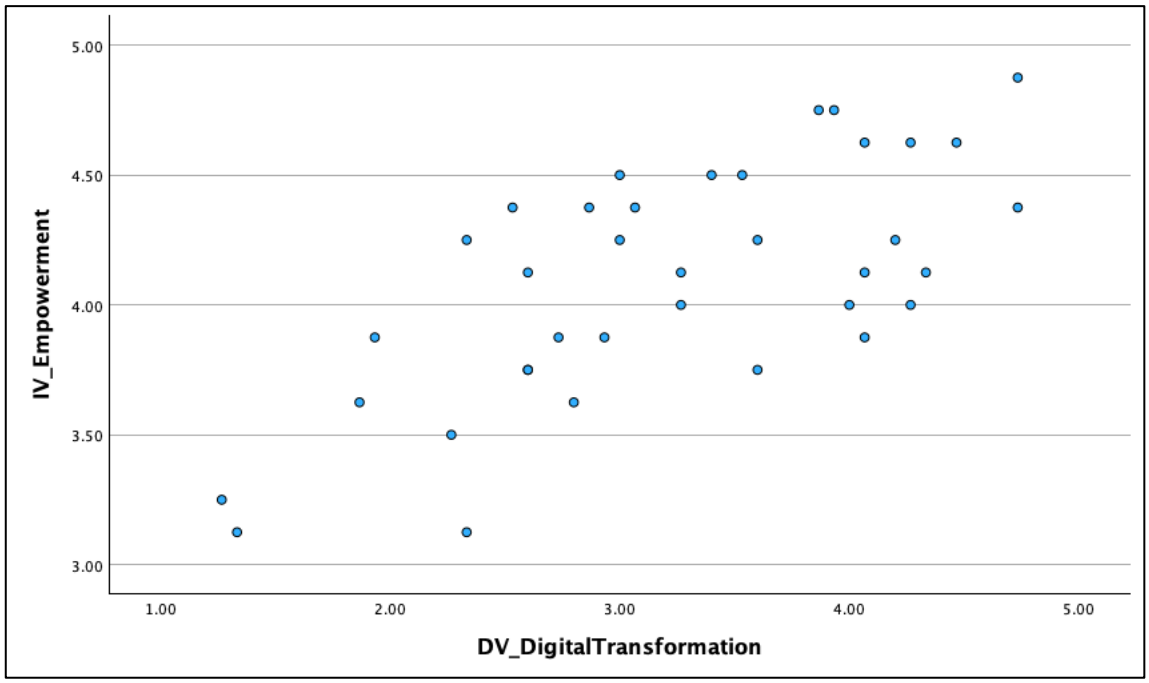
observation, with the horizontal axis displaying digital transformation levels and the vertical axis representing innovation levels.

Figure B3 Scatterplot of Digital Transformation vs Tech-savviness



Note. This figure illustrates the relationship between Digital Transformation (DV_DigitalTransformation) and Tech-savviness (IV_Techsavviness). Each point represents a data observation, with the horizontal axis displaying digital transformation levels and the vertical axis representing innovation levels.

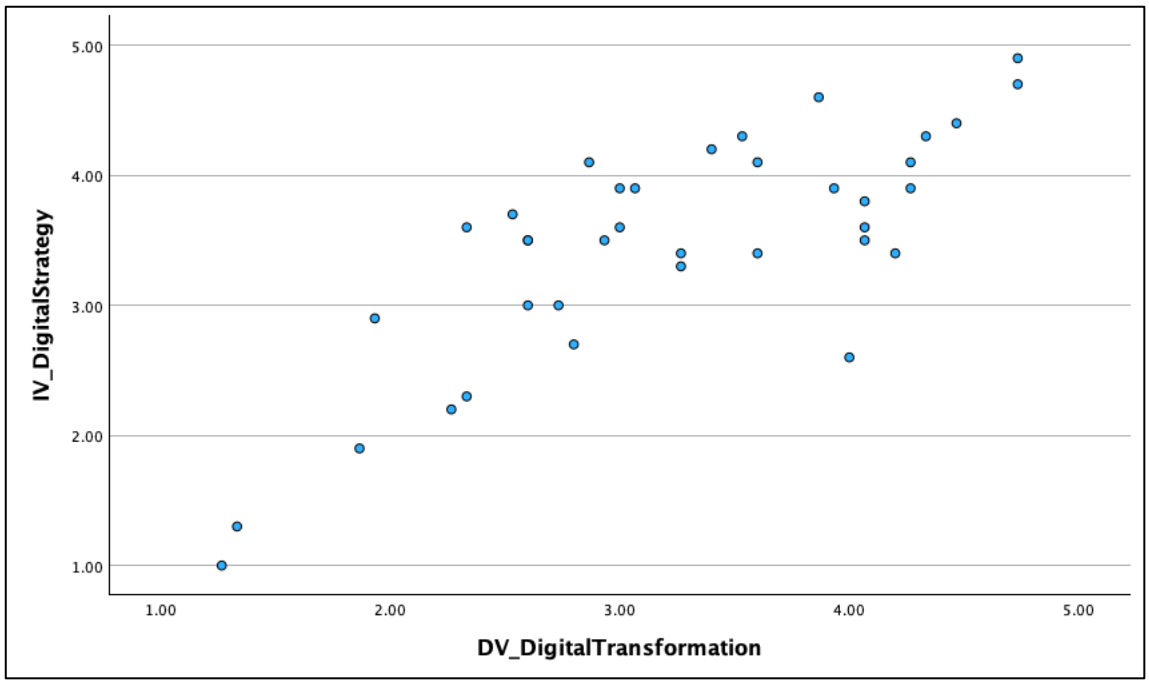
Figure B4 Scatterplot of Digital Transformation vs Empowerment



Note. This figure illustrates the relationship between Digital Transformation (DV_DigitalTransformation) and Empowerment (IV_Empowerment). Each point represents a data

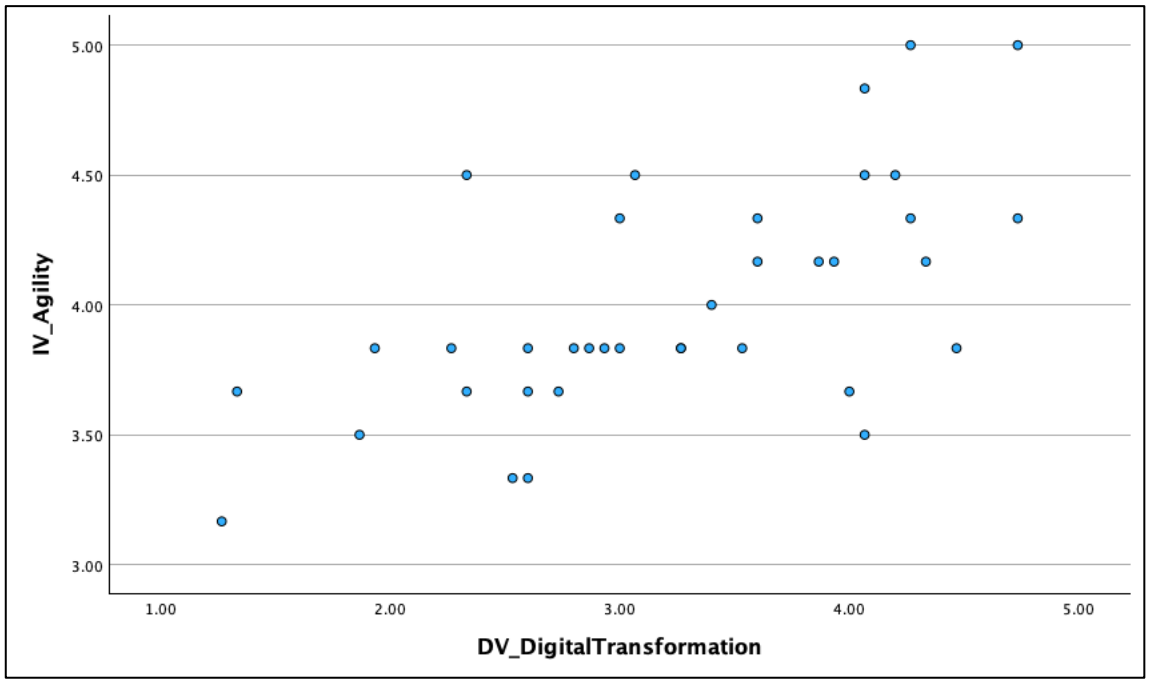
observation, with the horizontal axis displaying digital transformation levels and the vertical axis representing innovation levels.

Figure B5 Scatterplot of Digital Transformation vs Digital strategy



Note. This figure illustrates the relationship between Digital Transformation (DV_DigitalTransformation) and Digital strategy (IV_DigitalStrategy). Each point represents a data observation, with the horizontal axis displaying digital transformation levels and the vertical axis representing innovation levels.

Figure B6 Scatterplot of Digital Transformation vs Agility



Note. This figure illustrates the relationship between Digital Transformation (DV_DigitalTransformation) and Agility (IV_Agility). Each point represents a data observation, with

the horizontal axis displaying digital transformation levels and the vertical axis representing innovation levels.

Figure B7 Boxplot of Innovation

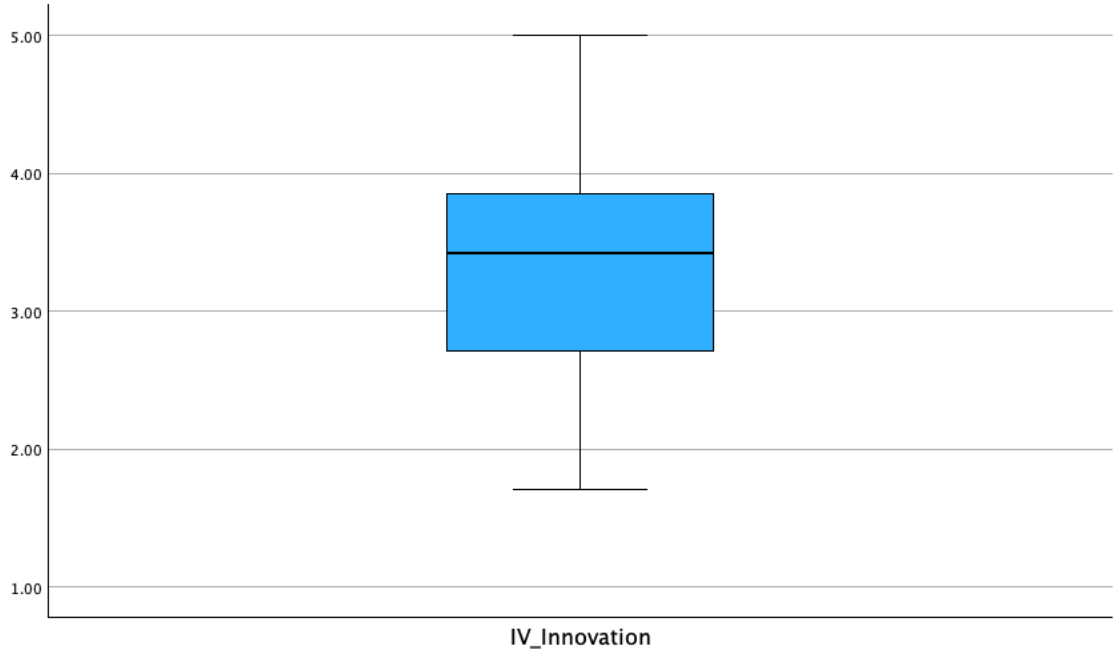


Figure B8 Boxplot of Networking

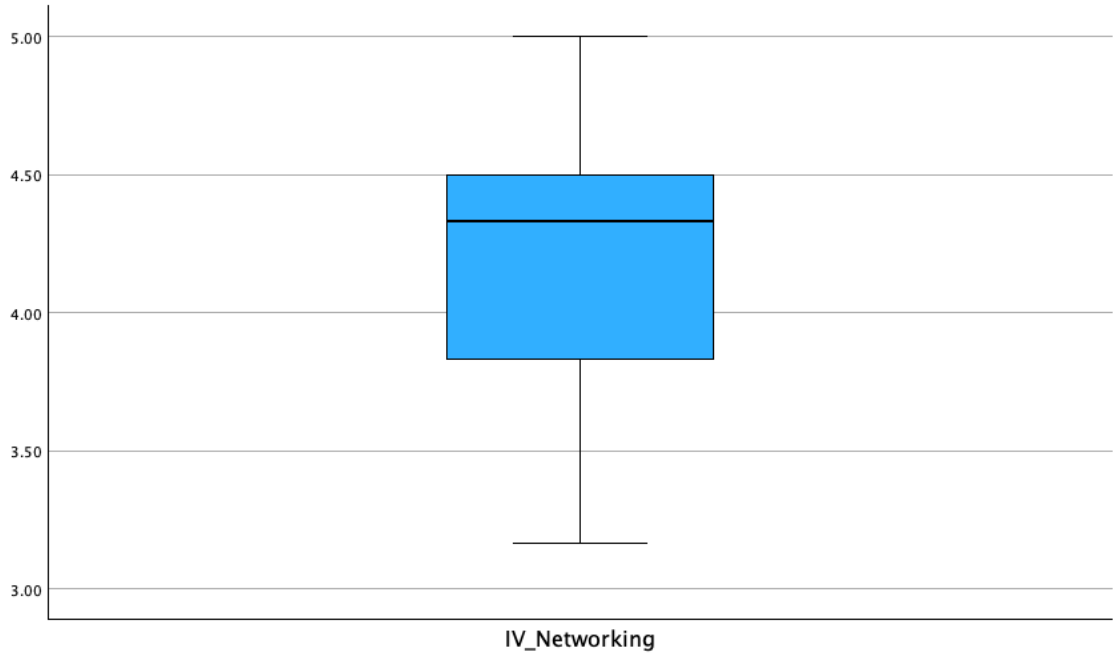


Figure B9 Boxplot of Tech-savviness

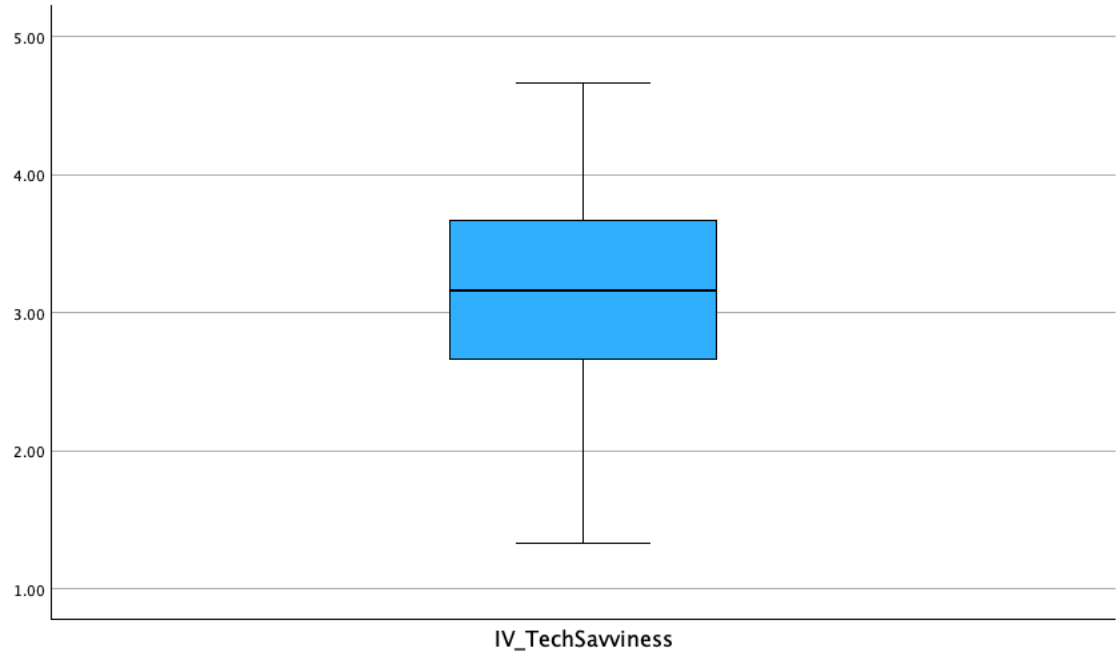


Figure B10 Boxplot of Empowerment

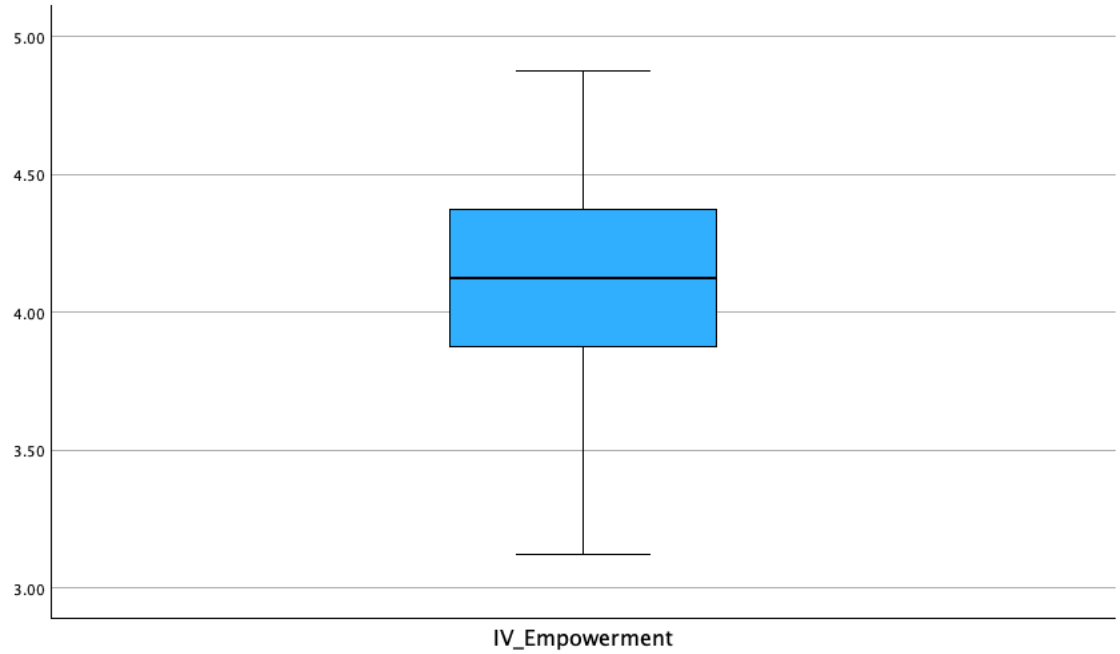


Figure B11 Boxplot of Digital Strategy

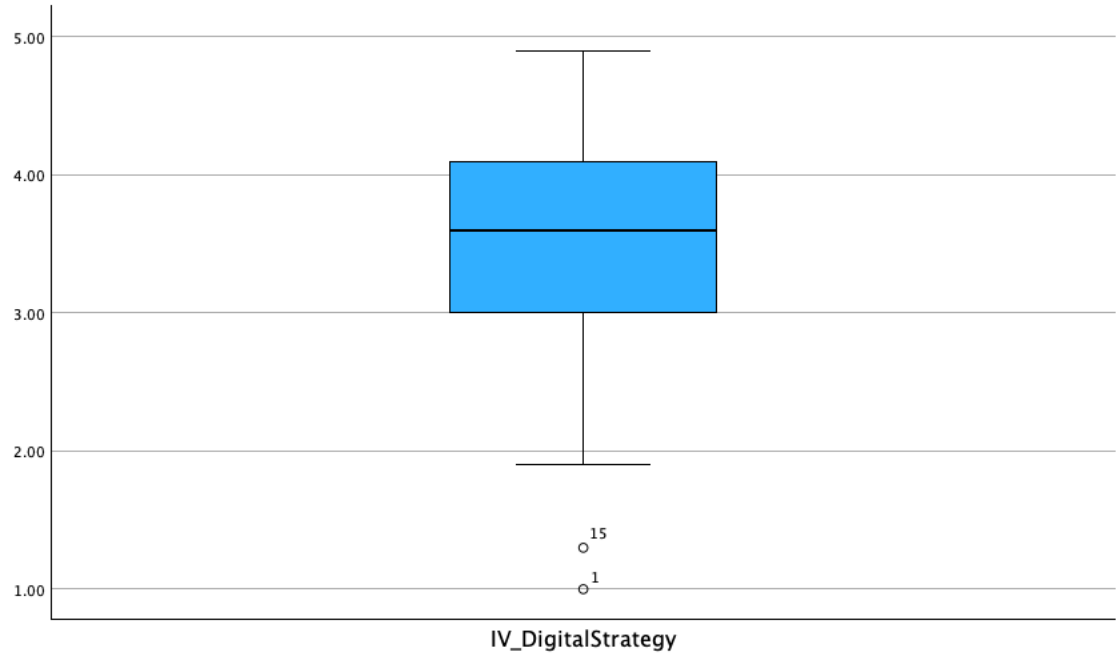


Figure B12 Boxplot of Agility

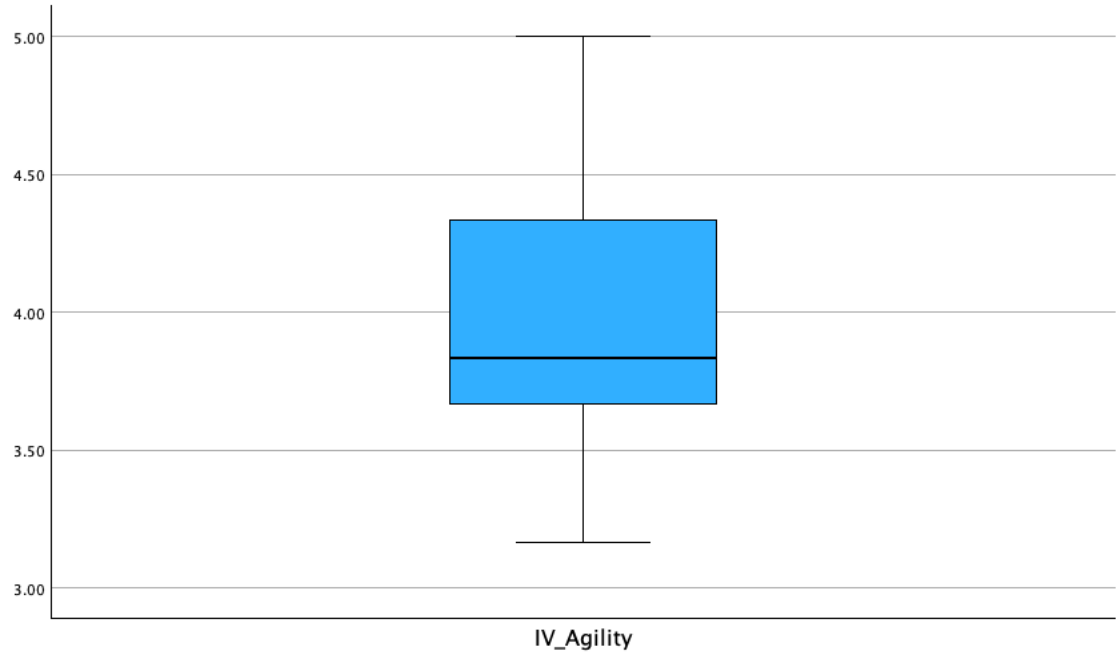


Table B8 Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
IV_Innovation	.139	37	.070	.969	37	.385
IV_Networking	.149	37	.037	.958	37	.175
IV_TechSavviness	.116	37	.200*	.967	37	.338
IV_Empowerment	.090	37	.200*	.967	37	.340
IV_DigitalStrategy	.176	37	.005	.931	37	.025
IV_Agility	.217	37	<.001	.948	37	.085
DV_DigitalTransformation	.105	37	.200*	.968	37	.345

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table B9 Pearson Correlations

		IV_Innovation	IV_Networking	IV_TechSavviness	IV_Empowerment	IV_Agility	DV_DigitalTransformation
IV_Innovation	Pearson Correlation	1	.673**	.784**	.773**	.435**	.620**
	Sig. (2-tailed)		<.001	<.001	<.001	.007	<.001
	N	37	37	37	37	37	37
IV_Networking	Pearson Correlation	.673**	1	.678**	.652**	.498**	.686**
	Sig. (2-tailed)	<.001		<.001	<.001	.002	<.001
	N	37	37	37	37	37	37
IV_TechSavviness	Pearson Correlation	.784**	.678**	1	.800**	.596**	.804**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001	<.001

		IV_Innovation	IV_Networking	IV_TechSaviness	IV_Empowerment	IV_Agility	DV_DigitalTransformation
	N	37	37	37	37	37	37
IV_Empowerment	Pearson Correlation	.773**	.652**	.800**	1	.351*	.687**
	Sig. (2-tailed)	<.001	<.001	<.001		.033	<.001
	N	37	37	37	37	37	37
IV_Agility	Pearson Correlation	.435**	.498**	.596**	.351*	1	.625**
	Sig. (2-tailed)	.007	.002	<.001	.033		<.001
	N	37	37	37	37	37	37
DV_DigitalTransformation	Pearson Correlation	.620**	.686**	.804**	.687**	.625**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001	
	N	37	37	37	37	37	37

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table B10 Spearman´s Rho Correlations

			IV_DigitalStrategy	DV_DigitalTransformation
Spearman's rho	IV_DigitalStrategy	Correlation Coefficient	1.000	.694**
		Sig. (2-tailed)	.	<.001
		N	37	37
	DV_DigitalTransformation	Correlation Coefficient	.694**	1.000
		Sig. (2-tailed)	<.001	.
		N	37	37

**. Correlation is significant at the 0.01 level (2-tailed).

Table B11 Cross-Tabulation of Networking Competency Level by Digital Transformation Maturity

		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
NetworkingLevel	Medium Competency	4	57.1%	1	5.9%	1	7.7%	6	16.2%
	High Competency	3	42.9%	16	94.1%	12	92.3%	31	83.8%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B12 Chi-Square Tests for Networking Competency Level and Digital Transformation Maturity

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.661[a]	2	.005
Likelihood Ratio	8.582	2	.014
Linear-by-Linear Association	5.941	1	.015
N of Valid Cases	37		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 1.14.

Table B13 Symmetric Measures for Networking Competency Level and Digital Transformation Maturity

		Value	Approximate Significance
Nominal by Nominal	Phi	.537	.005
	Cramer's V	.537	.005
N of Valid Cases		37	

Table B14 Cross-Tabulation of Innovation Competency Level by Digital Transformation Maturity

		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
InnovationLevel	Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
	Medium Competency	2	28.6%	9	52.9%	7	53.8%	18	48.6%
	High Competency	0	0.0%	8	47.1%	6	46.2%	14	37.8%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B15 Chi-Square Tests for Innovation Competency Level and Digital Transformation Maturity

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	25.413[a]	4	<.001
Likelihood Ratio	23.338	4	<.001
Linear-by-Linear Association	10.244	1	.001
N of Valid Cases	37		

a. 6 cells (66.7%) have expected count less than 5. The minimum expected count is .95.

Table B16 Symmetric Measures for Innovation Competency Level and Digital Transformation Maturity

		Value	Approximate Significance
Nominal by Nominal	Phi	.829	<.001
	Cramer's V	.586	<.001
N of Valid Cases		37	

Table B17 Cross-Tabulation of Tech-savviness Competency Level by Digital Transformation Maturity

		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
TechSavvinessLevel	Low Competency	6	85.7%	1	5.9%	0	0.0%	7	18.9%
	Medium Competency	1	14.3%	15	88.2%	5	38.5%	21	56.8%
	High Competency	0	0.0%	1	5.9%	8	61.5%	9	24.3%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B18 Chi-Square Tests for Tech-savviness Competency Level and Digital Transformation Maturity

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	37.935[a]	4	<.001
Likelihood Ratio	34.393	4	<.001
Linear-by-Linear Association	22.267	1	<.001
N of Valid Cases	37		

a. 7 cells (77.8%) have expected count less than 5. The minimum expected count is 1.32.

Table B19 Symmetric Measures for Tech-savviness Competency Level and Digital Transformation Maturity

		Value	Approximate Significance
Nominal by Nominal	Phi	1.013	<.001
	Cramer's V	.716	<.001
N of Valid Cases		37	

Table B20 Cross-Tabulation of Empowerment Competency Level by Digital Transformation Maturity

		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
EmpowermentLevel	Medium Competency	5	71.4%	1	5.9%	0	0.0%	6	16.2%
	High Competency	2	28.6%	16	94.1%	13	100.0%	31	83.8%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B21 Chi-Square Tests for Empowerment Competency Level and Digital Transformation Maturity

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	19.558[a]	2	<.001
Likelihood Ratio	16.817	2	<.001
Linear-by-Linear Association	13.428	1	<.001
N of Valid Cases	37		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 1.14.

Table B22 Symmetric Measures for Empowerment Competency Level and Digital Transformation Maturity

		Value	Approximate Significance
Nominal by Nominal	Phi	.727	<.001
	Cramer's V	.727	<.001
N of Valid Cases		37	

Table B23 Cross-Tabulation of Digital Strategy Competency Level by Digital Transformation Maturity

		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
DigitalStrategyLevel	Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
	Medium Competency	2	28.6%	10	58.8%	4	30.8%	16	43.2%
	High Competency	0	0.0%	7	41.2%	9	69.2%	16	43.2%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B24 Chi-Square Tests for Digital Strategy Competency Level and Digital Transformation Maturity

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	28.273[a]	4	<.001
Likelihood Ratio	26.209	4	<.001
Linear-by-Linear Association	15.926	1	<.001
N of Valid Cases	37		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .95.

Table B25 Symmetric Measures for Digital Strategy Competency Level and Digital Transformation Maturity

		Value	Approximate Significance
Nominal by Nominal	Phi	.874	<.001
	Cramer's V	.618	<.001
N of Valid Cases		37	

Table B26 Cross-Tabulation of Agility Competency Level by Digital Transformation Maturity

		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
AgilityLevel	Medium Competency	4	57.1%	4	23.5%	2	15.4%	10	27.0%
	High Competency	3	42.9%	13	76.5%	11	84.6%	27	73.0%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B27 Chi-Square Tests for Agility Competency Level and Digital Transformation Maturity

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.218[a]	2	.121
Likelihood Ratio	3.908	2	.142
Linear-by-Linear Association	3.401	1	.065
N of Valid Cases	37		

a. 3 cells (50.0%) have expected count less than 5. The minimum expected count is 1.89.

Table B28 Symmetric Measures for Agility Competency Level and Digital Transformation Maturity

		Value	Approximate Significance
Nominal by Nominal	Phi	.338	.121
	Cramer's V	.338	.121
N of Valid Cases		37	

Assumption Testing for Correlation Analysis Between Control and Dependent Variables

Several assumptions must be met to conduct a valid one-way ANOVA, and based on the analysis, most of these assumptions are satisfied (Pallant, 2010). First, the dependent variable, *digital transformation maturity*, is measured continuously, meeting the requirement (Assumption 1) to be at the interval or ratio level. Second, the independent variables—*company size*, *job position*, *decision-making role*, *gender*, and *age*—are all categorical with distinct and independent groups, fulfilling the second

assumption (Assumption 2). The third assumption of independence of observations is met, as the study's design ensures that data consists of independent responses from participants.

Assumption 4, which addresses the presence of significant outliers, was evaluated using boxplots (Pallant, 2010). Mild outliers were observed in the *company size* and *job position* categories, but these were not extreme and were unlikely to affect the ANOVA results substantially (see Figures B13 and B16). The *decision-making role*, *age*, and *gender* groups exhibited minimal or no outliers, with data mainly falling within the expected ranges (see Figures B14, B15, and B17). It was decided to retain the outliers to maintain data integrity and capture the full spectrum of cases—including typical and extreme scenarios—ensuring the results reflect real-world variability, such as differences in *digital transformation maturity* across SMEs and larger organizations.

Assumption 5, which focuses on normality, was tested using the Shapiro-Wilk test (Pallant, 2010). Results indicated that the data across all groups generally met the normality assumption, as the p-values were more significant than 0.05 for each group (see Tables B29-B33). This suggests that the dependent variable, *digital transformation maturity*, is approximately normally distributed across groups, supporting the use of one-way ANOVA for this analysis.

Assumption 6 requires homogeneity of variances, which is assessed using Levene's test (Pallant, 2010). For the *decision-making role*, *job position*, *age*, and *gender* groups, the p-values were non-significant ($p > 0.05$), indicating similar variances across these groups (see Tables B35-B38). However, for the *company size* variable, Levene's test based on the mean indicated a violation of this assumption ($p = 0.027$) (see Table B34). Despite this, alternative tests based on the median and other adjustments yielded non-significant results, suggesting that the variance differences may be minor. Therefore, the assumption of homogeneity of variances is upheld for most groups, but company size was analyzed using a non-parametric test to account for the violation.

In summary, one-way ANOVA was used to analyze the variable *decision-making role, job position*, *age*, and *gender*. At the same time, the *company size* variable required the Kruskal-Wallis test due to the violation of homogeneity of variances (Pallant, 2010).

Table B29 Tests of Normality for Digital Transformation by Company Size (Number of Employees)

	NumberEmployees	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
DV_DigitalTransformation	1-9 Employees (Micro)	.235	5	.200*	.832	5	.145
	10-49 Employees (Small)	.128	20	.200*	.942	20	.260
	50-249 Employees (Medium)	.115	12	.200*	.980	12	.985

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table B30 Tests of Normality for Digital Transformation by Gender

	Gender	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
DV_DigitalTransformation	Male	.161	13	.200*	.923	13	.280
	Female	.120	24	.200*	.968	24	.630

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table B31 Tests of Normality for Digital Transformation by Age

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Age	Statistic	df	Sig.	Statistic	df	Sig.
DV_DigitalTransformation	18 - 24	.260	2	.			
	25 - 34	.167	12	.200*	.928	12	.360
	35 - 44	.166	10	.200*	.942	10	.573
	45 - 54	.115	10	.200*	.977	10	.945
	55 - 64	.347	3	.	.835	3	.202

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table B32 Tests of Normality for Digital Transformation by Job Position

	JobPosition	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
DV_DigitalTransformation	Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	.145	18	.200*	.966	18	.717
	Mid-level Management (e.g., Director, Manager)	.228	8	.200*	.906	8	.323

	First-line Management (e.g., Assistant Manager, Supervisor)	.236	7	.200*	.854	7	.135
	Team Leader	.290	4	.	.823	4	.150

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table B33 Tests of Normality for Digital Transformation by Decision-Making Role[c]

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	DecisionMaking	Statistic	df	Sig.	Statistic	df	Sig.
DV_DigitalTransformation	Yes, I am the primary decision-maker.	.143	18	.200*	.965	18	.697
	Yes, I am part of the decision-making team.	.186	18	.101	.920	18	.132

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction
c. DV_DigitalTransformation is constant when DecisionMaking = No, I am not directly involved in the decision-making process… It has been omitted.

Figure B13 Boxplot of Digital Transformation by Company Size Groups (Number of Employees)

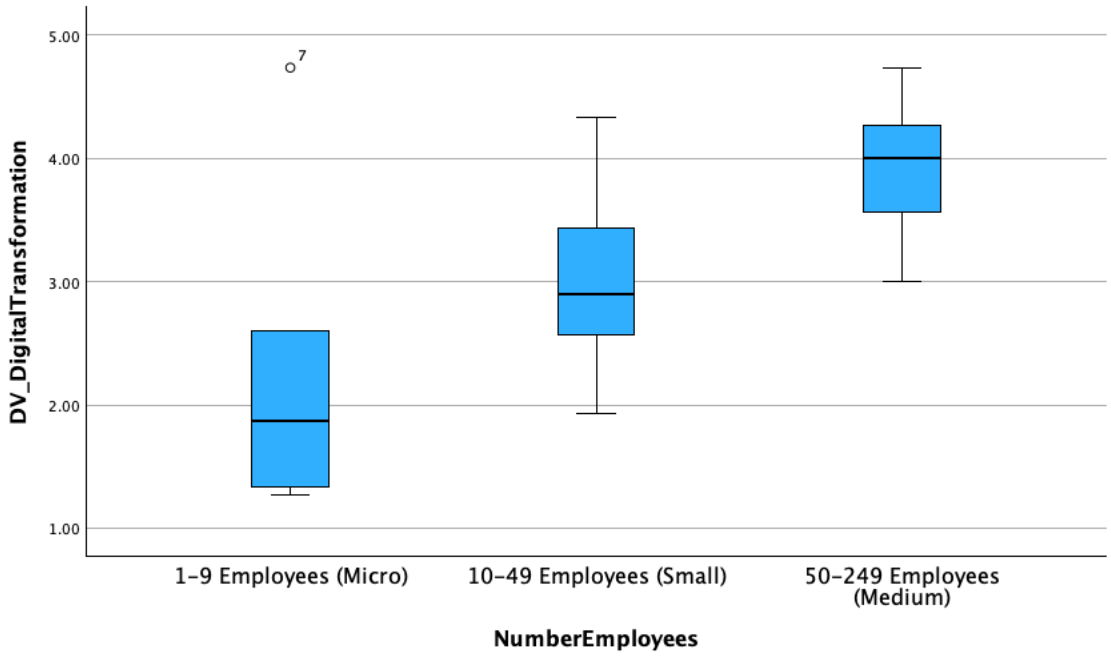


Figure B14 Boxplot of Digital Transformation by Gender Groups

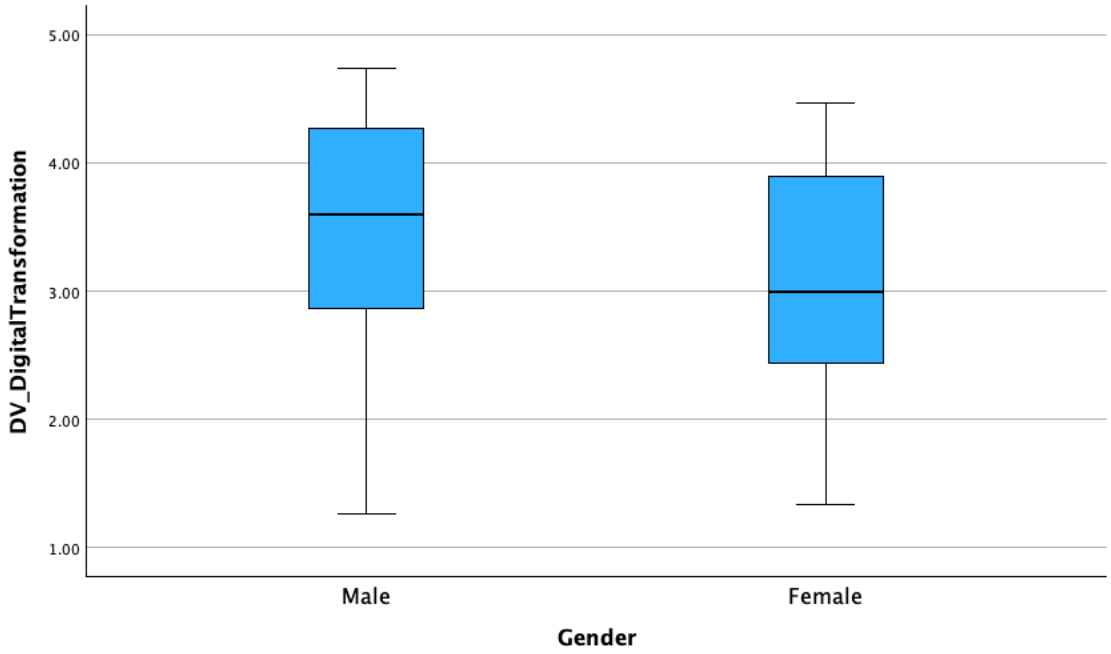


Figure B15 Boxplot of Digital Transformation by Age Groups

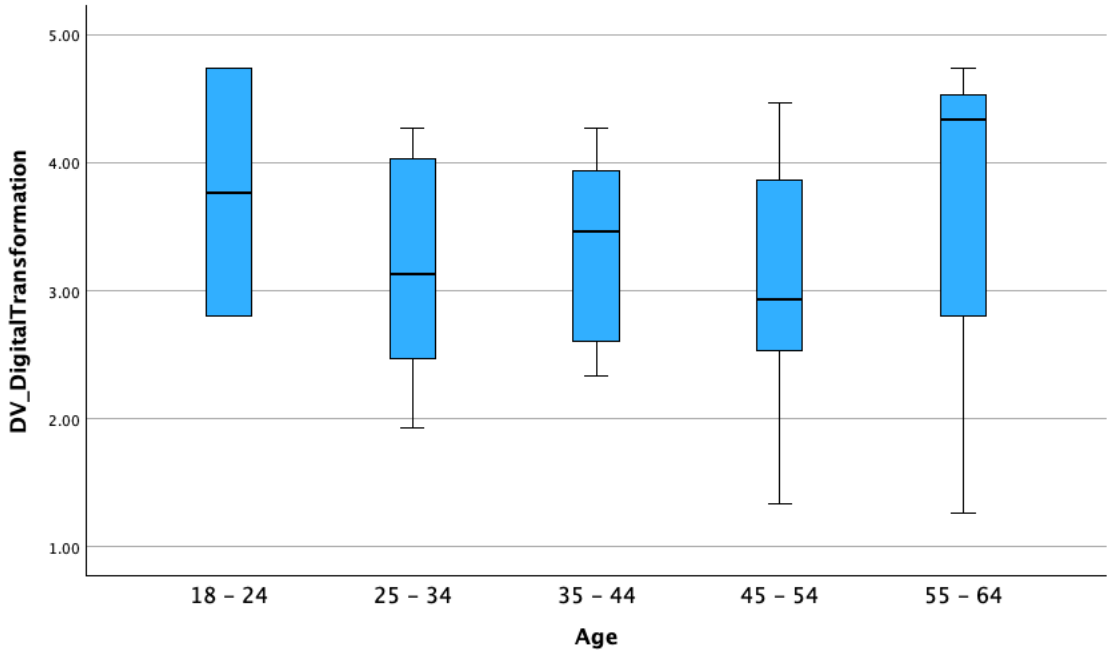


Figure B16 Boxplot of Digital Transformation by Job Position Groups

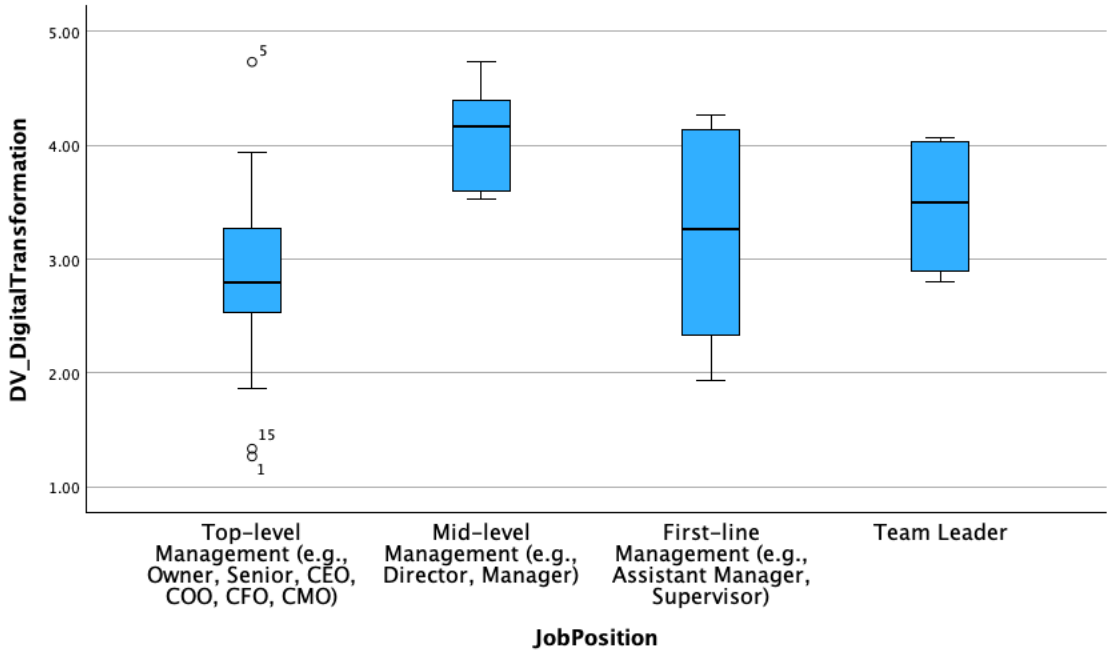


Figure B17 Boxplot of Digital Transformation by Decision-Making Role Groups

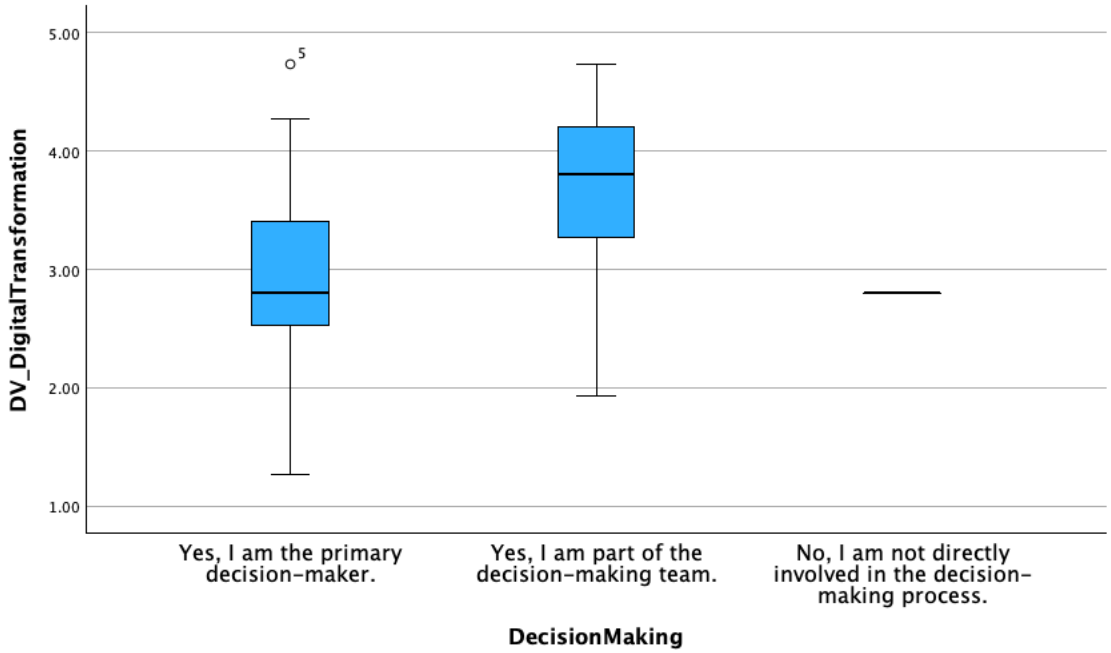


Table B34 Tests of Homogeneity of Variances for Digital Transformation by Company Size (Number of Employees)

		Levene Statistic	df1	df2	Sig.
DV_DigitalTransformation	Based on Mean	4.041	2	34	.027
	Based on Median	2.015	2	34	.149
	Based on Median and with adjusted df	2.015	2	12.796	.173
	Based on trimmed mean	3.735	2	34	.034

Table B35 Tests of Homogeneity of Variances of Digital Transformation by Gender

		Levene Statistic	df1	df2	Sig.
DV_DigitalTransformation	Based on Mean	.450	1	35	.507
	Based on Median	.439	1	35	.512
	Based on Median and with adjusted df	.439	1	33.589	.512
	Based on trimmed mean	.391	1	35	.536

Table B36 Tests of Homogeneity of Variances of Digital Transformation by Age

		Levene Statistic	df1	df2	Sig.
DV_DigitalTransformation	Based on Mean	2.441	4	32	.067
	Based on Median	.703	4	32	.596
	Based on Median and with adjusted df	.703	4	7.988	.612
	Based on trimmed mean	2.314	4	32	.079

Table B37 Tests of Homogeneity of Variances for Digital Transformation by Job Position

		Levene Statistic	df1	df2	Sig.
DV_DigitalTransformation	Based on Mean	1.415	3	33	.256
	Based on Median	1.319	3	33	.285
	Based on Median and with adjusted df	1.319	3	24.080	.291
	Based on trimmed mean	1.401	3	33	.260

Table B38 Tests of Homogeneity of Variances for Digital Transformation by Decision-Making Role

		Levene Statistic	df1	df2	Sig.
DV_DigitalTransformation	Based on Mean	.090	1	34	.766
	Based on Median	.078	1	34	.782
	Based on Median and with adjusted df	.078	1	32.753	.782
	Based on trimmed mean	.084	1	34	.773

Table B39 Kruskal-Wallis H Testa,b for Digital Transformation by Company Size (Number of Employees)

	DV_DigitalTransformation
Kruskal-Wallis H	12.112
df	2
Asymp. Sig.	.002

a. Kruskal Wallis Test
b. Grouping Variable: NumberEmployees

Table B40 ANOVA Test for Digital Transformation by Gender

DV_DigitalTransformation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.833	1	1.833	2.251	.142
Within Groups	28.501	35	.814		
Total	30.334	36			

Table B41 ANOVA Test for Digital Transformation by Age

DV_DigitalTransformation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.370	4	.342	.378	.822
Within Groups	28.964	32	.905		
Total	30.334	36			

Table B42 ANOVA Test for Digital Transformation by Job Position

DV_DigitalTransformation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8.880	3	2.960	4.553	.009
Within Groups	21.454	33	.650		
Total	30.334	36			

Table B43 ANOVA Test for Digital Transformation by Decision-Making Role

DV_DigitalTransformation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.035	2	2.518	3.384	.046
Within Groups	25.299	34	.744		
Total	30.334	36			

Table B44 Cross-Tabulation of Networking Competency Level by Digital Transformation Maturity across Company Size Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
NumberEmployees			N	%	N	%	N	%	N	%
1-9 Employees (Micro)	NetworkingLevel	Medium Competency	3	100.0%	0	0.0%	0	0.0%	3	60.0%
		High Competency	0	0.0%	1	100.0%	1	100.0%	2	40.0%
	Total		3	100.0%	1	100.0%	1	100.0%	5	100.0%
10-49 Employees (Small)	NetworkingLevel	Medium Competency	1	25.0%	1	8.3%	1	25.0%	3	15.0%
		High Competency	3	75.0%	11	91.7%	3	75.0%	17	85.0%
	Total		4	100.0%	12	100.0%	4	100.0%	20	100.0%
50-249 Employees (Medium)	NetworkingLevel	High Competency			4	100.0%	8	100.0%	12	100.0%
	Total				4	100.0%	8	100.0%	12	100.0%
Total	NetworkingLevel	Medium Competency	4	57.1%	1	5.9%	1	7.7%	6	16.2%
		High Competency	3	42.9%	16	94.1%	12	92.3%	31	83.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B45 Cross-Tabulation of Innovation Competency Level by Digital Transformation Maturity across Company Size Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
NumberEmployees			N	%	N	%	N	%	N	%
1-9 Employees (Micro)	InnovationLevel	Low Competency	3	100.0%	0	0.0%	0	0.0%	3	60.0%
		Medium Competency	0	0.0%	1	100.0%	0	0.0%	1	20.0%
		High Competency	0	0.0%	0	0.0%	1	100.0%	1	20.0%
	Total		3	100.0%	1	100.0%	1	100.0%	5	100.0%
10-49 Employees (Small)	InnovationLevel	Low Competency	2	50.0%	0	0.0%	0	0.0%	2	10.0%
		Medium Competency	2	50.0%	8	66.7%	4	100.0%	14	70.0%
		High Competency	0	0.0%	4	33.3%	0	0.0%	4	20.0%
	Total		4	100.0%	12	100.0%	4	100.0%	20	100.0%
50-249 Employees (Medium)	InnovationLevel	Medium Competency			0	0.0%	3	37.5%	3	25.0%
		High Competency			4	100.0%	5	62.5%	9	75.0%
	Total				4	100.0%	8	100.0%	12	100.0%
Total	InnovationLevel	Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
		Medium Competency	2	28.6%	9	52.9%	7	53.8%	18	48.6%
		High Competency	0	0.0%	8	47.1%	6	46.2%	14	37.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B46 Cross-Tabulation of Tech-savviness Competency Level by Digital Transformation Maturity across Company Size Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
NumberEmployees			N	%	N	%	N	%	N	%
1-9 Employees (Micro)	TechSavvinessLevel	Low Competency	3	100.0%	0	0.0%	0	0.0%	3	60.0%
		Medium Competency	0	0.0%	1	100.0%	0	0.0%	1	20.0%
		High Competency	0	0.0%	0	0.0%	1	100.0%	1	20.0%
	Total		3	100.0%	1	100.0%	1	100.0%	5	100.0%
10-49 Employees (Small)	TechSavvinessLevel	Low Competency	3	75.0%	1	8.3%	0	0.0%	4	20.0%
		Medium Competency	1	25.0%	11	91.7%	3	75.0%	15	75.0%
		High Competency	0	0.0%	0	0.0%	1	25.0%	1	5.0%
	Total		4	100.0%	12	100.0%	4	100.0%	20	100.0%
50-249 Employees (Medium)	TechSavvinessLevel	Medium Competency			3	75.0%	2	25.0%	5	41.7%
		High Competency			1	25.0%	6	75.0%	7	58.3%
	Total				4	100.0%	8	100.0%	12	100.0%
Total	TechSavvinessLevel	Low Competency	6	85.7%	1	5.9%	0	0.0%	7	18.9%
		Medium Competency	1	14.3%	15	88.2%	5	38.5%	21	56.8%
		High Competency	0	0.0%	1	5.9%	8	61.5%	9	24.3%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B47 Cross-Tabulation of Empowerment Competency Level by Digital Transformation Maturity across Company Size Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
NumberEmployees			N	%	N	%	N	%	N	%
1-9 Employees (Micro)	EmpowermentLevel	Medium Competency	3	100.0%	0	0.0%	0	0.0%	3	60.0%
		High Competency	0	0.0%	1	100.0%	1	100.0%	2	40.0%
	Total		3	100.0%	1	100.0%	1	100.0%	5	100.0%
10-49 Employees (Small)	EmpowermentLevel	Medium Competency	2	50.0%	1	8.3%	0	0.0%	3	15.0%
		High Competency	2	50.0%	11	91.7%	4	100.0%	17	85.0%
	Total		4	100.0%	12	100.0%	4	100.0%	20	100.0%
50-249 Employees (Medium)	EmpowermentLevel	High Competency			4	100.0%	8	100.0%	12	100.0%
	Total				4	100.0%	8	100.0%	12	100.0%
Total	EmpowermentLevel	Medium Competency	5	71.4%	1	5.9%	0	0.0%	6	16.2%
		High Competency	2	28.6%	16	94.1%	13	100.0%	31	83.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B48 Cross-Tabulation of Digital Strategy Competency Level by Digital Transformation Maturity across Company Size Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
NumberEmployees			N	%	N	%	N	%	N	%
1-9 Employees (Micro)	DigitalStrategyLevel	Low Competency	3	100.0%	0	0.0%	0	0.0%	3	60.0%
		Medium Competency	0	0.0%	1	100.0%	0	0.0%	1	20.0%
		High Competency	0	0.0%	0	0.0%	1	100.0%	1	20.0%
	Total		3	100.0%	1	100.0%	1	100.0%	5	100.0%
10-49 Employees (Small)	DigitalStrategyLevel	Low Competency	2	50.0%	0	0.0%	0	0.0%	2	10.0%
		Medium Competency	2	50.0%	9	75.0%	3	75.0%	14	70.0%
		High Competency	0	0.0%	3	25.0%	1	25.0%	4	20.0%
	Total		4	100.0%	12	100.0%	4	100.0%	20	100.0%
50-249 Employees (Medium)	DigitalStrategyLevel	Medium Competency			0	0.0%	1	12.5%	1	8.3%
		High Competency			4	100.0%	7	87.5%	11	91.7%
	Total				4	100.0%	8	100.0%	12	100.0%
Total	DigitalStrategyLevel	Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
		Medium Competency	2	28.6%	10	58.8%	4	30.8%	16	43.2%
		High Competency	0	0.0%	7	41.2%	9	69.2%	16	43.2%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B49 Cross-Tabulation of Agility Competency Level by Digital Transformation Maturity across Company Size Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
NumberEmployees			N	%	N	%	N	%	N	%
1-9 Employees (Micro)	AgilityLevel	Medium Competency	3	100.0%	1	100.0%	0	0.0%	4	80.0%
		High Competency	0	0.0%	0	0.0%	1	100.0%	1	20.0%
	Total		3	100.0%	1	100.0%	1	100.0%	5	100.0%
10-49 Employees (Small)	AgilityLevel	Medium Competency	1	25.0%	3	25.0%	2	50.0%	6	30.0%
		High Competency	3	75.0%	9	75.0%	2	50.0%	14	70.0%
	Total		4	100.0%	12	100.0%	4	100.0%	20	100.0%
50-249 Employees (Medium)	AgilityLevel	High Competency			4	100.0%	8	100.0%	12	100.0%
	Total				4	100.0%	8	100.0%	12	100.0%
Total	AgilityLevel	Medium Competency	4	57.1%	4	23.5%	2	15.4%	10	27.0%
		High Competency	3	42.9%	13	76.5%	11	84.6%	27	73.0%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B50 Cross-Tabulation of Networking Competency Level by Digital Transformation Maturity across Job Position Groups

JobPosition			DigitalTransformationMaturity: Low Maturity N	Low Maturity %	Medium Maturity N	Medium Maturity %	High Maturity N	High Maturity %	Total N	Total %
Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	NetworkingLevel	Medium Competency	3	75.0%	0	0.0%	0	0.0%	3	16.7%
		High Competency	1	25.0%	11	100.0%	3	100.0%	15	83.3%
	Total		4	100.0%	11	100.0%	3	100.0%	18	100.0%
Mid-level Management (e.g., Director, Manager)	NetworkingLevel	Medium Competency			1	33.3%	0	0.0%	1	12.5%
		High Competency			2	66.7%	5	100.0%	7	87.5%
	Total				3	100.0%	5	100.0%	8	100.0%
First-line Management (e.g., Assistant Manager, Supervisor)	NetworkingLevel	Medium Competency	1	33.3%	0	0.0%	1	33.3%	2	28.6%
		High Competency	2	66.7%	1	100.0%	2	66.7%	5	71.4%
	Total		3	100.0%	1	100.0%	3	100.0%	7	100.0%
Team Leader	NetworkingLevel	High Competency			2	100.0%	2	100.0%	4	100.0%
	Total				2	100.0%	2	100.0%	4	100.0%
Total	NetworkingLevel	Medium Competency	4	57.1%	1	5.9%	1	7.7%	6	16.2%
		High Competency	3	42.9%	16	94.1%	12	92.3%	31	83.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B51 Cross-Tabulation of Innovation Competency Level by Digital Transformation Maturity across Job Position Groups

JobPosition			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
			N	%	N	%	N	%	N	%
Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	InnovationLevel	Low Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
		Medium Competency	0	0.0%	6	54.5%	1	33.3%	7	38.9%
		High Competency	0	0.0%	5	45.5%	2	66.7%	7	38.9%
	Total		4	100.0%	11	100.0%	3	100.0%	18	100.0%
Mid-level Management (e.g., Director, Manager)	InnovationLevel	Medium Competency			1	33.3%	3	60.0%	4	50.0%
		High Competency			2	66.7%	2	40.0%	4	50.0%
	Total				3	100.0%	5	100.0%	8	100.0%
First-line Management (e.g., Assistant Manager, Supervisor)	InnovationLevel	Low Competency	1	33.3%	0	0.0%	0	0.0%	1	14.3%
		Medium Competency	2	66.7%	1	100.0%	1	33.3%	4	57.1%
		High Competency	0	0.0%	0	0.0%	2	66.7%	2	28.6%
	Total		3	100.0%	1	100.0%	3	100.0%	7	100.0%
Team Leader	InnovationLevel	Medium Competency			1	50.0%	2	100.0%	3	75.0%
		High Competency			1	50.0%	0	0.0%	1	25.0%
	Total				2	100.0%	2	100.0%	4	100.0%
Total	InnovationLevel	Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
		Medium Competency	2	28.6%	9	52.9%	7	53.8%	18	48.6%

	High Competency	0	0.0%	8	47.1%	6	46.2%	14	37.8%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B52 Cross-Tabulation of Tech-savviness Competency Level by Digital Transformation Maturity across Job Position Groups

JobPosition			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
			N	%	N	%	N	%	N	%
Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	TechSavvinessLevel	Low Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
		Medium Competency	0	0.0%	10	90.9%	1	33.3%	11	61.1%
		High Competency	0	0.0%	1	9.1%	2	66.7%	3	16.7%
	Total		4	100.0%	11	100.0%	3	100.0%	18	100.0%
Mid-level Management (e.g., Director, Manager)	TechSavvinessLevel	Medium Competency			3	100.0%	0	0.0%	3	37.5%
		High Competency			0	0.0%	5	100.0%	5	62.5%
	Total				3	100.0%	5	100.0%	8	100.0%
First-line Management (e.g., Assistant Manager, Supervisor)	TechSavvinessLevel	Low Competency	2	66.7%	0	0.0%	0	0.0%	2	28.6%
		Medium Competency	1	33.3%	1	100.0%	2	66.7%	4	57.1%
		High Competency	0	0.0%	0	0.0%	1	33.3%	1	14.3%
	Total		3	100.0%	1	100.0%	3	100.0%	7	100.0%
Team Leader	TechSavvinessLevel	Low Competency			1	50.0%	0	0.0%	1	25.0%
		Medium Competency			1	50.0%	2	100.0%	3	75.0%
	Total				2	100.0%	2	100.0%	4	100.0%
Total	TechSavvinessLevel	Low Competency	6	85.7%	1	5.9%	0	0.0%	7	18.9%
		Medium Competency	1	14.3%	15	88.2%	5	38.5%	21	56.8%

	High Competency	0	0.0%	1	5.9%	8	61.5%	9	24.3%
Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B53 Cross-Tabulation of Empowerment Competency Level by Digital Transformation Maturity across Job Position Groups

JobPosition			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
			N	%	N	%	N	%	N	%
Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	EmpowermentLevel	Medium Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
		High Competency	0	0.0%	11	100.0%	3	100.0%	14	77.8%
	Total		4	100.0%	11	100.0%	3	100.0%	18	100.0%
Mid-level Management (e.g., Director, Manager)	EmpowermentLevel	High Competency			3	100.0%	5	100.0%	8	100.0%
	Total				3	100.0%	5	100.0%	8	100.0%
First-line Management (e.g., Assistant Manager, Supervisor)	EmpowermentLevel	Medium Competency	1	33.3%	0	0.0%	0	0.0%	1	14.3%
		High Competency	2	66.7%	1	100.0%	3	100.0%	6	85.7%
	Total		3	100.0%	1	100.0%	3	100.0%	7	100.0%
Team Leader	EmpowermentLevel	Medium Competency			1	50.0%	0	0.0%	1	25.0%
		High Competency			1	50.0%	2	100.0%	3	75.0%
	Total				2	100.0%	2	100.0%	4	100.0%
Total	EmpowermentLevel	Medium Competency	5	71.4%	1	5.9%	0	0.0%	6	16.2%
		High Competency	2	28.6%	16	94.1%	13	100.0%	31	83.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B54 Cross-Tabulation of Digital Strategy Competency Level by Digital Transformation Maturity across Job Position Groups

JobPosition			DigitalTransformationMaturity: Low Maturity N	Low Maturity %	Medium Maturity N	Medium Maturity %	High Maturity N	High Maturity %	Total N	Total %
Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	DigitalStrategyLevel	Low Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
		Medium Competency	0	0.0%	6	54.5%	0	0.0%	6	33.3%
		High Competency	0	0.0%	5	45.5%	3	100.0%	8	44.4%
	Total		4	100.0%	11	100.0%	3	100.0%	18	100.0%
Mid-level Management (e.g., Director, Manager)	DigitalStrategyLevel	Medium Competency			1	33.3%	0	0.0%	1	12.5%
		High Competency			2	66.7%	5	100.0%	7	87.5%
	Total				3	100.0%	5	100.0%	8	100.0%
First-line Management (e.g., Assistant Manager, Supervisor)	DigitalStrategyLevel	Low Competency	1	33.3%	0	0.0%	0	0.0%	1	14.3%
		Medium Competency	2	66.7%	1	100.0%	2	66.7%	5	71.4%
		High Competency	0	0.0%	0	0.0%	1	33.3%	1	14.3%
	Total		3	100.0%	1	100.0%	3	100.0%	7	100.0%
Team Leader	DigitalStrategyLevel	Medium Competency			2	100.0%	2	100.0%	4	100.0%
	Total				2	100.0%	2	100.0%	4	100.0%
Total	DigitalStrategyLevel	Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
		Medium Competency	2	28.6%	10	58.8%	4	30.8%	16	43.2%
		High Competency	0	0.0%	7	41.2%	9	69.2%	16	43.2%

Total	7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B55 Cross-Tabulation of Agility Competency Level by Digital Transformation Maturity across Job Position Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
JobPosition			N	%	N	%	N	%	N	%
Top-level Management (e.g., Owner, Senior, CEO, COO, CFO, CMO)	AgilityLevel	Medium Competency	3	75.0%	4	36.4%	0	0.0%	7	38.9%
		High Competency	1	25.0%	7	63.6%	3	100.0%	11	61.1%
	Total		4	100.0%	11	100.0%	3	100.0%	18	100.0%
Mid-level Management (e.g., Director, Manager)	AgilityLevel	High Competency			3	100.0%	5	100.0%	8	100.0%
	Total				3	100.0%	5	100.0%	8	100.0%
First-line Management (e.g., Assistant Manager, Supervisor)	AgilityLevel	Medium Competency	1	33.3%	0	0.0%	1	33.3%	2	28.6%
		High Competency	2	66.7%	1	100.0%	2	66.7%	5	71.4%
	Total		3	100.0%	1	100.0%	3	100.0%	7	100.0%
Team Leader	AgilityLevel	Medium Competency			0	0.0%	1	50.0%	1	25.0%
		High Competency			2	100.0%	1	50.0%	3	75.0%
	Total				2	100.0%	2	100.0%	4	100.0%
Total	AgilityLevel	Medium Competency	4	57.1%	4	23.5%	2	15.4%	10	27.0%
		High Competency	3	42.9%	13	76.5%	11	84.6%	27	73.0%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B56 Cross-Tabulation of Networking Competency Level by Digital Transformation Maturity across Decision-Making Role Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
DecisionMaking			N	%	N	%	N	%	N	%
Yes, I am the primary decision-maker.	NetworkingLevel	Medium Competency	3	75.0%	0	0.0%	0	0.0%	3	16.7%
		High Competency	1	25.0%	10	100.0%	4	100.0%	15	83.3%
	Total		4	100.0%	10	100.0%	4	100.0%	18	100.0%
Yes, I am part of the decision-making team.	NetworkingLevel	Medium Competency	1	33.3%	1	16.7%	1	11.1%	3	16.7%
		High Competency	2	66.7%	5	83.3%	8	88.9%	15	83.3%
	Total		3	100.0%	6	100.0%	9	100.0%	18	100.0%
No, I am not directly involved in the decision-making process.	NetworkingLevel	High Competency			1	100.0%			1	100.0%
	Total				1	100.0%			1	100.0%
Total	NetworkingLevel	Medium Competency	4	57.1%	1	5.9%	1	7.7%	6	16.2%
		High Competency	3	42.9%	16	94.1%	12	92.3%	31	83.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B57 Cross-Tabulation of Innovation Competency Level by Digital Transformation Maturity across Decision-Making Role Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
DecisionMaking			N	%	N	%	N	%	N	%
Yes, I am the primary decision-maker.	InnovationLevel	Low Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
		Medium Competency	0	0.0%	5	50.0%	2	50.0%	7	38.9%
		High Competency	0	0.0%	5	50.0%	2	50.0%	7	38.9%
	Total		4	100.0%	10	100.0%	4	100.0%	18	100.0%
Yes, I am part of the decision-making team.	InnovationLevel	Low Competency	1	33.3%	0	0.0%	0	0.0%	1	5.6%
		Medium Competency	2	66.7%	3	50.0%	5	55.6%	10	55.6%
		High Competency	0	0.0%	3	50.0%	4	44.4%	7	38.9%
	Total		3	100.0%	6	100.0%	9	100.0%	18	100.0%
No, I am not directly involved in the decision-making process.	InnovationLevel	Medium Competency			1	100.0%			1	100.0%
	Total				1	100.0%			1	100.0%
Total	InnovationLevel	Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
		Medium Competency	2	28.6%	9	52.9%	7	53.8%	18	48.6%
		High Competency	0	0.0%	8	47.1%	6	46.2%	14	37.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B58 Cross-Tabulation of Tech-savviness Competency Level by Digital Transformation Maturity across Decision-Making Role Groups

DecisionMaking		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
Yes, I am the primary decision-maker.	TechSavvinessLevel Low Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
	Medium Competency	0	0.0%	9	90.0%	1	25.0%	10	55.6%
	High Competency	0	0.0%	1	10.0%	3	75.0%	4	22.2%
	Total	4	100.0%	10	100.0%	4	100.0%	18	100.0%
Yes, I am part of the decision-making team.	TechSavvinessLevel Low Competency	2	66.7%	0	0.0%	0	0.0%	2	11.1%
	Medium Competency	1	33.3%	6	100.0%	4	44.4%	11	61.1%
	High Competency	0	0.0%	0	0.0%	5	55.6%	5	27.8%
	Total	3	100.0%	6	100.0%	9	100.0%	18	100.0%
No, I am not directly involved in the decision-making process.	TechSavvinessLevel Low Competency			1	100.0%			1	100.0%
	Total			1	100.0%			1	100.0%
Total	TechSavvinessLevel Low Competency	6	85.7%	1	5.9%	0	0.0%	7	18.9%
	Medium Competency	1	14.3%	15	88.2%	5	38.5%	21	56.8%
	High Competency	0	0.0%	1	5.9%	8	61.5%	9	24.3%
	Total	7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B59 Cross-Tabulation of Empowerment Competency Level by Digital Transformation Maturity across Decision-Making Role Groups

DecisionMaking			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
			N	%	N	%	N	%	N	%
Yes, I am the primary decision-maker.	EmpowermentLevel	Medium Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
		High Competency	0	0.0%	10	100.0%	4	100.0%	14	77.8%
	Total		4	100.0%	10	100.0%	4	100.0%	18	100.0%
Yes, I am part of the decision-making team.	EmpowermentLevel	Medium Competency	1	33.3%	0	0.0%	0	0.0%	1	5.6%
		High Competency	2	66.7%	6	100.0%	9	100.0%	17	94.4%
	Total		3	100.0%	6	100.0%	9	100.0%	18	100.0%
No, I am not directly involved in the decision-making process.	EmpowermentLevel	Medium Competency			1	100.0%			1	100.0%
	Total				1	100.0%			1	100.0%
Total	EmpowermentLevel	Medium Competency	5	71.4%	1	5.9%	0	0.0%	6	16.2%
		High Competency	2	28.6%	16	94.1%	13	100.0%	31	83.8%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B60 Cross-Tabulation of Digital Strategy Competency Level by Digital Transformation Maturity across Decision-Making Role Groups

DecisionMaking		DigitalTransformationMaturity						Total	
		Low Maturity		Medium Maturity		High Maturity			
		N	%	N	%	N	%	N	%
Yes, I am the primary decision-maker.	DigitalStrategyLevel Low Competency	4	100.0%	0	0.0%	0	0.0%	4	22.2%
	Medium Competency	0	0.0%	5	50.0%	0	0.0%	5	27.8%
	High Competency	0	0.0%	5	50.0%	4	100.0%	9	50.0%
	Total	4	100.0%	10	100.0%	4	100.0%	18	100.0%
Yes, I am part of the decision-making team.	DigitalStrategyLevel Low Competency	1	33.3%	0	0.0%	0	0.0%	1	5.6%
	Medium Competency	2	66.7%	4	66.7%	4	44.4%	10	55.6%
	High Competency	0	0.0%	2	33.3%	5	55.6%	7	38.9%
	Total	3	100.0%	6	100.0%	9	100.0%	18	100.0%
No, I am not directly involved in the decision-making process.	DigitalStrategyLevel Medium Competency			1	100.0%			1	100.0%
	Total			1	100.0%			1	100.0%
Total	DigitalStrategyLevel Low Competency	5	71.4%	0	0.0%	0	0.0%	5	13.5%
	Medium Competency	2	28.6%	10	58.8%	4	30.8%	16	43.2%
	High Competency	0	0.0%	7	41.2%	9	69.2%	16	43.2%
	Total	7	100.0%	17	100.0%	13	100.0%	37	100.0%

Table B61 Cross-Tabulation of Agility Competency Level by Digital Transformation Maturity across Decision-Making Role Groups

			DigitalTransformationMaturity						Total	
			Low Maturity		Medium Maturity		High Maturity			
DecisionMaking			N	%	N	%	N	%	N	%
Yes, I am the primary decision-maker.	AgilityLevel	Medium Competency	3	75.0%	4	40.0%	0	0.0%	7	38.9%
		High Competency	1	25.0%	6	60.0%	4	100.0%	11	61.1%
	Total		4	100.0%	10	100.0%	4	100.0%	18	100.0%
Yes, I am part of the decision-making team.	AgilityLevel	Medium Competency	1	33.3%	0	0.0%	2	22.2%	3	16.7%
		High Competency	2	66.7%	6	100.0%	7	77.8%	15	83.3%
	Total		3	100.0%	6	100.0%	9	100.0%	18	100.0%
No, I am not directly involved in the decision-making process.	AgilityLevel	High Competency			1	100.0%			1	100.0%
	Total				1	100.0%			1	100.0%
Total	AgilityLevel	Medium Competency	4	57.1%	4	23.5%	2	15.4%	10	27.0%
		High Competency	3	42.9%	13	76.5%	11	84.6%	27	73.0%
	Total		7	100.0%	17	100.0%	13	100.0%	37	100.0%

12 Appendix C: Plan of Action

Week	Task	Duration
1	Evaluating survey questions	1 week
2	Constructing survey with Qualtrics	1 week
3-6	Distributing survey and collecting responses	4 weeks
7-8	Data analysis	2 weeks
9	Data interpretation	1 week
10-11	Discussion of results	2 weeks
12-14	Writing research paper conclusion	2 weeks