EXPLORING DIGITAL TRANSFORMATION COMPETENCIES FOR ENHANCING SME RESILIENCE AND COMPETITIVENESS: INSIGHTS FROM THE STUTTGART ECONOMIC REGION

Project to Universidade Católica Portuguesa to obtain a Master's Degree in Communication Studies – Strategic Communication and Leadership

By

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Faculdade de Ciências Humanas

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Abstract (English)

The rapid pace of digital transformation presents significant challenges for small and medium-sized enterprises (SMEs). In collaboration with the P3 Group in Stuttgart, this project investigated the hurdles SMEs in the Stuttgart economic region face during digital transformation and identified the competencies required to overcome these challenges. Moreover, the study explored how these competencies relate to the resilience and competitiveness of SMEs, drawing valuable lessons from this case. Leveraging established frameworks, this research employed a qualitative methodology involving semi-structured, in-depth interviews with 20 SME managers across various regional sectors. Key hurdles were identified at macro, meso, and micro levels, including the overwhelming pace of technological change, strategic and cultural barriers, and resistance to change, particularly in traditional sectors and among older generations. Six essential areas of competence emerged: (1) problem solving; (2) communication and collaboration; (3) safety; (4) leadership; (5) self-management; and (6) technological competencies. Among these, leadership and self-management were highlighted as particularly crucial. Thus, this research validates that simply adopting digital technologies does not guarantee a competitive advantage for SMEs. Aligning with existing research, these competencies help bolster SMEs' competitiveness and resilience by helping to address challenges, ensuring adaptability and agility and, thus, stability. Moreover, they contribute to efficiency increase and support effective stakeholder relationship management. Key lessons from this case also highlight the importance of contextual factors such as industry dynamics, inter-organizational relationships, regional support systems, geographical disparities, and cultural attitudes toward innovation. According to the derived recommendations, SMEs should align digital strategies with organizational culture and industry dynamics and use the identified portfolio of competencies to assess and bridge gaps. Moreover, they are advised to leverage regional support systems and collaborative networks with innovative niches to set up new regimes and influence the landscape, where policymakers are encouraged to support initiatives that facilitate digital adoption among SMEs. In summary, this project contributes to the broader discourse on digital transformation by providing empirical insights specific to SMEs in the Stuttgart economic region. Future research should explore these findings in diverse contexts to validate and expand upon the results.

Keywords: *digital transformation, SMEs, competencies, resilience, leadership*

Abstract (Portuguese)

O rápido ritmo da transformação digital apresenta desafios significativos para pequenas e médias empresas (PMEs). Em colaboração com o Grupo P3 em Estugarda, este projeto investigou os obstáculos que as PMEs na região económica de Estugarda enfrentam durante a transformação digital e identificou as competências necessárias para superá-los. Além disso, o estudo explorou como essas competências se relacionam com a resiliência e competitividade das PMEs, extraindo lições valiosas deste caso. Utilizando estruturas estabelecidas, a pesquisa empregou uma metodologia qualitativa, com entrevistas semiestruturadas e aprofundadas com 20 gestores de PMEs de vários setores da região. Obstáculos principais foram identificados nos níveis macro, meso e micro, incluindo o ritmo avassalador da mudança tecnológica, barreiras estratégicas e culturais, e resistência à mudança, especialmente em setores tradicionais. Emergiram seis áreas essenciais de competência: (1) resolução de problemas; (2) comunicação e colaboração; (3) segurança; (4) liderança; (5) autogestão; e (6) competências tecnológicas. Entre estas, liderança e autogestão foram destacadas como particularmente cruciais. Assim, a pesquisa valida que a simples adoção de tecnologias digitais não garante vantagem competitiva para as PMEs. Alinhando-se com pesquisas existentes, estas competências ajudam a reforçar a competitividade e resiliência das PMEs ao ajudar a resolver desafios, garantindo adaptabilidade, agilidade e estabilidade. Além disso, contribuem para o aumento da eficiência e apoiam uma gestão eficaz das relações com as partes interessadas. Lições-chave deste caso também destacam a importância de fatores contextuais, como dinâmicas industriais, relações interorganizacionais, sistemas de apoio regionais, disparidades geográficas e atitudes culturais em relação à inovação. De acordo com as recomendações, as PMEs devem alinhar estratégias digitais com a cultura organizacional e dinâmicas industriais e usar o portfólio de competências identificado para avaliar e colmatar lacunas. Além disso, recomenda-se que aproveitem sistemas de apoio regionais e redes colaborativas com nichos inovadores para estabelecer novos regimes e influenciar o panorama, onde legisladores são encorajados a apoiar iniciativas que facilitem a adoção digital entre as PMEs. Em resumo, este projeto contribui para o discurso mais amplo sobre transformação digital, fornecendo insights empíricos específicos para as PMEs na região de Estugarda. Pesquisas futuras devem explorar estes resultados em contextos diversos para validar e expandir os achados.

Palavras-chave*: transformação digital, PMEs, competências, resiliência, liderança*

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On a personal note, I wish to acknowledge the significant milestone of my pregnancy during the course of this Master's thesis. I dedicate this work to our daughter, who, while still in my womb, provided me with immense strength and motivation to complete this journey.

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List of Abbreviations

AI	Artificial Intelligence
DigComp	Digital Competence
EBIT	Earnings Before Interest And Taxes
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GVA	Gross Value Added
HR	Human Resources
ICT	Information and Communication Technology
IoT	Internet of Things
IT	Information Technology
OCTD	Organizational Competence for Digital Transformation
R&D	Research and Development
ROI	Return on Investment
RQ	Research Question
SMEs	Small and Medium-Sized Enterprises
SRQ	Sub-Research Question
VR	Virtual Reality

1. Introduction

Are German small and medium-sized enterprises (SMEs) still future-proof? This pressing question arises from a recent survey of 520 executives in German SMEs, which reveals a bleak outlook, with only 42 percent of respondents perceiving a promising future for this crucial economic sector (Lorch et al., 2023). This sentiment reflects the growing urgency and uncertainty faced by SMEs in Germany. In an era of constant change and rapid technological advancements, companies encounter unprecedented challenges, with digital transformation being a critical factor for survival. This shift demands a reevaluation of traditional business models, swift adaptability, and profound strategic rethinking (Gferer et al., 2021; Daugherty et al., 2021; Sweet et al., 2023; Icks & Brink, 2023; Rittmann, 2023). While large corporations have started to digitize early (Rittmann, 2023) and often benefit from scalability and abundant resources, SMEs face significant hurdles. Limited financial, human, and managerial resources and a lack of organizational experience often impede their digital transformation processes (Aldrich & Auster, 1986; BarNir et al., 2003; Li et al., 2017).

This places enormous pressure on SMEs to adapt to these challenges, ensure long-term competitiveness, and counteract high market concentration (Kretschmer & Khashabi, 2020; Slimane et al., 2022). Since SMEs form an economy's backbone, their success is vital for economic stability and growth (BPB, 2021). Therefore, supporting these to remain competitive and relevant is paramount. To harness the full potential of digital technologies, a critical factor for competitiveness, SMEs must develop new competencies to manage digital transformation effectively (O'Reilly & Tushman, 2011).

Despite the growing body of research on digital transformation, significant gaps persist. Much focus has been on large corporations, leaving the unique challenges SMEs face largely unexplored (Hausberg et al., 2019; Mai et al., 2023). Consequently, there is little consensus on mitigating the disruptive effects of digitalization in SMEs, and many companies are uncertain about which competencies to prioritize and how to implement them (Fonseca & Picoto, 2020; Moroz, 2018). Additionally, the necessary competencies may vary depending on the context, such as company size and industry (Fonseca & Picoto, 2020; Müller et al., 2024). However, most existing studies have primarily mapped the landscape of challenges

and competencies through literature reviews, lacking empirical validation in real-world settings (Wolff et al., 2019; Müller et al., 2024).

The study adopts a qualitative research approach to address these gaps, exploring SMEs' challenges in digital transformation and identifying the necessary competencies to overcome these hurdles. In collaboration with the P3 Group, a consultancy that plays a significant role in advising SMEs (P3 Group, n.d.-b), this project seeks to provide valuable insights and actionable recommendations to enhance the competitiveness and resilience of SMEs. To achieve this objective, in-depth interviews with SME managers in the Stuttgart economic region were conducted - an area recognized as a European hub for business and innovation and home to numerous SMEs (Landeshauptstadt Stuttgart, n.d.), many of which are globally successful or "hidden champions" in their fields, yet currently facing the challenges of digital transformation and needing to position themselves competitively in the long term (Dispan et al., 2023).

By integrating empirical data and contributing lessons from the Stuttgart economic region, the results of this investigation add to the digital transformation literature, highlighting how contextual factors influence SMEs' digital maturity. Furthermore, the study offers practical implications for SME managers, enhancing the future viability of SMEs and strengthening economic structures. The findings of this study, which are published in a white paper and thus made available to the study's addressees, are significant not only for SME managers but also for other stakeholders, such as policymakers, involved in digital transformation.

This project is divided into seven chapters. While the introduction in Chapter 1 outlined the research problem, objectives, and significance, Chapter 2 covers relevant background on SMEs, the Stuttgart economic region, and existing literature on digital transformation, including its hurdles and relevant competencies. Subsequently, in Chapter 3, gaps in current research are identified, and the specific research questions this study aims to address are formulated. The methodology in Chapter 4 details the conceptual framework, research design, data collection methods, sampling, and analytical approaches, considering ethical considerations and quality criteria. Chapter 5 presents the key findings from the interviews, highlighting major digital transformation hurdles and competencies and their implications.

Chapter 6, on learning opportunities, interprets the findings in relation to existing literature and theoretical frameworks, provides practical implications, discusses limitations, and offers recommendations for future research. Lastly, in Chapter 7, the final remarks answer the research questions and provide a brief outlook.

2. Background Research and Literature Review

This chapter addresses the relevant background for this work to lay the foundation for answering the research questions. This implies first an outline of the context, namely SMEs in the economic region of Stuttgart as a hub of innovation and economic activity, and the role of the P3 Group as a consultancy, which accompanies this project and plays a central role in supporting companies on their transformation journey by providing strategic advice, technological solutions, and change management support. Secondly, the chapter aims to clarify the concept of digital transformation in light of innovation theories and as a significant challenge for companies to expand on relevant competencies in this context.

2.1. Small and Medium-Sized Enterprises

SMEs represent the majority of businesses globally and play a crucial role in creating jobs, thereby driving economic growth worldwide (World Bank, n.d.). Thus, they are vital for the German economy, comprising approximately 99 percent of all businesses, employing the majority of the workforce (Destatis, 2024), and accounting for nearly half of the gross value added (GVA) (Destatis, 2019), which highlights the significance of SME policy and support (BPB, 2021).

In scientific discourse, SMEs are described through different lenses, which can be either of a quantitative or qualitative nature or, at times, a mixture of both (Arentz & Münstermann, 2013). On the one hand, qualitative dimensions describe SMEs as entities with a unique character, often characterized by unity of ownership and management, typically manifesting in family-run businesses. Moreover, these enterprises are characterized by their independence, deep-seated local roots, and an affinity for cultivating long-term, consensus-oriented relationships with key stakeholders, including employees, customers, and suppliers (Fear, 2012; Berghoff, 2016). On the other hand, the quantitative perspective offers a more measurable delineation, primarily focusing on metrics such as workforce size and turnover.

According to the European Commission, a micro company has up to nine employees and a turnover of up to two million euros. Subsequently, small enterprises include companies with up to 49 employees, generating a turnover of up to EUR 10 million. In this context, medium-sized enterprises comprise companies with up to 249 employees, with turnover thresholds extending up to EUR 50 million (Destatis, 2019). Supplementing this perspective, IfM Bonn provides an alternative quantitative perspective. To harmonize with the European Commission's definition of SMEs in the micro and small enterprise segment, micro and small enterprises are defined analogously to the EU definition. However, to underscore the German specificity, IfM Bonn defines the threshold value for medium-sized companies with 499 employees and annual sales below EUR 50 million (IfM Bonn, 2016). Moreover, venturing beyond conventional boundaries, the notion of upscale SMEs, as established by Venohr (2015), encompasses a broader spectrum. This extended classification encapsulated enterprises employing between 500 and 5,000 individuals and annual sales ranging from EUR 50 million to EUR one billion. This paper delves into this interpretation, including and focusing on this upper SME segment, to validate and extend previous findings through empirical research in real-world settings and investigating different contexts, such as company size (see Table 1).

Table 1
Overview of the Working Definition of SMEs

Company size	Number of employees	Turnover EUR/year	Source(s)
Micro	*Up to 9*	*Up to 2 Mio*	Destatis, 2019; IfM Bonn, 2016
Small	*Up to 49*	*Up to 10 Mio*	Destatis, 2019; IfM Bonn, 2016
Medium	*Up to 499*	*Up to 50 Mio*	IfM Bonn, 2016
Upscale	*Up to 5,000*	*Up to 1 B*	Venohr, 2015

Note. Developed by the author.

2.1.1. Impact of External Factors on Technology Adoption in Firms

The environmental context in which a firm operates has garnered attention for its potential impact on organizational decisions, such as the adoption of technology innovation. Even if internal factors, such as technological (e.g., existing IT infrastructure, previous exposure to

digital technologies of organization members) and organizational context (e.g., innovation rate, employee skills, corporate regulation, and financial resources), have a more significant influence on technology adoption (Omrani et al., 2022), pivotal triggers for innovation are seen in environmental changes, coupled with the inherent uncertainty they bring, fundamentally challenging traditional business models (Bouncken et al., 2021). The business environment encompasses a multitude of external forces, all of which exert either pressure or provide support for adopting new technologies. These include industry characteristics, market structure, competition (Yang et al., 2021), government regulation (Sherer et al., 2016), and the overarching business infrastructure (Liang et al., 2021), which refers to paradigmatic changes through the emergence of disruptive digital competitors and technologies or shifts in consumer behavior (Winkelhaus & Grosse, 2020; Yang et al., 2021). Cooperation with external business partners (Beliaeva et al., 2019) drives technology adoption by exerting pressure on companies within the same sphere to adapt similarly (Holmström & Partanen, 2014). Also, introducing digital technologies is increasingly viewed as a means to enhance competitiveness. Consequently, companies are likely to adopt digital technologies when they observe their competitors doing so, fostering a competitive environment that continually evolves with technological progress (Chen et al., 2015; Verhoef et al., 2021a). Moreover, many companies actively explore ways to deploy faster and more efficient digital management systems. These advancements are critical in supporting lean and agile operations, essential for maintaining competitiveness in a rapidly changing business environment (Yang et al., 2021). In this context, prior research has highlighted the role of the regulatory environment at the national level in promoting the development of digital technologies across entire industries, such as big data (Sun et al., 2020) and Artificial Intelligence (AI) sectors (Chen et al., 2021). Hence, government support is crucial in this dynamic, encouraging companies to embrace new digital technologies through policies and incentives (Omrani et al., 2022). For instance, it shows that governmental policies related to digital transformation can support SMEs in fostering their competencies and resilience in this context (Trieu et al., 2023).

2.1.2. The Economic Region of Stuttgart

To foster and expand this discussion, this section provides an overview of the Stuttgart economic region, diving into its most significant economic sectors, their interrelationships,

and the role of SMEs. It is primarily referred to the structural report for the Stuttgart region, a project by regional organizations that has been published for over 25 years. This report analyses structural developments in the economy and employment in the region to sustainably strengthen the economic region and maintain its competitiveness and future viability, thus securing employment and prosperity (Dispan et al., 2021; Dispan et al., 2023).

Situated in southwestern Germany, the Stuttgart region, encompassing the state capital and surrounding districts in Baden-Württemberg, is a key economic player in Germany (Region Stuttgart, 2022). It is known for its economic strength, international connections, and innovation (Dispan et al., 2023). The region hosts numerous SMEs next to large corporations like Daimler, Bosch, and Porsche. These SMEs, often termed "hidden champions," contribute significantly to the region's economic prowess and underscore its reputation for innovation and economic diversity (Dispan, 2021).

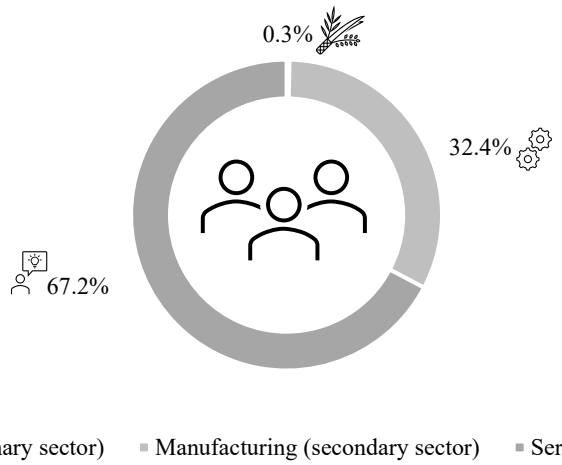
The Stuttgart economic region is among the top 20 most robust in the EU (Destatis, 2021) and leading in Baden-Württemberg (Region Stuttgart, 2022), generating a gross domestic product (GDP) of around 156 billion EUR in 2022 (Region Stuttgart, 2022). Also, the region secures a significant GVA per employee (EUR 85,857), surpassing the national average by 18.5 percentage points and placing second in Germany (Dispan et al., 2023). Since most employees work for SMEs, these companies ensure high employment levels and contribute substantially to economic growth (Dispan et al., 2021).

The economy is characterized as a service economy around the industrial core (Dispan et al., 2021), dominated by the automotive and production engineering clusters, in which the automotive industry and mechanical engineering represent significant components (Dispan, 2021). This industry-service combination with strong interaction between sectors and companies of different sizes bolsters regional companies' technological performance and innovative strength and represents a significant competitive and resilience factor (Region Stuttgart, 2022; Dispan et al., 2023). The regional business is also characterized by a strong export orientation, a focus on cutting-edge technology, high-quality and premium products, and a high value placed on skilled labor (Dispan et al., 2023). The automotive cluster, in particular, represents these aspects and is by far the most substantial economic sector in the

region (Region Stuttgart, 2022; Dispan et al., 2023). This is mainly reflected in a significant export quota, a high workforce proportion, and the fact that 15 percent of the automotive industry's sales in Germany are generated in this region (Region Stuttgart, 2022).

Overall, employment trends have continued since 2000, with robust employment growth (+26%) and sectoral and functional tertiarization. As presented in Figure 1, in 2022, over two-thirds of employees worked in the service sector and almost one-third in manufacturing (Dispan et al., 2023). The workforce is characterized by a growing number of employees with academic degrees and a stable proportion of women at around 44 percent (Dispan et al., 2023). Significantly, five percent of the workforce and eight percent of the GDP are allocated to research and development (R&D) activities. This is putting the region in a consistent pole position in the Innovation Index of Baden-Württemberg (Statistisches Landesamt Baden-Württemberg, 2022) and Germany, nearly six percentage points above the national average (Region Stuttgart, 2022) solidifying its standing as a pioneering innovation hub. The private sector, especially the automotive and production engineering clusters next to research institutes, contributes significantly to this innovative strength (Dispan et al., 2023).

Figure 1
Employees by Economic Sectors in the Stuttgart Region in 2022



Note. Based on Dispan et al. (2023, p. 12)

The Stuttgart economic region is much more strongly characterized by the manufacturing industry than other metropolitan regions, representing both a success factor and a unique

selling point. This sector's significance is evident in its contribution to the regional GVA, innovation, employment, and salaries (Dispan et al., 2023). It is mainly characterized by the processing industry, which has developed around the core sectors of the automotive industry and mechanical engineering. It employed 80 percent of the manufacturing workforce in 2022 and includes highly specialized, innovative, and often internationally oriented companies (Dispan et al., 2023). Also, the construction industry makes a significant contribution (16% of the manufacturing workforce), mainly comprising small craft businesses (Dispan et al., 2023).

Most of the workforce and over 70 percent of turnover generated in the processing industry are attributed to the automotive cluster, mainly driven by the automotive industry (Dispan et al., 2023). The industry is characterized by its focus on high-quality, premium, and luxury products (Dispan et al., 2023). Companies such as Daimler as a manufacturer of premium and luxury automobiles of the Mercedes-Benz, AMG, EQ, and Maybach brands, Porsche as an exclusive sports car manufacturer, and Daimler Truck as one of the world's largest commercial vehicle manufacturers stand for the strong economic power of the Stuttgart regions automotive cluster (Dispan et al., 2023). However, the automotive cluster's vital innovation and performance would be inconceivable without the companies in the automotive supply industry. On the one hand, these comprise large supplier groups, such as Bosch, the world's largest automotive supplier, Mahle, or Mann+Hummel. On the other hand, around 400 SME suppliers belong to the automotive cluster, coming from different industries (Region Stuttgart, 2022). For instance, numerous SMEs coming from mechanical engineering in the production engineering sector, like EMAG, Gebr. Heller Maschinenfabrik, Index-Werke, the MAG, or the Nagel Group are strongly oriented towards the automotive industry and represent elementary components (Dispan et al., 2023). Other companies and institutions that are fundamental to the cluster have their roots in the service sector, such as engineering service providers (Flörecke, 2023), information technology (IT) and software companies, design and communication service providers, research facilities, and university institutes, as well as intermediary players (Dispan et al., 2023).

Concurrently, the production engineering cluster is vital to the region's economy and is centered around mechanical engineering, representing the second-largest industry sector

after the automotive industry (Dispan et al., 2023). The focus of the regional companies, including many global market leaders and "hidden champions," concentrates on special machines, processing centers, and system solutions, but in many cases, also on high-quality components installed in machines and systems (Dispan et al., 2023). In addition to mechanical engineering, the regional cluster includes companies from the automation sector, the metal industry, and other industrial sectors, as well as service companies such as those in the information and communication technology (ICT) and knowledge-intensive services sectors (Dispan et al., 2023). On the one hand, the high concentration of machine manufacturers results from larger companies like Festool, Stihl, Kärcher, Trumpf, or Dürr and, on the other hand, from numerous SME-oriented mechanical engineering companies such as Gebr. Heller Maschinenfabrik, Index-Werke, or Putzmeister. Many of these classic SMEs, often family-owned and owner-operated, have developed into technology leaders in their niche markets and have become essential elements of the Stuttgart economic region (Region Stuttgart, 2022). Moreover, component manufacturers and suppliers, engineering offices, software companies, and research and innovation centers are further essential to the production technology cluster (Dispan et al., 2023).

Despite the dominance of manufacturing, the service sector takes the lead in employment and value creation, employing more than two-thirds of the regional workforce and generating over 60 percent of the regional value added in 2022 (Dispan et al., 2023). This sector has experienced significant growth in ICT (e.g., publishing, film and television, telecommunications) and knowledge-intensive services (e.g., auditing, management consulting, research), characterized by high digitalization, innovation, and a large proportion of highly qualified employees. These services often support and are intertwined with the manufacturing sector, highlighting the dynamic interplay between different sectors in the Stuttgart economic region (Dispan et al., 2023).

2.1.3. The P3 Group

This research project, conducted in collaboration with the P3 Group, a global management consulting and software development company headquartered in Stuttgart, Germany, is a testament to their expertise. Founded in 1996 by Christoph Theis, the P3 Group has grown into a multinational corporation, employing approximately 1800 people. The company's

international expansion, with a network of offices and subsidiaries across Europe, the Americas, and Asia, has diversified its service portfolio and strengthened its global presence (P3 Group, n.d.-a).

The P3 Group's services span various industries, including automotive, energy, consumer goods, retail, IT, and media. The company specializes in strategic and technology consulting as well as project management (P3 Group, n.d.-b).

In the Stuttgart region, the company is known for its support of SMEs, assisting them in adapting to the changing economic landscape and proactively addressing future challenges. This support strengthens the local economy and promotes sustainable development (Landeshauptstadt Stuttgart, n.d.; P3 Group, n.d.-c).

This project is anchored in P3 Group's organizational development and strategy unit. This department is critical for helping organizations manage change and maintain long-term viability. The focus here is on enhancing organizational effectiveness and preparing businesses to face current and future challenges (P3 Group, n.d.-d).

2.2. Current Challenges

Companies of all sizes in today's business landscape face a complex web of challenges. Despite the generally positive economic development in recent years, transformation processes and global crises have emerged as significant hurdles (Dispan et al., 2023; Raab et al., 2023). It demonstrates that businesses operate in a landscape characterized by multidimensional change. Challenges include geopolitical tensions, supply chain disruptions, inflation, demographic shifts, labor shortages, the need for sustainable business practices, and the overarching topic of digitalization (Raab et al., 2023). It shows that the most pressing issue facing European SMEs nowadays is the scarcity of skilled labor, a situation further exacerbated by the demands of digital transformation. This shortage hinders the business operations of these companies as they struggle to find workers with the necessary competencies. Moreover, the rapid pace of digital change only widens the gap between the available skills and the needs of SMEs (Nguyen et al., 2015; Eller et al., 2020; Scuotto et al., 2021).

The named challenges are also evident across companies of different sizes and sectors in the Stuttgart economic region (Dispan et al., 2023). The automotive cluster is undergoing the most significant upheaval in its history, transforming from digitalization and decarbonization towards software-defined electric vehicles (Dispan et al., 2023). Issues relating to the resilience and future viability of the automotive cluster in the Stuttgart region are becoming increasingly crucial for regional players due to the growing transformation pressure. Moreover, the production engineering cluster faces complex challenges related to skilled labor shortages, sustainability, digitalization, and global competition. These challenges are crucial for the future resilience and success of mechanical engineering and the entire production engineering cluster in the Stuttgart economic region (Dispan et al., 2023). The service sector also struggles with labor shortages and high energy prices, impacting its development and competitiveness (Dispan et al., 2023).

As a result of these multidimensional challenges, it is imperative to underscore that the environment is changing rapidly, and the requirements for transformation processes are becoming increasingly intense (Dispan et al., 2023). The current challenges clearly show that future-oriented innovations, from product and process innovations to business model innovations, are essential to counter crises and ensure organizational viability (Banf et al., 2023).

2.3. Digital Transformation in Organizations

Especially the advent of new digital technologies is catalyzing a substantial transformation across various industries, a process often referred to as digital transformation (Loebbecke & Picot, 2015; Ghosh et al., 2017; Richter et al., 2018; Butschan et al., 2019). Over the past decades, the evolution of digital technologies has been characterized by exponential growth, underpinned by three significant technological laws. According to Moore's law, the processing power of a computer will double every 18 months, enhancing its capabilities of computers at an impressive rate (Moore, 1965). Complementing this, Butters' law predicts a doubling in the volume of data communication every nine months (Butters, 1998), while Kryder's law forecasts a similar doubling in hard drive storage capacity approximately every 13 months (Kryder, 2005). These three principles have laid the foundation for digital

transformation by dramatically reducing costs and increasing data storage, processing, and communication efficiency. Hence, they have reshaped traditional business models and enabled companies to innovate in individual business functions, opening up new opportunities and growth potential, exemplified in the emergence of big industry players like Amazon or Tesla, disrupting the status quo (Shahi & Sinha, 2021). As Schwab (2017) suggests, the current landscape marks the fourth industrial revolution, distinct from its predecessors. This new era is defined by the convergence of digital, biological, and physical domains, necessitating a comprehensive digital transformation across all industries to remain viable and competitive (Schreckling & Steiger, 2017; Kane et al., 2019). The coronavirus pandemic alone has already shown that it has given companies that are advanced in digitalization a further boost and thus increased the pressure on companies to innovate (Raab et al., 2023). For instance, the pandemic caused a substantial increase in online shopping as physical stores closed due to lockdowns. E-commerce companies like Amazon saw significant growth, which pressured traditional retailers to rapidly enhance their digital capabilities to compete effectively (UNCTAD, 2021).

Henceforth, digital transformation has garnered increasing attention across academia and organizations (Markus & Rowe, 2023). In the last ten years, the literature on this subject has increased threefold (Hanelt et al., 2021). Numerous studies are aiming to grasp the scope, outcomes, and implications of digital transformation (Reis et al., 2018; Kohli & Melville, 2018; Vuksic et al., 2018; Hausberg et al., 2019; Mahmood et al., 2019; Vial, 2019; Verhoef et al., 2021b; Slimane et al., 2022). These reviews explore the phenomenon from various angles, including technological disruption and entrepreneurial activities within corporations (Nadkarni & Prügl, 2020), often stressing the urgency of embracing digital transformation to avoid obsolescence, exemplified by slogans such as “Digitize or drown!” (Getz & Robinson, 2003; Chen et al., 2016; Schreckling & Steiner, 2017). Also, contemporary studies indicate that digital transformation is a paramount long-term challenge for companies, regardless of their industry or size (Daugherty et al., 2021; Sweet et al., 2023; Icks & Brink, 2023; Marr, 2023; Rittmann, 2023). A recent expert survey shows that SMEs’ primary concerns are workforce shortages and competitiveness, with digitalization being paramount (Icks & Brink, 2023). Organizations are continually faced with emerging digital technologies capable of revolutionizing their business models and reshaping their

organizational identities (Wessel et al., 2021). Hence, many are grappling with the rapid pace of technological change, and success rates in digital transformation initiatives have been low (de la Boutetière et al., 2018). Consequently, the rising significance of these technologies has elevated digital transformation to a primary focus on business agendas (Imran et al., 2020; Zulu & Khosrowshahi, 2021).

The discourse on digital transformation is characterized by its complex and layered nature, lacking a universally accepted definition of the term (Markus & Rowe, 2023). According to Vial (2019), about 28 different definitions were reported, lacking in clarity about the meaning of digital technologies (Hanelt et al., 2015; Mahmood et al., 2019) and consistency in which contexts the concept is used, i.e., solely on an organizational level (Fitzgerald et al., 2014; Matt et al., 2015; Heilig et al., 2017), societal (Hobbs et al., 2017; Khitskov et al., 2017), or industry-level (Hanelt et al., 2015; Agarwal et al., 2010). However, digital transformation is widely recognized as a multifaceted (Vial, 2019; Hanelt et al., 2021; Verhoef et al., 2021b) and multidimensional phenomenon (Matt et al., 2015; Zangiacomi et al., 2020). In organizations, it is predominantly viewed as an extensive change process wherein firms employ digital technologies to fundamentally alter their business models, services, products, or organizational identity (Hanelt et al., 2021; Wessel et al., 2021; Noesgaard et al., 2023). It encompasses deploying new digital innovations for significant business improvements (Schallmo et al., 2017) and the socio-technical interplay between technical and organizational innovations (Nambisan et al., 2017; Hinings et al., 2018). In his extensive literature review, Vial (2019) provides a working definition and consolidated perspective on digital transformation, describing it as “a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies” (p. 121). This definition contains three central elements: (1) it is not organization-centric, recognizing the potential for transformation within broader societal and industrial contexts; (2) improvement is the desired outcome of digital transformation and it is not synonymous with success; and (3) the term digital technologies is intentionally omitted and instead the definition of digital technologies provided by Bharadwaj et al. (2013) is applied to ensure conceptual clarity and be able to claim future applicability as technologies evolve (Vial, 2019). Although technology plays a significant role in digitalization (Wimelius et al., 2020), digital

transformation implies not merely the implementation of technology in an organization, industry, or society but requires a thorough revamp of the strategic, operational, and cultural facets of an organization (Vuksic et al., 2018). Thus, digital transformation induces a redefinition of products and services through digital means, leveraging data to derive new value and forming ecosystems that support such shifts (Govindarajan & Immelt, 2019). This metamorphosis can extend to an organization's identity (Wessel et al., 2020). Instead of technical matters, however, the essence of an effective digital transformation lies with the people who act as the primary agents and facilitators of change and steer the transformation (Kane et al., 2019). For instance, leaders play a vital role in empowering employee innovation, essential for organizations to engage in digital transformation and maintain a competitive edge. By fostering an environment that encourages initiative and innovation, leaders help ensure the success of digital transformation efforts (Gao & Gao, 2024).

Unanimous with Vial (2019), authors like Kane et al. (2019) consider digital transformation as a process that spans a dimension of digital maturity, and organizations are constantly working to improve their digital maturity. According to the authors, it is, therefore, not a stagnant but an organic characteristic. It refers to "a firm's capability to purposefully leverage digital technologies, channels, and skills in support of transforming its processes, talent engagement, and production models" (Ghobakhloo, 2020, p. 2392). To assess digital maturity, Kane et al. (2015) asked respondents to "imagine an ideal organization transformed by digital technologies and capabilities that improve processes, engage talent across the organization and drive new value-generating business models" (p. 5), to then "[…] rate their company against that ideal on a scale of 1 to 10" (p. 5). This resulted in three digital maturity groups: (1) early (26%); (2) developing (45%); and (3) maturing (29%). However, the most well-known maturity model is the capability maturity model (Caiado et al., 2016), originally developed to assess software system development and management, considering factors such as human resources (HR), project planning, and IT governance. A significant limitation of these technology-centric models is the assumption that an organization's overall performance is directly correlated with its technological maturity, which does not always apply, especially for SMEs, calling for new digital assessment tools that consider the specifics of SMEs (Mittal et al., 2018). Therefore, Williams et al. (2019) provide a first framework of a digital maturity model for SMEs, which comprises six dimensions: (1)

strategy; (2) products or services; (3) technology; (4) people and culture; (5) management; and (6) processes, with people and culture standing out as the most significant dimension in the SME digital maturity model. This approach provides a guideline for SMEs to develop their customized digital maturity model and transform themselves digitally. However, it represents only a first step and needs further testing and exploration to achieve validity (Williams et al., 2019).

2.3.1. Digital Transformation and Innovation

Since digital transformation is strongly linked to innovation, this work examines digital transformation from the perspective of innovation theory. On the one hand, the innovation processes are being digitalized; on the other hand, innovation is being promoted primarily through new technical possibilities and digital transformation in general (Hinings et al., 2018).

The development of innovation theory has evolved significantly over time, transitioning from linear models to a more systemic and dynamic understanding. Early efforts by Joseph Schumpeter in the first half of the 20th century laid the foundation with his model that depicted innovation as a linear process, focusing on three stages: (1) invention; (2) innovation; and (3) diffusion. He stressed the importance of innovation for economic growth and the role of science, technology, and human capital in this context (Schumpeter, 1934). However, as these linear models were criticized and considered too simplistic as they ignored the economic conditions that affect innovation, innovation theory was expanded with models that addressed these complexities in the second half of the 20th century (Foxon, 2003; Nemet, 2007). Induced innovation, evolutionary economics, and path dependency were the fundamental approaches at that time (Ruttan, 2001). Contemporary innovation theories have evolved into systemic and dynamic frameworks, shifting from understanding innovation as a linear and isolated process to focusing on the interaction of various actors, institutions, and processes (Greenacre et al., 2012). A prominent theory is the multi-level perspective, which understands technological changes as part of broader socio-economic shifts (Geels & Kemp, 2007). This perspective will be further elaborated on in the methodology chapter, as it serves as an essential framework for this work.

Innovation is crucial for the viability of companies (Cefis & Marsili, 2006) and is usually understood as the use of new knowledge in the business context and the putting of ideas into practice. Moreover, it is a critical element in increasing a company's growth and efficiency (Slaper et al., 2011; Ganotakis, 2012) and a decisive factor in its competitiveness (Kuhlmann & Edler, 2003). A company's ability to innovate, evaluate, and utilize knowledge from internal and external sources contributes significantly to its competitive advantage (Cohen & Levinthal, 1990). In addition, human capital's skills, knowledge, and proactive nature are fundamental to giving companies a competitive advantage (Hewitt-Dundas, 2006) and are indispensable components of innovation (OECD, 2011). In the context of organizational innovation, the pivotal role played by individuals is paramount, with their contributions forming the backbone of innovation activities (Lundvall, 2016). The innovation process can be seen as a collective learning journey, engaging both individuals and the organization as a whole (Montes et al., 2005; Schneider et al., 2010). This continuous learning fosters a dynamic environment ripe for innovative development. Crucially, management's commitment to nurturing an innovative climate and its openness to technological advancements significantly bolsters the firm's overall innovative capacity (Hosseini et al., 2003). A recent survey by ServiceNow and ThoughtLab among 1,000 executives underscores the importance of a vibrant innovation culture. It finds that across industries, modernizing IT platforms is a significant stride towards cultivating such an innovative culture, thereby enabling the flexibility desired by talent. Hence, innovation culture profoundly influences how modern and attractive an organization appears to its employees and potential candidates (ServiceNow, 2023).

2.3.2. Implications of Digital Transformation

Digital transformation brings new opportunities for organizations, such as enhanced collaboration and connectivity and improved human-machine interactions, creating a more integrated and efficient working environment (Bodily & Venkataraman, 2004; Karakas, 2009). Mahmood et al. (2019) created a ranking of the main implications and benefits of digital transformation, which turned out as follows: (1) value creation; (2) operational efficiency; (3) customer relationship and engagement; (4) new business models; and (5) competitive advantage. Simultaneously, digital transformation is reshaping the business

landscape on multiple levels (i.e., macro, meso, and micro) (Geels & Kemp, 2007; Appio et al., 2021), thus also affecting SMEs at these levels (Slimane et al., 2022).

First, the macro level refers to the broad changes in how different actors in innovation ecosystems interact and emerge in the competitive environment. Essentially, this level comprises large-scale trends and shifts in innovation (Carayannis & Campbel, 2009), competition, and the interplay of the overall ecosystem of businesses, governments, society, universities, and research centers (Appio et al., 2021), forming the landscape (Geels & Kemp, 2007). Hence, digital transformation fundamentally impacts how industries are organized and how companies are interconnected, altering market and hierarchical relationships. Organizations face a dynamic environment where the social, economic, political, and competitive landscape fundamentally dictates their opportunities and challenges (Appio et al., 2021). Today, this evolution is driven by technological advancements in areas like cloud computing, big data, AI, the Internet of Things (IoT), and Virtual Reality (VR) (Appio et al., 2021). Amidst this complexity, companies face increased global competition and the urgent need to adapt to the evolving expectations of today's customers, requiring a broader market position and a keen sense of industry trends to stay ahead (Raab et al., 2023; Fujitsu Future Insights, 2021).

Second, the meso level, known as the regime (Geels & Kemp, 2007), narrows this down to how macro-level developments impact individual firms, so broader trends are being translated into specific organizational strategies, structures, and cultures (Appio et al., 2021). On this level, digital transformation deeply affects organizations in these aspects. Initially, it brings about a fundamental disruption across various levels, affecting organizational culture, operational management, infrastructure enhancements, and value creation (George et al., 2020). The swift pace of digitalization challenges established business models and strategies (Seo, 2017; Zaki, 2019) and forces companies to innovate, resulting in new business models and substantial investments in digital initiatives. Externally, digital transformation reshapes SMEs' interactions in the business ecosystem, i.e., suppliers, clients, and other stakeholders (Schilirò, 2021). SMEs must develop open and collaborative business models focusing on external environments (Seo, 2017; Zaki, 2019; Zutshi & Grilo, 2019) and navigate pressures due to advanced technologies (Zaki, 2019).

Henceforth, organizations must innovate their business models and enhance their infrastructure and operational management. This adaptation involves restructuring dynamic capabilities, focusing on cross-functional integration and adaptable organizational boundaries, as emphasized by Appio et al. (2021). For instance, research by del Giudice et al. (2021) investigated a sample of 280 Italian manufacturing SMEs on how agility, ambidexterity, and adaptability in organizational strategies make firms more capable of exploiting the opportunities and advantages of digital innovations. They found that SMEs that adjust to market changes and balance exploration and exploitation activities are better positioned to employ novel technologies and remain innovative. This study underscores the importance of flexibility and responsiveness in the digital age, enabling SMEs to leverage digital technologies effectively for sustained growth and innovation (del Giudice et al., 2021). Studies confirm that the challenge confronting firms today extends beyond merely integrating digital elements into existing practices and products. Instead, the actual task is to harness the full transformative potential of digital technologies, leveraging them not just for incremental improvements but for fundamental changes in business models and operations (Venkatraman, 1994; Fitzgerald et al., 2013; Birkinshaw et al., 2016; Teece, 2018). It is argued that digital transformation is less about simply bringing new technologies into the organization but rather about changing all aspects of the company, from processes to corporate culture, starting with individual mindsets on the micro level and as a collective organization on the meso level (Jones et al., 2021).

At the micro level, in the niche (Geels & Kemp, 2007), the implications of digital transformation are most acutely felt in individual and team behaviors within organizations (Appio et al., 2021). The transformation requires a rethinking of their organizational resilience, influencing innovation processes and work practices (Appio et al., 2021). This impact extends to employees' necessary skills and competencies, highlighting the evolving interplay between humans and technology. Managers especially confront unique challenges. They are tasked with reorganizing work, tailoring work models, decentralizing teams, and fostering an innovative culture in the hybrid work environment. They must effectively manage the integration of digital technologies in their day-to-day operations, all underpinned by a clear purpose (Raab et al., 2023). However, as the demand for digital transformation

expertise increases, organizations encounter a notable shortage of qualified personnel (Raab et al., 2023). This shortage is exacerbated by the accelerating pace of technological advancement, amplifying the need for a workforce skilled in new and emerging technologies (Piva et al., 2005).

2.3.3. Digital Transformation Hurdles

The question arises as to why some companies succeed in transforming themselves effectively while others struggle (Yu & Chieh Hang, 2010). So, what impedes digital transformation in firms, and where are the most prevalent hurdles? Studies have already dealt with the topic, primarily based on a comprehensive literature review (Mahmood et al., 2019; Williams et al., 2019; Stentoft et al., 2020; Slimane et al., 2022) or qualitative research in the form of interviews (Li et al., 2017; Degener, 2020; Shahi & Sinha, 2021), open-ended surveys (Shahi & Sinha, 2021), questionnaires (Shahi & Sinha, 2021; BarNir et al., 2003), or case studies (Steiber et al., 2020). The hurdles identified are often clustered or ranked according to their significance and the difficulty in overcoming them (Jones et al., 2021).

Generally, research indicates that the foremost hurdles to digital transformation are rooted in cultural and managerial issues (Bailie & Chinn, 2018). In the realm of strategy and management, Mahmood et al. (2019) identify an effective strategy and technology disruption as the primary challenges in their systematic literature review. This shows that, on the one hand, management is concerned with new technologies and, on the other hand, with how to implement which technologies and when. Steiber et al. (2020) expand on this by analyzing factors contributing to or hindering organizational digital transformation through a framework based on innovation diffusion theories (Steiber & Alänge, 2015). They uncover specific inhibitors, such as disruptive leadership changes, which can result in delays or a complete strategy overhaul. Moreover, siloed organizational structures hinder the seamless integration and diffusion of innovative practices across the organization, necessitating a more concerted effort from the top management and establishing a group-level governance structure to drive change. These structural barriers, along with the broad and complex scope of the business model, can significantly hamper the integration and application of new technologies. If the scope is too broad or complex, it may pose challenges in implementation and integration with existing systems and processes, slowing down or stalling the

transformation process as the organization struggles to adapt to the expansive changes required (Steiber et al., 2020). Furthermore, together with the Handelsblatt Research Institute, Degener (2020) interviewed experts in digital transformation or internal communication in 18 German industrial companies. The research highlights that 58 percent of digital transformation challenges relate to employee-related issues, such as the lack of openness or acceptance of change and new ideas, often tied to an outdated mindset, fear, and uncertainty about the unknown aspects of digital transformation. Moreover, the absence of pressure for change, particularly in successful companies, can lead to complacency, while risk aversion can stall innovation attempts. Also, siloed thinking and managers without a vision or a reputation as role models that do not foster a digital, forward-looking, and innovative transformation culture represent significant hurdles (Degener, 2020). Also, the study by Shahi and Sinha (2021) could confirm these results. The authors performed qualitative research and found that a lack of vision, resistance to change within the organizational culture, and siloed teams can severely hamper the innovation process (Shahi & Sinha, 2021).

Technologically and infrastructurally, next to the technological disruption (Mahmood et al., 2019), companies grapple with the legacy of outdated IT infrastructures and inadequate digital systems, which can make the transition costly and challenging (Degener, 2020; Shahi & Sinha, 2021). Beyond that, limited resources can hamper digital transformation efforts. Personnel resource constraints, such as a lack of qualifications among employees for navigating the digital landscape (Degener, 2020) or difficulties in finding the right talent and expertise (Shahi & Sinha, 2021) and financial resource constraints can limit a company's ability to invest in and prioritize digital initiatives (Degener, 2020; Steiber et al., 2020; Shahi & Sinha, 2021).

Moreover, the external environment and industry can pose substantial barriers. Degener (2020) points out that traditional conservative industries and serving customers face key external hurdles such as uncertainty, legal regulations, political constraints, and data protection laws. Furthermore, the challenges of managing data effectively, including scarcity, security, and ethical concerns, are pivotal to the transformation process (Degener, 2020; Shahi & Sinha, 2021).

Research also points to barriers that hinder companies in their digital transformation attempts and apply to SMEs in particular. These were summarized in a detailed literature review by Slimane et al. (2022) and are presented in Table 2. First, SMEs encounter higher technological risks when investing in digital processes due to potential incompatibilities with existing systems. This can disrupt digital supply chain systems and discourage SMEs from digital adoption (Corrocher & Fontana, 2008; Xue et al., 2013; Xue, 2014; Karimi & Walter, 2015). Moreover, the transition to digital technology involves significant switching costs and expenses. Firms may delay investments until digital technology becomes widespread and economically justifiable (Fuller-Love, 2000). Generally, limited financial resources can force SMEs to concentrate investments on internet-based activities and information collection, which may not be efficient in the long term (BarNir et al., 2003), and to adopt low-cost business models that emphasize efficiency (Horváth & Szerb, 2018). Next to financial constraints, a lack of skilled labor presents a significant hurdle for SMEs to implement and carry out digital initiatives (Nguyen et al., 2013; Eller et al., 2020; Scuotto et al., 2021). SMEs are prompted to adopt new business models that enhance openness and collaboration (Seo, 2017; Zutshi & Grilo, 2019). Given their geographically somewhat limited scope, SMEs may modernize IT or acquire complementary technologies through supply chains and alliances if they do not radically digitize their processes (BarNir et al., 2003; Corrocher & Fontana, 2008). Moreover, the novelty of digitalization can generate fear, potentially decreasing firms' agility and delaying response times (Matzler et al., 2018). SMEs may lack information about the tangible economic benefits and performance enhancements that digital investments offer, which inhibits them from embracing digital technologies (Beckinsale et al., 2011; Mathrani et al., 2013; Xue et al., 2013; Xue, 2014; Coreynen et al., 2017). Finally, SMEs often struggle to develop strong process assessment metrics, establish knowledge-leveraging processes for knowledge transfer and data transformation (Mathrani et al., 2013), and acquire dynamic capabilities to manage extensive network relations, compensating for their lack of knowledge and management experience (BarNir et al., 2003; Beckinsale et al., 2011; Horváth & Szerb, 2018; Williams et al., 2019). To sum up, the literature shows that the main barriers for SMEs in the context of innovation are limited financial and human resources, a lack of management skills and qualifications,

and vague internal structures in defining roles (Aldrich & Auster, 1986; BarNir et al., 2003; Li et al., 2017).

Table 2
Overview of SMEs' Digital Transformation Barriers

SMEs' digital transformation barriers	Source(s)
Technological risks and incompatibilities	Corrocher & Fontana, 2008; Xue et al., 2013; Xue, 2014; Karimi & Walter, 2015
Switching costs and investment timing	Fuller-Love, 2000; Xue et al., 2013
Financial constraints	BarNir et al., 2003; Horváth & Szerb, 2018
Lack of human resources	Eller et al., 2020; Scuotto et al., 2021
Lack of benefit expectations	Beckinsale et al., 2011; Mathrani et al., 2013; Xue et al., 2013; Xue, 2014; Coreynen et al., 2017
Adoption of new business models	Seo, 2017; Zutshi & Grilo, 2019
Limited geographical reach	BarNir et al., 2003; Corrocher & Fontana, 2008
Fear of novel technologies	Matzler et al., 2018
Challenges in process assessment	Mathrani et al., 2013
Lack of specific skills and experience	BarNir et al., 2003; Beckinsale et al., 2011; Horváth & Szerb, 2018; Williams et al., 2019
Insufficient relationships with the external environment	Seo, 2017; Zutshi & Grilo, 2019

Note. Based on Slimane et al. (2022, p. 106)

2.4. The Necessity for Digital Transformation Competencies

This shows that the prevalent challenges create a complex environment for companies to navigate digital transformation. Thus, guiding a company through the bumpy times of digital transformation represents a demanding task for managers (Berghaus & Back, 2016), and the rapid evolution of the digital landscape has made it difficult for organizations to adapt their management practices accordingly (Kane et al., 2016; Reis et al., 2018; Parviainen et al.,

2022). Although digital technologies are available to SMEs and they are trying to introduce new technologies, like AI, big data, or IoT, simply adopting or using them does not guarantee a source of competitive advantage (Omrani et al., 2022). Instead, it depends on how digital technologies are established in the organization and combined with the competencies within the organization (Sousa & Rocha, 2019), spanning digital, professional, and social dimensions (Ferrari, 2013; Gferer et al., 2021; Dispan et al., 2021).

Research underscores the pivotal role of internal factors as a primary predictor of business performance (Barney, 1991), respectively technological adoption (Omrani et al., 2022), such as organizational resilience and competencies (Mithani et al., 2021). Organizations that possess robust competencies in the digital context are better equipped to anticipate and manage disruptions, make swift and informed decisions, and foster innovation. The establishment of solid and robust digital infrastructures further supports rapid recovery and reinstatement of operations in the event of disturbances (Gotcheva et al., 2013), highlighting that information technology competencies appear to be rare and niche yet irreplaceable in promoting superior performance (Chakravarty et al., 2013). However, despite the recognized importance of competence development in organizational change, many companies struggle with a scarcity of necessary competencies (Buvat et al., 2017), facing a demand for digital talent that often exceeds supply (Gilch & Sieweke, 2021). This is exemplified by 64 percent of German family businesses prioritizing enhancing their digital competencies in 2023 (Rittmann, 2023), making upskilling and reskilling a top priority to address current challenges (Raab et al., 2023).

The relationship between digitalization and the development of competencies is mutually reinforcing. Rapid digitalization necessitates more investment in workforce competence development, preparing employees for digital transformation. Conversely, developing digital competencies can significantly accelerate an organization’s digital transformation (Banf et al., 2023). This underscores that as technological progress advances, so does the need for skilled labor (Piva et al., 2005). Consequently, managers tend to focus on skills, i.e., the lack of them and their development, when it comes to organizational change (Barsh & Lavoie, 2014).

2.4.1. Organizational Resilience and Competitiveness

The above discussion seamlessly transitions into the broader theme of organizational resilience. Resilience emerges as a critical trait for navigating crises, competitive threats, and disruptions, ensuring sustainable competitive advantage in volatile environments (Deloitte, 2021; Fujitsu Future Insights, 2021; Trieu et al., 2023). The concept, growing in popularity in public and academic discourse, extends beyond organizational contexts to broader applications, such as urban development (Elmqvist et al., 2019; Sharifi, 2020). Research addresses the growing complexity and interconnection of socio-economic, financial, and technological systems, highlighting the challenges these pose for businesses and the necessity for strategies to manage unexpected changes (Budak et al., 2021; Dispan et al., 2023). Introduced initially to organizational management by Meyer and Rowan (1977), organizational resilience has since become a crucial element in managing SMEs (Rodríguez-Sánchez et al., 2019; Hillmann & Guenther, 2020; Gayed & El Ebrashi, 2022).

While the definition of organizational resilience remains a subject of scholarly debate, it generally refers to an organization's ability to endure volatile environments, withstand shocks, and recover from disruptions (Corvello et al., 2022). It involves adapting to internal and external disturbances, enabling companies to capitalize on new opportunities and maintain competitiveness despite adverse conditions (Martin & Sunley, 2015; Strambrach & Klement, 2016). Recent discussions expand this understanding, distinguishing between resilience as absorption - maintaining pre-change conditions without actual adaptation - and adaptation, which involves incremental functional changes in response to evolving circumstances (Linnenluecke, 2017; Conz & Magnani, 2020). This distinction is critical in understanding organizational responses and actions in the face of change, with a growing focus on sustainable, long-term strategies beyond short-term crisis management (Boschma, 2015). This evolving interpretation acknowledges the need for organizations to survive and actively shape conditions, seeking transformation and renewal in response to changes (Miceli et al., 2021).

A study by Deloitte (2021) breaks down the elements of organizational resilience into the critical components of strategy, growth, operations, technology, workforce, capital, and society, with growth and technology being the most salient. Notably, digital transformation

stands out as a primary growth strategy, cementing its position as a significant area of focus for organizations aiming for resilience (Deloitte, 2021). It shows that digital transformation, mediated by ambidextrous innovation, positively impacts resilience by fostering agile processes and improving stakeholder communication and coordination (Miceli et al., 2021; Zhang et al., 2021). In this context, Casalino et al. (2019) underscore the critical role of enhancing digital resilience as an integral part of an organization's strategy and mission in managing digital transformation.

Moreover, proficiency in digital competencies can elevate SMEs' organizational resilience and ability to navigate market volatility (Trieu et al., 2023). The pivotal role of workforce training and further education emerges as a critical element in maintaining innovative strength and competitiveness within SMEs, thereby significantly bolstering their resilience against disruptions (McQuirk et al., 2015). Furthermore, von Hattburg (2019) posits that future competencies are crucial for responding flexibly and sustainably to challenges such as digitalization, ensuring resilience and future success. Consequently, companies prioritizing innovative and resilient strategies strongly emphasize staff and organizational development (Freel, 2005; Kolluru & Mukhopadhaya, 2017). This is reflected by the fact that companies with a higher digital maturity level invest more frequently and more resources in the training of their employees than companies with a lower digital maturity level (Janssen et al., 2018; Seyda et al., 2018).

Henceforth, organizations, including SMEs, in the Stuttgart economic region are faced with the question of which factors contribute to their future viability and actively participate in shaping transformation processes based on competencies (Dispan et al., 2023). The region's economy has repeatedly demonstrated its adaptability over the past decades, showing that the region's economic strength, international networking, and innovation capacity provide a solid foundation for companies to effectively manage and shape change supported by R&D investment and a diverse, highly skilled workforce (Dispan et al., 2023). These attributes contribute to the Stuttgart region's resilience and enable it to navigate and leverage transformation processes for business growth opportunities. However, while skilled professionals are critical to the region's economic strength, their shortage poses a significant risk (Dispan et al., 2023). Similarly, technology and industry are characterized by high

technological capabilities and industrial productivity. However, there is a risk of lagging in future technologies due to the dominance of traditional products (Dispan et al., 2023). Furthermore, effective collaboration among businesses, academia, associations, trade unions, citizens, and political entities at all levels emerges as critical to improving the resilience of companies in the Stuttgart region. This collective approach facilitates understanding different perspectives, fosters innovative business models, and supports legislative initiatives and reforms (Dispan et al., 2023).

The literature reveals gaps in understanding specific competencies essential for SMEs to navigate digital transformation. Existing research focuses more on corporate strategy than on the competencies needed to adapt to dynamic environments, highlighting the need for further exploration in this area (Kurtz & Varvakis, 2016; Kantur & İşeri-Say, 2012; Cooper et al., 2014; Mitsakis, 2019).

2.4.2. Understanding and Assessing Digital Competence

In order to address the competencies required in times of digital transformation, it is essential first to determine what constitutes competence. Competence can be defined as a "generic unit of ability" (Feeny & Willcocks, 1998, p. 16), understood as the ability to address and manage challenges effectively in specific situations (Bijedic, 2013; Jung, 2010). According to the European Commission, competencies encompass knowledge, skills, and attitudes and evolve over a lifetime (European Commission, 2019). According to Vuorikari et al. (2022), knowledge is the assimilation of information, concepts, and facts associated with a specific profession or study area. In contrast, skills are defined as the ability to use knowledge and expertise to accomplish tasks and address challenges. They are further divided into cognitive aspects (relating to logical, intuitive, and creative thinking) and practical aspects (involving hands-on proficiency and the application of methods, materials, tools, and instruments). Attitudes "are conceived as the motivators of performance, the basis for continued competent performance. They include values, aspirations, and priorities" (p. 3).

Moreover, competencies can be categorized into subject-related, such as disciplinary and methodological, and interdisciplinary, including personal and social competencies. Disciplinary competencies involve specialized knowledge, skills, and abilities pertinent to a

specific field. In contrast, methodological competencies refer to the mastery of subject-specific methods for knowledge acquisition, problem solving, and process design. Interdisciplinary competencies, conversely, enable individuals to navigate various situations beyond their subject matter, encompassing social competencies for handling communicative and interpersonal situations and personal competencies, which facilitate self-reflection and the strategic management of one's abilities, developmental opportunities, and goals (Euler & Hahn, 2014).

The Council of the European Union underscores the significance of digital competencies, which are essential for lifelong learning and defined as "the confident, critical, and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society" (European Commission, 2019, p. 10). These competencies are vital for managers and employees to adapt and thrive in digital transformation (Gferer et al., 2021).

Vuorikari et al. (2022) further refine this concept by introducing the Digital Competence Framework, also known as DigComp, designed to assess digital competence across five areas: (1) information and data literacy; (2) communication and collaboration; (3) digital content creation; (3) safety; and (4) problem solving. This framework, which will be further detailed in the methodology chapter, serves to evaluate and develop crucial digital transformation competencies.

2.4.3. Organizational Competencies in Digital Transformation

Digital transformation involves people and technology, impacting all organizational dimensions (Frankiewicz & Chamorro-Premuzic, 2020). It is about acquiring technology and digital knowledge to enhance organizational capabilities for value creation. Hence, analyzing individual and organizational competencies is essential, especially those of leaders who influence organizational and individual behavior (Schiuma et al., 2021).

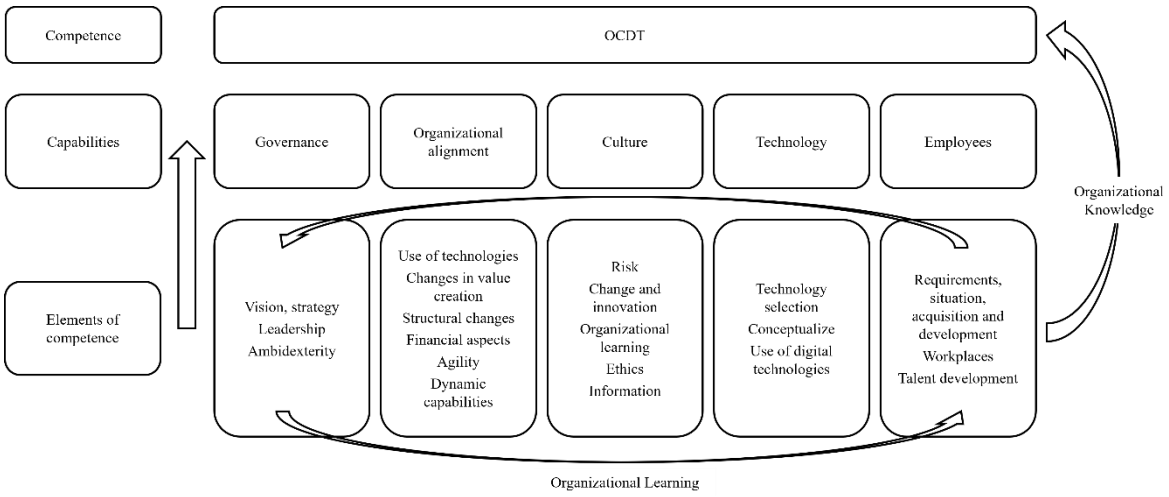
Organizational competence, as described by Sanchez et al. (1996), is the ability of a company to deploy its assets in a coordinated manner to realize its objectives. Teece et al. (1997) further conceptualize it as a cohesive accumulation of specific assets, including individuals

and teams capable of performing specific activities that form organizational routines and processes. In the digital realm, developing digital capabilities is essential for SMEs to drive digital maturity (Uhl & Gollenia, 2016; Ng et al., 2018). A specific definition of organizational competence for digital transformation (OCTD) within SMEs has been formulated by Gonzáles-Varona et al. (2021) as follows:

> "SMEs ability to integrate people, resources, technology, processes, structure, and culture in a digital transformation with a government and strategy that supports them. The Organizational Competence for Digital Transformation must be specifically aligned with the mission, vision, and strategy of the company; and its purpose must be to achieve the objectives set by the management and ensure continuous progress in digital maturity, serving as a basis for achieving a competitive advantage" (p. 22).

Based on a thorough literature review and qualitative interviews with academic professionals and managers, the authors refined and validated the model of OCDT (see Figure 2), which considers the specific characteristics of SMEs and helps them to identify and develop what is necessary to move forward in the digital transformation journey. Based on Jarvidan's hierarchy of competencies (Jardivan, 1998), at the foundation lie the elements of competence that comprise the capabilities, i.e., the organization's ability to leverage these elements. Competence, positioned at the third tier of the hierarchy, represents a multifunctional integration and coordination of capabilities and is central to a firm's strategic and competitive essence.

Figure 2
Model of OCDT within SMEs



Note. Based on Gonzáles-Varona et al. (2021, p. 21)

Hence, SMEs need to consider a variety of competencies that are integral to their digital transformation journey. The necessary competencies can be learned and help SMEs improve their company's digital maturity (Gonzáles-Varona et al., 2021).

Especially leadership (Fujitsu Future Insights, 2021) and clear strategic orientation (Kane et al., 2015) are indispensable in this transformative process. Gonzáles-Varona et al. (2021) emphasize the importance of management support and commitment, highlighting that a clear strategic vision and leadership are vital in fostering a conducive environment for digital transformation (Gonzáles-Varona et al., 2021). In their literature on digital transformation in SMEs, Slimane et al. (2022) support these results and underscore the need for strategic management and the importance of aligning corporate strategy with decisions and digital goals (BarNir et al., 2003; Leeflang et al., 2014; Coreynen et al., 2017; Sandeep & Ravishankar, 2017; Scuotto et al., 2017; Seo, 2017; Horváth & Szerb, 2018; Omrani et al., 2022). In the same vein, Kane et al. (2015) assert that digital transformation hinges more on strategy than technology, highlighting the importance of a digital transformation strategy.

Moreover, the literature stresses the importance of being prepared, adaptable, and collaborative (Deloitte, 2021), embracing risk (Kane et al., 2015), and embracing a culture of agility (Kane et al., 2015; Fujitsu Future Insights, 2021). Furthermore, Slimane et al. (2022) are naming the need for a clearly defined digital culture strategy (Corrocher & Fontana, 2008; Lopez-Nicolas & Soto-Acosta, 2010; Mathrani et al., 2013) and maintaining openness to the external environment (Bodily & Venkataraman, 2004; Tsou & Hsu, 2015; Seo, 2017; Zutshi & Grilo, 2019). It shows that an open information culture is another cornerstone, fostering an environment supporting SMEs' digital transformation initiatives (Gonzáles-Varona et al., 2021). Slimane et al. (2022) support this by naming knowledge sharing, particularly between senior managers (Lee & Bai, 2003; Lopez-Nicolas & Soto-Acosta, 2010; Coreynen et al., 2017; Zaki, 2019), internal openness in terms of cross-disciplinary collaborations (Lee & Bai, 2003; Karakas, 2009; Leeflang et al., 2014; Kane et al., 2015; Zaki, 2019;), and the development of network capabilities and business convergence (BarNir et al., 2003; Coreynen et al., 2017; Sandeep & Ravishankar, 2017; Seo, 2017; Cenamor et al., 2019) as essential aspects in digital transformation for SMEs.

Technologically, SMEs must prioritize selecting and integrating reliable and adaptable technology to their specific needs (Gonzáles-Varona et al., 2021). On top, the convergence of IT and business strategy also plays a critical role in this process (Lopez-Nicolas & Soto-Acosta, 2010; Zaki, 2019; Tumbas et al., 2020) as well as data-driven decision-making (Kane et al., 2015; Fujitsu Future Insights, 2021), internal innovative technology use (Loebbecke & Picot, 2015; Caputo et al., 2019; Zaki, 2019) and leveraging digital tools (Kane et al., 2015).

In addition, a further study by Fonseca and Picoto (2020) discussing organizational competencies in digital transformation employed Vuorikari et al.'s DigComp framework (2016). Leveraging a panel of 16 professionals in Portugal, the authors identify essential digital competencies, including evaluating, browsing, searching, filtering data, interacting through digital technologies, managing data, and collaborating through digital technologies, aligning with the first two competence area dimensions of the European DigComp framework (Vuorikari et al., 2016), namely, information and data literacy and communication and collaboration.

Generally, HR and capability management are further highlighted as SMEs require staff who are receptive to change, curious, and willing to engage with new technologies (Gonzáles-Varona et al., 2021). However, the accumulation of people with different personalities and characteristics was also mentioned by Gonzáles-Varona et al. (2021) as a driver for the emergence of new ideas. People should be empowered (Fujitsu Future Insights, 2021) and their soft skills leveraged in terms of promoting skills and training (Nylén & Holmström, 2015), encouraging creativity through incentives, talent attraction, adapted working environments and training (Karakas, 2009; Leeflang et al., 2014; Kane et al., 2015; Nylén & Holmström, 2015; Tsou & Hsu, 2015; Coreynen et al., 2017; Scuotto et al., 2017), and interactive learning (Lee & Bai, 2003; Leeflang et al., 2014; Coreynen et al., 2017; Zaki, 2019). Hence, rather than emulating other companies due to external pressure, SMEs looking to digitize should first assess their existing technologies and then develop a thorough technology roadmap that includes skills upgrades and investment in improving employee capabilities (Omrani et al., 2022).

Diving into the critical issue of retaining and attracting talent in times of digital transformation, the research underscores the synergy between hard (e.g., cloud computing, analytics, or data science) and soft skills (e.g., passion for learning, collaboration, comfort with ambiguity, entrepreneurial mindset, and change management), which embody a "digital-first mindset" and are essential across all professions, highlighting the discrepancies between organizational needs and employee proficiency (Buvat et al., 2017). This disparity was especially evident in almost all soft digital skills. The study indicated that many employees consider changing jobs due to digital skill gaps and an insufficient learning environment. When contemplating a switch, they favored organizations offering flexible work-life balance, approachable management, collaborative workspaces, clear career paths, robust training programs, an agile, entrepreneurial culture, community engagement, leadership focused on digital transformation, a digitally skilled peer environment, a reputation for attracting top digital talent, and a location in urban or tech hubs. Hence, organizations are advised to synchronize leadership on a talent strategy tailored to the unique demands of digital talent, diversify their recruitment tactics, cultivate a learning-centric environment, delineate clear career paths, empower digital talent to effectuate change, and champion flexible and collaborative work modalities (Buvat et al., 2017).

In regional contexts such as Baden-Württemberg, a study on future skills (Agentur Q, 2021) revealed various essential digital qualifications and interdisciplinary skills that largely reflect the literature described. Essential digital qualifications include agile working methods, digital and data literacy, digital collaboration and interaction, basic IT, and programming skills, alongside interdisciplinary skills such as initiative, flexibility, leadership skills, communication and persuasiveness, creativity, customer orientation, organizational skills, problem solving skills, resilience, and goal orientation (Agentur Q, 2021).

2.4.4. Leadership Competencies in Digital Transformation

As already indicated in the previous chapter, the process of transformation is predominantly initiated by the top of an organization, which does not imply a hierarchical approach to leadership but rather recognizes that lasting changes are spurred by the leaders within an organization (Sathe, 2007; Imran et al., 2020). Consequently, the significance of leadership in digital transformation is paramount in guiding and bolstering an organization on its digital

maturity path (Schiuma et al., 2021). For many years, leadership has been considered crucial in helping SMEs adapt their strategies, introduce change, and foster innovation (Miller & Toulouse, 1986; Wiesner & McDonald, 2001; Holt & Vardaman, 2013). However, managers still perceive leadership in digital transformation and leading a company through the bumpy times of digitalization in recurring crises as challenging (Berghaus & Back, 2016). This may also be due to the range of new competencies required for the success of the digital transformation (Gferer et al., 2021).

To further explore the necessary competencies of leaders in times of digital transformation, this section first briefly explains the concept of leadership. It is important to note that the literature differentiates between the concepts of leadership and management. Leadership can succinctly be defined as "doing the right thing" for the success of an organization, while management concerns itself with "doing things right" (Bennis & Townsend, 1989). Over recent years, the question has arisen whether leadership during digital transformation, referred to as digital leadership, requires a more precise definition and whether it differs significantly from the concept of leadership in general (Gferer et al., 2021). The concept of digital leadership has thus far been predominantly utilized by consultants, lacking a clear definition (Bersin, 2016; Kane et al., 2019). It is generally described as leadership in the digital age or amidst digital transformation (Wilson, 2004). From a corporate perspective, digital leadership holds significant importance at the organizational and individual levels. At the organizational level, it primarily concerns management support and, as described in the previous chapter, organizational competence. On the individual level, it pertains mainly to the individual beliefs and competencies, in this instance, of managers (Holt & Vardaman, 2013). El Sawy et al. (2020) focus on the organizational level in their case study, defining digital leadership as "doing the right things for the strategic success of digitalization for the enterprise and its business ecosystem" (p. 142). In contrast, Gferer et al. (2021) address the individual level, defining the concept based on interviews with female leaders as leadership in times of digital transformation, which differs not much from previous attempts to define digital leadership.

El Sawy et al. (2020) stress that organizations striving to manage digital transformation must focus on competence development. In this regard, studies have noted that the competencies

needed for leadership in digital transformation should be differentiated from those necessary for managing traditional organizations (Horner-Long & Schoenberg, 2002). Fundamentally, it is evident that the principles of good leadership remain consistent through times of change and are also applicable in digital transformation. According to Kane et al. (2019), the enduring skills that leaders require essentially involve articulating the value of change, owning the transformation, and empowering employees to tackle tasks successfully in the digital transformation era.

However, simultaneously, studies offer an initial glimpse into the unique challenges associated with digital leadership, including the accelerated speed of business operations, changes in organizational culture towards networked structures, the resulting conflict between innovators and employees adhering to traditional perspectives, and heightened productivity expectations (Kane et al., 2019). Successfully navigating a company through the required digital transformation significantly impacts and transforms the organizational structure and leadership approaches, as Schwarzmüller et al. (2018) highlighted. Operating within networked rather than hierarchical structures marks a profound shift in working practices and expectations for managers and employees, diverging from merely continuing "more of the same" within their organizations' more uniform internal environments. These shifts emphasize the critical nature of the leadership concept in times of digital transformation (Gferer et al., 2021). Leaders serve as role models to guide the organization through the necessary transformation processes. Furthermore, as role models, they must earn and keep the employees' confidence in the manager's competence to emerge as digital leaders and to effectively realize the envisioned transformation (Fuchs, 2011).

Hence, leading in digital transformation necessitates various further-reaching competencies (Andriole, 2018). The literature review by Müller et al. (2024) indicates that interest in digital leadership competencies has been sparked among scholars, especially recently. This is evidenced by the fact that most of the selected papers have been published between 2018 and 2020. Based on previous studies (Balcar, 2016; Aldie et al., 2022), Müller et al. (2024) differentiate between technical, business, and people-oriented dimensions in their literature study on digital transformation leadership competencies developed through experience and knowledge, highlighting the multidimensionality of the concept (Feeny & Willcocks, 1998;

Bassellier et al., 2003; Adie et al., 2022). Technical competencies refer to managing hardware, software, and data (Laker & Powell, 2011), possessing expertise in technical fields, and staying informed about new technical advancements (El Sawy et al., 2020; Adie et al., 2022). Business competencies involve developing visions and strategic plans, comprehending the business landscape, and driving the realization of benefits (Valentine & Stewart, 2015; Adie et al., 2022). People-oriented competencies refer to a leader's capability to self-manage and effectively interact with others (Laker & Powell, 2011), emphasizing the importance of building relationships and communication skills (Adie et al., 2022).

Müller et al. (2024) argue that leaders require a balanced combination of technical, business, and people-oriented competencies to facilitate digital transformation. In any case, technical competencies are essential and belong to the core competencies (Liu et al., 2018). However, it is acknowledged that leaders do not necessarily need to be technology experts but should possess a well-rounded understanding of digital tools (Valentine & Steward, 2013; Tahvanainen & Luoma, 2018; Imran et al., 2020). For instance, Valentine and Steward (2013) state that leaders "don't need to understand the details of technology as much as they need to understand how management should be dealing with technology" (p. 8). Imran et al. (2020) and Tahvanainen and Luoma (2018) emphasize that all-around technical know-how and a general understanding of digital tools are sufficient. Kane et al. (2019) also emphasize that technical and hard skills are indeed necessary and essential for the future. However, they can also be learned and are not necessarily the most critical skills needed. This is in line with Balcar (2016), who argues "that the productivity of hard skills results from their combination with soft skills" (p. 453). Here, the importance of communication, vision for change, and strong interpersonal competencies, especially in motivating employees and managing people issues, is highlighted (Müller et al., 2024).

This perspective aligns with research indicating that certain mindsets play a significant role in the success of organizational change efforts. However, the research on mindset is very blurry (French II, 2016). Definitions, methodologies, and discussions surrounding mindset differ widely, sometimes even clashing within the same academic field. Despite the significant gaps in research on mindset, it is undeniable that how individuals and organizations interpret their surroundings (Gupta & Govindarajan, 2002) - and consequently

respond to change - is profoundly influential. Boaz and Fox (2014) highlight that "[organizations that] can identify and address pervasive mindsets at the outset […] are four times more likely to succeed in organizational-change efforts than [organizations] that overlook this stage" (p. 2). If members of an organization hold a fixed mindset, believing they cannot learn new technological skills, they will naturally resist attempts at change. Conversely, if they are convinced that their abilities can be expanded and developed through further training and understand that they can indeed learn and evolve, they are more likely to embrace the challenges posed by digital transformation, both organizationally and personally (Dweck, 2006; Dweck, 2012; Dweck, 2015). This is reflected not only in the context of digital transformation but also, for example, in dealing with the COVID-19 pandemic. Viewing events like the digital transformation or the pandemic as an opportunity for growth rather than an insurmountable problem aligns with Dweck's narrative (Dweck, 2006; Dweck, 2012). Hence, leadership perception within organizations, particularly in how they view and respond to challenges like digital integration during such crises, could determine whether SMEs leverage these challenges to their advantage and sustain themselves through and beyond them (Jones et al., 2021).

Furthermore, Schiuma et al. (2021) introduce the transformative leadership compass, focusing on three pivotal leadership styles: (1) the wise; (2) the transformative; and (3) the digital leader. According to the authors, a digital transformation leader is convinced that ongoing innovation is essential for survival and ensures that all organization members are dedicated to implementing constant transformation. Such a leader understands the organization's need to either inspire or shape a new future to survive, driven by their visions and aspirations, rather than relying solely on the analysis of empirical data and deductive reasoning. This framework delineates six essential competencies for digital transformation leaders, including grasping the digital transformation's essence, envisioning digital wealth creation, shaping a knowledge-creating context, communicating the transformation's essence, engaging people to act within this framework, and making digital transformation a collective responsibility (Schiuma et al., 2021).

Gferer et al. (2021) referred to Vuorikari et al.'s DigComp framework (2013) and shed light on the competencies needed for digital leadership from a female manager's point of view.

They interviewed female managers from the DACH region and found that these competencies range from a genuine curiosity and interest in new technologies to playing an active role in the transformation process, underpinned by empathy, social skills, and the ability to articulate the value of change. Furthermore, these leaders value lifelong learning, open knowledge handling, eye-level communication, openness to alternative working-time models, and fostering an open error culture. A Deloitte report (2021) further emphasizes the importance of authenticity, alongside empathy and rationality, as foundational traits of resilient leaders (Deloitte, 2021).

Focusing on SMEs, Slimane et al. (2022) offer insights into the characteristics vital for digital transformation managers in organizations of this size, encompassing technical knowledge (Fuller-Love, 2000; Corrocher & Fontana, 2008; Beckinsale et al., 2010), open-mindedness, and risk-taking (Fuller-Love, 2000; Lee & Bai, 2003; Karakas, 2009; Beckinsale et al., 2010; Xue et al., 2013; Dutta et al., 2014; Leeflang et al., 2014; Tsou & Hsu, 2015). Moreover, managers should be strategically oriented, which involves being receptive to the external landscape, including competitors, clients, government, and technology, capitalizing on opportunities (Sambamurthy et al., 2003; Beckinsale et al., 2010; Tsou & Hsu, 2015; Cenamor et al., 2019) and being open to external events (Sambamurthy et al., 2003; Beckinsale et al., 2010; Tsou & Hsu, 2015). By determining the scope of business activities such as strategy for exploration, financial bootstrapping, digital business platforms, and innovation (BarNir et al., 2003; Scuotto et al., 2017; Horváth & Szerb, 2018; Cenamor et al., 2019; Zaki, 2019), as well as investing in skills and formulating essential strategies to stay ahead of competitors, managers should be able to enhance business outcomes (Lee & Bai, 2003; Sambamurthy et al., 2003; Dutta et al., 2014). Moreover, a manager needs to be involved in organizational development, creating spaces to boost creativity and minimize conflicts (Leeflang et al., 2014; Nylén & Holmström, 2015; Caputo et al., 2019), encouraging entrepreneurial behaviors and supporting the generation of new ideas (Tsou & Hsu, 2015), fostering a digital-centric culture and collaborative efforts (Sandeep & Ravishankar, 2017; Scuotto et al., 2017) as well as educating employees on the smart use of digital tools (Coreynen et al., 2017; Caputo et al., 2019).

However, it should be noted that the combination of needed competencies can also vary depending on the transformation's specific driving forces and objectives, and a one-fits-all approach does not apply (Müller et al., 2024). Here, the competing values framework by Cameron and Quinn (2006) can be employed to distinguish organizations in two dimensions. The first dimension encompasses flexibility (prioritizing flexibility, dynamism, and trust in human judgment) versus stability (prioritizing stability, order, and control). The second dimension refers to external (focus on external adaptation and market differentiation) versus internal focus (focus on internal integration and unity). Müller et al. (2024) applied this framework and developed archetypal competence portfolios for leadership in times of digital transformation, which either relate to the goal of exploring market innovation, supporting operational efficiency, ensuring active stakeholder involvement, or improving competitive positioning. For instance, should the objectives concentrate on external adaptation and market differentiation, the digital transformation effort should focus on improving customer engagement, fostering innovation, and boosting competitiveness. Conversely, when the emphasis is on internal integration and unity, the initiative should aim to bolster internal teamwork, enhance communication, and increase operational efficiency (Müller et al., 2024). This shows that required competencies depend on the organizational context, which should always be considered.

3. Research Gap and Research Questions

Despite the insights provided by existing research, gaps in this area remain apparent. Although the barriers and challenges to digital transformation are evident and tangible, and there is consensus that they should be addressed, there is still no clarity as to which challenges are the biggest and should therefore be prioritized and tackled first, especially in the context of SMEs (Kane et al., 2015; Kane et al., 2019). Also, necessary competencies may vary depending on the context (Fonseca & Picoto, 2020; Müller et al., 2024). Hence, companies often do not know which competencies to focus on and how to implement them (Moroz, 2018).

Therefore, exploring competencies necessary for overcoming the multifaceted challenges encountered during digital transformation efforts in real-world settings remains a critical area for future research (Wolff et al., 2019). While existing studies have begun to map out

the landscape of digital transformation challenges and competencies mainly based on literature reviews, there is a pressing need to validate and expand upon these findings through empirical research (Müller et al., 2024). Digital transformation, understood as a socio-technical change process, necessitates inclusive stakeholder participation and collaborative effort (Schmid et al., 2017; Vial, 2019), highlighting the importance of examining the dynamics between leadership and employees in building competencies for digital transformation. Moreover, the impact of organizational context, including factors such as company size, sector, and industry, on the challenges faced and the competencies required for digital transformation has been identified as an area ripe for investigation (Kraus et al., 2022), for example, focusing on the unique challenges of SMEs and how these translate into necessary competencies (Skare et al., 2023).

Addressing these gaps, this work examines SMEs within the Stuttgart economic region, identifying the primary challenges these organizations face in digital transformation and the necessary competencies needed from the perspective of SME managers. These findings are intended to serve as a guideline for these companies, assisting them in prioritizing future efforts to enhance their competitiveness and resilience, also beyond the Stuttgart economic region.

Accordingly, this work seeks to answer the following research question (RQ) and sub-research questions (SRQ):

RQ: What hurdles do SMEs in the Stuttgart economic region face in the context of digital transformation, and which corresponding competencies are needed from the perspective of SME managers?

SRQ1: How can these competencies strengthen the competitiveness and resilience of SMEs in the economic region of Stuttgart?

SRQ2: What lessons can be learned from the Stuttgart economic region?

4. Methodology

The following chapter addresses the methods for approaching and answering the research questions mentioned above. The focus lies on the conceptual framework, research design,

data collection, sampling, and analysis, respecting adequate quality criteria and ethical considerations.

4.1. Developing the Conceptual Framework

This section delineates the theoretical foundations and conceptual models underpinning the research. This framework guided the methodological approach and data analysis, ensuring a structured analysis of digital transformation hurdles and associated competencies within organizations. The stage was set by identifying digital maturity, i.e., the classification into the respective digital maturity level according to Kane et al. (2015), and the framework of digital maturity for SMEs by Williams et al. (2019) to determine the factors that influence this classification. However, the primary theoretical lenses employed were the multi-level perspective by Geels and Kemp (2007) next to the DigComp framework by Vuorikari et al. (2022), which could be complemented by additional hurdles and competencies identified through the literature review and empirical data analysis.

To assess digital maturity, Kane et al. (2015) surveyed executives, managers, and analysts from organizations across different countries, industries, and sizes. In addition, executives from various industries were interviewed to understand better the practical issues facing organizations today. To categorize organizations into different stages of digital maturity, the authors "[…] asked respondents to rate their company against an ideal organization - one transformed by digital technologies and capabilities - on a scale of 1 to 10" (p. 5). As a result, the three groups "early," "developing," and "maturing" emerged, which are also employed in this study. This approach was used to determine the digital maturity levels of the organizations studied and, thus, to analyze and classify the answers the interviewees gave better. Furthermore, Williams et al. (2019) provided a framework for identifying factors influencing digital maturity in SMEs. Based on a systematic literature review of digital maturity models for SMEs, the paper by Williams et al. (2019) provides a first digital maturity model consisting of six dimensions: (1) strategy; (2) products or services; (3) technology; (4) people and culture; (5) management; and (6) processes. This made it possible to examine what is crucial for digital maturity. Building on this, the results of this work could contribute to further validating this model.

Moreover, the well-established multi-level perspective proposed by Geels and Kemp (2007) is crucial for analyzing the complexity of socio-technical transitions. This framework is particularly relevant for understanding the dynamics of digital transformation, a process deeply rooted in social and technical elements. The multi-level perspective categorizes change into three distinct levels: (1) the micro level of "niches" where innovations emerge; (2) the meso level of "regimes" that represent prevailing practices and technologies; and (3) the macro level of "landscape" that encompasses broader societal and economic trends (Geels & Kemp, 2007). Hence, this model helped to conceptualize the challenges and barriers to digital transformation for SMEs across these three levels. This provides a holistic view of how systemic, organizational, and individual factors interact and influence transformation processes.

Furthermore, as touched on above, the DigComp framework by Vuorikari et al. (2022) and published by the Joint Research Center - the European Commission's science and knowledge service - aims to enhance competencies for digital transformation. This framework is particularly relevant in today's digital age since it provides a structured approach to understanding and developing the essential competencies to navigate the digital landscape. The paper outlines 21 competencies grouped into five key areas:

(1) Information and data literacy: To identify information needs, locate, retrieve, and organize digital data, and assess the relevance of sources.
(2) Communication and collaboration: To interact, communicate, and collaborate using digital tools, be aware of cultural and generational diversity, and manage digital identity and reputation.
(3) Digital content creation: To create and edit digital content, integrate information, understand copyright and licenses, and provide clear instructions for computer systems.
(4) Safety: To protect devices, personal data, and privacy in digital environments, safeguard physical and psychological health, and understand the impact of digital technologies on social inclusion.
(5) Problem solving: To identify and resolve digital-related problems, innovate processes and products using digital tools, and stay up-to-date with digital advancements.

Together, these areas provide comprehensive guidance on the competencies required to meet the challenges of digital transformation. The framework helps individuals and organizations improve digital capabilities, and policymakers develop strategies promoting digital growth and literacy (Vuorikari et al., 2022). Hence, it serves as a foundational framework for understanding and developing digital competencies and a dynamic tool that evolves with technological progress. Its continued relevance and potential future adaptations make it a significant model for current and future research in digital transformation and this study. Therefore, studies addressing digital transformation in organizations have already applied the framework, providing a solid foundation for future research (Gferer et al., 2021; Fonseca & Picoto, 2020).

Taken together, this conceptual framework helped contextualize the challenges and barriers within a multi-layered perspective and facilitated a structured approach to analyzing digital transformation competencies and their impact on organizational resilience and competitiveness across different digital maturity stages. The integration of multiple well-established frameworks aimed to contribute to the robustness of the model, making it comprehensive and applicable to different contexts.

4.2. Research Design

The thorough review of the literature and illustration of the theoretical background presented an intellectual challenge and suggested that an exploratory research design and qualitative strategy of inquiry would offer the opportunity to create an understanding of the challenges posed by digital transformation in this particular context and the competencies required to address them (Müller et al., 2024). Since it had been established that not much research had been done in this specific context yet, the research aimed to uncover unknown causes, motives, and ideas (Creswell, 2009). Hence, this method proved to be the most appropriate, also in the light of the researcher's resources in the context of a master's program.

Moreover, since the research object could not be observed directly but instead reported on and constructed by those with direct experience, semi-structured in-depth interviews with SME managers in the Stuttgart economic region were suitable (Blaikie, 2009). The semi-structured interviews gave a general structure to the interviews, allowed the researcher to

control the course of the interview and the line of questioning, and helped to focus on the main topics, allowing for cross-data analysis between the participants (Carson et al., 2001; Cresswell, 2009). At the same time, they allowed for flexibility and thus offered the opportunity to take up new aspects that arose during the interview (Kvale & Brinkmann, 2009). By using mainly open-ended questions that were broad and more general, participants were encouraged to share their perspectives on the situation being studied and form a narrative (Clandinin & Connelly, 2001). Hence, the meaning of those lived experiences could be constructed and thus analyzed and interpreted by the researcher, following quality criteria (Mertens, 1998). In addition, the aim was to generate consciousness about the matter from the opinions and perspectives of the participants and to evoke possibilities for change in practice (Kemmis & Wilkinson, 1998). In this context, the qualitative face-to-face interviews provided in-depth insights that could not have been obtained by applying other research methods (Cresswell, 2009).

4.3. Data Collection Strategy and Sampling

To fully explore the topic of interest, gain in-depth insights, and leverage quality criteria, a total of 20 qualitative face-to-face online interviews were conducted among managers with leadership functions at executive, middle management, or team lead levels in SMEs headquartered in the Stuttgart economic region, Germany, operating mainly in the manufacturing or service sector. Prospective companies and associated interview partners were selected following extensive research into the Stuttgart economic region and local SMEs. The participants act as "knowledgeable agents," helping to answer the research questions, following Giddens' (1984) structuration approach. Using a single-stage targeted non-probability sampling approach (Blaikie, 2009), it was ensured that the selected companies varied in their digital maturity level, size, and sector and that interviewees from different positions, subject areas, and sociodemographics were taken into consideration, aiming to achieve diversity within the desired target group. However, the focus was placed on the production engineering cluster in the Stuttgart region since this cluster consists of large companies next to numerous SMEs (Dispan, 2021). Many of these classic SMEs, often family-owned and owner-managed, have developed into technology leaders in their niche markets and have become essential components of the Stuttgart region. However, they are currently primarily confronted with the challenges of digitalization (Dispan, 2021). This

made those actors suitable in this context, whereby half of the participants were drawn from this sector, supplemented by interviews with managers from other sectors to validate the findings.

The prospective interview partners were recruited directly with the help of the P3 Group network, which facilitated the recruitment process. LinkedIn, a networking platform, was used to contact additional prospects. Thus, the researcher could start with a group of participants, which was expanded using the snowball method. Snowball sampling enabled further interviewees to be generated via interview partners already recruited. At the end of the interview, the participants were asked whether they had any further contacts of potential participants within the sample. This was well suited to this research context, as it involved a population that is difficult for the researcher to access but whose members are well-networked (Blaikie, 2009). In the interview request, the interview context was briefly introduced, the importance of their participation was emphasized, and an information sheet for participants (see Appendix B) and a consent form (see Appendix C) were attached, containing further information.

To gain a comprehensive impression of the companies (N=10) included in the sample, they are briefly described and listed in Table 3 according to their classification into different company sizes within the SME definition developed in this work, their respective industry, and their level of digital maturity. Since the focus was placed on the upscale SME segment, the sample thus consists of mainly upscale SMEs (n=6), followed by medium-sized SMEs (n=3), and one small SME. Half of the companies come from the production technology cluster (n=5), and the other half from knowledge-intensive services, i.e., IT services (n=3) and consulting (n=2), which could provide valuable insights due to their expertise in this area and interaction with different regional clusters. In terms of digital maturity, most of the examined organizations (60%; n=6) were classified in the midfield, i.e., as developed; three (30%) were rated in the highest third, i.e., as mature; and one organization (10%) as an early degree of maturity. To support this, Figure 3 illustrates the breakdown of the digital maturity levels.

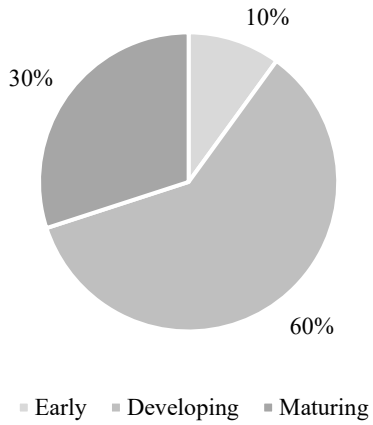
Table 3
Overview of the Organizations Investigated, Sorted by Size

Company size	Description	Industry	Maturity stage	Abbr.
Small	*Family-owned consultancy with a focus on process consulting and lean management*	Consulting	Early	O1
Medium	*Family-owned manufacturer of injection molding tools*	Mechanical engineering	Developing	O2
	Provider for the development and operation of digital business models and innovative security services	IT services	Developing	O3
	Software company for individual software, machine learning, and data science-related solutions	IT services	Maturing	O4
Upscale	*Software company specializing in cloud solutions*	IT services	Maturing	O5
	Family-owned manufacturer and developer of optical sensors	Electrical engineering	Developing	O6
	Management and software consultancy with a focus on automotive	Consulting	Maturing	O7

Company size	Description	Industry	Maturity stage	Abbr.
	Family-owned manufacturer of milling machines	Mechanical engineering	Developing	O8
	Family-owned machine tool manufacturer	Mechanical engineering	Developing	O9
	Family-owned manufacturer of door, window, and security systems	Metalworking construction	Developing	O10

Note. Developed by the author. Total *N*=10

Figure 3
Shares of the Digital Maturity Level of the Organizations Investigated



Note. Developed by the author. Total *N*=10

Furthermore, an overview of the interview partners (N=20) associated with the listed organizations is provided in Table 4. One to four individuals from different management positions (executive level, middle management, team lead level) were interviewed per organization, resulting in an average of two interviewees per company. A total of six interviewees at the executive level (e.g., Managing Director, Chief Sales Officer), five middle managers (e.g., Head of HR Global, Director Controlling), and nine individuals at the team lead level (e.g., Team Lead Validation, Senior Consultant Organizational and Staff Development) were interviewed, covering various areas of specialization. These areas

include digitalization and topics such as automation, security or software, machine learning, data science, and cloud solutions in this context, as well as organizational development, change management or strategy, next to classic sales, controlling, HR, legal and finance, and product development specifications. Regarding sociodemographics, most participants were between 28 and 35 (35%) or between 36 and 44 years (35%) old, while 20 percent were between 45 and 52 and five percent between 22 and 27 or between 53 and 59 years old, respectively. Moreover, most of the participants (n=16) were male (80%), and four were female (20%). This proportion of women is consistent with the latest statistics, which show that, on average, around 23 percent of leadership positions in German SMEs are held by women. This share varies depending on the state and industry. In the state of Baden-Württemberg, this proportion decreases to 22 percent. In the manufacturing industry, for example, the proportion drops to 13 percent, and in the construction industry to as low as seven percent. In contrast, the proportion of female leaders in other services, such as hairdressers and opticians, reaches 47 percent (KfW Research, 2024).

Table 4
Overview of Interview Partners Clustered in the Organizations Investigated

Organization	**Interview partner**			
Abbr.	**Age group**	**Gender**	**Position**	**Abbr.**
O1	28-35	Male	*Senior Consultant Lean Management*	I11
	28-35	Male	*Senior Project Manager Lean Management*	I14
O2	22-27	Male	*Team Lead Work Preparation and Digitalization*	I13
O3	36-44	Male	*Managing Director*	I6
	36-44	Male	*Senior Manager Advanced Driver Assistance Systems*	I8
O4	36-44	Male	*Managing Director*	I12
O5	53-59	Male	*Managing Director*	I10
O6	45-52	Male	*Chief Sales Officer*	I15
	45-52	Male	*Director Controlling*	I19

Organization	**Interview partner**			
Abbr.	**Age group**	**Gender**	**Position**	**Abbr.**
	36-44	Male	*Team Lead Automation Management International*	I17
O7	45-52	Male	*Managing Director and Chief Operating Officer Digitalization*	I3
	28-35	Female	*Partner and Lead Organizational Development and Strategy*	I4
	28-35	Male	*Team Lead Organizational Development and Strategy*	I7
	28-35	Female	*Senior Consultant Organizational and Staff Development*	I1
O8	28-35	Male	*Project Manager Digital Engineering*	I18
O9	36-44	Male	*Head of Organizational Development*	I16
O10	36-44	Female	*Chief Officer Legal and Finance*	I2
	45-52	Male	*Head of Development*	I5
	36-44	Female	*Head of HR Global*	I20
	28-35	Male	*Team Lead Validation*	I9

Note. Developed by the author. Total *N*=20

Microsoft Teams, enabled by the P3 Group, was used to conduct the interviews online. After pilot testing and minor adjustments to the interview guide, the interviews took place cross-sectionally from January 10th until March 25th, 2024. The interviews lasted an average of 45 minutes, while the shortest lasted around half an hour and the longest almost an hour and a half.

The interview guide (see Appendix D) entailed a few general questions, which were designed as open-ended, not entailing yes- or no-questions, considering existing research (Kane et al., 2015; Gferer et al., 2021; Shahi & Sinha, 2021), and intended to elicit the participant's perspectives and opinions in-depth (Cresswell, 2009). To avoid

misunderstandings, simple and clear language was used, and, if necessary, a brief introduction to the constructs was always given and definitions clarified. In addition, use was made of reacting to new findings during the interview and naturally adapting both questions and the course of the interview. However, when formulating questions, it was made sure not to formulate them as leading questions and not to allow any reaction or evaluation of the answers given to be noted to avoid unconsciously leading the interviewee in a certain direction (Cresswell, 2009).

Moreover, the interview guide was divided into five blocks, plus the introduction and conclusion. The first block covered background information on the person and organization; the second assessed the organization in the context of digital transformation; the third dealt with challenges and barriers; the fourth dealt with the associated competencies; and the fifth addressed implications in a broader context.

After a short introduction to the interview, covering a welcome, appreciation for participation, an introduction of the interviewer, context of the interview and outline of the topic, description of the duration and course of the interview, handling of data, and clarification of open questions, the interviews started with block one. In this block, the interviewees were asked to introduce themselves and describe their current profession and organization to get an impression of the context, i.e., the interviewee and organization. To determine age, participants were asked to classify themselves in one of the age groups: 21 or younger, 22 to 27, 28 to 35, 36 to 44, 45 to 52, 53 to 59, and 60 or older (Kane et al., 2015).

In block two, the topic of digital transformation in organizations was introduced to assess the company's digital maturity level. Participants were asked to rank the organization on a scale of 1 to 10 compared to an ideal organization transformed by digital technologies and capabilities (Kane et al., 2015) and describe their assessment criteria so the researcher could better understand their decision.

Building upon this in block three, respondents described the challenges they face today in the context of digital transformation and where they see barriers in digital transformation processes (Kane et al., 2015; Shahi & Sinha, 2021).

Moreover, in block four, the construct of competencies was introduced, and interviewees were asked which associated competencies they identify and consider as most important to overcome the named challenges and barriers (Gferer et al., 2021).

Finally, to place these competencies in a broader context, participants were asked to describe the extent to which they believe these competencies could contribute to a company's resilience and future viability and whether they could draw connections between the Stuttgart economic area and the digital transformation in regional companies in block five.

In order not to miss anything relevant, at the end of the interview, participants were asked if there was anything that had not yet been covered but that they thought was crucial to better understand the digital transformation of SMEs or if there was anything else they would like to share. After the last statement, the recording ended, thanks were expressed once again, and the next steps were explained to the participants.

4.4. Data Analysis Procedure

With the help of Microsoft Teams, the semi-structured interviews were audiotaped and transcribed verbatim, ensuring that data, such as emotions, pauses, and hesitations, were not lost in the process (Cresswell, 2009). As the interviews were conducted in German, the anonymized transcripts were translated into English using the translation tool DeepL, which complies with the data protection laws of the European Union and thus ensures data protection and confidentiality (DeepL, n.d.). The transcripts laid the foundation for the subsequent data analysis and can be found in Appendix F (file 2). However, the German transcripts were used for coding to avoid losing meaning through translation.

To be guided by the material and to capture the subjective viewpoints of the participants, the data was analyzed inductively according to the principles of grounded theory (Corbin & Strauss, 1998) and based on the steps of a structuring qualitative content analysis (Kuckartz,

2012; Mayring, 2015), which formed the guideline of the analysis. A central element involved thematic coding, assigning text passages to specific themes. These themes were further differentiated during the analysis and divided into sub-themes, which formed the categories and were compared with existing literature (Kuckartz, 2012). This approach made it possible to link theory and empiricism. Moreover, the procedure was carried out iteratively in cycles to increase the depth and quality of the results (Kuckartz, 2012).

The first step involved obtaining a general overview of the data and sample and making sense of the information supplied by participants (Cresswell, 2009). This step already began during the interview phase, in which key points, comments, and thoughts on the interviews were taken. Subsequently, a qualitative content analysis was conducted using the software MAXQDA (Kuckartz, 2012; Mayring, 2015). Initially, thematic main categories that represent the data and summarize the information were identified (Corbin & Strauss, 1998; Kuckartz, 2012) based on the thematic blocks of the interview guide, i.e., digital maturity stage, digital transformation challenges and barriers, digital transformation competencies, and implications. The material was worked through using those main categories (Kuckartz, 2012). In the further course, subcategories were formed inductively during the coding process, and the material was coded using the entire system of main and subcategories (Kuckartz, 2012). Each code was related to a category if the term, synonym, or description was stated by the interviewee (Mayring, 2015). The individual categories and their interrelationships were determined by identifying overlapping patterns (Corbin & Strauss, 1998; Kuckartz, 2012).

The resulting subcategories could be compared with existing literature. The evaluation of the digital maturity level consists of a classification of the organization on a scale of 1 to 10, through which three groups emerged: (1) early (first third); (2) developing (second third); and (3) maturing (top third), which are based on previous literature (Kane et al., 2015). Moreover, the identified subcategories of the factors for determining the digital maturity level could be compared with the six dimensions of the digital maturity framework for SMEs by Williams et al. (2019). The two further dimensions, adaptability as well as communication and collaboration, emerged during the coding process. Also, once the subcategories of challenges and barriers in the context of digital transformation could be

identified inductively as the material was combed through, these could be assigned to the micro, meso, and macro levels based on the multi-level perspective (Geels & Kemp, 2007). The resulting subcategories of the digital transformation competencies correspond to the categories of communication and collaboration, safety, and problem solving from the DigComp framework (Vuorikari et al., 2022). In addition, further emerging subcategories could be assigned to the categories of leadership, self-management, and technological competencies. Also, a category comprising possibilities for promoting digital transformation competencies could be identified. Concerning the implications of digital transformation hurdles and associated competencies, the categories competitiveness and resilience and Stuttgart region learnings with corresponding subcategories crystallized during the coding process. To make the coding process comprehensible, a coding guide was developed based on all the categories that emerged, which can be found in Appendix E.

The final step in the data analysis involved making meaning of the data and linking it to previous literature, aiming to enrich existing theory (Corbin & Strauss, 1998; Kuckartz, 2012) and deriving recommendations for action (Lincoln & Guba, 2006).

4.5. Quality Criteria

In designing the questionnaire, the quality criteria of qualitative research were observed to ensure a high standard of results.

For reliability, it was ensured that there was no shift in the definition of codes by constantly and iteratively matching the data with the codes during the analysis and describing them precisely (Creswell, 2009). This was supported by conducting a pretest, the iterative approach of the coding process using the software MAXQDA, and creating a coding guide. In addition, by documenting the process and applying broader frameworks, in particular the multi-level perspective (Geels & Kemp, 2007) and the DigComp framework (Vuorikari et al., 2022), an attempt was made to achieve generalizability of the results (Yin, 2014).

The validity, or the accuracy of the results, was meticulously ensured through trustworthiness, authenticity, and credibility (Creswell & Miller, 2000). This was achieved by a rigorous process of transparency and precise documentation of the procedures and

results, which were described and presented densely and richly in the methods and results sections. No diverging information was withheld, and an auditor, a university supervisor, was consistently involved in reviewing the project (Creswell, 2009). The inclusion of different sectors within the target group further bolstered the validity of the results.

Moreover, to analyze the results objectively, own preconceptions were acknowledged, and work was carried out as unbiased and value-free as possible. It was noted that the researcher conducted the master's thesis in cooperation with a company, ensuring the intersubjectivity of the research by making the subjectively obtained results plausible for outsiders (Ratner, 2002).

4.6. Ethics

Considering that the research involved people's data (Punch, 2006), the researcher was acutely aware of the potential ethical issues that could arise at all project stages (Hesse-Biber & Leavey, 2006). The commitment to ethical considerations, including conscientiousness, integrity, and doing good (Israel & Hay, 2006), was unwavering.

In anticipation of ethical challenges, objectives and conditions were disclosed to the participants before conducting the interviews to ensure that participants were fully aware of the research's scope and potential impacts. The interviewees were free to decide whether or not they wanted to participate in the interviews. Before the interviews, the researcher ensured that the interviewees had informed consent and that confidentiality and anonymity were always maintained. For this purpose, unique identifiers were used for each interviewee and organization. In addition, text passages that could be traced back to the person or organization were cut out. This approach extends to carefully handling sensitive information, with stringent data security measures in place to prevent unauthorized access. All data was therefore stored password-protected. Henceforth, care was always taken to ensure that the participants were not harmed in any way (Sarantakos, 2005). The interests of participants were permanently at the forefront, and emphasis was placed on ensuring that both researchers and participants benefited from the research (Patton, 2002). For this reason, the resulting white paper was sent to all participants after the interviews to show appreciation for their participation in the interview.

Furthermore, the ethical complexities of cooperating with a company were recognized. To maintain the integrity of the study, the research procedure was documented, and the researcher's standpoint was always reflected upon to mitigate conflicts of interest. The research design also included a feedback mechanism for participants, allowing them to express their experiences and concerns, thus enriching the ethical conduct and the overall value of the research. Likewise, the researcher is conscious of the study's limitations and has always ensured adherence to quality criteria (Cresswell, 2009).

5. Results

The section begins by revisiting the classification of organizations according to their levels of digital maturity, setting the stage for a more detailed discussion of the factors influencing these digital maturity stages and enabling a nuanced analysis and interpretation of the collected responses. Following this, the challenges and barriers associated with digital transformation across the macro, meso, and micro levels are described. This leads to an exploration of digital transformation competencies (RQ). The section concludes by discussing the implications of these competencies for organizational resilience and competitiveness (SRQ1) and examining the role of the Stuttgart context to derive lessons from this case (SRQ2).

5.1. Digital Maturity Stage Classification and Influencing Factors

The assessment of the organization's digital maturity level on a scale of 1 to 10 resulted in three groups: (1) early (first third); (2) developing (second third); and (3) maturing (top third), which are based on the authors Kane et al. (2015). Most interviewees (60%) classified their organizations' digital maturity level as being in the middle range, i.e., as developing. In contrast, 30 percent were classified as early and 10 percent in the top third, i.e., as maturing.

Eight different aspects were identified when evaluating the factors used by participants to determine their organizations' digital maturity stage: (1) strategy; (2) products or services; (3) technology; (4) people and culture; (5) management; and (6) processes as established by Williams et al. (2019). In addition, two further factors emerged in the data analysis: (7) adaptability; and (8) communication and collaboration. In the following, all factors are listed

according to the frequency with which they were mentioned and summarized according to what the interviewees said about the respective aspects.

Firstly, the analysis of the interviews revealed that for the interviewees, organizational processes play a central role in assessing digital maturity. Critical indicators of process advancement include the degree of automation, particularly for routine and administrative tasks such as travel expense reporting, as well as the level of integration of various systems and technologies to create seamless workflows and improve data exchange. Additionally, scalability and standardization of processes were frequently mentioned, along with reductions in processing times and error rates through digitalization. For instance, one interviewee who classified their organization as still in the early stages of their digital maturity described: "*We're still lagging behind, basically because […] many processes are very complex and difficult. […]. So it's because of that, it starts with small things like a hotel booking, it goes on to complex things like creating invoices, we still create them manually […]*" (I11: English transcript: p. 3, ll. 105-114; German transcript: pp. 3-4, ll. 113-123). Another interviewee from this organization noted that this leads to inefficiencies and high susceptibility to errors (cf. I14: English transcript: p. 14, l. 503; German transcript: p. 14, ll. 525-526). In contrast, interviewees who considered their organizations advanced reported fully automated administrative and support processes and striving for end-to-end digitalization of all business processes. For instance, interview partner 7 stated: "*[…] we have now mapped at least every process digitally, from target agreements, salary negotiations to, of course, Teams and all kinds of things […]*" (I7: English transcript: p. 4, ll. 130-131; German transcript: p. 4, ll. 138-140).

Similarly, corporate culture and employee mindset could be identified as central factors in digital transformation. A culture open to new developments, willingness to experiment, personal responsibility, and the routine use of digital tools were highlighted as critical elements. Interviewees stated that employees must be willing and able to work digitally, maintaining proper netiquette that is firmly established within the company. Advanced organizations were characterized by a culture that supports digital solutions and flexible, self-responsible working. It showed that maturing companies, especially in the IT industry, manage to promote a digital culture, like interviewee 12, who stated: "*[…] corporate culture,*

that was the point I was just thinking about. So, all our people are very, very, very practiced in working remotely, also working via video, working digitally" (I12: English transcript: p. 4, ll. 147-149; German transcript: p. 5, l. 156-158). Less progressive companies pointed to their traditional and conservative industry, which is deeply rooted in the corporate culture and dampens digital maturity. For instance, interview partner 17 stated: "W*e are a very traditional company that is opening up very slowly*" (I17: English transcript: p. 5, ll. 164-165; German transcript: p. 5, ll. 174).

The above is also linked to communication and collaboration, which could be revealed as another essential aspect of assessing an organization's digital maturity. The use of digital communication and collaboration tools such as Miro Boards, Microsoft Teams, and Outlook, which support digital working, was emphasized. As mentioned, using these tools and behaving appropriately within them was seen as essential. For example, one interviewee mentioned that this also includes the fact that almost all of their employees have their cameras switched on during video calls (cf. I12: English transcript: p. 5, l. 154; German transcript: p. 5, ll. 163-164). It was stated that these tools not only promote an effective digital filing structure but also facilitate decentralized working and availability of information. For example, interview partner 1 said: "*So of course the potential work setting allows you to work completely digitally, we have a digital filing structure, which are, let's say, very basic things, but nevertheless it is very paperless, which I would always rate as positive*" (I1: English transcript: pp. 5-6, ll. 193-191; German transcript: p. 6, ll. 203-206). Hence, organizations that can share information seamlessly and transparently and where people can work fully remotely were considered more advanced in their digital transformation. Most interviewees described that even if some documents are still in paper form, digital working is a must-have in their organizations, especially since the COVID-19 pandemic.

Furthermore, in the management realm, it became evident that effective governance and strategic management of IT resources are central elements in assessing digital maturity. Important aspects that were mentioned include comprehensive IT support and the organization's ability to manage large-scale digital projects, such as system migrations, efficiently and holistically. It showed that, on the one hand, organizations that were

considered mature actively look for and integrate new digital solutions. Additionally, the interviews displayed that the management of progressive organizations recognizes the importance of engaging and training their employees in digital processes to ensure that technological advances are fully utilized and integrated into the corporate culture. For instance, as stated by interviewee 9: "*[…] [company] is actually aware of the trends, what is going on at the moment and also involves the employees in this*" (I9: English transcript: p. 4, ll. 149-150; German transcript: p. 5, ll. 164-165). Conversely, interviewees who still identified potential for improvement in their organizations in this area primarily referred to the opportunities made possible by digital transformation and whether these are supported by management. Like, interview partner 14, who criticized: "*I would be violating all governance if I do it, so I'm not allowed to. And that's the issue, where, when push comes to shove, I could probably make the entire organization 30 percent more efficient if I could use these tools properly and if there was central support that properly rolled out the issue instead of bit by bit, lagging behind what the industry can actually achieve right now […]*" (I14: English transcript: p. 16, ll. 587-591; German transcript: p. 16, ll. 611-616).

Adaptability was also highlighted as a critical factor in assessing digital maturity. Agility was particularly emphasized, enabling organizations to respond quickly to changes and implement innovations. The openness to adapt to change and the ease with which innovations, such as new systems or processes, are introduced were emphasized as essential factors. Initiatives that reflect this dynamism, such as programs that promote continuous improvement and allow employees to submit their suggestions for improvement or an innovation lab, were used to illustrate this adaptability: "*That's why we launched the Better Than Yesterday program last year, where you can do exactly that, contribute your own suggestions for improvement, which we then usually implement digitally*" (I3: English transcript: p. 3, ll. 95-97; German transcript: p. 3, ll. 104-106). While advanced organizations were described as promoting agile working and being able to introduce innovations swiftly, organizations with a lower level of digital maturity were portrayed as tending to be less flexible. One interview partner, considering his organization as maturing, explained: "*One aspect is the ease of adopting software or tools, as well as the speed of change concerning these tools. For instance, today I might use a communication tool called email. Then, perhaps due to the circumstances like the pandemic, I find myself adopting Teams as a new*

communication tool. However, after its implementation, we quickly realize that Teams doesn't fulfill all our needs. We then decide to introduce Slack as a chat tool. It's about how easily one can adopt such tools and continuously adapt. How quickly is Miro actually accepted as a collaboration tool? Yes, I would base it on how easy it is, yes" (I10: English transcript: p. 5 ll. 157-165; German transcript: p. 5, 170-180).

Moreover, respondents highlighted the introduction of digital technologies and the provision of digital tools as critical aspects. The use of advanced technologies and the implementation of various tools, such as databases and planning tools, were considered essential for digital transformation. It was noted that the shift from manual to automated processes significantly contributes to efficiency improvements. Interviewees mentioned that the COVID-19 pandemic has accelerated the need to transition from paper-based to digital workflows. It showed that companies, considered to be more advanced, are using digital technologies to automate processes. For instance, interview partner 6 stated: "*Partially developing entirely digital business models. For example, part of our services related to management systems involves the review of documents and IT infrastructure provided by clients. Until now, this review process was always done manually. However, we now have a prototype running that uses a market solution to search for keywords, a crawler. With this, we've already been able to achieve nearly a 35 percent efficiency gain in this process*" (I6: English transcript: p. 8, ll. 277-282; German transcript: pp. 8-9, ll. 301-308). Also, an interview partner who classified their organization as developing said that it is about integrating technologies that offer real improvements and fit the company: "*[…] we as a company are […] not always […] the first pioneer, but also looking at what makes sense for us […], so that we don't put too much energy into topics that may not lead to success […]*" (I15: English transcript: pp. 3-4, ll. 113-116; German transcript: p. 4, ll. 119-123).

Respondents also linked their organization's digital maturity level with the quality and innovation of their products or services. A key aspect mentioned was the ability to offer innovative market solutions while improving customer relationships through digitalization and automation. This includes the introduction of advanced solutions that enhance efficiency and customer satisfaction, particularly in technology-intensive industries, and the promotion of digital and scalable digital business models, as described by interviewee 6 in the quotation

mentioned above concerning the deployment of advanced technologies (cf. I6: English transcript: p. 8, ll. 277-282; German transcript: pp. 8-9, ll. 301-308). It was highlighted that these measures drive digital transformation internally and manifest themselves in the external perception of the organization. It was found that most respondents rated the digital maturity level of their organization higher in this aspect, i.e., external towards the customer due to advanced market solutions, than the internal maturity level, i.e., concerning internal processes. For instance, interview partner 20 stated: "*In the area of products, we are already thinking very strongly in terms of digitalization. I believe that the digital transformation is actually already well underway, simply because the product developers are naturally also moving very strongly in the direction of software development and everything, we are becoming more digital in terms of the product*" (I20: English transcript: p. 3, ll. 86-90; German transcript: p. 3, ll. 96-100).

And lastly, the respondents emphasized that a thoughtful and holistic strategic approach is critical to driving digital transformation. The importance of comprehensive projects was highlighted, for instance, by interview partner 14, who stated: "*For the systems, this should have been a comprehensive relocation planning project, instead of leaving each department to deal with such a matter on their own, a matter in which a lot can go wrong and which doesn't correlate at all with the core business*" (I14: English transcript: p. 13, ll. 476-478; German transcript: p. 13, ll. 493-496). Also, the problems that arise when departments operate in isolation were pointed out, including inefficient "patchworks" of solutions that are not coherent with the core business and affect overall efficiency, as mentioned by interviewees in early-stage and developing organizations.

In summary, this section analyzed the digital maturity levels of organizations, categorizing them into three stages, as established by Kane et al. (2015): (1) early; (2) developing; and (3) maturing - of which most organizations were classified as developing. Key factors influencing digital maturity include strategy, products or services, technology, people and culture, management, processes, adaptability, and communication and collaboration. Except for the two factors of adaptability and communication and collaboration, which were added as a result of the analysis, the factors listed align with the framework of digital maturity for SMEs by Williams et al. (2019). Among these, organizational processes, as well as people

and culture, were mentioned most frequently and, therefore, represent the most critical determinants of digital maturity. Interviewees from organizations with advanced digital maturity reported automated processes, well-integrated systems, and a culture that supports digital innovation. In contrast, less mature organizations face challenges such as manual processes and resistance to change.

5.2. Identified Digital Transformation Hurdles

This section delves into the challenges encountered in digital transformation, identifying critical issues across macro, meso, and micro levels as conceptualized in the multi-level perspective framework by Geels and Kemp (2007). Hence, these insights provide a granular understanding of organizations' hurdles at different systemic layers. The following unpacks each level, highlighting specific aspects identified through data analysis.

5.2.1. Macro

At the macro level, the primary challenges identified encompass technological advancements, industry and market dynamics, data protection and cybersecurity, as well as legal and regulatory guidelines. Interviewees frequently highlighted the rapid pace of technological innovation as a significant hurdle. Concerns regarding industry and market dynamics and data protection also emerged prominently in the discussions. Legal and regulatory issues, while still relevant, were mentioned less frequently than other challenges.

Firstly, it showed that many respondents find the pace of change, specifically the rapid development and implementation of new technologies, overwhelming. The flood of information and options makes it difficult to distinguish between relevant and less relevant information, especially for themselves, and to maintain an overview. For instance, interview partner 15 stated: "*Barriers exist in the diversity, and also in distinguishing what is truly useful and what is merely hype, because at the moment everyone talks only about AI, and you kind of lose track of what is really good for you and what isn't*" (I15: English transcript: p. 7, ll. 243-245; German transcript: p. 7, ll. 260-263). It was mentioned that new developments require people to constantly adapt and familiarize themselves with new systems. Interviewees noted that especially for people who have been in the workforce for a long time, they were socialized with practices that have little in common with today's

realities and thus have had to continually adjust to new realities and keep up to stay current. Interview partner 12 pointed out that: "*[…] even for those who are very digitally savvy, there are always things they don't know*" (I12: English transcript: p. 10, ll. 375-376; German transcript: p. 11, ll. 407-408). This was reinforced by the impression that the dynamic nature of technology and its rapid changes create a feeling of never fully arriving and force individuals to remain in a constant learning process. Interviewee 10 illustrated this with the statement: "*You notice it in yourself sometimes, you just wish things could be calm, just three weeks with no surprising new developments, just some peace for a while, that really challenges people, yes*" (I10: English transcript: p. 23, ll. 854-856; German transcript: pp. 24-25, ll. 928-930). Additionally, it was noted that rapid changes, such as in the development of new products, often clash with more traditional, slower processes within corporate IT, leading to conflicts between the need for rapid adaptation and the need for stable, secure IT systems. In this regard, interview partner 16 stated: "A*djustments need to be made and security constantly updated. The entire IT of a company must also be as agile and quick as possible, which means transforming all departments to this agile way of working, otherwise, you will not succeed in placing these IT products on the market, because you are continuously too slow*" (I16: English transcript: p. 10, ll. 356-359; German transcript: pp. 10-11, ll. 385-390).

Moreover, in the aspect of industry and market dynamics, the evaluation of the interviews showed that the acceptance and implementation of digital technologies vary significantly across different industries. Some interviewees from traditional and conservative sectors, such as manufacturing, reported a certain reluctance towards new technologies and innovations, hampering digital transformation efforts. It was emphasized that digitalization is often progressing slowly in SMEs, as noted by interviewee 2: "*[…] generally, most SMEs, depending on the industry, are somewhat cautious, needing to first observe how others succeed before making investments themselves and then driving these initiatives forward in the long term*" (I2: English transcript: p. 10, ll. 346-348; German transcript: p. 10, ll. 372-376). In addition, a reluctant and conservative approach to innovation from the market was pointed out, which SMEs have to consider and are thus impeded. Nevertheless, a gradual establishment of digitalization in these areas became apparent, indicating a slow change in market needs and a gradual increase in acceptance. It showed that some companies actively

participate in digital transformation by keeping pace with market requirements and customer desires and trying to meet these through innovative offerings. However, interviewees emphasized that the challenge lies in evaluating market readiness and acceptance of new digital business models to avoid prematurely investing in technologies that the market is not yet ready to accept, as stated by interviewee 6: "*[…] we have noticed that we were well on track with the idea, but the market is not yet mature enough, so now, we have to ask ourselves how we might classify this. Generally, there is potential moving forward, but I believe the market is currently not yet ready to truly accept this concept*" (I6: English transcript: p. 5, ll. 182-186; German transcript: pp. 5-6, ll. 192-196).

Furthermore, data protection and cybersecurity were identified as central challenges in digital transformation. A recurring theme was the concern for data security and protection in an increasingly digitalized world. Respondents emphasized the need to continually adapt internal norms and security measures to new technologies and raise awareness about handling sensitive data, which goes hand in hand with the challenge of rapid technological advancements. For instance, interviewee 7 stated: "*As digitalization progresses, there's not only the general issue of data protection but also the concern of unwanted external access to data within systems. Certainly, those of us in leadership positions, whether working with sensitive data on projects or handling personal data, need to be trained in proper data handling and ensure that nothing is inadvertently exposed. This presents a clear challenge*" (I7: English transcript: pp. 6-7, ll. 231-236; German transcript: p.7, ll. 253-259). It was indicated a certain reluctance to make data transparent and accessible. Concerns about the potential for data loss and breaches were expressed particularly troubling older generations. It has been concluded that this leads to a widespread fear of losing data sovereignty and worries that data might be compromised without adequate security measures. For instance, interview partner 15 said: "*And also the dependency, imagine you have everything digital and you get hacked*" (I15: English transcript: p. 8, l. 285; German transcript: p. 9, ll. 304-305). As already indicated, the interviews revealed that balancing innovation and security is seen as a significant challenge. It requires careful consideration between quickly responding to market changes and maintaining data security. Also, adapting to legal data protection regulations like the General Data Protection Regulation (GDPR) was seen as a challenge by interviewee 16, forcing organizations to reconsider their data protection practices to ensure

they are compliant (cf. I16: English transcript: p. 6, ll. 201-202; German transcript: p. 6, ll. 213-214). Respondents highlighted the importance of establishing a secure infrastructure that allows the effective use of modern tools while ensuring a safe and compliant regulatory environment. This is reflected in interviewee 20's statement: "W*hat we need is an infrastructure that enables us to actually use the tools, but also a legal environment in which we can operate as we wish. Of course, we also need data protection conformity and security, that's clear. But now we have all the techniques available*" (I20: English transcript: p. 5, ll. 176-179; German transcript: p. 6, ll. 196-199).

This also corresponds to the next aspect of legal and regulatory guidelines, which were seen as crucial in digital transformation. It was emphasized that digitalization requires continuous adaptation of norms and laws to keep pace with technological developments. Specific hurdles, such as legal restrictions that hinder digitalization efforts, were pointed out. For instance, interview partner 12 stated: "*The challenges you then face are of a legal nature, as you simply cannot yet fully digitize everything in Germany, […]*" (I12: English transcript: p. 5, ll. 188-189; German transcript: p. 6, ll. 201-203). An example given by an interviewee coming from the HR department stated that until recently, digital contracts and processes were restricted by the Evidence Act (Nachweisgesetz), which required documents to be physically available on-site. However, it was emphasized that these regulations are beginning to change, which the interviewee saw as a positive development that allows for the efficient use of modern digital tools. She said: "*In HR, the Evidence Act put a huge obstacle in our way until last Friday. We could not go digital because we had to have everything on paper on-site. But as I said, that has just been overturned*" (I20: English transcript: p. 3, ll. 95-97; German transcript: Interview 20, p. 3, ll. 106-109). This illustrates the necessity of legal and regulatory adaptation to new circumstances and laying the groundwork for deploying digital technologies.

5.2.2. Meso

At the meso level, but also generally, the predominant challenges and barriers are centered around management and strategy. Additionally, cultural factors, organizational structure, and resource allocation are recognized as critical aspects of digital transformation processes. Although issues concerning expected benefits and value creation were not as frequently cited

by interviewees, they remain significant in understanding digital transformation hurdles at this level.

Concerning management and strategy, the interviews highlighted the priority of digital transformation, which is regarded as an indispensable component of corporate strategy and essential for companies to address. As stated, for example, by interviewee 4: "*I believe it's a fundamental issue for me; there's no way around it, nor should there be. I also think that very few people nowadays question the absolute necessity of it*" (I4: English transcript: p. 8, ll. 606-307; German transcript: p. 9, ll. 339-342). However, although the topic is generally given a high priority, interviewee 3 also noted that more pressing issues sometimes take a higher priority: "*The biggest challenge that every company faces, regardless of the sector, is economic success. When events happen in the world, such as COVID, wars, or economic recessions, companies face major strategic challenges that are more important than internal transformation. Yes, you can always continue to transform. At the end of the day, transformation in digitalization means increasing efficiency and possibly reducing costs. This is very important to remain competitive, but it is useless if you are not doing business. So, you are forced to keep the business running first*" (I3: English transcript: p. 5, ll. 661-167; German transcript: p. 5, ll. 177-187). Respondents often criticized the fact that the urgency of digital transformation is not fully recognized, especially in comparison to crises such as the COVID-19 pandemic, which created acute pressure to act. It was noted that many companies are primarily focused on their core business and view digitalization as a secondary issue that often lacks direct relevance concerning earnings before interest and taxes (EBIT). Also, successful companies often tend to rely on proven methods that have led to past success, which can make realignment challenging and reduce the willingness to engage with potential risks, as stated by interview partner 14: "*[…] the absence of this awareness also means there's no sense of urgency to act. We've been successful so far, so why change now?*" (I14: English transcript: p. 18, ll. 665-666; German transcript: pp. 18-19, ll. 695-697). Another central issue frequently raised in the interviews was the unclear definition and meaning of digitalization. Interviewees explained that individual digital improvements are often mistakenly perceived as comprehensive digitalization. For instance, interviewee 4 stated: "*[…] just because the travel expense process is now digital doesn't mean we've achieved digital transformation, and I think this is often forgotten*" (I4: English

transcript: p. 9, ll. 320-322; German transcript: p. 10, ll. 358-360). Thus, it was seen as a challenge for SMEs to generate awareness about what digitalization means for their own business and to evaluate what is useful and relevant in the individual case, as interviewee 4 continues: "*I believe most companies face a massive challenge in embracing this, deciding consciously what the right digital transformation is for them*" (I4: English transcript: p. 9, ll. 316-317; German transcript: p. 10, ll. 351-353). Therefore, the interview partners saw the implementation of a comprehensive digital strategy that goes beyond incremental improvements as essential. They noted that without a clear direction, the plethora of information and options can be overwhelming. However, it was observed that strategic focus and integration are often lacking, leading to siloed structures without a cohesive system landscape, complicating collaboration across departments and locations. For instance, interviewee 7 stated that: "*[…] when discussing digital solutions, one must first have the appropriate and functional infrastructure in the background, and it requires a company-wide approach to be implemented thoroughly*" (I7: English transcript: p. 4, ll. 144-146; German transcript: pp. 4-5, ll. 154-157). Also, interviewees mentioned that the challenge lies in thinking long-term and investing in technologies, even when substantial resources are required in the short term, and the immediate benefits are not directly evident. As stated, for example, by interviewee 18: "*[…], you have to believe in certain issues and have the backing of management to tackle them. Then, it can take off, creating a basic trust. If that backing and flexibility aren't there, financially or otherwise, then perhaps other projects that promise quicker returns are preferred […]*" (I18: English transcript: p. 20, ll. 754-757; German transcript: p. 22, ll. 822-827). However, it was highlighted that resistance to change is also often found among leaders who prefer traditional approaches and thus shy away from investing in new technologies. It was emphasized that this presents the challenge of profound rethinking among leaders and that leadership in an increasingly digital and hybrid world poses new demands on managers. Here, the lack of personal contact was highlighted as a challenge. This was stated, for instance, by interviewee 20: "*Establishing a new leadership culture is certainly a challenge. Leaders naturally lead by example, but it is much more difficult to lead in a hybrid world than when you can see your team all day and not just through digital means*" (I20: English transcript: p. 4, ll. 125-127; German transcript: p. 4, ll. 138-141). It showed that leaders also face challenges in managing diverse teams with varying attitudes and experiences in digital transformation. This is reflected in the statement

made by interviewee 17, who said: "*[…] finding the balance, just like with the management, between managing the employees according to the current circumstances, but also not neglecting the traditional and communal aspects that the employees have experienced over the last few years, is definitely a challenge for me*" (I17: English transcript: p. 8, ll. 285-288; German transcript: p. 8, ll. 298-302).

In line with the latter aspect, the analysis revealed that many points raised by the participants could be attributed to the aspect of culture. The interviews highlighted a strong rootedness in traditional values and practices, particularly in family-run SMEs. For instance, interviewee 11 stated: "*Digitalization is not yet so widespread here, they are quite rigid and live by the motto that it has historically grown, this is our standard and they find it difficult to change anything because they simply are not equipped to work digitally*" (I11: English Transcript: p. 4, ll. 132-134; German transcript: p. 4, ll. 143-146). It was noted that there is a certain reticence toward digital change, particularly among the older generation. The average length of company tenure and the high average age in many firms were mentioned as factors reinforcing the reluctance to change working methods. This is exemplified by the statement by interviewee 5: "[…] *but until people work on it and really accept it, that's easy with younger people and very, very difficult with older people. And if you then look at the age structure, you can deduce what that means afterwards, yes. And it goes across all management levels, so there are young managers who deal with the issue relatively easily and quickly and there are older ones. […]. Older managers find it very, very, very difficult to adhere to such rules if they have never learned them, yes*" (I5: English Transcript: pp. 4-5, ll. 150-162; German transcript: p. 5, ll. 163-176). This reflects a profound cultural challenge, as the interviews revealed that many companies are unwilling to deviate from proven practices. This became particularly evident in conservative industries such as mechanical engineering, where a reluctance to innovate and a strong focus on tried and tested methods could be found. For instance, interviewee 1 believes: "*[…], not without reason, we have many SMEs that have been around for a long time and find it harder with digitalization because there are fixed structures that have certainly proven themselves, which should not always be undervalued, but could definitely be optimized a bit more with a bit more salt in the soup, in the form of digitalization*" (I1: English transcript: pp. 13-14, ll. 501-505; German transcript: p. 15, ll. 547-551). The interviews revealed that there is often a lack of

experimental joy and openness to new processes. The interviewees saw this cultural rigidity as a hurdle to implementing effective digital solutions, as many organizations tend to stick to traditional ways of working and only reluctantly adopt new technologies. Interview partner 14 described this as: "*[…] just try nothing, make no mistakes, burn nothing*" (I14: English transcript: p. 16, l. 591; German transcript: p.16, l. 617). Moreover, the cultural challenge of hybrid working and its effects on company culture were discussed. It was noted that the shift to digital forms of communication and the lack of personal interactions could affect company culture and weaken employee attachment to the company, as emphasized by interviewee 15: "*A company has a soul, that's what I always call it, and values, what makes it worthwhile to work for a company, if everyone would work from home, where is the soul?*" (I15: English transcript: p. 13, ll. 465-466; German transcript: p.14, ll. 502-504).

Moreover, the interviews revealed that aspects concerning organizational structure often play a critical role in implementing digitalization measures. Commonly discussed problems include overwhelmed IT departments, a lack of process standardization, siloed structures, and poor implementation of structural changes. The central role of IT and its support for the departments was a frequently mentioned theme. The importance of a well-functioning IT infrastructure to successfully implement digital solutions was emphasized. However, it was criticized that IT departments often do not see responsibilities within themselves. Instead, they are perceived as isolated units, viewed more as cost factors than competitive differentiators, and thus are not actively involved in decision-making processes. In this regard, interview partner 12 stated: "*IT is still not seen as a competitive advantage to the extent it should be. Many IT leaders, formerly known as EDP managers, still come from a history where they were under the CFO and simply managed as a cost center. Although this has changed in words today, the structures in companies are often still the same. Many IT managers from medium-sized businesses have told me they would like to be business enablers for the business, but they are not perceived that way. The main challenge I see is that IT professionals know the technical possibilities but either do not understand the business or are not included in it*" (I12: English transcript: p. 6, ll. 205-212; German transcript: pp. 7-6, ll. 221-230). It was noted that this also applies to process automation, as the departments themselves, without involving the IT department, are often unable to assess what opportunities exist for them. The interviewees made it clear that structuring and

standardizing processes are seen as fundamental for digitalization. However, it was emphasized that there is often still significant potential for optimization to enable efficient workflows. Interview partner 12 continued: "*I have the impression that in the SME sector, the business still does not perceive IT as a competitive differentiator. They do not look for automation opportunities, especially in areas like machine learning and data science, they cannot even assess what possibilities exist. Often in process optimization, the view is limited to process steps, where a department does not consider that automation is possible*" (I12: English transcript: p. 7, ll. 237-241; German transcript: p. 7, ll. 256-262). Hence, the need for close cooperation between IT and production was stressed in order to develop individual and flexible solutions. In addition to the cooperation of IT with the various departments, the general problem of inadequate networking within organizations and siloed structures was addressed. Interviewees noted that often, different departments operate with diverse systems and standards, leading to inefficiencies. Hence, the need to create a uniform system landscape that allows for continuous and synchronized operation was seen as urgently necessary. For example, interviewee 2 stated: "*[…] if you do not have a continuous system landscape, I believe, that will be the most challenging aspect for us, that a lot runs on SAP, but also a lot on separate systems that are connected to SAP but still need to be opened separately and have their own issues*" (I2: English transcript: p. 5, ll. 177-180; German transcript: p. 5, ll. 189-192). Generally, the organizational structure was often described as inflexible, especially in traditional SMEs that react sluggishly to the requirements of digitalization. Therefore, the need for a more dynamic, adaptable structure that allows for quick and effective responses to changes was highlighted, for example, by interviewee 16: "*You have to react quickly to changes and come up with appropriate solutions. On the other hand, we have the classical IT operations in-house and at the client's side, which operates very statically and is decoupled from this agile approach; they move rather slowly, aiming for maximum security. This clashes with the overall line because if you consider, you want to sell digital products. […] You need to make adjustments and […] must be as agile and fast*" (I16: English transcript: pp. 9-10, ll. 346-357; German transcript: p. 10, ll. 373-387).

Overall, it became evident that resource scarcity - whether in the form of a shortage of skilled workers, inadequate financial means, or insufficient time - poses a significant barrier to digitalization and can severely hinder the development and implementation of digital

solutions. Several interviewees discussed the challenges associated with a lack of personnel and, consequently, the necessary competencies. Interviewee 19 noted: "*[…] topics involving know-how, such as when we undertake digital initiatives that we have not yet deployed, often reveal that we might not have the necessary expertise within the company. This means we either have to hire new staff or purchase external know-how, that's another point we've stumbled across*" (I19: English transcript: p. 10, ll. 363-366; German transcript: p. 11, ll. 388-391). It was emphasized that this issue often relates to location, as it was seen as particularly challenging to attract qualified personnel in rural or less attractive areas, especially in smaller companies that lack the financial means for significant investments in technology. Generally, the lack of budgets and investments was cited as a significant issue. Interviewee 3, for instance, noted that the budget is a common issue when discussing SMEs (cf. I3: English transcript: p. 3, l. 113; German transcript: p. 4, l. 125). Particularly for SMEs, there are insufficient financial resources to make the necessary adjustments or acquire external expertise. It showed that this financial restriction makes it challenging to develop and implement innovative solutions, as interviewee 3 continued: "*Most solutions would bring significant improvements and increase competitiveness. However, the biggest problem here is the budget*" (I3: English transcript: p. 15, ll. 568-569; German transcript: p. 17, ll. 624-626). Moreover, interviewee 12 noted that businesses often focus on handling operations during economically prosperous times, while savings are made during less favorable periods, thus not investing asynchronously and hindering continuous development (cf. I12: English transcript: pp. 9-10, ll. 345-347; German transcript: p. 10, ll. 375-378). Another recurring theme was the overload experienced by existing employees, who frequently have to manage digital projects alongside their daily tasks, which usually take up much more time than is available. It was concluded that this can lead to staff burnout and a lack of capacity to engage sufficiently with digitalization. This was seen as a particularly significant barrier for SMEs, where allocating the necessary time for transformation processes is difficult. Interview partner 19 said: "*A barrier, I would say, is capacity. People also need to have time to deal with the subject, and it is often the case, or mostly so. ….]. It's the same for us, that we are very busy, not having time in abundance. Eventually, when one wishes to implement something, one must take the time to do it, and I believe that this is the biggest challenge, especially for SMEs, to actually take the time slice needed for digital*

transformation" (I19: English transcript: p. 9, ll. 318-328; German transcript: pp. 9-10, ll. 341-352).

It was also discovered that many interview partners have difficulties capturing these investments' actual value and economic benefit. Numerous interviewees discussed the challenge of recognizing the potential of digitalization compared to the status quo. They stated that often, there is a lack of understanding of how significant the difference between the current situation and the possibilities offered by digitalization could be. It was emphasized that initially, the effort often outweighs the benefits, as a familiarization phase is necessary. These initial difficulties can lead to resistance among employees. For instance, interviewee 3 mentioned: "*Every new tool has fewer advantages at the beginning, because the effort to familiarize yourself with it is simply greater at the beginning and you have a phase where you have more effort than you had before and you have to guide people through this phase, afterwards they are all happy, but at the beginning they curse you*" (I3: English transcript: p. 4, ll. 140-143; German transcript: pp. 4-5, ll. 155-158). Interviewees also mentioned the risk associated with significant investments, especially in uncertain projects where the outcome is still unclear and a significant financial commitment is required. The fear of failure in new initiatives, particularly when associated with high costs, can lead companies to hesitate to invest in innovations. It shows that this is particularly the case in industries and projects involving large order volumes or substantial investment costs, where the risk of misinvestment could have enormous consequences, as stated by interview partner 18: "*In projects themselves, where there is a huge volume of orders involved, the risk is simply too great to introduce so much that is new*" (I18: English transcript: p. 4, ll. 125-126; German transcript: p. 4, ll. 134-136). A recurring theme was the uncertainty about whether investments in new technologies would indeed yield the desired economic benefit. Discussions highlighted the difficulty of calculating digital initiatives' return on investment (ROI). There is often a lack of concrete figures or benchmarks that could demonstrate the financial success of digitalization measures. Participants explained that this deficiency complicates decision-making and makes it challenging for companies to demonstrate the economic benefits of digitalization and to convince both internal and external stakeholders, as stated by interviewee 18: "*In general, it is often difficult to specify an exact ROI for digital products, and this makes it tough to deal with the topic because everyone knows it needs to*

be done, but […] yes, it's difficult to sell and quantify some issues" (I18: English transcript: p. 17, ll. 619-626; German transcript: p. 18, ll. 677-685). Thus, it became apparent that although digitalization is theoretically seen as an opportunity for development and enhancing competitiveness, the practical specification and assessment of these opportunities often remain unclear. The interviews showed that companies are aware of the potential benefits but struggle to quantify them and incorporate them into their strategic decisions. For instance, interview partner 5 noted: "*Now you have to go into more preliminary work, as I told you before, about the life cycle, I develop something today that might be relevant in ten years with appropriate information, meaning you are investing energy now and do not know if you will indeed benefit from it in ten years. And I believe that is also a challenge for all companies, when we have to invest much more money and time for it to pay us back short-term*" (I5: English transcript: p. 25, ll. 852-856; German transcript: p. 25, ll. 948-953).

Finally, the analysis of the interviews showed that hurdles to digital transformation are related to companies' business models and value creation. It turned out that automation proves to be particularly complex in companies that specialize in individual solutions, such as custom manufacturing, rather than mass solutions. Interview partners stated that often, standardized processes cannot be utilized, necessitating the development of customized solutions. For example, automation through AI in customer-specific orders or project business can be problematic when daily varying requirements exceed the capabilities of AI. For instance, interviewee 13 stated that: "*[…], we do not have series production, so we do not produce the same tool 20 times, but we have a custom manufacturing process, which makes it often difficult to automate processes because each tool is different*" (I13: English transcript: p. 6, ll. 214-216; German transcript: pp. 6-7, ll. 229-233). Furthermore, it was pointed out that many companies heavily depend on their core businesses and do little experimentation, which hampers introducing innovative ideas. Interviewee 12 noted: "*It feels like companies experiment too little here, they do not allow necessary wastage for experimentation, but perhaps focus too much on value creation and their core business*" (I12: English transcript: p. 16, ll. 606-608; German transcript: p. 18, ll. 667-669).

5.2.3. Micro

At the micro level, digital transformation challenges are predominantly manifested in people's behaviors and attitudes, along with communication and collaboration between organization members.

The interviews revealed significant challenges related to individuals within organizations. The statements made by the interviewees clearly showed that the individual level plays a critical role in digital transformation and can decisively influence the success or failure of innovation projects. The role of employees in the process of change and their acceptance of new technologies and work methods were particularly emphasized, for instance by interviewee 14, who said: "*[…], it is a significant extra effort, it's a change and no one really enjoys it, people are generally averse to change*" (I14: English transcript: p. 26, ll. 977-978; German transcript: p. 28, ll. 1047-1048). A central theme was the handling of digital tools and resistance to change. It was noted that many leaders and employees struggle to adapt to new digital processes, which is often due to a lack of experience, fear of change, and loss of control. Adapting to digital tools requires not only training but also a change in mindset, which was often seen as a challenge, for instance by interviewee 13: "*They simply are not necessarily open to new processes, so they prefer to stay in their usual routines, which they have been doing for years, and it's not always so, you have to convince them to introduce new processes and be open to digital solutions […]*" (I13: English transcript: p. 4, ll. 134-136; German transcript: p. 4, ll. 143-146). Another significant theme was the tension between younger and older employees. While younger employees are often seen as "digital natives" and adapt more quickly, a significant extra effort and greater skepticism towards digital innovations is observed among older employees. Interview partner 12 stated: "*Many companies have also tried to drive innovation in recent years by assigning younger people who may not have the experience yet, often referred to as the young wild ones with digital know-how, to roles outside of IT. However, they have not been able to solve the problem because they did not find acceptance with the responsible personnel from the existing business*" (I12: English transcript: pp. 8-9, ll. 306-310; German transcript: p. 9, ll. 331-337). Also, the need to qualify employees for digital transformation was emphasized, as there is often a scarcity of the necessary competencies. For instance, interviewee 11 stated: "*For me as a leader or project manager, it is difficult to get people to be able to work remotely*" (I11:

English transcript: p. 5, ll. 158-159; German transcript: p. 5, ll. 171-172). However, it was noted that there is often a lack of specialized training that qualifies employees for digital transformation. Instead, learning new technologies is often perceived as an additional burden that must be managed in one's free time, as stated by interviewee 14: "*That's always something I do on top to qualify myself, for the employee, there are of course dedicated training courses where people can register for I don't know Excel Advanced Part 3, but not for the topics that really have a new impact*" (I14: English transcript: p. 18, ll. 669-671; German transcript: p. 19, ll. 702-705). Furthermore, it became clear that digital transformation necessitates not only technological knowledge and adjustments but also changes in mindset. This includes trust in technology and company leadership, acceptance of change, and the willingness to learn and adopt new ways of working, which has shown to be a significant challenge for SMEs and their leaders. Interviewee 6 exemplified: "*[…] so we bought Microsoft Copilot, initially threw out 300 test licenses, conducted training, empowered people. I love it, I use it quite frequently, but then you ask the people who monitor the licenses, who actually uses it? Only five percent of them*" (I6: English transcript: p. 14, ll. 535-537; German transcript: p. 16, ll. 585-588).

Moreover, the interviewees frequently discussed challenges related to communication and collaboration in digital transformation. Firstly, establishing an effective digital communication culture was described as challenging. This includes selecting appropriate tools and regular and repeated communication on important matters. It was noted that an abundance of communication media and platforms can cause overwhelming and inadequate use among employees. Interviewee 11 stated: "*I don't need a fourth and fifth communication medium and not another platform*" (I11: English transcript: p. 25, l. 949; German transcript: p. 27, ll. 1017-1018). Furthermore, it was mentioned that physical distance and digital tools often lead to a shift in interpersonal interaction. On the one hand, it was noted that this poses a challenge in promoting personal appreciation and collaboration within the team and is particularly perceived as disadvantageous in creative and innovative processes. The interviews showed that spontaneous, personal interaction is important for innovation capability and building trust, which is considered difficult in an exclusively remote working culture. Interviewee 10 stated: "*It's not so easy in a remote situation; I really have to invest and make sure I regularly ping them and then hope that they will engage in a dialogue with*

me at that moment, this is a real challenge" (I10: English transcript: p. 9, ll. 309-312; German transcript: p. 9, ll. 337-340). Moreover, it was also noted that the use of digital tools creates a level of transparency that not everyone can cope with, as stated by interviewee 4: "*Digitalization also means a lot of transparency, a lot of availability, which for some people also harbors the danger that something could be taken away from them*" (I4: English transcript: p. 5, ll. 155-156; German transcript: p. 5, ll. 167-168). Additionally, it was described that the culture of meetings has also changed in that everyday work is much faster paced, where the challenge is seen in creating a healthy rhythm for oneself. Here, interviewee 4 said: "*I suddenly have days where I'm doing customer pitches every hour, something I've never done before because I had to drive from Stuttgart to Sindelfingen, taking an hour, […] eating a sandwich, drinking coffee, and sorting out my thoughts. There's always that moment when you log into the meeting and think, 'Okay, who are you, what's written in the headline, and what's my agenda point?*" (I4: English transcript: p. 12, ll. 428-437; German transcript: p. 13, ll. 476-486).

5.2.4. Concluding Remarks on Digital Transformation Hurdles

This section explored the challenges and barriers to digital transformation at the macro, meso, and micro levels, based on the multi-level perspective by Geels and Kemp (2007). Among the various challenges and barriers identified, it became particularly apparent that aspects related to management and strategy at the meso level and those concerning people at the micro level were the most frequently and extensively addressed by the interview partners.

It has been shown that critical challenges at the macro level can be attributed to rapid technological advancements, data protection and cybersecurity, industry and market dynamics, and legal and regulatory requirements. It emerged that the most significant issue at this level was the rapid pace of technological progress, which many respondents found overwhelming. It became apparent that it is tough for organizations to gain an overview of what is relevant and appropriate for them and to keep up with constant change. Moreover, new technologies in traditional sectors are often adopted hesitantly, making it difficult to assess market maturity. Data protection and cybersecurity concerns were also prominent, highlighting the challenge of balancing innovation with security. Legal and regulatory

hurdles, including the continuous adaptation of standards and restrictive legal regulations, further complicate digitalization efforts.

At the meso level, challenges center around management and strategy, organizational culture and structure, resources, expected benefits, and value creation. Hurdles regarding management and strategy were mentioned most frequently in the interviews. Although there is awareness of the importance of digital transformation, the urgency is often not recognized. Additionally, there is often no clarity about what digitalization means, especially for the organization itself, and a holistic strategic approach is often lacking. It was emphasized that addressing these challenges requires significant rethinking and adaptation on the part of managers. Cultural barriers include a strong rootedness in traditional practices and a lack of openness to new approaches, exacerbated by the impact of hybrid work on corporate culture. In addition, the organizational structure often causes difficulties when individual departments operate in isolation. Furthermore, resource constraints such as a lack of skilled labor, insufficient financial means, and limited time are significant hurdles. Added to this are challenges in capturing digital transformation's value and economic benefits and a strong focus on the core business, which leads to a reluctance to experiment with innovative ideas.

At the micro level, challenges primarily involve people since resistance to change, especially among older generations and traditional industries, was identified as a significant hurdle. In terms of communication and collaboration, there is often a lack of an effective digital communication culture. Also, the effects of physical distance on interpersonal interactions and innovation, discomfort with transparency, and the fast pace of everyday working life are seen as challenges.

Table 5 summarizes the hurdles to digital transformation mentioned in the interviews, categorized by macro, meso, and micro levels. It encapsulates the key insights and recurring themes discussed by the interview partners, providing a comprehensive overview of the multifaceted hurdles organizations face.

Table 5
Overview of the Identified Digital Transformation Hurdles

Level	Subcategory	Hurdles
Macro	Technological advancements	*Overwhelming pace of change, i.e., rapid technological progress*
		Distinguishing relevant from irrelevant information in the flood of information
		Constant need for adaptation and learning
	Industry and market dynamics	*Reluctance towards new technologies in traditional and conservative sectors*
		Evaluating market readiness and acceptance of digital initiatives
	Data protection and cyber security	*Concern for data security and protection*
		Reluctance to make data transparent and accessible
		Balancing innovation and security while continuously adapting security measures
	Legal and regulatory	*Continuous adaptation of norms and laws*
		Legal restrictions hindering digitalization
Meso	Management and strategy	*Urgency not fully recognized*
		Unclear definition of digitalization
		Absence of a holistic digital strategy
		Need for digital and transformative leadership
	Culture	*Strong rootedness in traditional values and practices impedes change*
		Lack of experimental joy and openness to new approaches
		Impact of hybrid work on corporate culture
	Organizational structure	*IT departments operate as isolated units and are not perceived as competitive differentiators*
		Lack of process standardization due to limited cooperation with IT

Level	Subcategory	Hurdles
		Inefficient system landscapes and siloed structures
	Resources	*Shortage of skilled workers*
		Inadequate financial means
		Not enough time available for existing employees
	Expected benefits	*Difficulty in capturing the actual value and economic benefits of digital transformation*
		Initial effort outweighing benefits
		Uncertainty in calculating ROI for digital initiatives and associated risk of misinvestment
	Value creation	*Often, customized approaches are necessary, and standardized processes cannot always be applied*
		Strong focus on core business results in reluctance to experiment with innovative ideas
Micro	People	*Resistance to digital change and limited acceptance*
		Difficulties in adapting to new digital processes and limited use of digital tools
		Tension between younger and older generations
		Lack of qualification programs
	Communication and collaboration	*Establishing an effective digital communication culture*
		Physical distance affecting interpersonal interaction and innovation
		Transparency creating discomfort
		Fast pace of everyday work life due to changing meeting culture

Note. Developed by the author

5.3. Identified Digital Transformation Competencies

The analysis of the interview data underscores the necessity for a broad spectrum of competencies to manage the challenges of digital transformation effectively. These competencies can be grouped into six distinct fields. Three align with the DigComp framework by Vuorikari et al. (2022), specifically: (1) problem solving; (2) communication and collaboration; and (3) safety competencies. Beyond these, the analysis identified three additional competencies not encompassed by Vuorikari et al.'s (2022) framework: (4) leadership; (5) self-management; and (6) technological competencies. Together, these six areas were found to be pivotal in navigating the complexities of digital transformation across all stages of digital maturity.

According to the frequency with which they were mentioned, leadership competencies emerged as particularly critical, reflecting their significant role in guiding transformation efforts. This is closely followed by self-management and basic technological competencies, frequently addressed and seen as essential for adapting to rapid technological changes. Problem solving and communication and collaboration competencies were similarly emphasized due to their fundamental role in fostering effective teamwork and innovation. While mentioned less frequently, safety competencies were nonetheless seen as crucial in ensuring secure digital environments. Each category contains specific competencies vital for meeting the demands of the modern digital workplace, as detailed in the subsequent sections.

5.3.1. Leadership

First, leadership emerged as a pivotal competence in the interviews. Key leadership competencies identified include guiding employees, having a clear vision, and strategic orientation. Additionally, fostering an open error culture, leading at eye level, and promoting diversity were highlighted as essential for addressing the multifaceted challenges of digital transformation.

The interviews revealed that the ability to guide employees through changes is critical, especially when implementing new technologies. Interviewees stressed that leaders should act as role models, provide support, and actively involve employees in the transformation

process. This includes being transparent, engaging employees, and alleviating their fears about digitalization. The interview partners stated that leaders should be able to clearly communicate the significance and long-term benefits of digital initiatives, ensuring that everyone understands and works towards strategic goals. This also entails empowering employees to use new digital work methods, training them, and improving their digitalization know-how. For instance, interview partner 17 said: "*I also really have to give the employees the opportunity to build up this know-how, in other words, I really have to take them by the hand and show them how it works, you mentioned Teams, for example*" (I17: English transcript: p. 16, ll. 592-594; German transcript: p. 17, ll. 636-638). Moreover, interviewee 12 exemplified: "*[…] for example, training such as communication, moderation, and presentations are simply included in the basic canon […]*" (I12: English transcript: p. 14, ll. 521-522; German transcript: p. 16, ll. 575-576). Other examples given in the interviews include basics about the importance of digitalization, the fundamentals of AI, design thinking workshops, and introductions to various specific digital tools and processes. It was also mentioned that it is essential to provide employees with thought-provoking ideas and to support their development, as noted by interviewee 10: "*[…] a kind of nudging, as I always say, giving repeated impulses like, 'Hey, read this article,' or 'I saw something interesting,' or 'Check out this thing,' […]*" (I10: English transcript: p. 13, ll. 465-467; German transcript: p. 14, ll. 510-511).

Moreover, it was strongly emphasized that having a clear vision and strategic orientation represents a fundamental leadership competence in digital transformation. This enables the organization to navigate through technological and market changes effectively and provides a guideline to which all company personnel can consistently refer. This includes weighing up all the trends and possibilities and finding the most suitable approach for the company in digital transformation, making decisions, committing to them, and building the appropriate infrastructure to support them. For instance, interview partner 16 stated: "*[…] the leaders need to know what they are doing, where they want to go*" (I16: English transcript: p. 4, ll. 145-148; German transcript: p. 22, l. 840). Moreover, interviewee 7 explained further: "*[…] it requires a company-wide approach to be implemented thoroughly. And that's why I believe that companies must always take a holistic approach if they decide to use digital solutions […]*" (I7: English transcript: p. 4, ll. 145-148; German transcript: p. 5, ll. 155-159).

Furthermore, the interviewees pointed out that an open error culture is of enormous importance in times of digital transformation, as it is seen as a driver for innovation. Leaders should create an environment where mistakes are seen as learning opportunities, and employees are encouraged to explore, try new ideas, and experiment extensively without fear of negative consequences from failures. For instance, as stated by interviewee 14: "*Also, a healthy error culture, where people know that it's okay to make mistakes […]*" (I14: English transcript: p. 27, l. 1013; German transcript p. 29, ll. 1084-1085). Having the courage to fail, admitting when something has not worked out, and being transparent about it were considered essential aspects by the interviewees. This explorative approach is seen as especially important in a rapidly changing digital landscape, where not every attempt will be successful but can have valuable learning effects. For instance, interviewee 10 elaborated: "*It's not actually wasted time, but people often feel like, after spending three hours on something and then having to start over, they've wasted their time. But that's not the case; we've learned something. That needs to be allowed, and in fact, it should even be encouraged*" (I10: English transcript: p. 12, ll. 458-461; German transcript p. 13, ll. 501-504).

The concept of leading at eye level represented another recurring theme in the interviews, and the importance of trust, empathy, and open dialogue between leaders and employees was emphasized. For instance, interview partner 10 said: "*[…] and the second thing is, of course, that it takes a lot of trust that people will make the right decisions and that they will do the right thing. I think this also promotes the idea that I don't control what you are doing*" (I10: English transcript: pp. 12-13, ll. 462-464; German transcript: p. 14, ll. 505-508). The interviewees described this approach of breaking down traditional hierarchies as essential for effective employee leadership in digital transformation processes. It entails delegating tasks to employees, actively involving them in decision-making processes, giving them the freedom to develop their own ideas and solutions, and bringing their strengths to bear. This should create an environment where employees feel valued and can fully realize their potential. Interview partner 12 said: "*And I think that's also a pattern of modern leadership, that on the one hand, you create orientation for an organization and at the same time also set strength-oriented deployment and also flexibility in the roles, so that you really give*

people the setting that they can act intrinsically motivated" (I12: English transcript: p. 11, ll. 389-392; German transcript: p. 12, ll. 424-427).

The last aspect discussed in the interviews that can be assigned to leadership competencies is promoting diversity. The interviewees recognized that diversity plays a crucial role in digital transformation and emphasized the importance of assembling teams with diverse demographic characteristics and varied abilities, experiences, and perspectives. They stressed that these mixed teams, which combine various strengths and integrate a broad range of competencies and viewpoints, are essential for learning from each other, effectively solving complex problems, and fostering innovation. It was also noted that it is further necessary for leaders to flexibly deploy these various individuals and collaborate as a team. For instance, interview partner 3 stated: "*I would first say that we need a very, very high degree of diversity, yes. You can only be successful in this environment if you bring together different mindsets and, accordingly, people with different competencies, […] different expertise*" (I3: English transcript: p. 6, ll. 210-214; German transcript: pp. 6-7, ll. 233-237).

5.3.2. Self-Management

Furthermore, traits such as openness to technological change, willingness for lifelong learning about digital technologies, flexibility and adaptability, curiosity and interest in technological innovation, and endurance were identified as essential in navigating the rapidly evolving digital landscape. These could be assigned to the aspect of self-management competencies. Henceforth, this section delves into this competence field, which is primarily about personal strengths but also aligns with organizational needs in digital transformation.

The interviews revealed that respondents consider a fundamental openness to technological advancements and innovations essential. This aspect was frequently and emphatically highlighted as one of the most crucial competencies. This openness includes the willingness to continuously face new challenges, approach them positively, engage with unfamiliar tools and processes, and embrace them. This also involves accepting and adopting change, actively questioning new topics and technologies, recognizing their benefits, and integrating them into daily life. For instance, interview partner 15 stated: "*But having the openness to question and understand the topics, and then to be honest and evaluate, 'Oh, we can do this*

better now than we did before,' is what I meant. In every change process, this should always be the foundation" (I15: English transcript: p. 15, ll. 560-562; German transcript: p. 16, ll. 603-606). Respondents emphasized that a positive mindset towards new topics is central. They stressed the need to be open to change and not to form an opinion prematurely but to give new solutions a chance, even if they may seem less interesting at first, as stated by interviewee 3: "*[…] not to form an opinion too early, but to give things a chance, even if they seem rather less interesting at first*" (I3: English transcript: p. 8, ll. 292-293; German transcript: p. 9, ll. 325-326). For instance, interview partner 4 confirmed: "*As a leader, you always need to be incredibly open, I've had good experiences with that. You mustn't judge things, perhaps just because you didn't understand them immediately or haven't seen them yet*" (I4: English transcript: p. 11, ll. 415-417; German transcript: p. 12, ll. 461-464). It was noted that this openness should not be a temporary state but a permanent attitude that enables continuous learning and integration of new processes and tools.

This corresponds with the next aspect, in which respondents emphasized the importance of a willingness to engage in lifelong learning when dealing with digital technologies. They stressed that continuous learning about new technologies is not only desirable but an essential competence in the modern world. Intrinsic motivation, the inner drive to continuously develop and apply the knowledge acquired, plays a key role here. Respondents highlighted that it is not necessarily about detailed technical knowledge, like learning specific programming languages, but more about the ability to continually learn and acquire new competencies. For instance, interview partner 14 stated: "*In my opinion, the core competence is simply learning: being able to continue learning, not stagnating, but acquiring knowledge and adapting it to your current everyday life, so to speak. In my opinion, that will be the most important competence. I don't think that you necessarily need detailed knowledge in terms of 'I have to be able to program, I have to do this, I have to do that.' There will also be some simplifications*" (I14: English transcript: p. 23, ll. 856-860; German transcript: p. 24, ll. 907-913). Interviewee 10 also referred to this as "competence competence," i.e., the ability to acquire new skills: "*[…] we once called it 'competence competence,' meaning the competence to acquire competences. […]. So, we have the competence to acquire competencies, yes. And to keep reminding ourselves that this is something that distinguishes each and every one of us. And I think it's very important to*

strengthen this competence, to keep acquiring competencies" (I10: English transcript: p. 12, ll. 426-443; German transcript: pp. 12-13, ll. 465-485). Hence, respondents see continuous information-seeking and acquiring new knowledge as crucial to staying up-to-date and actively participating in shaping digital transformation. The importance of learning by doing and possibly making mistakes to learn from them was also emphasized, as was encouraging colleagues to try out new digital tools, as noted by interviewee 3: "*So most of it is actually learning-by-doing and most of it is actually working with good colleagues who are intrinsically motivated to teach others, in my opinion, there is nothing better*" (I3: English transcript: p. 10, ll. 347-349; German transcript: pp. 10-11, ll. 385-388).

The interviews showed that these attitudes also enable individuals and, thus, organizations to react flexibly to changes and develop innovative solutions. Respondents underlined that flexibility and adaptability are crucial to keep pace with the rapid evolution of digital technologies and changing market conditions. It became clear that it is not just about reacting to changes but actively taking a leading role in driving change. It was mentioned that the ideal workforce is willing to adapt, actively seeks solutions, and engages in digitalization processes. For instance, interviewee 14 stated: "*Flexibility is essential because we will not retire in the professions we learned, that's just the way it is. The world is currently undergoing such significant changes that it's possible we'll need to work completely differently in two or three years, or perhaps embrace an entirely new idea. [...]. Therefore, a certain basic flexibility and willingness to adapt are simply necessary*" (I14: English transcript: p. 22, ll. 840-849; German transcript: p. 24, ll. 891-901). In the interviews, flexibility was also frequently discussed in the context of leadership and organizational structuring. Respondents argued that companies that promote and support a culture of adaptability are better positioned to respond to dynamic requirements and master future challenges. For instance, interviewee 12 stated: "*And having the perspective, especially as a leader, that you need to find many different ways for the respective organization and sometimes for a single project, individually tailored to that particular endeavor. You must also recognize that approaches shouldn't always be the same. Instead, you need to consider what is right for this specific case. Can we do it the way we've done it before?*" (I12: English transcript: p. 14, ll. 512-516; German transcript: p. 15, ll. 564-568). He continued that a modern leader must, therefore, be able to align an organization in such a way that individual

strengths are promoted and utilized while maintaining flexibility in roles and processes (cf. I12: English transcript: p. 11, ll. 389-392; German transcript: p. 12, ll. 424-427). Hence, it was advocated for a work culture that encourages stepping out of comfort zones, taking on new roles and tasks, and creating spaces that allow employees to assume roles flexibly.

Additionally, curiosity and a strong interest in technological innovations were emphasized as critical aspects in the context of digital transformation. Interview partners described curiosity, and the ability to replace fear with curiosity, as fundamental to keeping pace with the rapid development of technology, as stated, for instance, by interviewee 11: "*[…] that you swap fear for curiosity […]*" (I11: English transcript: p. 8, l. 272; German transcript: p. 8, ll. 297-298). Curiosity was not just seen as a passive state but as an active, investigative attitude that encouraged experimenting with and exploring new technologies. As stated, for instance, by interviewee 10: "*[…] curiosity, the tendency to play around with technology*" (I10: English transcript: p. 15, l. 554; German transcript: p. 16, ll. 606-607). Thus, respondents saw curiosity as a driving force that enables continuous learning. It was argued that a curious attitude helps gain deeper insights into how new technologies work, proactively engage with new topics, and thus overcome potential fears of the unknown. For instance, interviewee 15 noted: "*[…] on the other hand, it also helps to better understand other issues in the future, which is why I think the concept of curiosity is very important. If you can maintain this generally and manage to encourage people to be open and curious, then they can handle any change process, and they will be able to fully engage with new topics*" (I15: English transcript: p. 16, ll. 608-612; German transcript: p. 18, ll. 653-658).

Moreover, the respondents' statements indicated that endurance, the willingness to always continue and to get up after failures, are essential in a constantly changing technological environment. Respondents argued that this endurance not only helps overcome digital transformation challenges but also contributes to advancing the team or organization and keeping it up-to-date. They emphasized that it is crucial to keep going after setbacks and not give up but look for new solutions. It was made clear that it is often necessary to try multiple times and test different approaches before finding a successful solution. For instance, interviewee 10 noted: "*You just have to try things out and then, if you've failed twice, you still have to try the third time and not say, this digital transformation, it's not going to work*

anyway, now I'm going to fall back on what I've already got and just do it the way it is, yes, it'll be fine, no. That's not going to work" (I10: English transcript p. 21, ll. 805-808; German transcript p. 23, ll. 875-878). Additionally, the importance of being proactive and always thinking one step ahead was highlighted. And if this sometimes meets resistance, it was seen as essential to be patient, keep going, and show perseverance, as interview partner 5 stated: "*A certain perseverance, a consistency, so not everything is done in a week, so that means perseverance has to be there*" (I5: English transcript p. 21, ll. 805-808; German transcript p. 19, ll. 719-721).

5.3.3. Technological

Although the above-mentioned competencies were named more frequently and seen as more critical, respondents agreed that a basic technical understanding is essential to effectively utilizing and integrating current and emerging technologies.

Respondents discussed the importance of technical competencies as a foundation for working in the modern digital world. It became apparent that a basic technical understanding and an overview of current developments and technologies were considered indispensable. For instance, interviewee 6 stated: "*Generally, I would say that important competencies include having a fundamental understanding of the various technologies available, both as a responsible citizen in this country and in the world*" (I6: English transcript: pp. 15-16, ll. 576-578; German transcript: p. 17, ll. 631-633). This includes a fundamental understanding of current technologies, such as how an algorithm works, cloud services, and analytics. Established digital tools and software, like those from Office 365, were considered state-of-the-art, which should be part of everyone's basic understanding, as interviewee 6 continued: "*That's already completed. Office 365 and its components like Power Automate, Power BI, and Teams are not considered digital transformation to me; they are already state-of-the-art and have been implemented*" (I6: English transcript: p. 16, ll. 613-615; German transcript: p. 18, ll. 671-673). This also encompasses not just an understanding of the functions of these technologies but also their application in professional daily life. The interviewees, however, agreed that not everyone needs in-depth specialist knowledge but a basic technological understanding. For instance, interviewee 3 said: "*And what's certainly not wrong is having some technology competence. For example, [Name] definitely can't*

write a line of code, and that's completely unnecessary, but [Name] does understand roughly how things are put together, like front end and back end, and so on" (I3: English transcript: p. 10, ll. 360-363; German transcript: p. 11, ll. 397-400). Instead, a willingness to keep learning and keep up with new technological developments was described as crucial. For instance, interview partner 6 stated: "*[…] therefore, I would say quite clearly that what is really needed is a mindset that is open to new ideas, that's the must-have. The nice-to-have would be to have someone who is already familiar with the specific topics*" (I6: English transcript: p. 16, ll. 602-605; German transcript: p. 18, ll. 660-663).

5.3.4. Problem solving

Moreover, the interview partners highlighted the ability to recognize the need for action. This involves critically evaluating existing processes, developing innovative, technology-supported solutions, appropriately utilizing digital technologies, and identifying competence gaps. These aspects could be assigned to the competence field of problem solving.

Interviewees emphasized the need to identify needs and technological responses, i.e., critically examine outdated or inefficient processes, analyze them, and seek improvements. This reflects the ability to appropriately assess needs and match digital tools and potential technological solutions. For instance, interviewee 13 noted: "*[…] for me, first and foremost, […], the competence to think about processes would be important because we often have processes in our organization that have developed over the years. People don't think about why they exist as they do; they just accept them, even though sometimes they are nonsensical or could be much more straightforward*" (I13: English transcript: p. 14, ll. 499-503; German transcript: p. 14, ll. 536-540).

Furthermore, it was noted that it also involves applying digital technologies creatively and effectively as well as using them for one's benefit, as stated by interviewee 7: "*And here, of course, the competence is even more important to understand what different figures and data tell me in combination and then to draw the right conclusions and make the right decisions*" (I7: English transcript: p. 13, ll. 475-477; German transcript: p. 14, ll. 517-520).

Also, interviewees discussed the importance of continuous education and updating their skills to keep up-to-date with digital development. This reflects the ability to identify digital competence gaps and actively support oneself and others in developing digital competencies. For instance, interviewee 13 noted: "*[…] then I can think about what competencies and abilities I need*" (I13: English transcript: p. 15, l. 539; German transcript: pp. 15-16, ll. 579-580).

5.3.5. Communication and Collaboration

Moreover, the effective and appropriate use of digital technologies to promote collaboration and communication within teams and organizations was frequently discussed.

The interviewees emphasized the importance of clear, open, and transparent communication and ongoing dialogue via digital technologies. This includes setting up and using clear and effective communication channels to avoid information overload and provide essential information. For instance, interviewee 19 noted: "*Yes, ensuring that there are clear communication channels and avoiding information overload, which already exists to some extent, but creating clarity for employees and providing a framework in this regard, yes*" (I19: English transcript: p. 15, ll. 569-571; German transcript: p. 16, ll. 610-612). Furthermore, it entails addressing the recipient's communication preferences and utilizing the most appropriate communication channels in this context. It was noted that this is important not only from leaders to employees but also among employees to support each other and to share and increase knowledge. For instance, interviewee 5 stated: "*And it is also very important to communicate a lot in that area. I believe that this is definitely a competence that needs to be included because it usually isn't just handled by one person. We need to maintain a certain level of dialogue across all hierarchical levels to make progress, yes*" (I5: English transcript: p. 17, ll. 649-652; German transcript: p. 19, ll. 721-725). Also, interviewee 20 noted: "*[…] with continuous exchange, especially when looking towards new tools, one might say, 'Hey, look, colleague XY tried out a new tool, I'll share it with you. Let's see what good we can do with it.' So, it's about constantly bringing up these new possibilities* […]" (I20: English transcript: p. 9, ll. 290-293; German transcript: p. 9, ll. 328-331).

Furthermore, it became evident that the interviewees value knowledge about using digital tools for collaboration. The significance of exchanging knowledge and skills to ensure efficient and effective use of digital resources was emphasized. Additionally, it was discussed how to make collaboration dynamic and agile, where a digital environment acts supportively. It was stated that it is about creating settings where dynamic decision-making processes are negotiated and flexibly chosen, determining which team composition is most suitable for a specific task to make a decision. Here, interviewee 12 stated: "*Creating settings where this negotiation of dynamic decision-making processes also takes place on a meta-level, namely negotiating which person is best suited to make a decision in this specific situation for this task*" (I12: English transcript: p. 14, ll. 505-507; German transcript: p. 15, ll. 555-558).

The interviewees' discussions also related to netiquette in digital environments. This involves adapting one's behavior appropriately through digital tools and creating aspects like appreciation, trust, or sympathy without direct personal contact. Moreover, interviewees addressed the need to be aware of the diversity of people and generations, thus adjusting the interaction accordingly. For instance, interviewee 9 stated: "*How do I approach people, and how do I engage with different individuals? For one person, I might just throw something their way, like, 'Hey, use this, here's ChatGPT,' and they'd say, 'Cool, I'll do it,' while another person might ask, 'What is that even? Explain it to me first.' And I believe having the competence as a leader […] to address individuals personally and to understand who needs what amount of, bluntly put, support, is important*" (I9: English transcript: p. 17, ll. 621-631; German transcript: p. 18, ll. 686-696).

5.3.6. Safety

Furthermore, the interviewees stressed the importance of safety in terms of awareness and measures to protect data and privacy and promote physical and psychological health and well-being in digital work environments.

Several interviewees highlighted the necessity of keeping IT security systems up-to-date to protect sensitive company data. This was directly linked to protecting personal data and privacy in digital environments. Moreover, it was seen as crucial to train employees on this

matter. For instance, interviewee 19 noted: "*[…] the issue of security, specifically IT security, is crucial because, with data no longer stored locally, it becomes more vulnerable to hacker attacks and such. Therefore, it is more important than ever to keep security systems up-to-date and maintained to a very high standard*" (I19: English transcript: p 14, ll. 517-520; German transcript p. 15, ll. 555-558).

The interviewees also highlighted the importance of protecting health and well-being, i.e., critically and consciously handling health risks and threats related to physical and psychological well-being when using digital technologies. The rapid pace of digital transformation was noted, making it increasingly necessary to take care of personal health and to find an appropriate pace for oneself. Concerning this, interviewee 4 emphasized: "*[…] with all the possibilities of digitalization, it ultimately leads to the point where people can no longer cope, and I believe this must be particularly clear to leaders in consulting. We need to be fully aware not only of the advantages that allow us to push further but also be very conscious of the risk that it may eventually become unmanageable […]*" (I4: English transcript: pp. 14-15, ll. 540-544; German transcript: p. 16, ll. 606-610).

5.3.7. Concluding Remarks on Digital Transformation Competencies

This section explored the competencies required in times of digital transformation, emphasizing the importance of a broad spectrum of competencies. The findings identified six key competence areas: (1) problem solving; (2) communication and collaboration; (3) safety; (4) leadership; (5) self-management; and (6) technological competencies. While the first three align with the DigComp framework by Vuorikari et al. (2022), the additional competence areas of leadership, self-management, and technological competencies emerged as crucial through the analysis. Each of these areas of competence encompasses its very own set of competencies.

Leadership competencies were highlighted as particularly critical, reflecting their significant role in guiding transformation efforts. This includes having a clear vision and strategy and leading employees through the digital transformation at eye level. Also, promoting an open error culture and diversity was emphasized. Moreover, self-management and technological competencies were frequently highlighted. Self-management competencies encompass

openness, curiosity, and a willingness for lifelong learning about new technologies. These competencies also include the ability to adapt flexibly and show perseverance in the face of constant change. Regarding technological competencies, it was noted that while they are important, having a basic understanding of digital technologies was considered sufficient, and self-management competencies such as those mentioned above take precedence. Moreover, both problem solving next to communication and collaboration competencies were found essential for fostering innovation and effective teamwork. These include recognizing competence gaps and opportunities for improvement, utilizing digital technologies to address them, and communicating and collaborating through digital means while maintaining proper netiquette. Also, safety competencies, both in terms of data and privacy protection and mental and physical well-being, are critical for ensuring secure digital environments, although they were mentioned less frequently.

Overall, these competencies were identified as pivotal for organizations to navigate the complexities of digital transformation effectively. After the individual digital transformation competencies have been described in detail in this chapter, Table 6 provides a comprehensive summary of the individual competence fields of leadership, self-management, technological, problem solving, communication and collaboration, and safety, and their respective competencies, sorted according to their frequency of mention.

Table 6
Overview of the Identified Digital Transformation Competencies

Competence field	**Competence field description**	**Digital transformation competencies**
Leadership	To guide and inspire people within the organization through the process of digital transformation. This includes having a clear vision, promoting an open error culture, leading at eye level, and encouraging diversity.	*Guiding employees through digital transformation* *Having a clear vision and strategic orientation* *Encouraging an open error culture* *Leading at eye level* *Promoting Diversity*

Competence field	**Competence field description**	**Digital transformation competencies**
Self-management	To continuously develop and adapt in an evolving digital landscape. This includes being open to technological change, being willing to learn about digital technologies throughout life, having flexibility and adaptability, being curious, and having the persistence to keep going.	*Openness to technological change* *Willingness for lifelong learning about digital technologies* *Flexibility and adaptability in a rapidly changing landscape* *Curiosity and interest in technological innovations* *Endurance to keep going*
Technological	To have a basic understanding of current technologies and their applications to ensure effective use and integration of digital tools in the workplace.	*Understanding of technological basics*
Problem solving	To critically analyze existing processes, develop innovative solutions in digital worlds, and creatively use technologies to generate knowledge and innovate. To identify and resolve competence gaps within the organization.	*Identifying needs and technological responses* *Creatively using digital technology* *Identifying digital competence gaps*
Communication and collaboration	To use digital tools for communication and collaboration within the organization effectively while being aware of the appropriate behavior within these networks.	*Communication via digital technologies* *Collaborating through digital technologies* *Preserve netiquette*

Competence field	Competence field description	Digital transformation competencies
Safety	To protect data and privacy and ensure physical and mental well-being in digital working environments. This includes maintaining up-to-date IT security systems and promoting health-conscious practices in the digital workplace.	*Protecting personal data and privacy* *Protecting health and well-being*

Note. Developed by the author

5.3.8. Promotion of Digital Transformation Competencies

Furthermore, interviewees discussed approaches to fostering these competencies. Regarding external sources, the importance of exchanging information with other companies and industry experts to discover and learn from best practices was highlighted. This includes both formal partnerships and the engagement of external consultants, as well as informal networks that serve as platforms for knowledge transfer and inspiration. For instance, interviewee 15 stated: "*Once this is recognized, there are multiple options available. There are many consulting firms that can support you in this area. There are companies that are already doing a great job, and we often use them. We always look to see who is doing something very well, then I meet with those people and see how they have set it up. […]. You can create your own teams that start working on these issues, so there are no limits to creativity. The most important step is making the decision*" (I15: English transcript: p. 19, ll. 697-708; German transcript: p. 20, ll. 751-755). It was also suggested to regularly provide resources, such as online courses and platforms for self-directed learning, to promote continuous training. Internally, another critical aspect mentioned was "learning on the job," which is encouraged through exchanges within the company and practical application. Here, the value of direct feedback and the opportunity to learn immediately from real projects and internal workshops was emphasized. For instance, interviewee 18 stated: "*There are now several platforms where you can do something. Yes, I would say it's good, and otherwise, there's always a certain amount of learning on the job involved, where you exchange ideas*

with others within the company. It doesn't always have to be traditional training […]" (I18: English transcript: p. 14, ll. 529-532; German transcript: p. 15-16, ll. 574-577). Also, establishing company-internal teams specifically addressing digital topics was discussed. These teams are intended to develop specific competencies and disseminate them throughout the company through training and workshops. For instance, interviewee 5 explained: "*[…] we have solved this by setting up competence clusters and these competence clusters deal with specific subject areas. So, they have the task of making sure that they acquire the relevant competencies and […] they then report at regular intervals and I think every quarter or half-year there is an event where all […] the relevant topics are simply presented*" (I5: English transcript: p. 13, ll. 487-501; German transcript: p. 15, ll. 544-560).

5.4. Implications of Digital Transformation Hurdles and Competencies

Finally, this section examines the role of the aforementioned digital transformation competencies in strengthening SMEs' competitiveness and resilience in the Stuttgart economic region and the conclusions that can be drawn from this case.

5.4.1. Competitiveness and Resilience

Concerning the extent to which the competencies mentioned above contribute to the resilience and competitiveness of organizations, the interviewees regarded them as indispensable and critically important for the future viability of companies. Those that fail to develop these competencies risk falling behind in the marketplace. These competencies are seen as pivotal for addressing immediate business challenges and enhancing organizational adaptability, stability, and efficiency. Additionally, it was emphasized that they are essential for sustaining robust customer relationships. The following sections elaborate on how these competencies interplay to bolster organizational strengths across these dimensions.

In the interviews, it was noted that the deployment of digital technologies enhances the resilience of companies against global challenges such as natural disasters, political unrest, or supply chain disruptions. For instance, interviewee 10 said: "*For me, digital transformation is almost certainly the next step for me, as it naturally addresses issues like global trade, supply chain matters, or the shortage of skilled workers, and the aging of*

society. It's actually a topic that counteracts these challenges […]" (I10: English transcript: p. 10, ll. 354-356; German transcript: pp. 10-11, ll. 386-389). However, they cannot be seen as panaceas but as supportive tools. For example, digital instruments can provide real-time updates and alternatives for reconfiguring the supply chain, which is considered essential for survival in a connected global economy. Here, interview partner 15 stated: "*There are certainly things where digitalization can help, but if materials don't get from A to B or aren't produced at all, then we can't do anything either*" (I15: English transcript: p. 10, ll. 353-352; German transcript: pp. 10-11, ll. 378-380). In particular, demographic change and the associated shortage of skilled workers were central themes discussed in the interviews. It was noted that effective knowledge management and transfer are crucial with the retirement of older employees and the integration of younger generations into the workforce. Digital tools enable the systematic capture, storage, and accessibility of knowledge for new generations of employees, making it transparent. This facilitates the continuous transfer of essential know-how and supports the onboarding of new employees. This was noted, for instance, by interviewee 17: "*Demographic change is a major challenge for [company]. This transfer of know-how simply has to be managed now. In some cases, it can't be done face-to-face. That means it has to be written down somewhere in a digital way, recorded, in order to pass it on […]*" (I17: English transcript: p.10, ll. 348-352; German transcript: p. 10, ll. 368-372). Also, it was frequently noted that young workers are increasingly seeking positions within digitally advanced environments that feature robust digital infrastructure and a modern corporate culture. Interviewees stressed that companies that do not meet these criteria risk becoming unattractive to this demographic. Therefore, the digitalization of workplaces, including providing tools such as home office capabilities, modern IT infrastructures, and opportunities for further education, is seen as essential for attracting and retaining young talent. Interviewee 13 stated: "*[…] digitalization is also an aspect that cannot be neglected when it comes to attracting young employees to the company*" (I13: English transcript: p. 19, ll. 722-723; German transcript: p. 21, ll. 778-780). The flexibility to work from various locations is not just seen as a convenience but increasingly a necessity to access broader talent pools and ensure location independence, as noted, for example, by interviewee 11: "*If they are present? Absolutely. If not, companies will essentially eliminate themselves because they become unattractive. Particularly, the ability to work remotely, I believe, is a key point, but so is digitalization, especially in relation to young professionals*"

(I11: English transcript: p. 10, ll. 379-381; German transcript: p. 11, ll. 412-415). Additionally, it was noted that the automation of processes, which will be discussed in more detail below, can help mitigate the shortage of skilled workers by reducing the need for personnel to perform routine and repetitive tasks and allowing employees to focus on more complex and value-adding activities. Interviewees 10 stated: "*It's actually a topic that counteracts these challenges, right. Because it can of course eliminate the shortage of skilled workers, because you can simply do a lot more digitally, you can automate it, you can do it with AI*" (I10: English transcript: p. 10, ll. 356-358; German transcript: p. 11, ll. 388-391).

The interviews also revealed that these competencies signify adaptability on the one hand, which implies resilience and is seen as crucial for a company's competitiveness. Respondents emphasized that the named competencies are essential for quickly adapting to changing market conditions, technological developments, and internal challenges. For instance, interviewee 10 said: "*[...] a high degree of adaptability, flexibility, and adjustability is essential. The world keeps turning at the same speed, but it feels like everything is happening faster*" (I10: English transcript: p. 16, ll. 581-582; German transcript: p. 17, ll. 636-637). The importance of employing agile methods was underscored, which enables companies to act flexibly and respond swiftly to changes. Additionally, the use of digital technologies was deemed critical to increase response speed, as noted by interviewee 20: "*[...] with more digitalization, making mistakes becomes easier. I can recover faster, adjust, and continue moving forward*" (I20: English transcript: p. 11, ll. 409-410; German transcript: pp. 12-13, ll. 464-466). Interview participants also discussed how dynamic strategy development, as opposed to long-term, rigid plans, allows for rapid response to unforeseen changes by enabling leaders to understand that their role is to follow and implement plans, be sensitive to market changes, and act proactively and anticipatorily. This was noted, for instance, by interview partner 6: "*And of course, the topic of transformation is also very clearly part of this and leaders understanding that their role is no longer just to follow and implement plans, but also to grasp what is happening externally and to reconnect with the product and markets. But yes, to answer your question, this is absolutely relevant to me*" (I6: English transcript: p. 19, ll. 699-703; German transcript: p. 20, ll. 762-766).

On the other hand, interviewees emphasized that, in addition to adaptability, this set of competencies in digital transformation is associated with stability and security, as they aid in maintaining long-term success and competitiveness in the market. For instance, interviewee 15 stated: "*I think an open culture and a culture of error […] makes the company fit for the future, yes, and provides security*" (I15: English transcript: p. 22, ll. 822-829; German transcript p. 24, ll. 883-891).

Next, the interviewees highlighted that automation and the resulting increase in efficiency and cost savings through digital transformation are crucial aspects for a company's competitiveness and sustainability. It was emphasized that digitalization and automation allow companies to use their resources more strategically and save on personnel costs, which is particularly important in high-wage countries like Germany. Here, interviewee 3 stated: "*At the end of the day, transformation in digitalization means increasing efficiency and possibly reducing costs. That's very important to remain competitive*" (I3: English transcript: p. 5, ll. 166-168; German transcript: p. 5, ll. 183-185). This increase in efficiency extends from manufacturing to administrative areas, where automation of processes, such as travel expense reporting, can save significant time. This allows for a focus on value-creating processes, where digital processes and tools, such as workflows, dashboards, and digital collaboration, can significantly enhance productivity. For instance, interviewee 14 stated: "*So, we need to become more efficient […]. One of the major levers is digitalization and the processes it generates, especially in the administrative area. […]. This can be achieved by changing waiting times through workflows, having partially automated processes, or using dashboards that automatically pull information*" (I14: English transcript: pp. 29-30, ll. 1117-1124; German transcript: p. 32, ll. 1200-1210).

Lastly, some interviewees emphasized that digital transformation competencies are also crucial for relationship management with stakeholders, i.e., communication with customers and suppliers, which is considered essential for maintaining market competitiveness. It is viewed as a "must-have" for effective relationship management, without which companies cannot remain competitive. For instance, interviewee 8 stated: "*It's a must-have. It won't work without it, so it's definitely a must-have if you want to stay in the market and you want to communicate with the customer*" (I8: English transcript: p. 17, ll. 636-368; German

transcript: p. 19, ll. 701-703). This necessitates a robust digital infrastructure and interfaces that enable effective communication with customers and suppliers and data exchange. These platforms serve not only for information but also for quality assurance, which customers expect. It was assumed that the quality of digital services directly influences the perception of customer satisfaction and is thus critical for competitiveness. The transparency and availability of this information and digital services regarding the entire product lifecycle are considered essential by interview participants to meet the needs of customers and suppliers. For instance, interviewee 5 stated: "*[...] you have various target groups throughout the entire lifecycle, and I believe that this lifecycle is becoming increasingly important in the allocation of objects and products. Thus, you are not only required to make the individual product good, but also to present all information around the product throughout its entire lifecycle in such an adequate and simple manner that the user can access this information with as few clicks as possible*" (I5: English transcript: p. 18, ll. 681-686; German transcript: p. 20, ll. 757-762).

5.4.2. Transferrable Learnings from the Stuttgart Economic Region

To draw lessons from the Stuttgart economic region, various aspects could be derived from the interviews that extend beyond local boundaries to encompass broader implications across a country perceived by interviewees as lagging in digitalization. The interviewees highlighted several critical factors, including the dynamic interplay among diverse companies residing in the region and the role of different initiatives in promoting innovation. Additionally, the progress in digitalization was noted to vary significantly between rural and urban areas, illustrating the influence of geographical context. The substantial impact of cultural attitudes on digital adoption also emerged as a prominent theme.

In the evaluation of the interviews, it became evident that the most frequently discussed topic by interviewees in this aspect was the interaction between different types of companies in the Stuttgart region. Participants highlighted industry differences, noting, for instance, that sectors such as construction or mechanical engineering, widely represented in the Stuttgart area, generally exhibit less advancement in digital competencies compared to the consulting or IT sectors. In these latter sectors, interviewees consider human capital the most significant asset, leading to tremendous pressure on competence development. For instance, interviewee

3 stated: "*The second issue is, of course, to what extent is the human factor relevant when considering economic efficiency? So, if you have medium-sized companies with a very high degree of automation, working with some assembly robots, then that is probably less relevant. For us, it is vital. We are in constant competition, and our people make the difference. The greatest asset at [Company] is the people who work here. Accordingly, it is, of course, exceptionally high for us*" (I3: English transcript: p. 11, ll. 385-390; German transcript: p. 12, ll. 427-435). Also, interviewee 20 noted: *"[…] of course, the IT sector is a bit faster. Indeed, because there it might also happen that you collaborate with colleagues from abroad. These are simply different dimensions, especially compared here, as mentioned, with the heavy German companies in the Stuttgart area, which are very production-heavy. This is usually associated with on-site activities. It's not entirely feasible to digitalize everything […]*" (I20: English transcript: p. 10, ll. 381-385; German transcript: p. 12, ll. 431-436). However, the analysis of the interviews highlights the dynamic between large corporations and SMEs. Many interviewees discussed the high concentration of major corporations, particularly those from the strong automotive cluster such as Daimler, Bosch, or Porsche, which are prominently represented in the region. These corporations are often seen as drivers of digitalization, thereby setting standards for digital processes and expecting similar digital competencies from their suppliers. This causes smaller companies, often suppliers in this sector, to feel significant competitive pressure. For example, interviewee 3 explained: "*[…] the requirements are naturally very high because a customer who has achieved a certain level of digitalization within their company expects the same from their partners and suppliers*" (I3: English transcript: p. 11, ll. 411-413; German transcript: p. 12, ll. 460-463). To remain competitive, they are compelled to increasingly engage with digitalization and adapt. This situation offers opportunities for innovation and growth but also places considerable pressure on smaller businesses. Many of these SMEs are also described by respondents as "hidden champions," leading globally in specific niches. They face the challenge of differentiating themselves from large corporations, finding their appropriate paths for digitalization where dimensions differ significantly from those of larger companies, and, at the same time, meeting the digital expectations set by the presence of these large corporations in the region. For instance, interviewee 4 noted: "*And that's why I think it's particularly difficult in high-pressure regions like this, where there are such incredibly large players around, both in the connection between the companies and in the*

combination with applicants or employees, because you have to compare yourself with things that are not comparable or use things that don't suit you because you are simply forced to" (I4: English transcript: p. 18, ll. 675-679; German transcript: p. 20, ll. 750-754).

Furthermore, the interviewees emphasized the importance of promoting innovation through regional initiatives, i.e., infrastructure, regional networks, open dialogue, educational institutions, and political measures that shape the innovation capacity of a region like Stuttgart. They reported a significant increase in beneficial exchanges and open discussions about digital transformation in recent years, which are seen as crucial for sharing knowledge and learning from each other. For instance, interviewee 1 stated: "*[…] to engage in dialogue and explore, to take it to the meta level, how we can as an economic area, of which there are of course many […] how can we make progress together? This also involves considering our position in an international context […]*" (I1: English transcript: p. 21, ll. 779-788; German transcript: p. 23, ll. 855-866). It was also noted that the region has a high level of education, with many universities promoting continuing education. Similarly, associations that drive and advance initiatives and exchanges on digitalization were mentioned. For instance, interviewee 16 stated: *"[…] there are many initiatives here, driven by the IHK and other institutions and associations like VDMI, VDMA, and VDW, which are actively promoting and advancing digitalization and exchange*" (I16: English transcript: p. 24, ll. 909-911; German transcript: p. 26, ll. 976-979). Interviewee 10 also highlighted the significant role of politics in consistently supporting innovation, driving it forward, and setting impulses (cf. I10: English transcript: pp. 18-19, ll. 686-703; German transcript: p. 20, ll. 751-768).

Moreover, the interviewees discussed regional differences in digitalization, noting that urban areas like Stuttgart are perceived to be more advanced compared to rural regions. Relating to the aspect mentioned above of the interplay between different company types, some respondents pointed out that the presence of large, often international companies and industries in urban areas, which set digitalization standards, leads to a more intense digital development. The interviewees emphasized that urban centers and metropolitan areas experience greater competition, increasing the pressure to stay technologically up-to-date. This results in higher innovation dynamics and an exchange about new technologies, which

was noted to be less prevalent in sparsely populated or rural areas. This aspect is well represented by the quote from interviewee 14, who said: "*Across Germany, I'm not sure if there's such a strong differentiation, but from my experience, it seems more a matter of urban versus non-urban areas. In urban areas, progress is generally more advanced, at least that's my impression from what I've seen intuitively. As I move into more remote areas, especially the new federal states, I often find companies operating in semi-craft structures within niche markets, enjoying good margins without any urgency. So, I believe it's not so much a regional issue as it may be an urbanization issue"* (I14: English transcript: p. 36, ll. 1376-1382; German transcript: p. 39, ll. 1482-1489). This was confirmed, for example, by interview partner 17: "*[…] in rural areas, driving digital transformation isn't necessarily a priority. The mindset, lifestyle, and attitudes of the people and employees are generally more laid-back. In contrast, in urban areas, it's very different. People tend to ensure they stay up-to-date*" (I17: English transcript: p. 27, ll. 1001-1004; German transcript: p. 28, ll. 1073-1077). Additionally, some participants noted that a company's location significantly affects its overall attractiveness and, hence, its ability to recruit employees. For example, it was perceived as easier to attract and retain qualified personnel in urban centers, as these areas are often seen as more desirable for living. In contrast, it was noted that companies in rural areas often need to offer more incentives to attract talent. Interviewee 17 continued: "*[…] in the countryside? […] Yes, you really have to recruit the employees and make it attractive for them to come to you*" (I17: English transcript: p. 23, ll. 847-854; German transcript: p. 24, ll. 915-922).

Finally, cultural characteristics were highlighted in the interviews. The interviewees pointed to a region where traditional values and caution in dealing with digital innovations prevail. The culture in this area was often described as conservative and reserved, as reflected in how businesses, particularly those led by older generations of SMEs, approach innovation and digital transformation. This attitude was often associated with a cultural fear of mistakes and a tendency to preserve the status quo, which the interviewees mentioned as generally recognizable in Germany. For instance, interviewee 8 said: "*[…] we are so reserved that we often don't dare to try certain things […]*" (I8: English transcript: p. 36, ll. 1348-1349; German transcript: p. 39, ll. 1476-1477), while interviewee 15 stated: "*[…] Germany is simply not at the forefront when it comes to digitalization*" (I15: English transcript: p. 23, l.

854; German transcript: p. 24, l. 918). Interviewee 12 described the region as characterized by a strong focus on value creation, with a certain skepticism towards investments in new, untested technologies. He stated: "*I believe that a lot of digitalization is not pursued because it's quite clear that it probably wouldn't be worth it for us, and this feeling may also be due to the German culture of fear. There are also studies indicating that we in Germany have a lot of anxiety about the future and little optimism. It feels like companies here experiment too little; they do not allow for the necessary wastefulness that comes with experimenting, but rather focus too much on value creation and their core business*" (I12: English transcript: p. 16, ll. 602-607; German transcript: p. 18, ll. 662-669). The interviewees repeatedly emphasized that many companies tend to avoid "unnecessary wastage" and instead focus on proven processes and their core business. This attitude was cited as one of the reasons why experimental approaches and a propensity for innovation are sometimes not so pronounced. Interviewee 12 also linked this approach to business innovation to the so-called "innovator's dilemma," where SMEs that are successful in their niche may have good reasons to focus on their proven core business and less on radical innovations (cf. I12: English transcript: p. 19, ll. 719-723; German transcript: p. 21, ll. 790-794). Thus, he emphasized: "*Instilling the spirit in a company that is partly based in Baden-Württemberg and has existed for a long time to constantly question the status quo and ask whether things can be done better or differently, or whether we can use new technologies. This spirit is something the companies have known for a long time. I believe that promoting this spirit more, in combination with what we mentioned earlier about perhaps other organizational forms that align with an increasingly interconnected and complex environment, is, in essence, the most important aspect*" (I12: English transcript: p. 19, ll. 705-711; German transcript: p. 21, ll. 773-782).

5.4.3. Concluding Remarks on the Implications of Digital Transformation Hurdles and Competencies

This analysis underscores the crucial role of digital transformation competencies in enhancing the competitiveness and resilience of SMEs in the Stuttgart economic region. The competencies discussed - spanning leadership, self-management, technological understanding, problem solving, communication and collaboration, and safety - are deemed indispensable for future viability. The interviewees agree that SMEs that fail to develop these competencies risk falling behind in the marketplace, while those that embrace them can

significantly improve their handling of other challenges, their adaptability, stability, efficiency, and stakeholder engagement.

It has been shown that these competencies play a supportive role in addressing global challenges such as supply chain disruptions, demographic shifts, and the shortage of skilled workers. In the latter aspects, modern and digital work culture can particularly help with knowledge management, attracting and retaining young talent, and accessing larger pools of potential employees. Moreover, the synergy between adaptability and stability, enabled by digital competencies, allows companies to operate with agility and respond swiftly to change while safeguarding long-term competitiveness. Additionally, the automation facilitated by digitalization can lead to efficiency gains and cost savings, primarily through the automation of administrative and repetitive tasks. This shift enables a greater focus on customized solutions and value creation, saving resources. Furthermore, it was pointed out that effective relationship management with stakeholders, particularly with customers and suppliers, can be enhanced through modern approaches concerning the business model, communication, transparency, and quality management. Together, these aspects reflect how the identified digital transformation competencies can strengthen the resilience and competitiveness of the companies.

To draw lessons from the Stuttgart context, the extent to which this area influences the maturity of digital transformation in regional companies was investigated. The findings indicate that the results are not strongly limited to the Stuttgart region but can be applied more broadly since certain characteristics, rather than the specific location, play a crucial role in the degree of digital maturity. These include industry differences, the presence of large corporations that act as benchmarks, regional initiatives, the urban-rural digital divide, and cultural attitudes toward innovation and change.

Concerning the dynamic interplay among different types of companies, significant industry differences were noted, with sectors like mechanical engineering lagging in digital development compared to progressive sectors like IT and consulting. It was emphasized that large corporations, in this case, particularly in the automotive sector, act as benchmarks for digital transformation, compelling smaller companies, which are strongly interconnected

with major corporations, to follow suit. Furthermore, the role of regional initiatives from politics and education and the importance of exchange in promoting innovation was emphasized. A supportive infrastructure, regional networks, open dialogue, educational institutions, and political measures were identified as critical factors in fostering a conducive environment for digital transformation. The analysis also revealed differences in digitalization levels between urban and rural areas. Urban centers like Stuttgart are considered more advanced due to greater competition, exchange, and a larger talent pool. Additionally, cultural attitudes were identified as significantly influencing digital adoption. It showed that regions with traditional values and a conservative, cautious approach to change tend to experience inhibited innovation. This cultural characteristic, noted as a general issue in Germany, results in a strong focus on core business operations and a reluctance to experiment with emerging technologies.

6. Learning Opportunities

From the perspective of SME managers in the Stuttgart economic region, this work identified relevant factors impacting how these organizations operate in the context of digital transformation at macro (landscape), meso (regime), and micro (niche) levels (Geels & Kemp, 2007), as listed in Table 5 (p. 75). Additionally, the digital transformation competencies required to address these challenges were examined based on the DigComp framework (Vuorikari et al., 2022). Six areas of competence have emerged as critical for overcoming the identified hurdles, each of which contains an individual set of competencies (see Table 6, p. 90). These encompass (1) problem solving; (2) communication and collaboration; (3) safety; (4) leadership; (5) self-management; and (6) technological competencies. While the first three align with the DigComp framework by Vuorikari et al. (2022), the other competence areas were further identified through the analysis.

It showed that these competencies are crucial in bolstering SMEs' competitiveness and resilience. They help address other challenges, ensure both adaptability and stability, increase efficiency, and support effective relationship management with stakeholders. Moreover, this study provides valuable theoretical contributions by integrating empirical findings from the Stuttgart region into the broader discourse on digital transformation, highlighting the importance of contextual factors in shaping the digital maturity of SMEs.

These include industry dynamics, inter-organizational relationships, regional support systems, geographical disparities, and cultural attitudes toward innovation and change.

6.1. Implications for Theory

Since there are still evident gaps in research in this field, this work contributes to previous research in several ways. Most studies (Slimane et al., 2022; Müller et al., 2024) have primarily mapped the landscape of challenges and competencies in digital transformation through literature reviews. This study addresses the need to validate and expand upon these findings and theoretical frameworks through empirical research in a real-world setting (Wolff et al., 2019; Müller et al., 2024). Additionally, since necessary competencies may vary depending on the context (Fonseca & Picoto, 2020; Müller et al., 2024), this paper focuses on SMEs in the economic region of Stuttgart operating in the production engineering sector to explore the influence of organizational context, including factors such as company size and industry (Kraus et al., 2022; Skare et al., 2023). The results provide a deeper understanding of how SMEs can overcome the complex hurdles of digital transformation by identifying the key competencies these organizations should focus on to foster resilience and compete in a dynamic environment (Moroz, 2018). Hence, this study adds to existing knowledge by offering a nuanced understanding of the barriers and competencies essential for digital transformation, providing valuable lessons learned from the Stuttgart economic region and practical insights for SMEs, thus contributing to the broader discourse on digital transformation in various organizational contexts.

This study provides a new and nuanced understanding of digital transformation, particularly for SMEs. This work confirms and extends existing research showing that digital transformation impacts the business environment at macro, meso, and micro levels (Geels & Kemp, 2007; Appio et al., 2021; Slimane et al., 2022). At the macro level, i.e., the landscape, the study confirms that technological advancements, industry and market dynamics - especially in traditionally conservative sectors - data protection, cybersecurity requirements, and legal and regulatory constraints pose significant challenges (Degener, 2020; Appio et al., 2021; Shahi & Sinha, 2021). It showed that the rapid pace of technological change was particularly overwhelming for respondents. At the meso level, i.e., the regime, the findings corroborate existing literature by identifying management and

strategy issues and cultural aspects as the most significant challenges for SMEs (Bailie & Chinn, 2018; Mahmood et al., 2019). A lack of urgency, unclear vision and strategy, inhibitive culture, and siloed organizational structures could be confirmed as significant barriers (Steiber & Alänge, 2015), necessitating a shift in thinking and action at the management level (Raab et al., 2023). Additionally, this research identified the unclear definition of digitalization as a hurdle that has not been discussed in detail in previous studies. Consistent with prior research, resource constraints - particularly the lack of qualified personnel and financial resources - were also emphasized in this study (Nguyen et al., 2013; Degener, 2020; Eller et al., 2020; Steiber et al., 2020; Scuotto et al., 2021; Shahi & Sinha, 2021; Raab et al., 2023). Moreover, this work validates that SMEs lack information about the tangible economic benefits and performance improvements from digital investments (Beckinsale et al., 2011; Mathrani et al., 2013; Xue et al., 2013; Xue, 2014; Coreynen et al., 2017) and tend to focus on their historically successful core value creation activities (Degener, 2020). In line with existing literature, individual behaviors and attitudes were identified as significant hurdles (Appio et al., 2021), with a lack of acceptance and openness to change confirmed as a significant issue at the micro, i.e., the niche level (Degener, 2020). This research highlighted this as particularly evident among older generations and more conservative industries. Additionally, respondents noted that an effective digital communication culture is lacking and that physical distance hampers interpersonal interactions and innovation capabilities.

This study confirms the need for specific digital transformation competencies to address the identified hurdles. Three of the identified competence areas align with the DigComp framework by Vourikari et al. (2022): (1) problem solving; (2) communication and collaboration; and (3) safety. Problem solving competencies include identifying needs and technological solutions, creatively using digital technology, and identifying competence gaps. These competencies are also supported by further literature (Kane et al., 2015; Gonzáles-Varona et al., 2021; Omrani et al., 2022). Communication and collaboration competencies, as outlined in the DigComp framework (Vourikari et al., 2022) and other studies (Fonseca & Picoto, 2020; Gonzáles-Varona et al., 2021), involve using digital technologies for communication, collaboration, and maintaining netiquette. Also, safety competencies, which include protecting personal data and privacy as well as ensuring

physical and psychological health, are part of the DigComp framework (Vourikari et al., 2022). However, this study identified three additional competence areas: (4) leadership; (5) self-management; and (6) technological competencies, essential for the digital transformation of SMEs. The leadership competencies, which involve guiding employees through digital transformation, developing a clear vision and strategic orientation, fostering an open error culture, and leading at eye level are well-documented in the literature (Sambamurthy et al., 2003; Beckinsale et al., 2010; Fuchs, 2011; Kane et al., 2015; Nylén & Holmström, 2015; Tsou & Hsu, 2015; Coreynen et al., 2017; Sandeep & Ravishankar, 2017; Scuotto et al., 2017; Schwarzmüller et al., 2018; Kane et al., 2019; Caputo et al., 2019; Cenamor et al., 2019; Gferer et al., 2021; Gonzáles-Varona et al., 2021; Slimane et al., 2022), while the competence of promoting diversity could be identified in the interviews. Also, the competencies pertaining to self-management have been widely documented in the literature (Fuller-Love, 2000; Lee & Bai, 2003; Karakas, 2009; Beckinsale et al., 2010; Xue et al., 2013; Dutta et al., 2014; Leeflang et al., 2014; Kane et al., 2015; Tsou & Hsu, 2015; Schwarzmüller et al., 2018; Ferrari, 2013; Gferer et al., 2021), which include openness to technological change, willingness for lifelong learning about digital technologies, flexibility and adaptability in a rapidly changing landscape, and curiosity and interest in technological innovations. As a novelty, a new idea to enhance the digital transformation lexicon is introduced. The competence of endurance to keep going has emerged explicitly through the interviews and is not yet found in the existing literature. However, there is excellent support in the literature concerning technological competencies. It was found that these include a fundamental understanding of technological basics. This finding is also reflected in previous literature, which emphasizes that while technical competencies are indeed necessary for the future, they can be learned and are not necessarily the most crucial competencies. Instead, basic knowledge is sufficient, while soft skills and mindset are paramount (Valentine & Steward, 2013; Boaz & Fox, 2014; Balcar, 2016; Tahvanainen & Luoma, 2018; Kane et al., 2019; Imran et al., 2020; Müller et al., 2024). Hence, it is underscored that SMEs need to consider a broad range of competencies to effectively meet the challenges of digital transformation and improve their digital maturity (Gonzáles-Varona et al., 2021).

Thus, this study confirms that simply adopting digital technologies does not guarantee a competitive advantage for SMEs (Sousa & Rocha, 2019); it necessitates specific digital transformation competencies. The interviewees emphasized that these competencies are

critical for competitiveness and resilience, aligning with existing research that robust competencies enable organizations to handle various challenges, adapt flexibly, and operate agilely (Gotcheva et al., 2013; Deloitte, 2021; Fujitsu Future Insights, 2021; Mithani et al., 2021; Trieu et al., 2023). It can also be confirmed that these competencies enhance communication and stakeholder collaboration, which is crucial for long-term success (Miceli et al., 2021). Furthermore, this work highlights the importance of stability provided by the set of competencies as well as automation and efficiency improvements, contributing to competitiveness and resilience by enabling strategic resource use and cost savings, which is particularly significant in high-wage countries like Germany. This finding supports the literature that stresses the role of digital competencies in enhancing operational efficiency (Dispan et al., 2023).

Building on the specific context of the Stuttgart economic region, this study adds new dimensions to the theoretical understanding of digital transformation processes, verifying the importance of the context in which an organization operates (Omrani et al., 2022). First, the research underlines significant industry differences in digital maturity (Yang et al., 2021), emphasizing the necessity for sector-specific strategies. In this work, it became apparent that industries such as mechanical engineering are lagging behind sectors such as IT and consulting, underscoring the need for tailored approaches in the digital transformation literature. Moreover, the influence of large corporations on SMEs, mainly through setting digital standards and creating competitive pressure, underscores the importance of inter-organizational dynamics in driving digital competencies (Chen et al., 2015; Verhoef et al., 2021a; Yang et al., 2021). This dynamic suggests that large corporations, as established in the Stuttgart economic region (Dispan et al., 2023), can act as catalysts for digital transformation, however exerting massive pressure on SMEs to adapt. This work also confirms the role of regional support systems, including open dialogue, infrastructure, educational institutions, and political initiatives, as critical in fostering a conducive environment for digital transformation (Sherer et al., 2016; Beliaeva et al., 2019; Chen et al., 2021; Liang et al., 2021; Omrani et al., 2022; Trieu et al., 2023). Hence, the emphasis on collaboration and open dialogue shows how external support structures can facilitate organizational change and improvement. Beyond that, this work revealed geographical disparities in digital progress, highlighting the impact of location-specific factors on digital transformation. The advanced digital development in urban centers compared to rural areas

in the Stuttgart region suggests the need for strategies that address the unique challenges of different geographical contexts. Lastly, the conservative cultural attitude towards digital innovation in the Stuttgart region, reflecting broader national trends, emphasizes the importance of understanding cultural barriers. This shows that encouraging a shift towards a more experimental and innovative mindset is crucial for digital transformation, which can be applied to other regions with similar characteristics.

6.2. Implications for Practice

This study offers several practical implications for SMEs, particularly in the context of the Stuttgart economic region, but also applicable to similar settings globally. By drawing from the multi-level perspective by Geels and Kemp (2007) and the DigComp framework by Vourikari et al. (2022), this research provides valuable insights into the critical competencies needed for digital transformation, highlighting the importance of addressing specific challenges at the landscape, regime, and niche level. The findings provide actionable insights for managers sitting at the niche level and other stakeholders, such as policymakers involved in digital transformation initiatives at the landscape level. Managers operating at the niche level can facilitate progress through their actions and joint efforts with peers and other stakeholders. These actions can shape the regime level, consolidating in the landscape and having far-reaching implications at all levels (Geels & Kemp, 2007). The main results of this project are also presented and published in a white paper (see Appendix A) as an outcome of this project, making them accessible to the target audience of this work.

First, this study developed a portfolio of essential digital transformation competencies, including problem solving, communication and collaboration, safety, leadership, self-management, and technological competencies. Managers can use this portfolio of competencies to assess discrepancies between the competencies required for digital transformation and those currently available within their organizations. This helps SMEs identify potential gaps and provides insights into how they can drive the development of their digital transformation competencies. The study allows to conclude that the more significant the competence gap, the greater the need for further competence development or to bring new people on board that meet these competence requirements. This is critical given the increasing difficulty of finding skilled workers and experienced managers essential to an

organization's digital transformation (Skare et al., 2023). The developed portfolio of digital transformation competencies can assist board members and senior management in making hiring decisions based on their specific needs. However, there should also be a willingness to invest resources in digital initiatives.

Additionally, this work can serve as a reference point for senior management when planning their digital transformation strategy, allowing them to tailor their approach to their unique circumstances and digital maturity level. It is important to consider that digital transformation is a continuous process characterized by "episodic spurts" (Hanelt et al., 2021), meaning that the need for competencies evolves over time. Also, aligning the relevant competencies between the organizational culture and strategy is essential to ensure that the demand for specific competencies matches the company's value drivers and strategic directions rather than adopting mimetic behaviors based on external pressure. Therefore, SMEs should first assess their status quo and then implement a fully integrated strategic approach that includes competence development. Adopting strategies and leadership styles that do not align with the existing culture could create substantial difficulties, resulting in cultural mismatches, transformation barriers, and management issues (Müller & Nielsen, 2013). Therefore, it is crucial to assess the organizational context and identify the corresponding critical competencies required (Cameron & Quinn, 2006).

Furthermore, an important lesson learned was that cultural attitudes toward digital innovation play a significant role in the success of digital transformation initiatives. Hence, SMEs should foster a culture that embraces change, encourages experimentation, and is open to new technologies. This involves shifting from a conservative, risk-averse mindset to one that values innovation and continuous improvement. Organizations need to support their employees in adopting an adequate mindset and values for working in a digital environment. The digital awareness of employees can be raised by clearly communicating values and guidelines that promote the introduction and use of new technologies.

Lastly, regional initiatives, including infrastructure development, educational programs, and political support, are critical in fostering a conducive environment for digital transformation. SMEs should actively engage with regional networks, for instance, with other innovative

niches, participate in educational programs and dialogues to set up new regimes, and hence leverage political initiatives designed to promote digitalization. For example, regional clusters and innovation hubs can provide platforms for collaboration, knowledge exchange, and access to funding opportunities. Furthermore, policymakers at the landscape level are encouraged to support these initiatives and implement policies that facilitate digital adoption among SMEs.

6.3. Scope and Opportunities for Future Research

While this project provides significant insights into the digital transformation of SMEs in the Stuttgart economic region, it is essential to acknowledge its limitations and their implications for the findings (Creswell, 2009). These limitations arise from the researcher's limited resources in the context of a master's thesis, the qualitative nature and sampling, the interview setting and responses, and the researcher's worldview.

One of the main limitations of this study was the constraint on resources, particularly time and access to a broader sample (Cresswell, 2009). Despite this, within the context of the Master's program, a significant sample of 20 participants from 10 companies was achieved. While this scope provides insightful findings, it may not capture the full diversity of experiences and practices across all SMEs in the region or other contexts. Moreover, using non-probability sampling within the researcher's network may have led to a sample that was not representative of the broader population of SMEs. Consequently, the results should be interpreted and generalized with caution beyond the study's specific context (Blaikie, 2009). While yielding deep and rich data, the qualitative approach also introduces potential biases. In the interviews, information is filtered through the participants' self-reported responses and not obtained in a natural field setting. The interview setting, including the researcher's presence, might influence the answers given, possibly leading to socially desirable responses rather than pragmatic reflections. Furthermore, some participants may not articulate their thoughts as clearly as others, leading to potential misinterpretations (Cresswell, 2009). Given the interpretive nature of this qualitative research, the role of the researcher, including personal background and potential biases, must be considered when reflecting on the results (Cresswell, 2009).

However, efforts were made to mitigate this through rigorous methodology and adherence to quality criteria (Schofield, 1993). The use of established frameworks provided a robust foundation for analyzing the data, enhancing the study's credibility. Future research can build on the results and address the limitations identified in this study. For example, further exploration of individual constructs and including more extensive and diverse samples could enhance generalizability and allow for the investigation of SMEs across different regions and sectors. Comparative studies across different regions or countries could highlight contextual factors affecting digital transformation. Also, a mixed-methods approach combining qualitative and quantitative data could provide a more comprehensive understanding of digital transformation in SMEs. While quantitative surveys could capture broader trends and patterns, qualitative interviews could continue to provide in-depth insights. Moreover, longitudinal studies could track changes over time, offering insights into the evolution of digital maturity and the impact of developing these competencies on SMEs' performance and resilience. Furthermore, a deeper investigation into leadership roles and organizational culture could provide practical guidance for SME leaders. Also, investigating the similarities and differences between the competencies required for digital transformation and those for organizational change could yield valuable insights. Finally, as diversity is an essential driver of innovation and digital transformation success (Østergaard et al., 2011; Yang & Konrad, 2011; Zhan et al., 2015), it is crucial to consider different perspectives from diverse personalities. This aspect is particularly important, given that the study primarily involved men, reflecting the unequal distribution of men and women in leadership positions in SMEs. Hence, future research should aim to include a more balanced representation of genders and diverse backgrounds.

7. Final Remarks on Answering the Research Questions

This study has provided valuable insights into the challenges faced by SMEs in the Stuttgart economic region in the context of digital transformation and identified the corresponding competencies needed to address these hurdles from the perspective of SME managers. By answering the main research question and its sub-questions in this last chapter, this research provides valuable learnings from the Stuttgart economic region. It contributes to a deeper understanding of how SMEs can navigate the complexities of digital transformation and enhance their competitiveness and resilience.

Addressing the main RQ, the study identified several hurdles at different systemic levels. At the macro level, the primary challenge revolves around the rapid pace of technological advancements, making it difficult for organizations to stay current. Additionally, industry and market dynamics, such as a traditional and conservative industry affecting digital maturity, data protection and cybersecurity concerns, and legal and regulatory restrictions further complicate the digital transformation process. At the meso level, management and strategy issues are prominent, particularly the lack of urgency and holistic strategy and the need for leadership and cultural shifts. Organizational silos and resource constraints, such as a shortage of skilled workers and limited budgets, also impede digital transformation efforts. Despite the potential benefits, investment in digital initiatives is often limited due to unclear value propositions, leading organizations to prioritize their core business activities. At the micro level, resistance to change emerged as a significant barrier, especially among older generations. Also, challenges in establishing an appropriate communication and collaboration culture were identified at this level.

To address these challenges, six areas of competence emerged as essential for overcoming the identified hurdles and driving digital transformation: (1) problem solving; (2) communication and collaboration; (3) safety; (4) leadership; (5) self-management; and (6) technological competencies, while leadership and self-management competencies were mentioned most frequently. Leadership competencies encompass guiding employees through digital transformation, developing a clear vision and strategy, fostering an open error culture, leading at eye level, and promoting diversity, while self-management competencies revolve around openness to technological change, willingness for lifelong learning, adaptability in a rapidly changing landscape, curiosity and interest in technological innovations, and endurance. Next, technological competencies provide a fundamental understanding of the technological requirements necessary for digital initiatives, emphasizing that while technical competencies are essential, soft skills and mindset are paramount. Problem solving competencies involve identifying needs, finding technological solutions, and creatively using digital tools to address challenges. Communication and collaboration competencies encompass the ability to effectively use digital technologies for communication, work collaboratively, and maintain netiquette. Lastly, safety competencies

include protecting personal data and privacy, ensuring cybersecurity, and maintaining physical and psychological health in a digital environment.

Concerning SRQ1, the findings reveal that developing these competencies can help bolster SMEs' competitiveness and resilience by helping to overcome global challenges such as demographic change, increasing efficiency through automation, promoting adaptability and stability, and supporting effective relationship management with stakeholders. These factors are critical for sustaining competitiveness and resilience in a dynamic environment.

Addressing SRQ2, several lessons can be drawn from the Stuttgart economic region. Firstly, the importance of aligning digital transformation strategies with organizational culture and specific industry dynamics cannot be overstated. Tailored approaches are necessary to address unique challenges and leverage sector- and location-specific opportunities. The influence of large corporations in setting digital standards and creating competitive pressure highlights the need for SMEs to stay agile and responsive to external changes. Secondly, regional support systems, including infrastructure, educational institutions, and political initiatives, play a significant role in fostering a conducive environment for digital transformation. Additionally, collaboration and open dialogue among regional stakeholders are essential for sharing knowledge and resources. Lastly, cultural attitudes towards digital innovation must shift towards a more experimental and innovative mindset. Encouraging a culture that embraces change and values continuous improvement is crucial for the success of digital transformation initiatives.

To summarize, this study's findings underscore the need for a comprehensive and context-specific approach to digital transformation in SMEs. By addressing the identified challenges and focusing on the critical competencies, SMEs in the Stuttgart economic region and comparable settings globally can enhance their ability to navigate the complexities of digital transformation, supporting their competitiveness and resilience in the face of ongoing technological advancements.

Bibliography

Adie, B. U., Tate, M., Cho, W., & Valentine, E. (2022). Digital leaders and digital leadership: a literature review and research agenda.

Agarwal, R., Gao, G. (Gordon), DesRoches, C., & Jha, A. K. (2010). Research Commentary: The Digital Transformation of Healthcare: Current Status and the Road Ahead. *Information Systems Research*, *21*(4), 796–809. https://doi.org/10.1287/isre.1100.0327

Agentur Q. Future Skills: Welche Kompetenzen für den Standort Baden-Württemberg heute und in Zukunft erfolgskritisch sind, 2021.

Aldrich, H., & Auster, E. R. (1986). Even dwarfs started small: Liabilities of age and size and their strategic implications. *Research in Organizational Behavior, 8,* 165–198.

Andriole, S. J. (2018). Skills and competencies for digital transformation. *It Professional*, *20*(6), 78-81.

Appio, F. P., Frattini, F., Petruzzelli, A. M., & Neirotti, P. (2021). Digital transformation and innovation management: A synthesis of existing research and an agenda for future studies. *Journal of Product Innovation Management, 38*(1), 4-20.

Arentz, O., & Münstermann, L. (2013). *Wo Liegt der Kern des Deutschen Mittelstands?*. Wirtschaftsdienst. https://www.wirtschaftsdienst.eu/inhalt/jahr/2013/heft/9/beitrag/wo-liegt-der-kern-des-deutschen-mittelstands.html

Bailie, B., & Chinn, M. (2018, April). Effectively harnessing data to navigate the new normal: Overcoming the barriers of digital adoption. In *Offshore Technology Conference* (p. D011S002R002). OTC.

Balcar, J. (2016). Is it better to invest in hard or soft skills?. *The Economic and Labour Relations Review*, *27*(4), 453-470.

Banf, Dr. M., Bijedić, T., Günther, Prof. Dr. C., Großheim, K., Großheim, P., Juschkus, U., Sonntag, A., & Wewezow, C. (2023, August 8). *Deutschlands Mittelstand #3 - innovationsmotor personal - publikation*. RKW Kompetenzzentrum. https://www.rkw-kompetenzzentrum.de/publikationen/studie/deutschlands-mittelstand-3/

Barney, J. (1991). Firm Resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

BarNir, A., Gallaugher, J. M., & Auger, P. (2003). Business Process Digitization, strategy, and the impact of firm age and size: The case of the magazine publishing industry. *Journal of Business Venturing*, *18*(6), 789–814. https://doi.org/10.1016/s0883-9026(03)00030-2

Barsh, J., & Lavoie, J. (2014). Lead at your best. *McKinsey Quarterly*.

Bassellier, G., Benbasat, I., & Reich, B. H. (2003). The influence of business managers' IT competence on championing IT. *Information systems research*, *14*(4), 317-336.

Beckinsale, M., Ram, M., & Theodorakopoulos, N. (2010). ICT adoption and ebusiness development. *International Small Business Journal: Researching Entrepreneurship*, *29*(3), 193–219. https://doi.org/10.1177/0266242610369745

Beliaeva, T., Ferasso, M., Kraus, S., & Damke, E. J. (2019). Dynamics of digital entrepreneurship and the innovation ecosystem: A multilevel perspective. *International Journal of Entrepreneurial Behavior & Research, 26*(2), 266-284.

Bennis, W. G., & Townsend, R. (1989). *On becoming a leader*. Addison-Wesley.

Berghaus, S., & Back, A. (2016). Stages in digital business transformation: Results of an empirical maturity study. In Proceedings of the Mediterranean Conference on Information Systems, 22, 1–17. https://aisel.aisnet.org/mcis2016/22

Berghoff, H. (2016). *Moderne Unternehmensgeschichte: Eine themen- und Theorieorientierte Einführung*. De Gruyter Oldenbourg.

Bersin, J. (2016). *Digital leadership is not an optional part of being a CEO*. Harvard Business Review.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital Business Strategy: Toward a next generation of insights. *MIS Quarterly*, *37*(2), 471–482. https://doi.org/10.25300/misq/2013/37:2.3

Bijedic, T. (2013). Entwicklung unternehmerischer Persönlichkeit im Rahmen einer Entrepreneurship Education. Didaktische Lehr-Lern-Konzeption und empirische Analyse für die Sekundarstufe II. *Books*.

Birkinshaw, J., Zimmermann, A., & Raisch, S. (2016). How do firms adapt to discontinuous change? Bridging the dynamic capabilities and ambidexterity perspectives. *California management review*, *58*(4), 36-58.

Blaikie, N. (2009). *Designing social research: The logic of anticipation*. Polity.

Boaz, N., & Fox, E. A. (2014). Change leader, change thyself. *McKinsey Quarterly*.

Bodily, S., & Venkataraman, S. (2004). Not walls, windows: Capturing value in the Digital age. *Journal of Business Strategy*, *25*(3), 15–25. https://doi.org/10.1108/02756660410536964

Boschma, R. (2017). Towards an evolutionary perspective on regional resilience. In *Evolutionary Economic Geography* (pp. 29-47). Routledge.

Bouncken, R. B., Kraus, S., & Roig-Tierno, N. (2021). Knowledge-and innovation-based business models for future growth: Digitalized business models and portfolio considerations. *Review of Managerial Science*, *15*(1), 1-14.

Budak, J., Rajh, E., Slijepčević, S., & Škrinjarić, B. (2021). Conceptual research framework of consumer resilience to privacy violation online. *Sustainability*, *13*(3), 1238.

Bundeszentrale für politische Bildung. (2021, June 23). *Mittelstand*. bpb.de. https://www.bpb.de/kurz-knapp/lexika/lexikon-der-wirtschaft/20129/mittelstand/

Butschan, J., Heidenreich, S., Weber, B., & Kraemer, T. (2019). Tackling hurdles to digital transformation — the role of competencies for Successful Industrial Internet of Things (IIoT) implementation. *International Journal of Innovation Management*, *23*(04), 1950036. https://doi.org/10.1142/s1363919619500361

Butters, G. (1998). Networking in 2005: Its only Limitations May Be the Boundaries of Imagination. *Telecommunications, 32*(1), 39-41.

Buvat, J., Slatter, M., Pasquet, L., Crummenerl, C., Puttur, R.K., van As, J. (2017). The Digital Talent Gap: Are Companies Doing Enough?. *Capgemini Digital Transformation Institute and LinkedIn.* https://www.capgemini.com/wp-content/uploads/2017/10/report_the-digital-talent-gap_final.pdf

Caiado, R. G. G., Lima, G. B. A., Nascimento, D. L. M., Vieira Neto, J., & Oliveira, R. A. M. (2016). Guidelines to risk management maturity in construction projects. *Brazilian Journal of Operations and Production Management, 13,* 372-385.

Cameron, K., & Quinn, R. (2006). *Diagnosing and changing organizational culture. Based on the Competing Values Framework*. Addison-Wesley.

Caputo, F., Cillo, V., Candelo, E., & Liu, Y. (2019). Innovating through digital revolution. *Management Decision*, *57*(8), 2032–2051. https://doi.org/10.1108/md-07-2018-0833

Carayannis, E. G., & Campbell, D. F. (2009). 'Mode 3'and'Quadruple Helix': toward a 21st century fractal innovation ecosystem. *International journal of technology management, 46*(3-4), 201-234.

Carson, D., Gilmore, A., Perry, C., & Gronhaug, K. (2001). *Qualitative marketing research*. Sage.

Casalino, N., Żuchowski, I., Labrinos, N., Munoz Nieto, Á. L., & Martín, J. A. (2019). Digital Strategies and organizational performances of smes in the age of coronavirus: Balancing digital transformation with an effective business resilience. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3563426

Cefis, E., & Marsili, O. (2006). Survivor: The role of innovation in firms' survival. *Research policy, 35*(5), 626-641.

Cenamor, J., Parida, V., & Wincent, J. (2019). How entrepreneurial SMEs compete through digital platforms: The roles of digital platform capability, network capability and ambidexterity. *Journal of Business Research*, *100*, 196–206. https://doi.org/10.1016/j.jbusres.2019.03.035

Chakravarty, A., Grewal, R., & Sambamurthy, V. (2013). Information technology competencies, organizational agility, and firm performance: Enabling and facilitating roles. *Information Systems Research*, *24*(4), 976–997. https://doi.org/10.1287/isre.2013.0500

Chen, D. Q., Preston, D. S., & Swink, M. (2015). How the use of big data analytics affects value creation in supply chain management. *Journal of management information systems, 32*(4), 4-39.

Chen, H., Li, L., & Chen, Y. (2021). Explore success factors that impact artificial intelligence adoption on telecom industry in China. *Journal of Management Analytics, 8*(1), 36-68.

Chen, T., Li, F., Chen, X.P., & Ou, Z. (2016). *Innovate or die: how do product development teams adapt to environmental technological turbulence?.* Paper presented at 76th Annual Meeting of the Academy of Management (AOM), Anaheim, United States.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 128-152.

Conz, E., & Magnani, G. (2020). A dynamic perspective on the resilience of firms: A systematic literature review and a framework for future research. *European Management Journal*, *38*(3), 400-412.

Cooper, C. L., Liu, Y., & Tarba, S. Y. (2014). Resilience, HRM practices and impact on organizational performance and employee well-being. *The International Journal of*

Human Resource Management, *25*(17), 2466–2471. https://doi.org/10.1080/09585192.2014.926688

Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and Dynamic Resource Configurations for manufacturers. *Industrial Marketing Management*, *60*, 42–53. https://doi.org/10.1016/j.indmarman.2016.04.012

Corrocher, N., & Fontana, R. (2008). Objectives, obstacles and drivers of ICT adoption: What do it managers perceive? *Information Economics and Policy*, *20*(3), 229–242. https://doi.org/10.1016/j.infoecopol.2008.03.001

Corvello, V., Verteramo, S., Nocella, I., & Ammirato, S. (2022). Thrive during a crisis: The role of digital technologies in fostering antifragility in small and medium-sized enterprises. *Journal of Ambient Intelligence and Humanized Computing*, *14*(11), 14681–14693. https://doi.org/10.1007/s12652-022-03816-x

Costantino, T. E. (2001). [Review of *Narrative inquiry: Experience and story in qualitative research; Personalizing evaluation*, by D. J. Clandinin, F. M. Connelly, & S. Kushner]. *Visual Arts Research*, *27*(1), 107–111. http://www.jstor.org/stable/20716027

Creswell, J. W. (2009*). Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Sage Publications, Inc.

Creswell, J. W., & Miller, D. L. (2000). Determining validity in Qualitative Inquiry. *Theory Into Practice*, *39*(3), 124–130. https://doi.org/10.1207/s15430421tip3903_2

Daugherty, P., Carrel-Billiard, M., & Biltz, M. (2021). *Accenture Technology Vision*. Accenture. https://www.accenture.com/us-en/insights/technology/technology-trends-2021

Davenport, T. H., & Kirby, J. (2016). Only humans need apply: *Winners and losers in the age of smart machines*. New York: Harper Business.

de la Boutetière, H., Montagner, A., & Reich, A. (2018, October 29). *Unlocking success in digital transformations*. McKinsey & Company. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/unlocking-success-in-digital-transformations

DeepL. (n.d.). DeepL EU Data Protection Standards. https://www-deepl-com.translate.goog/en/pro-privacy_info?_x_tr_sl=en&_x_tr_tl=de&_x_tr_hl=de&_x_tr_pto=rq#:~:text=Even%20better%2C%20as%20a%20company,as%20enshrined%20in%20EU%20law.

Degener, E. (2020). *Die Rolle der internen Kommunikation - Handelsblatt*. Die Rolle der internen Kommunikation bei der Transformation. https://research.handelsblatt.com/assets/uploads/Studie_Transformationskommunikation.pdf

del Giudice, M., Scuotto, V., Papa, A., Tarba, S. Y., Bresciani, S., & Warkentin, M. (2021). A self-tuning model for smart manufacturing SMEs: Effects on digital innovation. *Journal of Product Innovation Management, 38*(1), 68-89.

Deloitte. (2021). Crisis as catalyst: Accelerating transformation. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/about-deloitte-global-report-full-version-2020.pdf

Destatis. (2021). Die 20 wirtschaftsstärksten EU-Regionen. https://www.destatis.de/Europa/DE/Thema/Allgemeines-Regionales/_Grafik/_Interaktiv/BIP_Top20_Regionen.html

Destatis. (2024, August 29). *56 % in Kleinen und Mittleren Unternehmen Tätig*. Statistisches Bundesamt. https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Unternehmen/Kleine-Unternehmen-Mittlere-Unternehmen/aktuell-beschaeftigte.html

Destatis. Kleine und Mittlere Unternehmen. (2019, August 12). https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Unternehmen/Kleine-Unternehmen-Mittlere-Unternehmen/_inhalt.html

Dispan, J. (2021, January 29). *Die Region Stuttgart im Umbruch*. bpb.de. https://www.bpb.de/shop/zeitschriften/apuz/stuttgart-2021/326252/die-region-stuttgart-im-umbruch/

Dispan, J., Koch, A., König, T., & Seibold, B. (2021). *Strukturbericht Region Stuttgart 2021. Entwicklung von Wirtschaft und Beschäftigung im Zeichen von Transformation und corona-pandemie*. Verband Region Stuttgart.

Dispan, J., Koch, A., König, T., & Seibold, B. (2023). *Strukturbericht Region Stuttgart 2023. Entwicklung von Wirtschaft und Beschäftigung. Resilienz der regionalen Wirtschaft vor dem Hintergrund von Krisen und Transformation*. Verband Region Stuttgart.

Dutta, A., Lee, H., & Yasai-Ardekani, M. (2014). Digital Systems and competitive responsiveness: The dynamics of IT business value. *Information & Management*, *51*(6), 762–773. https://doi.org/10.1016/j.im.2014.05.005

Dweck, C. (2015). Carol Dweck revisits the growth mindset. *Education week*, *35*(5), 20-24.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random house.

Dweck, C. S. (2012). Mindsets and human nature: promoting change in the Middle East, the schoolyard, the racial divide, and willpower. *American psychologist*, *67*(8), 614.

Ederer, P. (2006). *Innovation at work: The European human capital index*. Lisbon Council.

El Sawy, O. A., Kræmmergaard, P., Amsinck, H., & Vinther, A. L. (2020). How LEGO built the foundations and enterprise capabilities for digital leadership. In *Strategic information management* (pp. 174-201). Routledge.

Eller, R., Alford, P., Kallmünzer, A., & Peters, M. (2020). Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization. *Journal of Business Research*, *112*, 119–127. https://doi.org/10.1016/j.jbusres.2020.03.004

Elmqvist, T., Andersson, E., Frantzeskaki, N., McPhearson, T., Olsson, P., Gaffney, O., ... & Folke, C. (2019). Sustainability and resilience for transformation in the urban century. *Nature sustainability*, *2*(4), 267-273.

Euler, D., & Hahn, A. (2014). *Wirtschaftsdidaktik*. utb.

European Commission, Directorate-General for Education, Youth, Sport and Culture. (2019). *Key competencies for lifelong learning*. Publications Office. https://data.europa.eu/doi/10.2766/569540

Fear, J. (2012). Straight outta Oberberg: transforming mid-sized family firms into global champions 1970–2010. *Jahrbuch Für Wirtschaftsgeschichte / Economic History Yearbook*, *53*(1), 125–169. https://doi.org/10.1524/jbwg.2012.0007

Feeny, D. F., & Willcocks, L. P. (1998). Core IS capabilities for exploiting information technology. *MIT Sloan Management Review*.

Ferrari, A. (2013). DIGCOMP: A framework for developing and understanding digital competence in Europe. In Y. Punie & B. N. Brecko (Eds.), *JRC scientific and policy reports*. Publications Office of the European Union.

Filkins, B. L., Kim, J. Y., Roberts, B., Armstrong, W., Miller, M. A., Hultner, M. L., ... & Steinhubl, S. R. (2016). Privacy and security in the era of digital health: what should translational researchers know and do about it?. *American journal of translational research, 8*(3), 1560.

Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2014). Embracing digital technology: A new strategic imperative. *MIT sloan management review, 55*(2), 1.

Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2016, October 07). *Embracing Digital Technology: A New Strategic Imperative*. MIT Sloan Management Review. https://sloanreview.mit.edu/projects/embracing-digital-technology/

Flörecke, K.D. (2023). Capgemini holt sich die Krone. https://www.automobilwoche.de/bc-online/capgemini-neue-nummer-eins-im-ranking-der-top-25-entwicklungsdienstleister

Fonseca, P., & Picoto, W. N. (2020). The competencies needed for digital transformation. *Online Journal of Applied Knowledge Management*, *8*(2), 53–70. https://doi.org/10.36965/ojakm.2020.8(2)53-70

Foxon, T. J. (2005). Inducing innovation for a low carbon future: drivers, barriers and policies.

Frankiewicz, B., & Chamorro-Premuzic, T. (2020). Digital transformation is about talent, not technology. *Harvard Business Review*, *6*(3), 1-6.

Freel, M. S. (2005). Patterns of innovation and skills in small firms. *Technovation*, *25*(2), 123-134.

French II, R. P. (2016). The fuzziness of Mindsets. *International Journal of Organizational Analysis*, *24*(4), 673–691. https://doi.org/10.1108/ijoa-09-2014-0797

Fuchs, S. (2011). The impact of manager and top management identification on the relationship between perceived organizational justice and change-oriented behavior. *Leadership & Organization Development Journal*, *32*(6), 555-583.

Fujitsu Future Insights. (2021). *Priorities in the post-pandemic world*. Global Digital Transformation Survey Report. https://www.fujitsu.com/downloads/GLOBAL/vision/2021/download-center/FTSV2021_Survey_EN.pdf

Fuller-Love, N. (2000). The impact of digital technology on small businesses in the media industry. *International Small Business Journal: Researching Entrepreneurship*, *18*(4), 80–83. https://doi.org/10.1177/0266242600184005

Ganotakis, P. (2012). Founders' human capital and the performance of UK new technology based firms. *Small Business Economics, 39*, 495-515.

Gao, P., & Gao, Y. (2024). How does digital leadership foster employee innovative behavior: A cognitive–affective processing system perspective. *Behavioral Sciences*, *14*(5), 362. https://doi.org/10.3390/bs14050362

Gayed, S., & El Ebrashi, R. (2022). Fostering firm resilience through organizational ambidexterity capability and resource availability: Amid the COVID-19 outbreak. International Journal of Organizational Analysis, 31(1), 253–275. https://doi.org/10.1108/ijoa-09-2021-2977

Geels, F. W., & Kemp, R. (2007). Dynamics in socio-technical systems: Typology of change processes and contrasting case studies. *Technology in Society*, *29*(4), 441–455. https://doi.org/10.1016/j.techsoc.2007.08.009

George, G., Lakhani, K. R., & Puranam, P. (2020). What has changed? the impact of Covid pandemic on the technology and Innovation Management Research Agenda. *Journal of Management Studies*, *57*(8), 1754–1758. https://doi.org/10.1111/joms.12634

Getz, I., & Robinson, A. G. (2003). Innovate or die: Is that a fact? *Creativity and Innovation Management*, *12*(3), 130–136. https://doi.org/10.1111/1467-8691.00276

Gfrerer, A. E., Rademacher, L., & Dobler, S. (2021). Digital Needs Diversity: Innovation and Digital Leadership from a female managers' perspective. *Management for Professionals*, 335–349. https://doi.org/10.1007/978-3-030-69380-0_19

Ghobakhloo, M. (2020). Determinants of information and digital technology implementation for smart manufacturing. *International Journal of Production Research, 58*(8), 2384-2405.

Ghosh, S., Hughes, M., & Hughes, P. (2017). Developing dynamic transformation capabilities in high velocity environment: A study of industrial internet companies (Version 1). Loughborough University. https://hdl.handle.net/2134/24626

Giddens, A. (1984). *The constitution of society. Outline of the theory of structuration*. Bell and Bain Limited.

Gilch, P. M., & Sieweke, J. (2021). Recruiting digital talent: The strategic role of recruitment in organisations' digital transformation. *German Journal of Human Resource Management, 35*(1), 53-82.

González-Varona, J., López-Paredes, A., Poza, D., & Acebes, F. (2021). Building and development of an organizational competence for digital transformation in smes. *Journal of Industrial Engineering and Management*, *14*(1), 15. https://doi.org/10.3926/jiem.3279

Gotcheva, N., Watts, G., & Oedewald, P. (2013). Developing smart and safe organizations: An evolutionary approach. *International Journal of Organizational Analysis*, *21*(1), 83–97. https://doi.org/10.1108/19348831311322551

Govindarajan, V., & Immelt J.R. (2019, March 12). *The Only Way Manufacturers Can Survive*. MIT Sloan Management Review. https://sloanreview.mit.edu/article/the-only-way-manufacturers-can-survive/

Greenacre, P., Gross, R., & Speirs, J. (2012). Innovation Theory: A review of the literature. *Imperial College Centre for Energy Policy and Technology*, London.

Gupta, A. K., & Govindarajan, V. (2002). Cultivating a global mindset. *Academy of Management Perspectives*, *16*(1), 116–126. https://doi.org/10.5465/ame.2002.6640211

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of Management Studies*, 58(5), 1159–1197.

Hanelt, A., Piccinini, E., Gregory, R.W., Hildebrandt, B., Kolbe, L. (2015). *Digital Transformation of Primarily Physical Industries – Exploring the Impact of Digital Trends on Business Models of Automobile Manufacturers.* Wirtschaftsinformatik Proceedings, Osnabrück, Germany.

Hausberg, J. P., Liere-Netheler, K., Packmohr, S., Pakura, S., & Vogelsang, K. (2019). Research streams on digital transformation from a holistic business perspective: A systematic literature review and citation network analysis. *Journal of Business Economics, 89*(8/9), 931-963. https://doi.org/10.1007/s11573-019-00956-z

Heavin, C., & Power, D. J. (2018). Challenges for digital transformation–towards a conceptual decision support guide for managers. *Journal of Decision Systems, 27*(sup1), 38-45.

Heilig, L., Schwarze, S., Voss, S. (2017). *An Analysis of Digital Transformation in the History and Future of Modern Ports.* Proceedings of the 50th Hawaii International Conference on System Sciences (HICSS), Waikoloa Village, Hawaii. https://doi.org/10.24251/HICSS.2017.160

Hesse-Biber, S. N., & Leavy, P. (2006). *The practice of qualitative research*. Sage.

Hewitt-Dundas, N. (2006). Resource and capability constraints to innovation in small and large plants. *Small business economics, 26*, 257-277.

Hillmann, J., & Guenther, E. (2020). Organizational resilience: A valuable construct for management research? *International Journal of Management Reviews*, *23*(1), 7–44. https://doi.org/10.1111/ijmr.12239

Hinings, B., Gegenhuber, T., & Greenwood, R. (2018). Digital Innovation and Transformation: An Institutional Perspective. *Information and Organization*, *28*(1), 52–61. https://doi.org/10.1016/j.infoandorg.2018.02.004

Hobbs, M., Owen, S., & Gerber, L. (2016). Liquid love? dating apps, sex, relationships and the digital transformation of intimacy. *Journal of Sociology*, *53*(2), 271–284. https://doi.org/10.1177/1440783316662718

Holmström, J., & Partanen, J. (2014). Digital manufacturing-driven transformations of service supply chains for complex products. *Supply Chain Management: An International Journal, 19*(4), 421-430.

Holt, D. T., & Vardaman, J. M. (2013). Toward a comprehensive understanding of readiness for change: The case for an expanded conceptualization. *Journal of change management*, *13*(1), 9-18.

Horner-Long, P., & Schoenberg, R. (2002). Does e-business require different leadership characteristics?: An empirical investigation. *European Management Journal*, *20*(6), 611-619.

Horváth, K., & Szerb, L. (2018). Managerial practices and the productivity of knowledge-intensive service businesses: An analysis of digital/IT and cash management practices. *Strategic Change*, *27*(2), 161–172. https://doi.org/10.1002/jsc.2191

Hosseini, H. K., Azar, A., & Rostamy, A. A. A. (2003). The intervening role of innovative climate: A study of middle managers in manufacturing organizations in Iran. *Public Organization Review, 3,* 151-170.

Icks, A., & Brink, S. (2023). Zukunftspanel Mittelstand 2023: Erhöhter Wettbewerbsdruck fordert die Unternehmen heraus. https://www.ifm-bonn.org/fileadmin/data/redaktion/publikationen/chartbooks/Chartbook_Zukunftspanel_Mittelstand_2023.pdf

IfM Bonn. KMU-Definition des IfM Bonn. (2016). https://www.ifm-bonn.org/definitionen-/kmu-definition-des-ifm-bonn#:~:text=Das%20IfM%20Bonn%20grenzt%20in,(%3C%20500%20Mitarbeiter)%20ab

Imran, F., Shahzad, K., Butt, A., & Kantola, J. (2020). Leadership competencies for digital transformation: Evidence from multiple cases. *Advances in Intelligent Systems and Computing, 1209*, 81–87.

Israel, M., & Hay, I. (2006). *Research ethics for social scientists*. Sage Publications Ltd.

Janssen, S., Leber, U., Arntz, M., Gregory, T., & Zierahn, U. (2018). *Betriebe und Arbeitswelt 4.0: Mit Investitionen in die Digitalisierung steigt auch die Weiterbildung* (No. 26/2018). IAB-Kurzbericht.

Javidan, M. (1998). Core competence: what does it mean in practice?. *Long range planning*, *31*(1), 60-71.

Jones, M. D., Hutcheson, S., & Camba, J. D. (2021). Past, present, and future barriers to digital transformation in manufacturing: A Review. *Journal of Manufacturing Systems*, *60*, 936–948. https://doi.org/10.1016/j.jmsy.2021.03.006

Jung, E. (2014). *Kompetenzerwerb: Grundlagen, Didaktik, Überprüfbarkeit*. Walter de Gruyter GmbH & Co KG.

Kane, G. (2019). The technology fallacy: people are the real key to digital transformation. *Research-Technology Management*, *62*(6), 44-49.

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015). Strategy, Not Technology, Drives Digital Transformation. *MIT Sloan Management Review and Deloitte University Press*. https://www2.deloitte.com/content/dam/Deloitte/fr/Documents/strategy/dup_strategy-not-technology-drives-digital-transformation.pdf

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2016, July 26). *Aligning the Organization for its Digital Future*. MIT Sloan Management Review. https://sloanreview.mit.edu/projects/aligning-for-digital-future/

Kantur, D., & İşeri-Say, A. (2012). Organizational resilience: A conceptual integrative framework. *Journal of Management & Organization*, *18*(6), 762–773. https://doi.org/10.1017/s1833367200000420

Karakas, F. (2009). Welcome to World 2.0: The New Digital Ecosystem. *Journal of Business Strategy*, *30*(4), 23–30. https://doi.org/10.1108/02756660910972622

Karimi, J., & Walter, Z. (2015). The role of dynamic capabilities in responding to Digital Disruption: A factor-based study of the newspaper industry. *Journal of Management Information Systems*, *32*(1), 39–81. https://doi.org/10.1080/07421222.2015.1029380

Kemmis, S., & Wilkinson, M. (1998). Participatory action research and the study of practice. In *Action research in practice* (pp. 21-36). Routledge.

KfW Research. (2024). Frauen in Führungspositionen. https://www.kfw.de/%C3%9Cber-die-KfW/KfW-

Research/Frauen.html#:~:text=Der%20Anteil%20von%20kleinen%20und,liegt%20aktuell%20bei%20rund%20602.000.

Khitskov, E. A., Veretekhina, S. V., Medvedeva, A. V., Mnatsakanyan, O. L., Shmakova, E. G., & Kotenev, A. (2017). Digital Transformation of society: Problems entering in the digital economy. *Eurasian Journal of Analytical Chemistry*, *12*(5b), 855–873. https://doi.org/10.12973/ejac.2017.00216a

Kohli, R., & Melville, N. P. (2018). Digital Innovation: a review and synthesis. *Information Systems Journal*, *29*(1), 200–223. https://doi.org/10.1111/isj.12193

Kolluru, S., & Mukhopadhaya, P. (2017). Empirical studies on innovation performance in the manufacturing and service sectors since 1995: A systematic review. *Economic Papers: A journal of applied economics and policy*, *36*(2), 223-248.

Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International journal of information management*, *63*, 102466.

Kretschmer, T., & Khashabi, P. (2020). Digital Transformation and Organization Design: An integrated approach. *California Management Review*, *62*(4), 86–104. https://doi.org/10.1177/0008125620940296

Kryder, M. (2005). Kryder's law. *Scientific American*, 32-33.

Kuckartz, U. (2012). *Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung*. Beltz Juventa.

Kuhlmann, S., & Edler, J. (2003). Scenarios of technology and innovation policies in Europe: Investigating future governance. *Technological Forecasting and Social Change, 70*(7), 619-637.

Kurtz, D. J., & Varvakis, G. (2016). Dynamic capabilities and organizational resilience in Turbulent Environments. *Competitive Strategies for Small and Medium Enterprises*, 19–37. https://doi.org/10.1007/978-3-319-27303-7_2

Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing*. Sage.

Laker, D. R., & Powell, J. L. (2011). The differences between hard and soft skills and their relative impact on training transfer. *Human resource development quarterly*, *22*(1), 111-122.

Landeshauptstadt Stuttgart. (n.d.). *Wirtschaft*. https://www.stuttgart.de/wirtschaft/

Lee, G., & Bai, R. (2003). Organizational mechanisms for successful is/it strategic planning in the Digital Era. *Management Decision*, *41*(1), 32–42. https://doi.org/10.1108/00251740310445536

Leeflang, P. S. H., Verhoef, P. C., Dahlström, P., & Freundt, T. (2014). Challenges and solutions for marketing in a digital era. *European Management Journal*, *32*(1), 1–12. https://doi.org/10.1016/j.emj.2013.12.001

Li, L., Su, F., Zhang, W., & Mao, J. (2017). Digital transformation by SME entrepreneurs: A capability perspective. *Information Systems Journal*, *28*(6), 1129–1157. https://doi.org/10.1111/isj.12153

Liang, T. P., Kohli, R., Huang, H. C., & Li, Z. L. (2021). What drives the adoption of the blockchain technology? A fit-viability perspective. *Journal of Management Information Systems, 38*(2), 314-337.

Lincoln, Y. S., & Guba, E. G. (2006). *Naturalistic inquiry*. Sage Publ.

Linnenluecke, M. K. (2017). Resilience in business and management research: A review of influential publications and a research agenda. *International Journal of Management Reviews*, *19*(1), 4-30.

Liu, C., Ready, D., Roman, A., Van Wart, M., Wang, X., McCarthy, A., & Kim, S. (2018). E-leadership: an empirical study of organizational leaders' virtual communication adoption. *Leadership & Organization Development Journal*, *39*(7), 826-843.

Loebbecke, C., & Picot, A. (2015). Reflections on societal and business model transformation arising from digitization and Big Data Analytics: A research agenda. *The Journal of Strategic Information Systems*, *24*(3), 149–157. https://doi.org/10.1016/j.jsis.2015.08.002

Lopez-Nicolas, C., & Soto-Acosta, P. (2010). Analyzing ICT adoption and use effects on knowledge creation: An empirical investigation in SMEs. *International Journal of Information Management*, *30*(6), 521–528. https://doi.org/10.1016/j.ijinfomgt.2010.03.004

Lorch, J., Lotter, W., Gatterer, H., & Gutmann, M. (2023, October). *Wie zukunftsfähig ist der deutsche Mittelstand?* Metafinanz Informationssysteme GmbH. Retrieved from https://metafinanz.de/downloads/wie-zukunftsfaehig-ist-der-deutsche-mittelstand

Lundvall, B. Å. (2016). *The learning economy and the economics of hope*. Anthem Press.

Mahmood, F., Khan, A. Z., & Khan, M. B. (2019). Digital organizational transformation issues, challenges and impact: A systematic literature review of a decade. *Abasyn Journal of Social Sciences*, *12*(2). https://doi.org/10.34091/ajss.12.2.03

Mai, B. T., Nguyen, P. V., Ton, U. N. H., & Ahmed, Z. U. (2023). Government policy, IT capabilities, digital transformation, and innovativeness in the post-Covid context: Case of Vietnamese SMEs. *International Journal of Organizational Analysis*. Advance online publication. https://doi.org/10.1108/IJOA-11-2022-3480

Markus, M. L., & Rowe, F. (2023). The digital transformation conundrum: Labels, definitions, phenomena, and theories. *Journal of the Association for Information Systems*, 24(2), 328–335.

Marr, B. (2023, October 13). *The impact of digital transformation on business models: Opportunities and challenges*. Forbes. https://www.forbes.com/sites/bernardmarr/2023/10/12/the-impact-of-digital-transformation-on-business-models-opportunities-and-challenges/?sh=9eb44ee44f82

Martin, R., & Sunley, P. (2015). On the notion of regional economic resilience: conceptualization and explanation. *Journal of economic geography*, *15*(1), 1-42.

Mathrani, S., Mathrani, A., & Viehland, D. (2013). Using enterprise systems to realize Digital Business Strategies. *Journal of Enterprise Information Management*, *26*(4), 363–386. https://doi.org/10.1108/jeim-01-2012-0003

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business & Information Systems Engineering*, *57*(5), 339–343. https://doi.org/10.1007/s12599-015-0401-5

Matzler, K., Friedrich von den Eichen, S., Anschober, M., & Kohler, T. (2018). The Crusade of Digital Disruption. *Journal of Business Strategy*, *39*(6), 13–20. https://doi.org/10.1108/jbs-12-2017-0187

Mayring, P. (2015). Qualitative Inhaltsanalyse: Grundlagen und Techniken. Weinheim: Beltz. https://doi.org/10.1007/978-3-531-18939-0_38

McAdam, R. (2002). Large scale innovation reengineering methodology in SMEs. *International Small Business Journal: Researching Entrepreneurship*, *20*(1), 33–52. https://doi.org/10.1177/0266242602201004

Mertens, D. M. (1998). *Research methods in education and psychology: Integrating diversity with quantitative and qualitative approaches*. SAGE.

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American journal of sociology*, *83*(2), 340-363.

Miceli, A., Hagen, B., Riccardi, M. P., Sotti, F., & Settembre-Blundo, D. (2021). Thriving, not just surviving in changing times: How sustainability, agility and digitalization intertwine with organizational resilience. *Sustainability*, *13*(4), 2052. https://doi.org/10.3390/su13042052

Miller, D., & Toulouse, J.-M. (1986). Chief executive personality and corporate strategy and structure in small firms. *Management Science*, *32*(11), 1389–1409. https://doi.org/10.1287/mnsc.32.11.1389

Mithani, M. A., Gopalakrishnan, S., & Santoro, M. D. (2021). Does exposure to a traumatic event make organizations resilient? *Long Range Planning*, *54*(3), 102031. https://doi.org/10.1016/j.lrp.2020.102031

Mitsakis, F. V. (2019). Human resource development (HRD) resilience: A new 'success element' of organizational resilience? *Human Resource Development International*, *23*(3), 321–328. https://doi.org/10.1080/13678868.2019.1669385

Mittal, S., Khan, M. A., Romero, D., & Wuest, T. (2018). A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs). *Journal of manufacturing systems, 49*, 194-214.

Montes, F. J. L., Moreno, A. R., & Morales, V. G. (2005). Influence of support leadership and teamwork cohesion on organizational learning, innovation and performance: an empirical examination. *Technovation, 25*(10), 1159-1172.

Moore, G. (1965). Moore's law. *Electronics Magazine, 38*(8), 114.

Moroz, M. (2018). Acceleration of digital transformation as a result of launching programs financed from public funds: Assessment of the implementation of the operational program digital Poland. *Foundations of Management, 10*(1), 59–74. https://doi.org/10.2478/fman-2018-0006

Müller, N. (2012). Weiterbildung und Belegschaftsfluktuation in deutschen Betrieben. *WSI-Mitteilungen*, *65*(5), 365-373.

Müller, S. D., Konzag, H., Nielsen, J. A., & Sandholt, H. B. (2024). Digital Transformation Leadership Competencies: A contingency approach. *International Journal of Information Management*, *75*, 102734. https://doi.org/10.1016/j.ijinfomgt.2023.102734

Müller, S., & Nielsen, P. (2013). Competing values in software process improvement: A study of cultural profiles. *Information Technology & People*, *26*(2), 146–171.

Nadkarni, S., & Prügl, R. (2020). Digital Transformation: A review, synthesis and opportunities for future research. *Management Review Quarterly*, *71*(2), 233–341. https://doi.org/10.1007/s11301-020-00185-7

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *MIS Quarterly*, *41*(1), 223–238. https://doi.org/10.25300/misq/2017/41:1.03

Nemet, G. F. (2007). *Policy and innovation in low-carbon energy technologies*. University of California, Berkeley

Ng, H. Y., Tan, P. S., & Lim, Y. G. (2018). Methodology for digitalization - a conceptual model. *2018 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*. https://doi.org/10.1109/ieem.2018.8607457

Nguyen, T. H., Newby, M., & Macaulay, M. J. (2013). Information technology adoption in small business: Confirmation of a proposed framework. *Journal of Small Business Management*, *53*(1), 207–227. https://doi.org/10.1111/jsbm.12058

Nicoletti, G., von Rueden, C., & Andrews, D. (2020). Digital Technology Diffusion: A matter of capabilities, incentives or both? *European Economic Review*, *128*, 103513. https://doi.org/10.1016/j.euroecorev.2020.103513

Noesgaard, M. S., Nielsen, J. A., Jensen, T. B., & Mathiassen, L. (2023). Same but different: Variations in reactions to digital transformation within an organizational field. *Journal of the Association of Information Systems, 24*(1), 12–34.

Nylén, D., & Holmström, J. (2015). Digital Innovation Strategy: A framework for diagnosing and improving digital product and Service Innovation. *Business Horizons*, *58*(1), 57–67. https://doi.org/10.1016/j.bushor.2014.09.001

O'Reilly, C. A., & Tushman, M. L. (2011). Organizational ambidexterity in action: How managers explore and exploit. *California Management Review*, *53*(4), 5–22. https://doi.org/10.1525/cmr.2011.53.4.5

Omrani, N., Rejeb, N., Maalaoui, A., Dabić, M., & Kraus, S. (2022). Drivers of digital transformation in SMEs. *IEEE Transactions on Engineering Management*, *71*, 5030–5043. https://doi.org/10.1109/tem.2022.3215727

Organisation for Economic Co-operation and Development. (2011). *Skills for innovation and research*. Paris: OECD.

Østergaard, C. R., Timmermans, B., & Kristinsson, K. (2011). Does a different view create something new? The effect of employee diversity on innovation. *Research policy*, 40(3), 500-509. https://doi.org/10.1016/j.respol.2010.11.004

P3 Group. (n.d.a). *About*. P3 group. https://www.p3-group.com/en/about/

P3 Group. (n.d.-b). *Industries*. P3 group. https://www.p3-group.com/en/industries/

P3 Group. (n.d.-c). *Expertises*. P3 group. https://www.p3-group.com/en/expertises/

P3 Group. (n.d.-d). *Organizational development*. P3 group. https://www.p3-group.com/en/expertises/organizational-development/

Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2022). Tackling the digitalization challenge: How to benefit from digitalization in practice. *International Journal of Information Systems and Project Management*, *5*(1), 63–77. https://doi.org/10.12821/ijispm050104

Patton, M. Q. (2002). Two decades of developments in Qualitative Inquiry. *Qualitative Social Work*, *1*(3), 261–283. https://doi.org/10.1177/1473325002001003636

Piva, M., Santarelli, E., & Vivarelli, M. (2005). The skill bias effect of technological and organisational change: Evidence and policy implications. *Research Policy, 34*(2), 141-157.

Punch, K. F. (2006). *Introduction to social research quantitative and qualitative approaches*. SAGE Publ.

Raab, C., Hagenmüller, M., & Bongardt , S. (2023, May 9). Innovationsdruck und Wertewandel: Die multidimensionale Transformation der Top500. https://www.accenture.com/de-de/insights/consulting/top500-2022

Ratner, C. (2002). Subjectivity and Objectivity in Qualitative Methodology. *Forum Qualitative Sozialforschung Forum: Qualitative Social Research*, *3*(3). https://doi.org/10.17169/fqs-3.3.829

Region Stuttgart. (2022). https://www.region-stuttgart.de/wp-content/uploads/2022/05/Infografik-lang-D-22-05-23.pdf

Reis, J., Amorim, M., Melão, N., & Matos, P. (2018). Digital Transformation: A literature review and guidelines for future research. *Advances in Intelligent Systems and Computing*, 411–421. https://doi.org/10.1007/978-3-319-77703-0_41

Richter, A., Heinrich, P., Stocker, A., & Schwabe, G. (2018). Digital Work Design. *Business & Information Systems Engineering*, *60*(3), 259–264. https://doi.org/10.1007/s12599-018-0534-4

Rittmann, U. (2023). *Family business survey 2023*. PwC. https://www.pwc.de/de/mittelstand/family-business-survey.html

Rodríguez-Sánchez, A., Guinot, J., Chiva, R., & López-Cabrales, Á. (2019). How to emerge stronger: Antecedents and consequences of organizational resilience. *Journal of Management & Organization*, *27*(3), 442–459. https://doi.org/10.1017/jmo.2019.5

Ruttan, V. W. (2001) *Technology, Growth and Development: An Induced Innovation Perspective*. Oxford University Press.

Sambamurthy, V., Bharadwaj, S., & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of Information Technology in contemporary firms. *MIS Quarterly*, *27*(2), 237. https://doi.org/10.2307/30036530

Sandeep, M. S., & Ravishankar, M. N. (2017). Sociocultural transitions and developmental impacts in the digital economy of impact sourcing. *Information Systems Journal*, *28*(3), 563–586. https://doi.org/10.1111/isj.12149

Sarantakos, S. (2005). *Social Research*. Palgrave Macmillan.

Sathe, V. (2007). *Corporate entrepreneurship: Top managers and new business creation*. Cambridge University Press.

Schallmo, D., Williams, C. A., & Boardman, L. (2017). Digital Transformation of business models — best practice, enablers, and roadmap. *International Journal of Innovation Management*, *21*(08), 1740014. https://doi.org/10.1142/s136391961740014x

Schilirò, D. (2021). Digital transformation, COVID-19, and the future of work. Published in. *International Journal of Business Management and Economic Research*, *12*(3), 1945–1952. https://mpra.ub.uni-muenchen.de/108817/

Schiuma, G., Schettini, E., Santarsiero, F., & Carlucci, D. (2021). The transformative leadership compass: Six competencies for digital transformation entrepreneurship. *International Journal of Entrepreneurial Behavior & Research*, *28*(5), 1273–1291. https://doi.org/10.1108/ijebr-01-2021-0087

Schmid, A. M., Recker, J., & Vom Brocke, J. (2017). The socio-technical dimension of inertia in digital transformations.

Schneider, L., Günther, J., & Brandenburg, B. (2010). Innovation and skills from a sectoral perspective: a linked employer–employee analysis. *Economics of Innovation and New Technology, 19*(2), 185-202.

Schofield, J. W. (1993). Increasing the generalizability of qualitative research. In M. Hammersley (Ed.), *Social research: Philosophy, politics and practice* (pp. 200–225). Open University Press; Sage Publications, Inc.

Schreckling, E., Steiger, C. (2017). Digitalize or Drown. In: Oswald, G., Kleinemeier, M. (eds), *Shaping the Digital Enterprise* (p. 3-27). Springer, Cham. https://doi.org/10.1007/978-3-319-40967-2_1

Schumpeter, J., 1934. *The Theory of Economic Development*. Transaction Publishers.

Schwab, K. (2017). *The fourth industrial revolution*. Currency.

Schwarzmüller, T., Brosi, P., Duman, D., & Welpe, I. M. (2018). How does the digital transformation affect organizations? Key themes of change in work design and leadership. *Management Revue*, *29*(2), 114-138.

Scuotto, V., Nicotra, M., Del Giudice, M., Krueger, N., & Gregori, G. L. (2021). A microfoundational perspective on smes' growth in the Digital Transformation Era. *Journal of Business Research*, *129*, 382–392. https://doi.org/10.1016/j.jbusres.2021.01.045

Seo, D. (2017). Digital Business Convergence and emerging contested fields: A conceptual framework. *Journal of the Association for Information Systems*, *18*(10), 687–702. https://doi.org/10.17705/1jais.00471

ServiceNow. (2023, June 14). *Erfolg 2023: Wenn Herausforderungen zu Chancen Werden*. DER SPIEGEL. https://www.spiegel.de/wirtschaft/contentspecial-erfolg-2023-wenn-herausforderungen-zu-chancen-werden-a-cff34565-2389-44e5-8306-c95b4382f9e9

Seyda, S. (2021a). Digitale Lernmedien beflügeln die betriebliche Weiterbildung: Ergebnisse der zehnten IW-Weiterbildungserhebung. *IW-Trends-Vierteljahresschrift zur empirischen Wirtschaftsforschung*, *48*(1), 79-94.

Seyda, S. (2021b). Digitale Lernmedien beflügeln die betriebliche Weiterbildung: Ergebnisse der zehnten IW-Weiterbildungserhebung. *IW-Trends-Vierteljahresschrift zur empirischen Wirtschaftsforschung*, *48*(1), 79-94.

Seyda, S., & Placke, B. (2020). IW-Weiterbildungserhebung 2020: Weiterbildung auf Wachstumskurs. *IW-Trends-Vierteljahresschrift zur empirischen Wirtschaftsforschung*, *47*(4), 105-123.

Seyda, S., Meinhard, D. B., & Placke, B. (2018). Weiterbildung 4.0-digitalisierung als treiber und innovator betrieblicher weiterbildung. *IW-Trends-Vierteljahresschrift zur empirischen Wirtschaftsforschung*, *45*(1), 107-124.

Shahi, C., & Sinha, M. (2021). Digital Transformation: Challenges faced by organizations and their potential solutions. *International Journal of Innovation Science*, *13*(1), 17–33. https://doi.org/10.1108/ijis-09-2020-0157

Sharifi, A. (2020). Urban resilience assessment: Mapping knowledge structure and trends. *Sustainability*, *12*(15), 5918.

Sherer, S. A., Meyerhoefer, C. D., & Peng, L. (2016). Applying institutional theory to the adoption of electronic health records in the US. *Information & Management, 53*(5), 570-580.

Skare, M., de Obesso, M. D. L. M., & Ribeiro-Navarrete, S. (2023). Digital transformation and European small and medium enterprises (SMEs): A comparative study using digital economy and society index data. *International Journal of Information Management*, *68*, 102594.

Slaper, T. F., Hart, N. R., Hall, T. J., & Thompson, M. F. (2011). The index of innovation: a new tool for regional analysis. *Economic Development Quarterly, 25*(1), 36-53.

Slimane, S. B., Coeurderoy, R., & Mhenni, H. (2022). Digital transformation of small and Medium Enterprises: A systematic literature review and an integrative framework. *International Studies of Management & Organization*, *52*(2), 96–120. https://doi.org/10.1080/00208825.2022.2072067

Sousa, M. J., & Rocha, Á. (2019). Skills for disruptive digital business. *Journal of Business Research, 94*, 257-263.

Statistisches Landesamt Baden-Württemberg. (2022). *Zahlen und Fakten Innovationsindex*. Innovationsindex für die Stadt-/Landkreise und Regionen Baden-Württembergs. https://www.statistik-bw.de/GesamtwBranchen/ForschEntwicklung/Innovation-I_BW.jsp?path=%2FEuropa%2FZahlen%2F

Steiber, A., & Alänge, S. (2015). Organizational innovation: verifying a comprehensive model for catalyzing organizational development and change. *Triple Helix, 2*(1), 1-28.

Steiber, A., Alänge, S., Ghosh, S., & Goncalves, D. (2020). Digital transformation of industrial firms: an innovation diffusion perspective. *European Journal of Innovation Management, 24*(3), 799-819.

Stentoft, J., Adsbøll Wickstrøm, K., Philipsen, K., & Haug, A. (2021). Drivers and barriers for Industry 4.0 readiness and practice: empirical evidence from small and medium-sized manufacturers. *Production Planning & Control, 32*(10), 811-828.

Strambach, S., & Klement, B. (2016). Resilienz aus wirtschaftsgeographischer Perspektive: Impulse eines „neuen "Konzepts. *Multidisziplinäre Perspektiven der Resilienzforschung*, 263-294.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Sage Publications, Inc.

Sun, S., Hall, D. J., & Cegielski, C. G. (2020). Organizational intention to adopt big data in the B2B context: An integrated view. *Industrial Marketing Management, 86*, 109-121.

Sweet, J., Gruzin, T., Azagury, J., Wright, O., Ghosh, B., & Moore, M. (2023). *Total enterprise reinvention*. Accenture. https://www.accenture.com/us-en/insights/consulting/total-enterprise-reinvention

Tahvanainen, S., & Luoma, E. (2018). Examining the competencies of the chief digital officer. In *Americas Conference on Information Systems*. Association for Information Systems.

Teece, D. J. (2018). Business models and dynamic capabilities. *Long range planning, 51*(1), 40-49.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, *18*(7), 509-533.

Thomas, H., Sanchez, R., & Heene, A. (1996). Towards the theory and practice of competence based competition.

Trieu, H. D., Nguyen, P. V., Tran, K. T., Vrontis, D., & Ahmed, Z. (2023). Organisational resilience, ambidexterity and performance: the roles of information technology competencies, digital transformation policies and paradoxical leadership. *International Journal of Organizational Analysis*.

Tsou, H.-T., & Hsu, S. H.-Y. (2015). Performance effects of technology–organization–environment openness, service co-production, and digital-resource readiness: The case of the IT industry. *International Journal of Information Management*, *35*(1), 1–14. https://doi.org/10.1016/j.ijinfomgt.2014.09.001

Tumbas, S., Berente, N., & vom Brocke, J. (2020). Three types of chief digital officers and the reasons organizations adopt the role. *Strategic Information Management*, 292–308. https://doi.org/10.4324/9780429286797-14

Uhl, A., & Gollenia, L. A. (2016). *Digital Enterprise Transformation*. https://doi.org/10.4324/9781315577166

UNCTAD. (2021, March 15). *How COVID-19 triggered the digital and e-commerce turning point*. United Nations Conference on Trade and Development. https://unctad.org/news/how-covid-19-triggered-digital-and-e-commerce-turning-point

Valentine, E., & Stewart, G. (2013). Director competencies for effective enterprise technology governance. In *ACIS 2013: Information systems: Transforming the Future: Proceedings of the 24th Australasian Conference on Information Systems* (pp. 1-11). RMIT University.

Valentine, E., & Stewart, G. (2015, January). Enterprise business technology governance: Three competencies to build board digital leadership capability. In *2015 48th Hawaii International Conference on System Sciences* (pp. 4513-4522). IEEE.

Venkatraman, N. (1994). IT-enabled business transformation: from automation to business scope redefinition. *Sloan management review, 35*, 73-73.

Venohr, B. (2015). Das Erfolgsmodell der deutschen Weltmarktführer. In F. Langenscheidt & B.Venohr (Eds.), Gipfeltreffen der Weltmarktführer, Lexikon der deutschen Weltmarktführer. https://www.researchgate.net/publication/283085972_Das_Erfolgsmodell_der_deutschen_Weltmarktfuhrer

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2021b). Digital Transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, *122*, 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

von Hattburg, A. T. (2019). *Definition: Zukunftskompetenzen*. Gabler Wirtschaftslexikon. https://wirtschaftslexikon.gabler.de/definition/zukunftskompetenzen-121646/version-371739

Vuksic, V.B., Ivančić, L., Vugec, D.S. (2018). *A preliminary literature review of digital transformation case studies.* 20th International Conference on Managing Information Technology, Rome, Italy. 10.5281/zenodo.1474581

Vuorikari, R., Kluzer, S., & Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens. *JRC scientific and policy reports*. Publications Office of the European Union. https://doi.org/ 10.2760/115376

Vuorikari, R., Punie, Y., Carretero Gomez S., & Van den Brande, G. (2016). *DigComp 2.0: The digital competence framework for citizens*. Update Phase 1: The Conceptual Reference Model, Luxembourg Publication Office of the European Union, 1-40.

Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Jensen, T. B. (2021). Unpacking the difference between digital transformation and IT-enabled organizational transformation. *Journal of the Association for Information Systems*, *22*(1), 102–129.

Wiesner, R., & McDonald, J. (2001). Bleak House or Bright Prospect? Human Resource Management in Australian SMEs. *Asia Pacific Journal of Human Resources*, *39*(2), 31–53. https://doi.org/10.1177/103841110103900203

Williams, C.A., Lanmg, K., Schallmo, D., & Boardman, L., (2019). *Digital Maturity Models for Small and Medium-sized Enterprises: A Systematic Literature Review.* International Society for Professional Innovation Management (ISPIM) Innovation Conference, Florence, Italy.

Wimelius, H., Mathiassen, L., Holmström, J., & Keil, M. (2020). A paradoxical perspective on technology renewal in digital transformation. *Information Systems Journal*, *31*(1), 198–225. https://doi.org/10.1111/isj.12307

Winkelhaus, S., & Grosse, E. H. (2020). Logistics 4.0: a systematic review towards a new logistics system. *International Journal of Production Research, 58*(1), 18-43.

Wolff, C., Omar, A., & Shildibekov, Y. (2019, September). How will we build competences for managing the digital transformation?. In *2019 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS)* (Vol. 2, pp. 1122-1129). IEEE.

World Bank. (n.d.). *World Bank SME Finance*. https://www.worldbank.org/en/topic/smefinance#:~:text=SMEs%20account%20for%20the%20majority,(GDP)%20in%20emerging%20economies

Xue, L. (2014). Governance–knowledge fit and strategic risk taking in supply chain digitization. *Decision support systems, 62*, 54-65.

Xue, L., Zhang, C., Ling, H., & Zhao, X. (2013). Risk mitigation in supply chain digitization: System modularity and Information Technology Governance. *Journal of Management Information Systems*, *30*(1), 325–352. https://doi.org/10.2753/mis0742-1222300110

Yang, M., Fu, M., & Zhang, Z. (2021). The adoption of digital technologies in supply chains: Drivers, process and impact. *Technological Forecasting and Social Change, 169*, 120795.

Yang, Y., & Konrad, A. M. (2011). Diversity and organizational innovation: The role of employee involvement. *Journal of Organizational Behavior*, 32(8), 1062-1083. https://doi.org/10.1002/job.724

Yin, R. K. (2014). *Case study research: Design and methods*. Sage Publication.

Yu, D., & Hang, C. C. (2010). A reflective review of disruptive innovation theory. *International Journal of Management Reviews*, *12*(4), 435–452. https://doi.org/10.1111/j.1468-2370.2009.00272.x

Zaki, M. (2019). Digital Transformation: Harnessing Digital Technologies for the next generation of services. *Journal of Services Marketing*, *33*(4), 429–435. https://doi.org/10.1108/jsm-01-2019-0034

Zangiacomi, A., Pessot, E., Fornasiero, R., Bertetti, M., & Sacco, M. (2019). Moving towards digitalization: A multiple case study in manufacturing. *Production Planning & Control*, *31*(2–3), 143–157. https://doi.org/10.1080/09537287.2019.1631468

Zhan, S., Bendapudi, N., & Hong, Y. Y. (2015). Re-examining diversity as a double-edged sword for innovation process. *Journal of Organizational Behavior*, 36(7), 1026-1049. https://doi.org/10.1002/job.2027

Zhang, J., Long, J., & von Schaewen, A. M. (2021). How does digital transformation improve organizational resilience?—findings from PLS-SEM and FSQCA. *Sustainability*, *13*(20), 11487. https://doi.org/10.3390/su132011487

Zulu, S. L., & Khosrowshahi, F. (2021). A taxonomy of digital leadership in the construction industry. *Construction Management and Economics, 39*(7), 565–578.

Zutshi, A., & Grilo, A. (2019). The emergence of digital platforms: A conceptual platform architecture and impact on Industrial Engineering. *Computers & Industrial Engineering*, *136*, 546–555. https://doi.org/10.1016/j.cie.2019.07.027

Appendices

Appendix A: White Paper

Digital Transformation to Strengthen SME Resilience and Competitiveness: Insights from the Stuttgart Economic Region

Authors: Leonie Gutemann, Nicol Spiridon-Mattes, and Dr. Merle Tegeler, P3 automotive GmbH

Executive Summary

The rapid pace of digital transformation poses significant challenges for small and medium-sized enterprises (SMEs). Hence, in the context of a commissioned master's thesis, specific hurdles faced by SMEs in the Stuttgart economic region regarding digital transformation were identified, along with the necessary competencies. In addition, this study examined how these competencies contribute to the resilience and competitiveness of SMEs, drawing valuable lessons from this case.

This study is based on empirical research findings obtained using established frameworks and a qualitative methodology. This methodology included semi-structured qualitative interviews with 20 SME managers in the Stuttgart economic region, covering different sectors and sizes within the SME segment. Key hurdles were identified at macro, meso, and micro levels, including the overwhelming pace of technological change, strategic and cultural barriers, and resistance to change, especially in traditional sectors. Six key competence areas were identified: (1) problem solving; (2) communication and collaboration; (3) safety; (4) leadership; (5) self-management; and (6) technological competencies. Leadership and self-management were highlighted as particularly important. This research shows that the mere adoption of digital technologies does not guarantee a competitive advantage for SMEs; instead, digital transformation competencies are required. These competencies enhance the competitiveness and resilience of SMEs by helping them overcome challenges, ensure adaptability and agility, and maintain stability. In addition, they contribute to efficiency gains and support effective stakeholder relationship management. Lessons from this case highlight the importance of contextual factors such as industry dynamics, cross-organizational relationships, regional support systems, geographic differences, and cultural attitudes toward innovation. The derived recommendations suggest that SMEs should align their digital strategies with corporate culture and industry dynamics and use the identified competence portfolio to identify and close competence gaps. It is advisable to utilize regional support systems and collaborative networks with innovative niches to influence higher levels and encourage policymakers to promote digitalization initiatives in SMEs.

Problem Statement and Relevance

Only 42 percent see German small and medium-sized enterprises (SMEs) as viable for the future, according to a recent study of 520 executives in Germany.[1] This sentiment reflects the growing uncertainty faced by German SMEs. In today's rapidly evolving technological landscape, digital transformation is a crucial factor in the competitiveness and resilience of SMEs[2], and it is known as a process aiming to achieve improvements through the use of various technologies[3]. The ability to effectively integrate and utilize these technologies within the company is essential for these organizations to drive innovation, optimize processes, respond to market changes, and remain viable.[4]

However, managing the digital transformation process presents numerous challenges that require careful consideration and strategic action.[5] SMEs, in particular, face unique hurdles compared to larger corporations.[6] These companies are integral to the German economy and significantly contribute to employment, economic growth, and technological progress.[7] Therefore, they must develop competencies, including knowledge, skills, and attitudes[8], to tackle these challenges and thrive in a constantly changing market environment.[9] Much of the previous research has focused mainly on large companies, leaving the specific difficulties of SMEs largely unexplored.[10] Consequently, there is no consensus on addressing the disruptive effects of digital transformation in SMEs, and many companies are uncertain about which competencies to prioritize and how to implement them.[11] Moreover, the required competencies can vary depending on the context, such as company size and industry.[12] However, empirical validation in practice needs to be improved, as most existing studies have presented challenges and competencies primarily through literature reviews.[13]

In collaboration with numerous SMEs, challenges in digital transformation were repeatedly identified. This led to an interest in empirically substantiating the observations from practice. Therefore, the research aimed to investigate the central question of the hurdles SMEs face in digital transformation and the competencies required to overcome them. Additionally, it examined how these competencies can strengthen SMEs' competitiveness and resilience.

The Stuttgart economic region was chosen as an exemplary setting known for its strong industrial base and innovative power.[14] The goal was to explore this region and derive meaningful insights and recommendations for SMEs, thus contributing to their future viability.

The following sections will examine the underlying empirical research, provide an overview of the results and implications for practice, and summarize and contextualize the key findings.

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[1] Lorch et al., 2023
[2] Trieu et al., 2023
[3] Vial (2019)
[4] Omrani et al., 2022
[5] Gferer et al., 2021; Daugherty et al., 2021; Sweet et al., 2023; Icks & Brink, 2023; Rittmann, 2023
[6] Aldrich & Auster, 1986; BarNir et al., 2003; Li et al., 2017
[7] bpb, 2021
[8] Vuorikari et al., 2022
[9] O'Reilly & Tushman, 2011
[10] Hausberg et al., 2019, Mai et al., 2023
[11] Fonseca & Picoto, 2020; Moroz, 2018
[12] Fonseca & Picoto, 2020; Slimane et al., 2022; Müller et al., 2024
[13] Wolff et al., 2019; Müller et al., 2024
[14] Dispan et al., 2023

About the Research

The research employed a qualitative approach, conducting 20 semi-structured, in-depth interviews with managers at executive, middle management, and team lead levels from ten different SMEs in the Stuttgart economic region. Participants were selected through a targeted, non-probabilistic sampling involving companies from various industries and varying sizes within the SME segment. The sample included six participants at the executive level, five at middle management, and nine at the team lead level, from one small (≤ 49 employees and EUR 2 million annual turnover), three medium-sized (≤ 499 employees and EUR 50 million annual turnover), and six upscale SMEs (≤ 5,000 employees and EUR 1 billion annual turnover). Participants specialized in various fields, including digitalization and automation, organizational development, change management, strategy, sales, controlling, and HR. Most participants were aged between 28 and 44 (70%) and predominantly male (80%). As shown in Table 1, half of the companies came from the production technology cluster, particularly mechanical engineering, and the other half from knowledge-intensive services such as IT and consulting. Additionally, participants were asked to rate their company's digital maturity against an ideal state. Six organizations were classified in the middle, three in the upper third, and one in an early maturity stage. Participants based this classification on eight different factors, listed by frequency of mention: (1) processes; (2) people and culture; (3) communication and collaboration; (4) management; (5) adaptability; (6) technology; (7) products or services; and (8) strategy. Figure 1 illustrates these and briefly explains what the individual factors entail.

Interviews were recorded, transcribed, and analyzed using qualitative content analysis[15], enabling systematic and traceable identification of central themes and patterns in participants' statements[16]. Recognized theoretical frameworks[17] placed the empirical data in a broader theoretical context. Throughout the process, great emphasis was placed on adhering to quality criteria and ethical standards.

[15] Kuckartz, 2012; Mayring, 2015
[16] Corbin & Strauss, 1998
[17] Geels & Kemp, 2007; Vuorikari et al., 2022

Table 7: Overview of the organizations surveyed, sorted by company size

Company size	Description	Industry	Digital maturity stage
Small	Consultancy (focus: process consulting & lean management)	Consulting	Early
Medium	Manufacturer of injection molding tools	Mechanical engineering	Developing
	Provider for development and operation of digital business models and security services	IT services	Developing
	Software company for individual software, machine learning and data science related solutions	IT services	Maturing
Upscale	Software company specializing in cloud solutions	IT services	Maturing
	Manufacturer of optical sensors	Electrical engineering	Developing
	Management and software consultancy (focus: automotive)	Consulting	Maturing
	Manufacturer of milling machines	Mechanical engineering	Developing
	Machine tool manufacturer	Mechanical engineering	Developing
	Manufacturer of door, window, and security systems	Metalworking construction	Developing

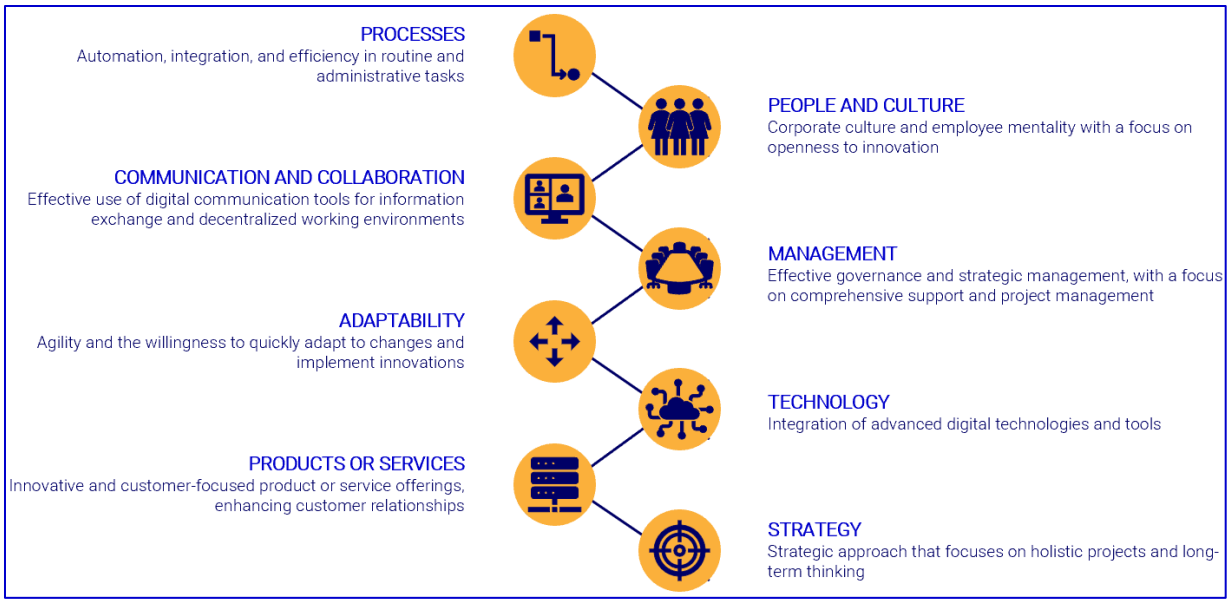

Figure 4: Factors for determining the digital maturity level

Key Findings

Challenges in the context of digital transformation were identified at macro, meso, and micro levels (see Figure 2).

Macro-level challenges include rapid technological advancements, market and industry dynamics, data protection and cybersecurity, and legal and regulatory guidelines. It became apparent that the most significant challenge at this level is the overwhelming pace of technological change. Companies find it difficult to keep up with what is relevant and appropriate and to cope with constant change. Moreover, it was noted that new technologies are often slowly adopted in traditional sectors, and assessing their market maturity is challenging. Data protection and cybersecurity concerns are also prominent, highlighting the challenge of balancing innovation and security. Legal and regulatory challenges, including constant adaptation of standards and restrictive regulations, further complicate digitalization efforts and lead to high dependency on these guidelines.

Meso-level challenges focus on management and strategy, cultural factors, and organizational structures. The need for a clear digital strategy, leadership commitment, and a culture and structure supporting change was emphasized. While awareness of the importance of digital transformation exists, urgency is often not recognized. Additionally, there is often no clarity about what digitalization means for the organization itself, and a holistic strategic approach is lacking. This requires significant rethinking and adjustment by leaders. Cultural barriers include deep-rooted traditional practices and a lack of openness to new approaches. Hybrid work is also challenging when establishing a corporate culture. Moreover, organizational structures can be problematic when departments work in isolation, lacking a holistic approach. Also, resource constraints such as skill shortages, insufficient financial resources, and limited time pose significant hurdles. Additionally, challenges in capturing digital transformation's value and economic benefits and a strong focus on core business lead to reluctance to implement innovative ideas.

Micro-level hurdles primarily involve individual acceptance of digital transformation. These challenges mainly affect the people in the company and their behaviors and attitudes. Resistance to change, particularly among older generations, turned out to be a significant hurdle. Regarding communication and collaboration, there is often a lack of effective digital communication culture. The impact of physical distance on interpersonal interactions and innovations, discomfort with transparency, and the fast pace of work are also seen as challenges.

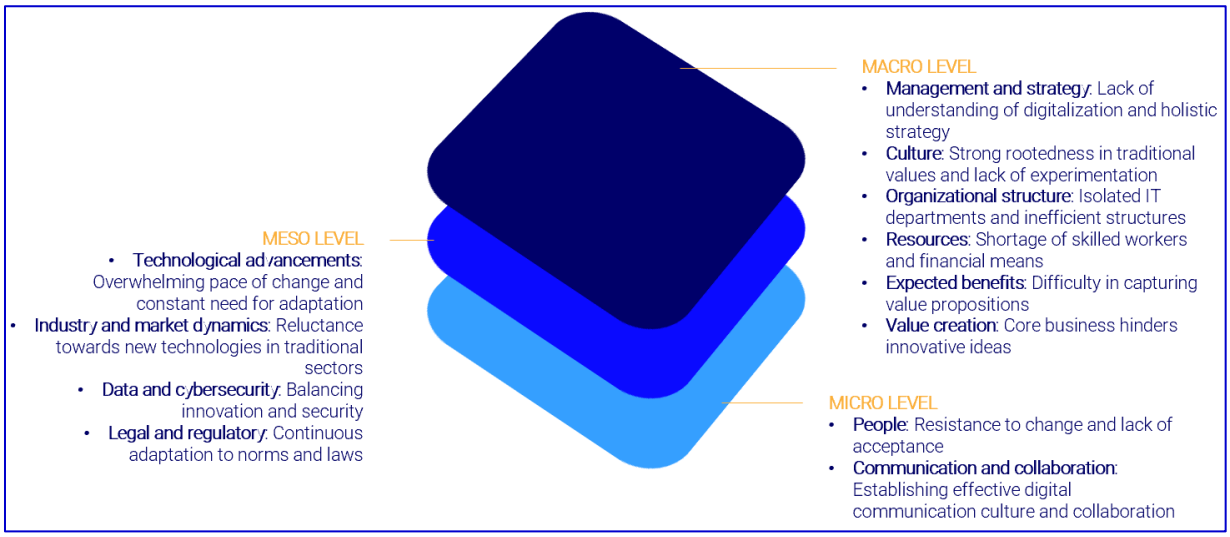

Figure 5: Overview of the major identified hurdles to digital transformation

This research confirms the need for specific digital transformation competencies to overcome the identified hurdles.

These competencies fall into six central competence fields: (1) problem solving; (2) communication and collaboration; (3) safety; (4) leadership; (5) self-management; and (6) technological competencies. These competencies are elaborated upon based on frequency of mention and are illustrated in Figure 3.

It was found that leadership competencies play a central role in the digital transformation of SMEs. Essential competencies include leading employees through changes, providing direction, fostering an open error culture that promotes innovation, and leading on eye level, involving trust, empathy, and employee inclusion in decision-making processes. Promoting and handling team diversity is also crucial to integrating different perspectives and competencies and effectively solving complex problems.

In addition to leadership competencies, competencies in the area of self-management were also frequently mentioned. These include openness to technological change, willingness to engage in lifelong learning about digital technologies, flexibility and adaptability, curiosity, and endurance. Openness to technological advancements enables new challenges to be approached positively and changes to be embraced. Continuous learning ensures staying up to date and actively participating in digital transformation. Flexibility and adaptability are necessary to respond to rapid technological and market changes. Curiosity drives continuous learning and helps explore new technologies and reduce fears, while endurance is essential to overcome setbacks, keep going, and continuously seek new solutions.

In addition, interviewees agreed that regarding technological competencies, a fundamental technical understanding, including knowledge of current technologies like algorithms, cloud services, and digital tools like Office 365, is necessary. However, it was emphasized that while these are important, soft skills and the right mindset are essential prerequisites.

Moreover, problem-solving competencies involve identifying the need for action, critically evaluating existing processes, and developing innovative, technology-supported solutions. This includes identifying outdated or inefficient processes, creatively and effectively using digital technologies, and identifying and closing gaps in digital competencies.

Effective communication and collaboration through digital technologies were also highlighted. Clear, open, and transparent communication and continuous dialogue are essential to avoid information overload and provide essential information. This includes adapting communication to recipients' preferences and using appropriate channels. Netiquette in digital environments and adjusting behavior to different people and generations were emphasized. Knowledge of digital collaboration tools and promoting dynamic and agile work methods and decision-making processes are also considered central.

Safety competencies, covering data and privacy protection and promoting physical and mental health in digital work environments, were less frequently mentioned but remain essential. These involve keeping IT security systems current to protect sensitive corporate and personal data and training employees in this area. Also, managing health risks associated with digital technologies to ensure both physical and mental well-being was highlighted. Given the rapid pace of digital transformation, paying attention to personal health and finding an appropriate pace is seen as increasingly important.

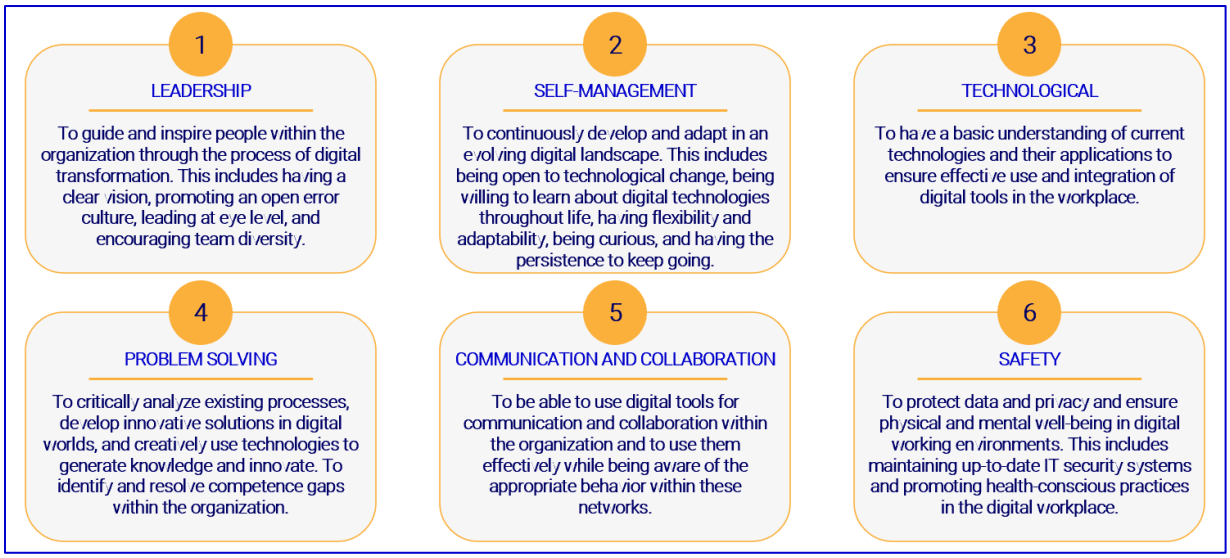

Figure 6: Overview of the digital transformation competencies identified

These competencies can be promoted through various approaches such as training, workshops, exchange, and "learning by doing."

Various approaches to promoting competencies in digital transformation emerged from the results, including an exchange with other companies and industry experts to discover and learn from best practices. This includes formal partnerships involving external consultants and informal networks for knowledge transfer. Moreover, providing resources like online courses and self-directed learning platforms supports continuous education. The principle of "learning on the job," supported by internal company exchange and practical application, was highlighted, with learning from real projects and direct feedback being particularly valuable. Establishing internal teams focused on digital topics to develop specific competencies and spread them throughout the company through training and workshops was also discussed.

Promoting these competencies can significantly contribute to the competitiveness and resilience of SMEs.

Interviews revealed that simply introducing digital technologies does not guarantee a direct competitive advantage for SMEs. Instead, specific competencies for digital transformation are needed. These can significantly contribute to resilience and competitiveness, and companies that do not develop these competencies risk falling behind in competition. These competencies help address other challenges, such as demographic change and skill shortages, as a modern and digital work environment supports knowledge management, attracting and retaining young talent, and accessing larger talent pools. They enable agility and faster organizational adaptability to market changes and technological developments, increasing both stability and innovation capability. Additionally, automating processes leads to efficiency gains and cost savings, which is particularly important in high-wage countries like Germany, allowing a focus on value-added activities. Using digital tools also supports effective stakeholder relationship management, especially with customers and suppliers, which is also seen as crucial for competitiveness.

The study of the Stuttgart economic region highlighted the role of contextual factors in companies' digital maturity.

Based on the specific context of the Stuttgart economic region, this research contributes to the theoretical understanding of digital transformation processes and verifies the importance of the context in which an organization operates. The region's strong industrial base and innovative power present both opportunities and challenges. Significant industry differences were observed, with rather traditional often lagging behind more progressive sectors in digital transformation. Differences in digitalization levels between urban and rural areas were also noted, with urban centers seen as more advanced due to stronger competition, greater exchange, and larger talent pools. It was frequently mentioned that the presence of large companies puts pressure on SMEs to adapt and meet digital standards. Yet, the region offers supportive infrastructure through networks, educational institutions, and political initiatives. Furthermore, it became clear that cultural attitudes also significantly influence digital acceptance, with areas having traditional values and a conservative approach to change being more innovation-resistant. This cultural characteristic, highlighted as a general problem in Germany, leads to a strong focus on the core business and reluctance to experiment with new technologies.

Practical Recommendations

The findings of this study derived practical recommendations for SMEs, particularly in the Stuttgart economic region and beyond. Implementing these recommendations can help SMEs improve their digital transformation competencies and strengthen their competitiveness and resilience in a dynamic environment.

(1) Increasing digital transformation competencies and resources.

The developed portfolio of essential competencies for digital transformation, including problem solving, communication and collaboration, safety, leadership, self-management, and technological competencies, should be used by executives to assess discrepancies between the competencies required for digital transformation and those currently present in their companies. The more significant the competence gap, the greater the need to develop competencies or bring in new employees who meet these competence requirements. The portfolio can also help make hiring decisions based on specific needs. However, there should be a willingness to allocate resources for digital initiatives.

(2) Developing context-specific digital strategies.

This work can serve as a reference point for management when planning their digital transformation strategy, which should be tailored to the company's specific circumstances and digital maturity level. Instead of mimetic behaviors due to external pressure, it is essential to continually adjust relevant competencies and align them with corporate culture and strategic goals. To avoid cultural misunderstandings and transformation barriers, it is crucial for SMEs to assess their status quo and organizational context first and then implement a fully integrated strategic approach that includes competence development.

(3) Promoting a culture of (digital) change.

Encouraging SMEs to foster a culture that welcomes change and experimentation and is open to new technologies is also beneficial. This involves shifting from a conservative, risk-averse mindset to a culture that values innovation and continuous improvement. Employees should be empowered to develop an appropriate mindset and participate actively. This can be reinforced by clearly communicating values and guidelines that promote adopting and using new digital technologies.

(4) Leveraging regional initiatives.

SMEs should actively participate in regional networks, invest in educational programs, and utilize political initiatives to promote digitalization. Regional clusters and innovation centers can provide platforms for collaboration, knowledge exchange, and access to funding opportunities. Policymakers are also encouraged to support these initiatives and take measures to promote digital transformation in SMEs.

Conclusion and Summary of Key Findings

This research provides valuable insights into the challenges faced by SMEs from the perspective of managers in the Stuttgart economic region in the context of digital transformation. Competencies were identified to address these challenges and strengthen resilience and competitiveness, with valuable lessons drawn from the Stuttgart case. In summary, this project contributes to the broader discussion on digital transformation by providing empirical insights from SMEs in the Stuttgart economic region. Future research should explore these findings in other contexts to validate and expand on the results.

The identified challenges include rapid technological advancements, industry-specific dynamics, data protection and cybersecurity requirements, as well as legal and regulatory guidelines at the macro level. At the meso level, management and strategy issues are particularly challenging, especially the lack of a holistic strategy and the need for leadership and cultural change. Organizational silos and resource constraints such as skill shortages and limited budgets also hinder digital transformation efforts. At the micro level, resistance to change, particularly due to conservative mindsets, and challenges in establishing appropriate communication and collaboration culture are significant hurdles.

To address these challenges, six central competence areas were identified: (1) problem solving; (2) communication and collaboration; (3) safety; (4) leadership; (5) self-management; and (6) technological competencies. Especially, leadership and self-management competencies are considered fundamental. Interestingly, technological competencies mainly involve a basic technical understanding, while soft skills and a positive attitude toward change are seen as essential prerequisites.

Developing these competencies can significantly enhance SMEs' competitiveness and resilience. They enable companies to address global challenges such as demographic change and skill shortages, increase efficiency through automation, promote adaptability and stability, and maintain relationships with stakeholders.

Key lessons from the Stuttgart economic region emphasize the importance of context-specific digital transformation strategies, regional support systems, and a cultural shift toward

innovation and experimentation. The findings highlight the need for a comprehensive approach to digital transformation in SMEs to strengthen their competitiveness and resilience amid ongoing technological developments and ensure their future viability.

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References

Aldrich, H., & Auster, E. R. (1986). Even dwarfs started small: Liabilities of age and size and their strategic implications. *Research in Organizational Behavior, 8,* 165–198.

BarNir, A., Gallaugher, J. M., & Auger, P. (2003). Business Process Digitization, strategy, and the impact of firm age and size: The case of the magazine publishing industry. *Journal of Business Venturing*, *18*(6), 789–814. https://doi.org/10.1016/s0883-9026(03)00030-2

Bundeszentrale für politische Bildung. (2021, June 23). *Mittelstand*. bpb.de. https://www.bpb.de/kurz-knapp/lexika/lexikon-der-wirtschaft/20129/mittelstand/

Daugherty, P., Carrel-Billiard, M., & Biltz, M. (2021). *Accenture Technology Vision*. Accenture. https://www.accenture.com/us-en/insights/technology/technology-trends-2021

Dispan, J., Koch, A., König, T., & Seibold, B. (2023). *Strukturbericht Region Stuttgart 2023. Entwicklung von Wirtschaft und Beschäftigung. Resilienz der regionalen Wirtschaft vor dem Hintergrund von Krisen und Transformation*. Verband Region Stuttgart.

Fonseca, P., & Picoto, W. N. (2020). The competencies needed for digital transformation. *Online Journal of Applied Knowledge Management*, *8*(2), 53–70. https://doi.org/10.36965/ojakm.2020.8(2)53-70

Geels, F. W., & Kemp, R. (2007). Dynamics in socio-technical systems: Typology of change processes and contrasting case studies. *Technology in Society*, *29*(4), 441–455. https://doi.org/10.1016/j.techsoc.2007.08.009

Gfrerer, A. E., Rademacher, L., & Dobler, S. (2021). Digital Needs Diversity: Innovation and Digital Leadership from a female managers' perspective. *Management for Professionals*, 335–349. https://doi.org/10.1007/978-3-030-69380-0_19

Hausberg, J. P., Liere-Netheler, K., Packmohr, S., Pakura, S., & Vogelsang, K. (2019). Research streams on digital transformation from a holistic business perspective: A systematic literature review and citation network analysis. *Journal of Business Economics*, *89*(8–9), 931–963. https://doi.org/10.1007/s11573-019-00956-z

Icks, A., & Brink, S. (2023). Zukunftspanel Mittelstand 2023: Erhöhter Wettbewerbsdruck fordert die Unternehmen heraus. https://www.ifm-bonn.org/fileadmin/data/redaktion/publikationen/chartbooks/Chartbook_Zukunftspanel_Mittelstand_2023.pdf

Kuckartz, U. (2012). *Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung*. Beltz Juventa.

Li, L., Su, F., Zhang, W., & Mao, J. (2017). Digital transformation by SME entrepreneurs: A capability perspective. *Information Systems Journal*, *28*(6), 1129–1157. https://doi.org/10.1111/isj.12153

Lorch, J., Lotter, W., Gatterer, H., & Gutmann, M. (2023, October). *Wie zukunftsfähig ist der deutsche Mittelstand?* Metafinanz Informationssysteme GmbH. Retrieved from https://metafinanz.de/downloads/wie-zukunftsfaehig-ist-der-deutsche-mittelstand

Mayring, P. (2015). Qualitative Inhaltsanalyse: Grundlagen und Techniken. Weinheim: Beltz. https://doi.org/10.1007/978-3-531-18939-0_38

Moroz, M. (2018). Acceleration of digital transformation as a result of launching programs financed from public funds: Assessment of the implementation of the operational program digital Poland. *Foundations of Management, 10*(1), 59–74. https://doi.org/10.2478/fman-2018-0006

Müller, S. D., Konzag, H., Nielsen, J. A., & Sandholt, H. B. (2024). Digital Transformation Leadership Competencies: A contingency approach. *International Journal of Information Management*, *75*, 102734. https://doi.org/10.1016/j.ijinfomgt.2023.102734

O'Reilly, C. A., & Tushman, M. L. (2011). Organizational ambidexterity in action: How managers explore and exploit. *California Management Review*, *53*(4), 5–22. https://doi.org/10.1525/cmr.2011.53.4.5

Omrani, N., Rejeb, N., Maalaoui, A., Dabić, M., & Kraus, S. (2022). Drivers of digital transformation in SMEs. *IEEE Transactions on Engineering Management*, *71*, 5030–5043. https://doi.org/10.1109/tem.2022.3215727

Rittmann, U. (2023). *Family business survey 2023*. PwC. https://www.pwc.de/de/mittelstand/family-business-survey.html

Slimane, S. B., Coeurderoy, R., & Mhenni, H. (2022). Digital transformation of small and Medium Enterprises: A systematic literature review and an integrative framework. *International Studies of Management & Organization*, *52*(2), 96–120. https://doi.org/10.1080/00208825.2022.2072067

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). Sage Publications, Inc.

Sweet, J., Gruzin, T., Azagury, J., Wright, O., Ghosh, B., & Moore, M. (2023). *Total enterprise reinvention*. Accenture. https://www.accenture.com/us-en/insights/consulting/total-enterprise-reinvention

Trieu, H. D., Nguyen, P. V., Tran, K. T., Vrontis, D., & Ahmed, Z. (2023). Organisational resilience, ambidexterity and performance: the roles of information technology competencies, digital transformation policies and paradoxical leadership. *International Journal of Organizational Analysis*.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Vuorikari, R., Kluzer, S., & Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens. *JRC scientific and policy reports*. Publications Office of the European Union. https://doi.org/ 10.2760/115376

Wolff, C., Omar, A., & Shildibekov, Y. (2019, September). How will we build competences for managing the digital transformation?. In *2019 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS)* (Vol. 2, pp. 1122-1129). IEEE.

Digitale Transformation zur Stärkung der Resilienz und Wettbewerbsfähigkeit von KMU: Erkenntnisse aus der Wirtschaftsregion Stuttgart

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Executive Summary

Der rasante Fortschritt der digitalen Transformation stellt kleine und mittelständische Unternehmen (KMU) vor erhebliche Herausforderungen. Im Kontext einer ausgeschriebenen Masterarbeit wurden spezifische Hürden, denen KMU in der Wirtschaftsregion Stuttgart im Kontext der digitalen Transformation gegenüberstehen, herausgearbeitet und erforderliche Kompetenzen identifiziert. Darüber hinaus untersuchte diese Arbeit inwiefern diese Kompetenzen zur Resilienz und Wettbewerbsfähigkeit von KMU beitragen und konnte wertvolle Erkenntnisse aus diesem Case ziehen.

Die Basis stellen empirische Forschungsergebnisse dar, welche unter Nutzung etablierter Frameworks und mittels einer qualitativen Methodik erhoben wurden. Die Methodik beinhaltete halbstrukturierte qualitative Interviews mit 20 Führungskräften in KMU aus der Wirtschaftsregion Stuttgart, welche verschiedene Sektoren und Größen innerhalb des KMU-Segments abdecken. Es konnten zentrale Hürden auf Makro-, Meso- und Mikroebene identifiziert werden, darunter das überwältigende Tempo des technologischen Wandels, strategische und kulturelle Barrieren sowie Widerstand gegen Veränderungen, insbesondere in traditionellen Sektoren. Damit einhergehend wurden sechs wesentliche Kompetenzbereiche ermittelt: (1) Problemlösung; (2) Kommunikation und Zusammenarbeit; (3) Sicherheit; (4) Führung; (5) Selbstmanagement; und (6) technologische Kompetenzen. Unter diesen wurden Führung und Selbstmanagement als besonders entscheidend hervorgehoben. Diese Forschung zeigt, dass die bloße Einführung digitaler Technologien keinen direkten Wettbewerbsvorteil für KMU garantiert, sondern weiterführende Kompetenzen benötigt werden. Diese tragen zur Stärkung der Wettbewerbsfähigkeit und Resilienz von KMU bei, indem sie dabei helfen sowohl Herausforderungen zu bewältigen als auch Anpassungsfähigkeit und Agilität sowie Stabilität zu gewährleisten. Darüber hinaus tragen sie zur Effizienzsteigerung bei und unterstützen ein effektives Beziehungsmanagement mit Stakeholdern. Die Erkenntnisse aus diesem Case betonen zudem die Bedeutung kontextueller Faktoren wie Branchendynamik, organisationsübergreifende Beziehungen, regionale Supportsysteme, geografische Unterschiede und kulturelle Einstellungen gegenüber Innovation. Den abgeleiteten Handlungsempfehlungen zufolge sollten KMU ihre digitalen Strategien mit der Unternehmenskultur und den Branchendynamiken in Einklang bringen und das identifizierte Kompetenzportfolio nutzen, um Kompetenzlücken zu identifizieren und zu schließen. Es ist ratsam regionale Supportsysteme und kollaborative Netzwerke mit innovativen Nischen zu nutzen, um Einfluss auf höhere Ebenen zu nehmen und politische Entscheidungsträger zu ermutigen, Digitalisierung-Initiativen in KMU zu fördern.

Problemstellung und Relevanz

Nur 42 Prozent sehen den deutschen Mittelstand als zukunftsfähig an, wie eine aktuelle Studie unter 520 Führungskräften in Deutschland ergab.[18] Diese Einschätzung spiegelt die wachsende Unsicherheit des Mittelstands in Deutschland wider. In der heutigen, sich schnell entwickelnden technologischen Landschaft ist vor allem die digitale Transformation ein entscheidender Faktor in der Wettbewerbsfähigkeit und Resilienz von kleinen und mittleren Unternehmen (KMU).[19] Hierunter wird ein Prozess verstanden, der darauf abzielt Verbesserungen durch den Einsatz verschiedener Technologien hervorzurufen.[20] Die Fähigkeit, diese Technologien effektiv ins Unternehmen einzubringen und zu nutzen ist entscheidend für diese Organisationen, um Innovation voranzutreiben, Abläufe zu optimieren und entsprechend auf Marktveränderungen zu reagieren und zukunftsfähig zu bleiben.[21]

Die Bewältigung des digitalen Transformationsprozesses bringt jedoch zahlreiche Herausforderungen mit sich, die sorgfältige Überlegungen und strategisches Handeln erfordern.[22] Vor allem KMU stehen im Gegensatz zu größeren Konzernen oft vor einzigartigen Hürden.[23] Diese Unternehmen sind ein integraler Bestandteil der deutschen Wirtschaft und leisten einen wesentlichen Beitrag zur Beschäftigung, zum Wirtschaftswachstum und technologischen Fortschritt.[24] Daher ist es von entscheidender Bedeutung, dass sie Kompetenzen, welche eine Kombination aus Wissen, Fähigkeiten und Einstellungen beinhalten[25], entwickeln, um diese Herausforderungen zu bewältigen und in einem sich ständig wandelnden Marktumfeld bestehen zu können.[26] Ein Großteil der bisherigen Forschung konzentrierte sich vor allem auf Großunternehmen, während die besonderen Herausforderungen von KMU weitgehend unerforscht blieben.[27] Infolgedessen herrscht bisher kein Konsens über die Bewältigung der disruptiven Auswirkungen der digitalen Transformation in KMU, und viele Unternehmen sind sich unsicher, welche Kompetenzen sie priorisieren und wie sie diese umsetzen sollen.[28] Zudem können die erforderlichen Kompetenzen je nach Kontext, wie Unternehmensgröße und Branche, variieren.[29] Doch an empirischer Validierung in der Praxis fehlt es bisher, da die meisten vorhandenen Studien die Landschaft der Herausforderungen und Kompetenzen in erster Linie anhand von Literaturübersichten darstellten.[30]

In der Zusammenarbeit mit zahlreichen KMU wurden immer wieder Herausforderungen im Kontext der digitalen Transformation identifiziert. Auf Grund dessen war das Interesse gegeben die Beobachtungen aus der Praxis empirisch zu untermauern. Deshalb wurde die Forschung dahingehend ausgerichtet, die zentrale Frage zu untersuchen, vor welchen Hürden KMU im Rahmen der digitalen Transformation stehen und welche Kompetenzen erforderlich sind, um

[18] Lorch et al., 2023
[19] Trieu et al., 2023
[20] Vial (2019)
[21] Omrani et al., 2022
[22] Gferer et al., 2021; Daugherty et al., 2021; Sweet et al., 2023; Icks & Brink, 2023; Rittmann, 2023
[23] Aldrich & Auster, 1986; BarNir et al., 2003; Li et al., 2017
[24] bpb, 2021
[25] Vuorikari et al., 2022
[26] O'Reilly & Tushman, 2011
[27] Hausberg et al., 2019, Mai et al., 2023
[28] Fonseca & Picoto, 2020; Moroz, 2018
[29] Fonseca & Picoto, 2020; Müller et al., 2024
[30] Wolff et al., 2019; Müller et al., 2024

diese zu überwinden. Zudem stellte sich die Frage, inwiefern diese Kompetenzen die Wettbewerbsfähigkeit und Resilienz von KMU stärken können.

Zur Beantwortung dieser wurde die Wirtschaftsregion Stuttgart als beispielhafte Umgebung herangezogen, bekannt für ihre starke industrielle Basis und Innovationskraft[31]. Ziel war es, aus der Erforschung dieser Region hilfreiche Erkenntnisse und Handlungsempfehlungen für KMU abzuleiten und somit zur Unterstützung ihrer Zukunftsfähigkeit beizutragen.

Im Folgenden wird ein Blick auf die zugrundeliegende empirische Forschung geworfen, um anschließend einen Überblick über die Ergebnisse und Implikationen für die Praxis zu geben. Schlussendlich werden die zentralen Erkenntnisse noch einmal zusammengefasst und eingeordnet.

Über die Forschung

Die Forschung verfolgte einen qualitativen Ansatz und es wurden insgesamt 20 halbstrukturierte, tiefgehende Interviews mit Führungskräften auf Geschäftsführungs-, mittlerer Management- und Teamleiter-Ebene aus zehn verschiedenen KMU aus der Wirtschaftsregion Stuttgart durchgeführt. Die Auswahl der Teilnehmenden erfolgte durch ein gezieltes, nicht-probabilistisches Stichprobenverfahren, bei dem Unternehmen aus unterschiedlichen Branchen und mit variierenden Unternehmensgrößen im KMU-Segment einbezogen wurden. Die Stichprobe umfasste sechs Teilnehmende auf Geschäftsführungs-, fünf auf mittlerer Management- und neun auf Teamleiter-Ebene, kommend aus einem kleinen (≤ 49 Mitarbeiter und 2 Mio. Euro Jahresumsatz), drei mittelgroßen Unternehmen (≤ 499 Mitarbeiter und 50 Mio. Euro Jahresumsatz) sowie sechs Unternehmen aus dem gehobenen Mittelstand (≤ 5.000 Mitarbeiter und 1 Mrd. Euro Jahresumsatz). Die Interviewteilnehmenden hatten ihre Spezialisierungen in verschiedenen Fachgebieten, darunter Digitalisierung und Automatisierung, Organisationsentwicklung, Change-Management, Strategie, Vertrieb, Controlling oder HR. Die meisten Teilnehmenden waren zwischen 28 und 44 Jahre alt (70%) und überwiegend männlich (80%). Wie in Tabelle 1 zu sehen ist, stammte die Hälfte der Unternehmen aus dem Produktionstechnik-Cluster, insbesondere aus dem Maschinenbau, die andere Hälfte aus dem Bereich der wissensintensiven Dienstleistungen, wie IT und Beratung. Zusätzlich wurden die Teilnehmenden darum gebeten, den digitalen Reifegrad ihres Unternehmens gegenüber einem Idealzustand zu bewerten. Hier wurden sechs der untersuchten Organisationen im Mittelfeld, also als entwickelnd, eingestuft, drei im oberen Drittel, also als reif, und eine Organisation in einem frühen Reifegrad. Diese Klassifizierung wurde anhand acht verschiedener Faktoren festgemacht, welche im Folgenden nach Häufigkeit ihrer Nennung aufgelistet werden: (1) Prozesse; (2) Menschen und Kultur; (3) Kommunikation und Zusammenarbeit; (4) Management; (5) Anpassungsfähigkeit; (6) Technologie; (7) Produkte oder Dienstleistungen; und (8) Strategie. In Abbildung 1 sind diese anschaulich dargestellt und es wird kurz erläutert, was die einzelnen Faktoren grundsätzlich beinhalten.

Die Interviews wurden aufgezeichnet, transkribiert und mittels einer qualitativen Inhaltsanalyse[32] ausgewertet. Diese Methode ermöglichte es, systematisch und nachvollziehbar zentrale Themen und Muster in den Aussagen der Teilnehmenden zu

[31] Dispan et al., 2023
[32] Kuckartz, 2012; Mayring, 2015

identifizieren.[33] Zudem wurden anerkannte theoretische Rahmen[34] herangezogen, um die empirischen Daten in einen größeren theoretischen Kontext zu stellen. Während des gesamten Vorgehens wurde großen Wert auf die Einhaltung von Qualitätskriterien und ethischen Standards gelegt, um die Verlässlichkeit und Integrität der Forschung sicherzustellen.

Tabelle 1: Überblick über die untersuchten Organisationen, sortiert nach Unternehmensgröße

Unternehmensgröße	Beschreibung	Branche	Digitaler Reifegrad
Klein	Unternehmensberatung (Schwerpunkt: Prozessberatung & Lean Management)	Beratung	Früh
Mittel	Hersteller von Spritzgusswerkzeugen	Maschinenbau	Entwickelnd
	Anbieter für Entwicklung und Einsatz digitaler Geschäftsmodelle und Sicherheitsdienste	IT-Dienstleistungen	Entwickelnd
	Softwareunternehmen für individuelle Softwarelösungen, maschinelles Lernen und Data Science	IT-Dienstleistungen	Reifend
Gehoben	Softwareunternehmen, spezialisiert auf Cloud-Lösungen	IT-Dienstleistungen	Reifend
	Hersteller von optischen Sensoren	Elektrotechnik	Entwickelnd
	Management- und Softwareberatung (Schwerpunkt: Automobilindustrie)	Beratung	Reifend
	Hersteller von Fräsmaschinen	Maschinenbau	Entwickelnd
	Werkzeugmaschinenhersteller	Maschinenbau	Entwickelnd
	Hersteller von Tür-, Fenster- und Sicherheitssystemen	Metallbau	Entwickelnd

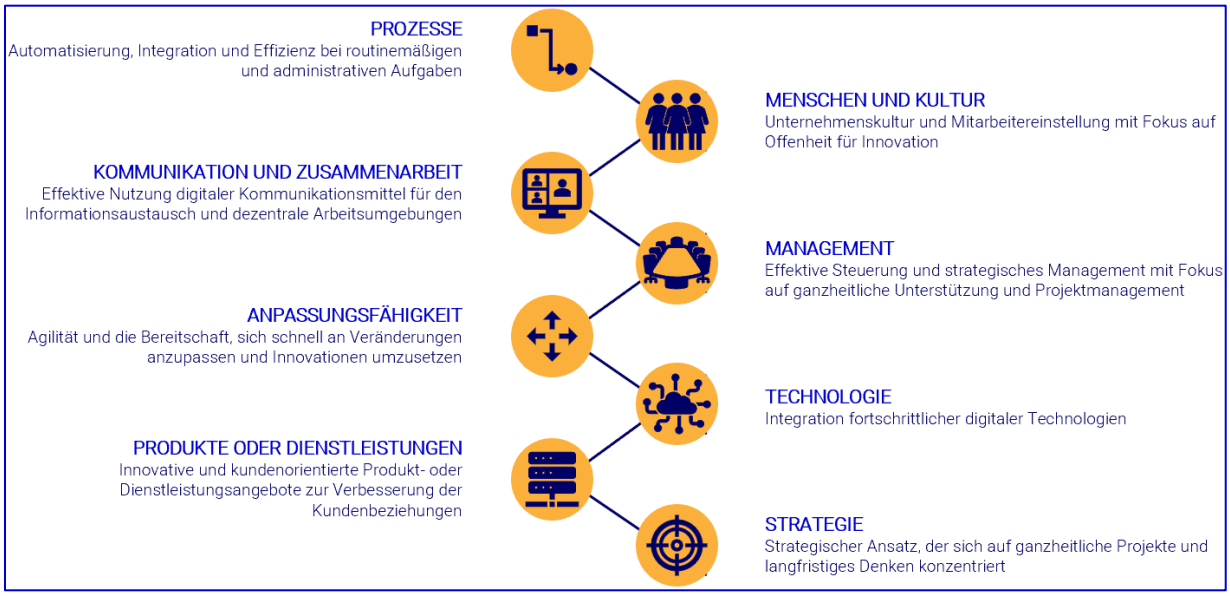

Abbildung 1: Faktoren zur Bestimmung des digitalen Reifegrades

[33] Corbin & Strauss, 1998
[34] Geels & Kemp, 2007; Vuorikari et al., 2022

Zentrale Erkenntnisse

Herausforderungen im Kontext der digitalen Transformation konnten auf Makro-, Meso- und Mikroebene identifiziert werden (siehe Abbildung 2).

Die Herausforderungen auf der **Makroebene** umfassen rasche technologische Fortschritte, Markt- und Branchendynamiken, Datenschutz und Cybersicherheit sowie rechtliche und regulatorische Rahmenbedingungen. Es zeigte sich, dass die größte Herausforderung auf dieser Ebene vor allem der rasante technologische Fortschritt ist, den viele der Befragten als überwältigend empfinden. Es wurde deutlich, dass es für die Unternehmen schwierig ist, sich einen Überblick darüber zu verschaffen, was für sie relevant und angemessen ist, und mit dem ständigen Wandel Schritt zu halten. Darüber hinaus wurde angemerkt, dass neue Technologien in traditionellen Sektoren oft nur zögerlich angenommen werden und es schwierig ist, deren Marktreife zu beurteilen. Bedenken hinsichtlich des Datenschutzes und der Cybersicherheit standen ebenfalls im Vordergrund und verdeutlichen die Herausforderung, Innovation und Sicherheit in Einklang zu bringen. Zusätzlich erschweren rechtliche und regulatorische Hürden, einschließlich der ständigen Anpassung von Standards und restriktiver gesetzlicher Vorschriften, die Digitalisierungsbemühungen und führen zu einer hohen Abhängigkeit von diesen Vorgaben.

Auf der **Mesoebene** konzentrieren sich die Herausforderungen vor allem auf Management und Strategie, kulturelle Faktoren und organisatorische Strukturen. Es wurde vor allem die Notwendigkeit einer klaren digitalen Strategie und Engagement auf der Führungsebene sowie einer Kultur und Struktur, die Veränderung unterstützt, hervorgehoben. Es zeigte sich, dass obwohl das Bewusstsein für die Bedeutung der digitalen Transformation vorhanden ist, die Dringlichkeit häufig nicht erkannt wird. Darüber hinaus besteht oft keine Klarheit darüber, was Digitalisierung, insbesondere für die Organisation selbst, bedeutet, und es fehlt häufig ein ganzheitlicher strategischer Ansatz. Dies erfordert ein erhebliches Umdenken und Anpassung seitens der Führungskräfte. Zu den kulturellen Barrieren gehören eine starke Verwurzelung in traditionellen Praktiken und eine mangelnde Offenheit für neue Ansätze. Zudem wird das hybride Arbeiten als herausfordernd in der Etablierung einer Unternehmenskultur gesehen. Darüber hinaus bereitet die Organisationsstruktur oft Schwierigkeiten, wenn einzelne Abteilungen isoliert arbeiten und somit oft die Ganzheitlichkeit fehlt. Auch stellen Ressourcenbeschränkungen wie Fachkräftemangel, unzureichende finanzielle Mittel und begrenzte Zeit erhebliche Hürden dar. Hinzu kommen Herausforderungen bei der Erfassung des Werts und des wirtschaftlichen Nutzens der digitalen Transformation sowie eine starke Fokussierung auf das Kerngeschäft, was zu einer Zurückhaltung bei der Umsetzung innovativer Ideen führt.

Auf der **Mikroebene** wurde vor allem die Bedeutung des individuellen Akzeptanzverhaltens in der digitalen Transformation unterstrichen. Die Hürden auf dieser Ebene betreffen in erster Linie die Menschen im Unternehmen und ihre individuellen Verhaltensweisen und Einstellungen. Vor allem wurde Widerstand gegen Veränderungen, insbesondere bei älteren Generationen, als großes Hindernis identifiziert. Was die Kommunikation und Zusammenarbeit betrifft, so mangelt es oft an einer effektiven digitalen Kommunikationskultur. Die Auswirkungen der räumlichen Distanz auf zwischenmenschliche Interaktionen und Innovationen, das Unbehagen gegenüber Transparenz und das schnelle Tempo des Arbeitsalltags werden ebenfalls als Herausforderungen angesehen.

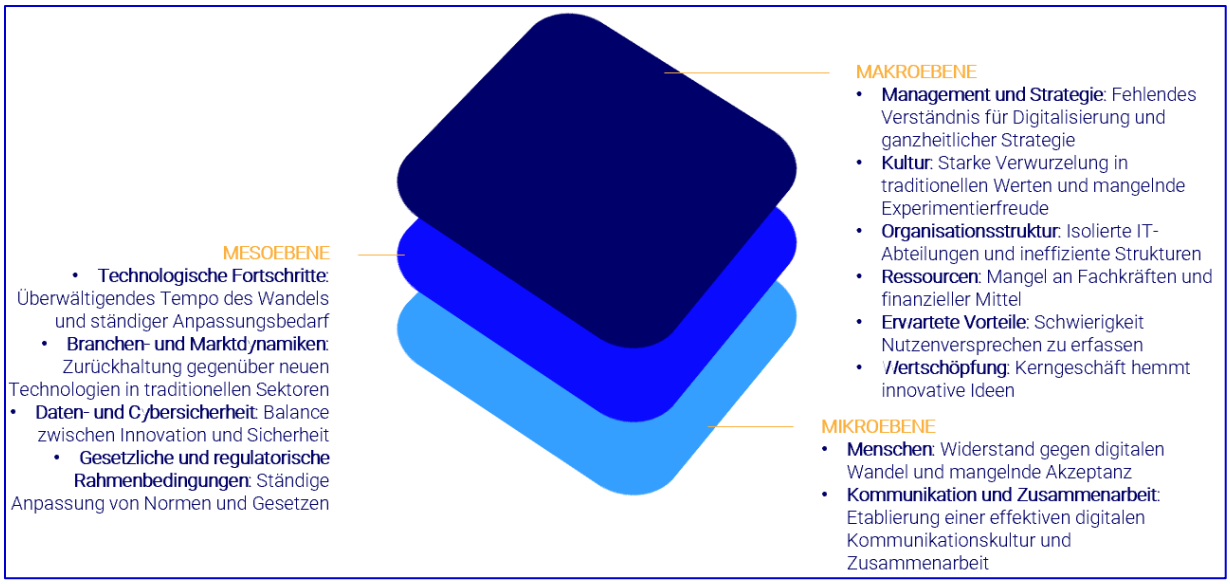

Abbildung 2: Überblick über die größten identifizierten Hürden der digitalen Transformation

Um die ermittelten Hürden zu überwinden, bestätigt diese Forschungsarbeit die Notwendigkeit spezifischer Kompetenzen für die digitale Transformation.

Die einhergehenden Kompetenzen können in **sechs zentrale Kompetenzfelder** eingeordnet werden: (1) Problemlösung; (2) Kommunikation und Zusammenarbeit; (3) Sicherheit; (4) Führung; (5) Selbstmanagement; und (6) technologische Kompetenzen. Diese werden im Folgenden nach der Häufigkeit ihrer Nennung genauer erläutert und in Abbildung 3 übersichtlich dargestellt.

Es stellte sich heraus, dass vor allem **Führungskompetenzen** eine zentrale Rolle in der digitalen Transformation von KMU spielen. Wesentlich sind hier die Fähigkeiten, Mitarbeiter durch Veränderungen zu führen, ihnen Impulse zu geben und eine klare Vision und strategische Orientierung zu bieten, sowie eine offene Fehlerkultur zu fördern, die Innovationen begünstigt. Zudem wurde Führung auf Augenhöhe, was Vertrauen, Empathie und die Einbindung der Mitarbeiter in Entscheidungsprozesse beinhaltet, als entscheidend betont, um ihre Motivation und Kreativität zu steigern. Auch zeigte sich die Förderung von und Umgang mit Diversität in Teams als entscheidend, um unterschiedliche Perspektiven und Kompetenzen zu integrieren und komplexe Probleme effektiv zu lösen.

Neben den Führungskompetenzen wurden besonders häufig Kompetenzen im Bereich **Selbstmanagement** angesprochen. Diese umfassen Offenheit für technologische Veränderungen, die Bereitschaft zu lebenslangem Lernen über digitale Technologien, Flexibilität und Anpassungsfähigkeit, Neugier und Interesse an technologischen Innovationen sowie Ausdauer. Es wurde betont, dass eine grundlegende Offenheit für technologische Fortschritte es ermöglicht, neue Herausforderungen positiv anzugehen und Veränderungen anzunehmen. Die Bereitschaft zu kontinuierlichem Lernen stellt zudem sicher, stets auf dem neuesten Stand zu bleiben und aktiv an der digitalen Transformation teilzunehmen. Flexibilität und Anpassungsfähigkeit sind notwendig, um auf rasante technologische und marktbedingte Veränderungen reagieren zu können. Neugier treibt das kontinuierliche Lernen an und hilft, neue Technologien zu erkunden und Ängste abzubauen. Schließlich ist Ausdauer wichtig, um Rückschläge zu überwinden und stets nach neuen Lösungen zu suchen.

Zudem waren sich die Befragten einig, dass bezüglich technologischer Kompetenzen ein grundlegendes technisches Verständnis, einschließlich der Kenntnisse über aktuelle Technologien wie Algorithmen, Cloud-Dienste und digitale Tools wie Office 365, nötig ist. Jedoch wurde betont, dass obwohl diese wichtig sind, Soft Skills und die passende Einstellung die wesentlichen Grundvoraussetzungen darstellen.

Des Weiteren sprachen die Befragten Problemlösungskompetenzen an. Diese umfassen die Fähigkeit, Handlungsbedarfe zu erkennen, bestehende Prozesse kritisch zu evaluieren und innovative, technologiegestützte Lösungen zu entwickeln. Dazu gehört, veraltete oder ineffiziente Prozesse zu identifizieren, digitale Technologien kreativ und effektiv zu nutzen sowie Lücken in digitalen Kompetenzen zu erkennen und zu schließen.

Die Bedeutung effektiver Kommunikation und Zusammenarbeit durch digitale Technologien wurde ebenfalls betont. Klare, offene und transparente Kommunikation sowie ein kontinuierlicher Dialog wurden als essenziell hervorgehoben, um Informationsüberflutung zu vermeiden und wesentliche Informationen bereitzustellen. Hierzu gehört es auch die Kommunikation an die Präferenzen der Empfänger anzupassen und die geeigneten Kanäle zu nutzen. Hier wurde zudem die Bedeutung von Netiquette in digitalen Umgebungen und die Anpassung des Verhaltens an unterschiedliche Personen und Generationen betont. Auch das Wissen über die Verwendung digitaler Tools zur Zusammenarbeit und die Förderung dynamischer und agiler Arbeitsweisen und Entscheidungsprozesse wird als zentral betrachtet.

Der Bereich Sicherheit, der sowohl den Schutz von Daten und Privatsphäre als auch die Förderung von physischer und psychischer Gesundheit in digitalen Arbeitsumgebungen umfasst, wurde zwar seltener angesprochen, stellt aber dennoch einen wesentlichen Kompetenzbereich dar. Hierzu gehört es, dass IT-Sicherheitssysteme aktuell gehalten werden, um sensible Unternehmens- und persönliche Daten zu schützen. Ebenso ist es von besonderer Wichtigkeit, Mitarbeiter in diesem Bereich zu schulen. Die Notwendigkeit, gesundheitliche Risiken durch den Umgang mit digitalen Technologien bewusst zu managen, um sowohl körperliches als auch psychisches Wohlbefinden zu gewährleisten, wurde ebenfalls hervorgehoben. Angesichts des rasanten Tempos der digitalen Transformation wird es als zunehmend wichtig erachtet, auf die persönliche Gesundheit zu achten und ein angemessenes Tempo zu finden.

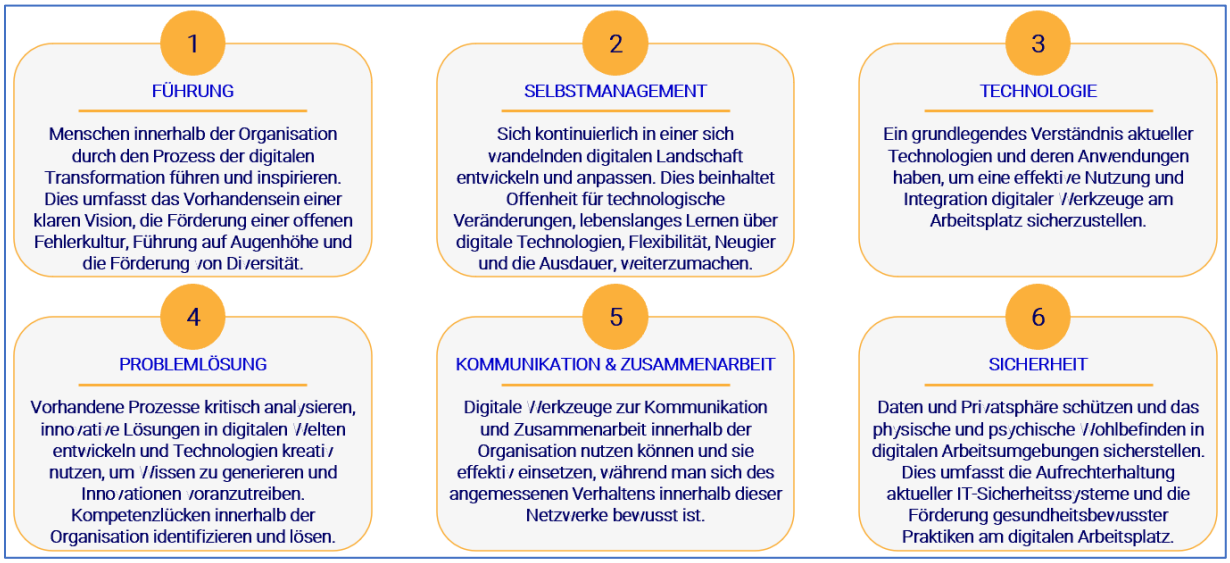

Abbildung 3: Überblick über die identifizierten Kompetenzen im Kontext digitaler Transformation

Diese Kompetenzen können durch verschiedene Ansätze, wie Schulungen, Workshops, Austausch und „learning by doing“ gefördert werden.

Aus den Ergebnissen ergaben sich verschiedene Ansätze zur Förderung der Kompetenzen im Kontext digitaler Transformation. Zum einen wurde der Austausch mit anderen Unternehmen und Branchenexperten angesprochen, um Best Practices zu entdecken und von diesen zu lernen. Dies umfasst formelle Partnerschaften, die Einbindung externer Berater sowie informelle Netzwerke für Wissenstransfer. Zum anderen unterstützt die regelmäßige Bereitstellung von Ressourcen wie Online-Kurse und Plattformen für selbstgesteuertes Lernen die kontinuierliche Weiterbildung. Zudem wurde das Prinzip „learning on the job“ hervorgehoben, welches durch den Austausch innerhalb des Unternehmens und praktische Anwendung gefördert wird. Lernen aus realen Projekten und direkte Rückmeldung werden hier als besonders wertvoll angesehen. Ebenfalls wurde die Einrichtung von unternehmensinternen Teams diskutiert, die sich speziell mit digitalen Themen beschäftigen, spezifische Kompetenzen entwickeln und diese durch Schulungen und Workshops im gesamten Unternehmen verbreiten.

Die Förderung dieser Kompetenzen kann maßgeblich zur Wettbewerbsfähigkeit und Resilienz von KMU beitragen.

Durch die Interviews zeigte sich, dass die simple Einführung digitaler Technologien keinen direkten Wettbewerbsvorteil für KMU garantiert, sondern es spezifischer Kompetenzen für die digitale Transformation bedarf. Die genannten Kompetenzen können erheblich in Resilienz und Wettbewerbsfähigkeit einzahlen und Unternehmen, die diese Kompetenzen nicht entwickeln, riskieren, im Wettbewerb zurückzufallen. Zum einen können die genannten Kompetenzen dabei helfen andere Herausforderungen zu bewältigen. Hier wurde vor allem der demografische Wandel und Fachkräftemangel angesprochen, da ein modernes und digitales Arbeitsumfeld insbesondere beim Wissensmanagement, der Gewinnung und Bindung junger Talente sowie beim Zugang zu größeren Talentpools unterstützend sein kann. Zudem ermöglichen sie Agilität und eine schnellere organisatorische Anpassungsfähigkeit an Marktveränderungen und technologische Entwicklungen. Somit steigern sie sowohl die Stabilität als auch die Innovationsfähigkeit eines Unternehmens. Des Weiteren führt die Automatisierung von Prozessen zu Effizienzgewinnen und Kosteneinsparungen. Dies ist besonders in Hochlohnländern wie Deutschland von besonderer Bedeutung und ermöglicht eine Fokussierung auf wertschöpfende Tätigkeiten. Auch wird durch den Einsatz digitaler Tools effektives Beziehungsmanagement mit Stakeholdern, vor allem zu Kunden und Lieferanten, unterstützt, was ebenfalls als entscheidend für die Wettbewerbsfähigkeit gesehen wird.

Die Untersuchung der Wirtschaftsregion Stuttgart beleuchtete die Rolle kontextueller Faktoren im Hinblick auf die digitale Reife von Unternehmen.

Aufbauend auf dem spezifischen Kontext der Wirtschaftsregion Stuttgart trägt diese Forschung zum theoretischen Verständnis digitaler Transformationsprozesse bei und verifiziert die Bedeutung des Kontexts, in dem eine Organisation agiert. Die Region zeichnet sich durch eine starke industrielle Basis und Innovationskraft aus, was sowohl Chancen als auch Herausforderungen mit sich bringt. Zum einen konnten erhebliche Branchenunterschiede festgestellt werden, wobei traditionellere im Vergleich zu progressiveren Sektoren in ihrer digitalen Transformation häufig zurückliegen. Unterschiede im Digitalisierungsgrad zwischen städtischeren und ländlicheren Gebieten wurden ebenfalls festgestellt, wobei städtische Zentren aufgrund des stärkeren Wettbewerbs, des größeren Austauschs und Talentpools als

fortschrittlicher gelten. Es wurde häufig angesprochen, dass die Präsenz großer Unternehmen KMU unter Druck setzt, sich anzupassen und digitale Standards zu erfüllen. Gleichzeitig bietet die Region durch ihre Netzwerke, Bildungsinstitutionen und politischen Initiativen eine unterstützende Infrastruktur. Darüber hinaus kristallisierte sich heraus, dass kulturelle Einstellungen einen wesentlichen Einfluss auf die Akzeptanz gegenüber digitaler Transformation haben. Es zeigte sich, dass Regionen mit traditionellen Werten und einer konservativen, vorsichtigen Herangehensweise an Veränderungen eher innovationshemmend wirken. Dieses kulturelle Merkmal, das in Deutschland als allgemeines Problem betont wurde, geht mit einer starken Konzentration auf das Kerngeschäft und einer Zurückhaltung beim Experimentieren mit neuen Technologien einher.

Praktische Handlungsempfehlungen

Aus den Ergebnissen dieser Arbeit konnten praktische Empfehlungen für KMU, insbesondere im Wirtschaftsraum Stuttgart und darüber hinaus abgeleitet werden. Durch die Umsetzung dieser Empfehlungen können KMU ihre digitalen Transformationskompetenzen verbessern und ihre Wettbewerbsfähigkeit und Resilienz in einem dynamischen Umfeld stärken.

(1) Aufstockung der Kompetenzen und Ressourcen für die digitale Transformation.

Das entwickelte Portfolio an wesentlichen Kompetenzen für die digitale Transformation, darunter Problemlösungskompetenz, Kommunikation und Zusammenarbeit, Sicherheit, Führung, Selbstmanagement und technologische Kompetenzen, sollte von Führungskräften herangezogen werden, um Diskrepanzen zwischen den für die digitale Transformation erforderlichen Kompetenzen und den derzeit in ihren Unternehmen vorhandenen Kompetenzen zu bewerten. Je größer die Kompetenzlücke, desto größer die Notwendigkeit, Kompetenzen weiterzuentwickeln oder neue Mitarbeiter an Bord zu holen, die diese Kompetenzanforderungen erfüllen. Auch hier kann das entwickelte Portfolio an Kompetenzen dabei helfen, Einstellungsentscheidungen auf der Grundlage spezifischer Bedürfnisse zu treffen. Allerdings sollte auch die Bereitschaft vorhanden sein, Ressourcen für digitale Initiativen aufzubringen.

(2) Entwicklung kontextspezifischer digitaler Strategien.

Diese Ausarbeitung kann als Bezugspunkt für die Geschäftsleitung bei der Planung ihrer digitalen Transformationsstrategie dienen. Diese sollte jedoch auf die spezifischen Umstände und das digitale Reifegradniveau des Unternehmens abgestimmt sein. Anstatt mimetische Verhaltensweisen aufgrund von externem Druck anzunehmen ist es wichtig, dass die relevanten Kompetenzen stetig angepasst werden und mit der Unternehmenskultur sowie den strategischen Zielen des Unternehmens übereinstimmen. Um kulturelle Missverständnisse und Transformationsbarrieren zu vermeiden, ist es also von entscheidender Bedeutung für KMU zunächst ihren Status quo und organisatorischen Kontext zu bewerten und dann einen vollständig integrierten strategischen Ansatz umsetzen, der die Kompetenzentwicklung einschließt.

(3) Förderung einer Kultur des (digitalen) Wandels.

Zielführend ist zudem eine Ermutigung von KMU zur Förderung einer Kultur, die Veränderungen sowie Experimentierfreudigkeit begrüßt und offen für neue Technologien ist. Dies beinhaltet den Wandel von einer konservativen, risikoaversen Haltung hin zu einer Kultur, die Innovation und kontinuierliche Verbesserung schätzt. Mitarbeiter sollten in die Lage versetzt werden, eine entsprechende Denkweise zu entwickeln und sich aktiv einbringen zu können. Dies kann durch die klare Vermittlung von Werten und Richtlinien, welche die Einführung und Nutzung neuer digitaler Technologien fördern, gestärkt werden.

(4) Nutzung regionaler Initiativen.

KMU sollten aktiv an regionalen Netzwerken teilnehmen, in Bildungsprogramme investieren und politische Initiativen zur Förderung der Digitalisierung nutzen. Regionale Cluster und Innovationszentren können Plattformen für Zusammenarbeit, Wissensaustausch und Zugang zu Finanzierungsmöglichkeiten bieten. Darüber hinaus werden politische Entscheidungsträger ermutigt, diese Initiativen zu unterstützen und Maßnahmen zu ergreifen, die digitale Transformation in KMU fördern.

Schlussbemerkungen und Zusammenfassung der zentralen Ergebnisse

Diese Forschung bietet wertvolle Einblicke in die Herausforderungen, denen KMU aus Sicht von Führungskräften in der Stuttgarter Wirtschaftsregion im Kontext der digitalen Transformation gegenüberstehen. Es konnten Kompetenzen identifiziert werden, um diese Herausforderungen zu bewältigen und Resilienz und Wettbewerbsfähigkeit zu stärken sowie wertvolle Lehren aus dem Stuttgarter Case gezogen werden. Zusammenfassend trägt dieses Projekt zur breiteren Diskussion über digitale Transformation bei, indem es empirische Einblicke aus KMU in der Wirtschaftsregion Stuttgart liefert. Zukünftige Forschung sollte diese Erkenntnisse in weiteren Kontexten erkunden, um die Ergebnisse zu validieren und auszubauen.

Zu den identifizierten Herausforderungen gehören rasante technologische Entwicklungen, branchenspezifische Dynamiken, Datenschutz- und Cybersicherheitsanforderungen sowie rechtliche Rahmenbedingungen auf Makroebene. Auf der Mesoebene sind Themen rund um Management- und Strategie besonders herausfordernd, insbesondere das Fehlen einer ganzheitlichen Strategie und die Notwendigkeit von Führungs- und Kulturwandel. Organisatorische Silos und Ressourceneinschränkungen wie Fachkräftemangel und begrenzte Budgets hemmen ebenfalls die Bemühungen um digitale Transformation. Auf der Mikroebene stellen vor allem Widerstände gegen Veränderungen, insbesondere durch konservative Denkweisen, sowie Herausforderungen in der Etablierung einer geeigneten Kommunikations- und Kollaborationskultur große Hürden dar.

Um diesen Herausforderungen zu begegnen, wurden sechs zentrale Kompetenzbereiche identifiziert: (1) Problemlösung; (2) Kommunikation und Zusammenarbeit; (3) Sicherheit; (4) Führung; (5) Selbstmanagement; und (6) technologische Kompetenzen. Besonders werden Kompetenzen in den Bereichen Führung und Selbstmanagement als grundlegend erachtet. Interessant ist, dass technologische Kompetenzen vor allem ein grundlegendes technisches Verständnis beinhalten, während Soft Skills und eine positive Einstellung gegenüber dem Wandel als essenzielle Voraussetzungen betrachtet werden.

Es zeigt sich, dass die Entwicklung dieser Kompetenzen maßgeblich zur Steigerung der Wettbewerbsfähigkeit und Resilienz von KMU beiträgt. Sie ermöglichen es den Unternehmen,

globalen Herausforderungen wie dem demografischen Wandel oder dem Fachkräftemangel zu begegnen, Effizienz durch Automatisierung zu steigern, Anpassungsfähigkeit und Stabilität zu fördern sowie Beziehungen zu Stakeholdern zu pflegen.

Wichtige Lehren, die aus der Stuttgarter Wirtschaftsregion abgeleitet werden können, betonen vor allem die Bedeutung kontextspezifischer digitaler Transformationsstrategien, regionaler Supportsysteme und eines kulturellen Wandels hin zu Innovation und Experimentierfreudigkeit. Die Ergebnisse unterstreichen die Notwendigkeit eines umfassenden Ansatzes zur digitalen Transformation in KMU, um ihre Wettbewerbsfähigkeit und Resilienz angesichts fortlaufender technologischer Entwicklungen zu stärken und somit ihre Zukunftsfähigkeit zu sichern.

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Literaturverzeichnis

Aldrich, H., & Auster, E. R. (1986). Even dwarfs started small: Liabilities of age and size and their strategic implications. Research in Organizational Behavior, 8, 165–198.

BarNir, A., Gallaugher, J. M., & Auger, P. (2003). Business Process Digitization, strategy, and the impact of firm age and size: The case of the magazine publishing industry. Journal of Business Venturing, 18(6), 789–814. https://doi.org/10.1016/s0883-9026(03)00030-2

Bundeszentrale für politische Bildung. (2021, June 23). Mittelstand. bpb.de. https://www.bpb.de/kurz-knapp/lexika/lexikon-der-wirtschaft/20129/mittelstand/

Daugherty, P., Carrel-Billiard, M., & Biltz, M. (2021). Accenture Technology Vision. Accenture. https://www.accenture.com/us-en/insights/technology/technology-trends-2021

Dispan, J., Koch, A., König, T., & Seibold, B. (2023). Strukturbericht Region Stuttgart 2023. Entwicklung von Wirtschaft und Beschäftigung. Resilienz der regionalen Wirtschaft vor dem Hintergrund von Krisen und Transformation. Verband Region Stuttgart.

Fonseca, P., & Picoto, W. N. (2020). The competencies needed for digital transformation. Online Journal of Applied Knowledge Management, 8(2), 53–70. https://doi.org/10.36965/ojakm.2020.8(2)53-70

Geels, F. W., & Kemp, R. (2007). Dynamics in socio-technical systems: Typology of change processes and contrasting case studies. Technology in Society, 29(4), 441–455. https://doi.org/10.1016/j.techsoc.2007.08.009

Gfrerer, A. E., Rademacher, L., & Dobler, S. (2021). Digital Needs Diversity: Innovation and Digital Leadership from a female managers' perspective. Management for Professionals, 335–349. https://doi.org/10.1007/978-3-030-69380-0_19

Hausberg, J. P., Liere-Netheler, K., Packmohr, S., Pakura, S., & Vogelsang, K. (2019). Research streams on digital transformation from a holistic business perspective: A systematic literature review and citation network analysis. Journal of Business Economics, 89(8–9), 931–963. https://doi.org/10.1007/s11573-019-00956-z

Icks, A., & Brink, S. (2023). Zukunftspanel Mittelstand 2023: Erhöhter Wettbewerbsdruck fordert die Unternehmen heraus. https://www.ifm-bonn.org/fileadmin/data/redaktion/publikationen/chartbooks/Chartbook_Zukunftspanel_Mittelstand_2023.pdf

Kuckartz, U. (2012). Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung. Beltz Juventa.

Li, L., Su, F., Zhang, W., & Mao, J. (2017). Digital transformation by SME entrepreneurs: A capability perspective. Information Systems Journal, 28(6), 1129–1157. https://doi.org/10.1111/isj.12153

Lorch, J., Lotter, W., Gatterer, H., & Gutmann, M. (2023, October). Wie zukunftsfähig ist der deutsche Mittelstand? Metafinanz Informationssysteme GmbH. Retrieved from https://metafinanz.de/downloads/wie-zukunftsfaehig-ist-der-deutsche-mittelstand

Mayring, P. (2015). Qualitative Inhaltsanalyse: Grundlagen und Techniken. Weinheim: Beltz. https://doi.org/10.1007/978-3-531-18939-0_38

Moroz, M. (2018). Acceleration of digital transformation as a result of launching programs financed from public funds: Assessment of the implementation of the operational program digital Poland. Foundations of Management, 10(1), 59–74. https://doi.org/10.2478/fman-2018-0006

Müller, S. D., Konzag, H., Nielsen, J. A., & Sandholt, H. B. (2024). Digital Transformation Leadership Competencies: A contingency approach. International Journal of Information Management, 75, 102734. https://doi.org/10.1016/j.ijinfomgt.2023.102734

O'Reilly, C. A., & Tushman, M. L. (2011). Organizational ambidexterity in action: How managers explore and exploit. California Management Review, 53(4), 5–22. https://doi.org/10.1525/cmr.2011.53.4.5

Omrani, N., Rejeb, N., Maalaoui, A., Dabić, M., & Kraus, S. (2022). Drivers of digital transformation in SMEs. IEEE Transactions on Engineering Management, 71, 5030–5043. https://doi.org/10.1109/tem.2022.3215727

Rittmann, U. (2023). Family business survey 2023. PwC. https://www.pwc.de/de/mittelstand/family-business-survey.html

Slimane, S. B., Coeurderoy, R., & Mhenni, H. (2022). Digital transformation of small and Medium Enterprises: A systematic literature review and an integrative framework. International Studies of Management & Organization, 52(2), 96–120. https://doi.org/10.1080/00208825.2022.2072067

Strauss, A., & Corbin, J. (1998). Basics of qualitative research: Techniques and procedures for developing grounded theory (2nd ed.). Sage Publications, Inc.

Sweet, J., Gruzin, T., Azagury, J., Wright, O., Ghosh, B., & Moore, M. (2023). Total enterprise reinvention. Accenture. https://www.accenture.com/us-en/insights/consulting/total-enterprise-reinvention

Trieu, H. D., Nguyen, P. V., Tran, K. T., Vrontis, D., & Ahmed, Z. (2023). Organisational resilience, ambidexterity and performance: the roles of information technology competencies, digital transformation policies and paradoxical leadership. International Journal of Organizational Analysis.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Vuorikari, R., Kluzer, S., & Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens. JRC scientific and policy reports. Publications Office of the European Union. https://doi.org/ 10.2760/115376

Wolff, C., Omar, A., & Shildibekov, Y. (2019, September). How will we build competences for managing the digital transformation?. In 2019 10th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS) (Vol. 2, pp. 1122-1129). IEEE.

Appendix B: Participant Information Sheet

Participant Information Sheet

Research Project	Competencies for SMEs in Times of Digital Transformation
Institution	Universidade Católica Portuguesa (UCP)
Supervisor	Luís Lourenço Soares
Researcher	Leonie Gutemann

I cordially invite you to participate in a research study in the form of an interview. It is important that you understand why this study is being conducted and what it involves. Please take time to carefully read the following information to decide if you would like to participate.

What is the purpose and scope of the study?

- As part of a master's thesis, challenges and necessary competencies for SMEs in the Stuttgart economic region are being researched.
- The study is conducted in cooperation with UCP and P3 Group.

Why was I selected?

- Due to your role in this context, you can share your professional expertise and perspective.

What does participation involve?

- You are asked to participate in an interview that will last about 30-45 minutes.
- The interview is scheduled to be conducted online via MS Teams in early 2024 and will be recorded.

Do I have to participate?

- Your participation in this study is completely voluntary.
- You can withdraw at any time without any disadvantages.

What are the potential advantages and disadvantages of participating?

- There are no known risks associated with this research.
- Your participation will significantly contribute to the validity of the research findings.
- Furthermore, you will gain insights into the results of this study.

How do I consent to participate?

- If you decide to participate, you will be asked to sign a consent form before the start of the interview.

How will the data be handled?

- Your responses will be treated with strict confidentiality and securely stored.
- All data will be anonymized, ensuring that personal and company-related identifiers are not linked to your responses.
- Personal and company-related data, as well as the recording of the interview, will be deleted after the study's conclusion, leaving only the anonymized transcripts.

Who do I contact for questions and comments?

If you have any questions, please feel free to contact the following people:

Researcher
Leonie Gutemann, s-lgutemann@ucp.pt or leonie.gutemann@p3-group.com

Supervisors

UCP	Luís Lourenço Soares, llsoares@ucp.pt
P3 Group	Merle Tegeler, merle.tegeler@p3-group.com
P3 Group	Nicol Spiridon-Mattes, nicol.spiridon-mattes@p3-group.com

Thank you!

Your participation is greatly appreciated and provides valuable insights into this area of research. If you decide to participate, you will receive the consent form. Please read it carefully as it contains important information about your rights and the use of your data.

Informationsblatt für Teilnehmende

Forschungsprojekt	Kompetenzen für KMU in Zeiten Digitaler Transformation
Institution	Universidade Católica Portuguesa (UCP)
Betreuer	Luís Lourenço Soares
Forscherin	Leonie Gutemann

Ich lade Sie herzlich ein, an einer Forschungsstudie in Form eines Interviews teilzunehmen. Mir ist es wichtig, dass Sie verstehen, warum die Studie durchgeführt wird und was sie beinhaltet. Bitte lesen Sie die folgenden Informationen sorgfältig durch, um zu entscheiden, ob Sie teilnehmen möchten.

Was ist der Zweck und Rahmen der Studie?

- Im Rahmen einer Masterarbeit werden Herausforderungen und notwendige Kompetenzen für KMU in der Wirtschaftsregion Stuttgart erforscht.
- Die Studie erfolgt in Kooperation mit der UCP und der P3 Group GmbH.

Warum wurde ich ausgewählt?

- Aufgrund Ihrer Rolle in diesem Kontext, können Sie Ihre fachliche Expertise und Perspektive teilen.

Was beinhaltet die Teilnahme?

- Sie werden gebeten, an einem Interview teilzunehmen, das etwa 30 Minuten dauert.
- Das Interview soll Anfang 2024 online über MS Teams durchgeführt und aufgenommen werden.

Muss ich teilnehmen?

- Ihre Teilnahme an dieser Studie ist vollkommen freiwillig.
- Sie können jederzeit ohne jegliche Nachteile zurücktreten.

Was sind mögliche Vor- und Nachteile der Teilnahme?

- Es sind keine bekannten Risiken mit dieser Forschung verbunden.
- Ihre Teilnahme wird wesentlich zur Aussagekraft der Forschungsergebnisse beitragen.
- Darüber hinaus erhalten Sie Einblicke in die Ergebnisse dieser Studie.

Wie willige ich der Teilnahme ein?

- Wenn Sie sich zur Teilnahme entscheiden, werden Sie gebeten, vor Beginn des Interviews eine Einwilligungserklärung zu unterzeichnen.

Wie werden die Daten behandelt?

- Ihre Antworten werden streng vertraulich behandelt und sicher aufbewahrt.
- Alle Daten werden anonymisiert, und sichergestellt, dass persönliche und unternehmensbezogene Identifikatoren nicht mit Ihren Antworten verknüpft werden.
- Personen- und unternehmensbezogene Daten, sowie die Aufnahme des Interviews werden nach Abschluss der Studie gelöscht, sodass nur die anonymisierten Transkripte bestehen bleiben.

Wo melde ich mich bei Fragen und Anmerkungen?

Wenn Ihnen etwas unklar ist, wenden Sie sich gerne an folgende Personen:

Forscherin
Leonie Gutemann, s-lgutemann@ucp.pt oder leonie.gutemann@p3-group.com

Betreuer:innen

UCP	Luís Lourenço Soares, llsoares@ucp.pt
P3 Group	Merle Tegeler, merle.tegeler@p3-group.com
P3 Group	Nicol Spiridon-Mattes, nicol.spiridon-mattes@p3-group.com

Vielen Dank!

Ihre Teilnahme wird sehr geschätzt und liefert wertvolle Einblicke in diesen Forschungsbereich. Wenn Sie sich dafür entscheiden teilzunehmen, bekommen Sie die Einverständniserklärung zugeschickt. Lesen Sie diese sorgfältig durch, da sie wichtige Informationen über Ihre Rechte und Verwendung Ihrer Daten enthält.

Appendix C: Consent Form for the Collection and Processing of Personal Data

Consent Form for the Collection and Processing of Personal Data

Research Project	Competencies for SMEs in Times of Digital Transformation
Institution	Universidade Católica Portuguesa (UCP)
Supervisor	Luís Lourenço Soares
Interviewer	Leonie Gutemann
Interview Date	_____
Interview Code	_____

I hereby confirm my participation in an interview as part of the aforementioned research project. I have been informed about the goal and course of the research project.

I agree to the recording of the interview and its transcription. The audio recordings will be deleted after the completion of the research project. The transcripts of the interviews will be anonymized, meaning personal and company-related identifiers will be altered or removed.

I also agree that individual sentences from the transcripts, which cannot be linked to my person or the company, may be used as material for scientific purposes. Contact details will be stored separately from interview data and kept inaccessible to third parties. After the completion of the research project, personal and company-related data will be deleted unless I expressly consent to further storage for contact purposes. I can object to this at any time.

My participation in the survey and my consent to the use of the data as described above are voluntary. I have the right to withdraw my consent at any time and to terminate the interview. No disadvantages will arise from my refusal or withdrawal. I have the right to access, rectification, blocking and deletion, restriction of processing, objection to further processing, and data portability of my personal and company-related data.

Under these conditions, I agree to give the interview and consent to its recording, transcription, anonymization, and evaluation.

_____

First Name, Last Name of Interviewee

_____ _____

Place, Date, Signature of Interviewee Place, Date, Signature of Interviewer

Einwilligungserklärung zur Erhebung und Verarbeitung personenbezogener Daten

Forschungsprojekt	Kompetenzen für KMU in Zeiten Digitaler Transformation
Institution	Universidade Católica Portuguesa (UCP)
Betreuer	Luís Lourenço Soares
Interviewerin	Leonie Gutemann
Interviewdatum	_____
Interviewkürzel	_____

Hiermit bestätige ich, im Rahmen des genannten Forschungsprojekts an einem Interview teilzunehmen. Ich wurde über das Ziel und den Verlauf des Forschungsprojekts informiert.

Ich bin damit einverstanden, dass das Interview aufgezeichnet und in Schriftform gebracht wird. Die Audioaufnahmen werden nach Beendigung des Forschungsprojekts gelöscht. Die Transkripte der Interviews werden anonymisiert, d.h. persönliche und unternehmensbezogene Identifikationsmerkmale werden verändert oder entfernt.

Zudem bin ich damit einverstanden, dass einzelne Sätze aus den Transkripten, die nicht mit meiner Person oder dem Unternehmen in Verbindung gebracht werden können, als Material für wissenschaftliche Zwecke genutzt werden können. Kontaktdaten werden von Interviewdaten getrennt und für Dritte unzugänglich gespeichert. Nach Beendigung des Forschungsprojekts werden personen- und unternehmensbezogene Daten wieder gelöscht, es sein denn, ich stimme einer weiteren Speicherung zur Kontaktmöglichkeit ausdrücklich zu. Selbstverständlich kann ich dem zu jedem Zeitpunkt widersprechen.

Meine Teilnahme an der Erhebung und meine Zustimmung zur Verwendung der Daten, wie oben beschrieben, ist freiwillig. Ich habe jederzeit die Möglichkeit, meine Zustimmung zu widerrufen und das Interview abzubrechen. Durch Verweigerung oder Widerruf entstehen mir keine Nachteile. Ich habe das Recht auf Auskunft, Berichtigung, Sperrung und Löschung, Einschränkung der Verarbeitung, Widerspruch gegen die weitere Verarbeitung sowie auf Datenübertragbarkeit meiner personen- und unternehmensbezogenen Daten.

Unter diesen Bedingungen erkläre ich mich bereit, das Interview zu geben, und bin damit einverstanden, dass es aufgezeichnet, verschriftlicht, anonymisiert und ausgewertet wird.

_____

Vornahme, Nachname Interviewparter:in

_____ _____

Ort, Datum, Unterschrift Interviewparter:in Ort, Datum, Unterschrift Interviewerin

Appendix D: Interview Guide

Table 7
Interview Guide (English)

Intro *(Sample texts: Please do not read out loud)*	
Greetings, Thanks, and Introduction	Hello, and thank you for taking the time for this interview. My name is Leonie Gutemann, and I am studying Strategic Communication and Leadership at the Universidade Católica Portuguesa in Lisbon.
Context of the Interview and Outline of the Topic	This interview is part of my master's thesis, which I am writing in cooperation with the company P3 in Stuttgart. As is well-known, digital technologies continue to advance and pose challenges for companies of all sizes and industries. In this context, I am interested in what this means for small and medium-sized enterprises (SMEs) in the Stuttgart region and would like to find out what hurdles they face and what competencies are crucial to overcoming them. A brief definition: I define SMEs as companies with up to 5,000 employees and an annual turnover of up to 1 billion euros.
Description of Duration and Procedure	The interview will last around 30 minutes, during which I will mainly ask open questions so that you can share your viewpoints openly and honestly. There are no right or wrong answers; your experience and opinion are important to me.
Reference to Consent Form	As already mentioned, the conversation will be recorded for later analysis and transcription. All data will be treated confidentially, and your statements will be anonymized and aggregated so that they cannot be traced back to you or the company. Do you agree and have you signed the consent form?
Unsolved Questions in Advance	Do you have any questions before we start the interview? If so, please feel free to ask them now.
Start of the Interview and Recording	Let us begin. I am starting the recording now. [Start recording]
Block 1: Background Information on the Person and Organization	
Introduction to the Block	Before we start, I have a few questions about you and the company you work for.

Person and Company	Please introduce yourself as a person and then continue with your professional position.
	Possible follow-up questions:
	• Sociodemographics
	  ○ In which age range do you position yourself: 21 or younger, 22-27, 28-35, 36-44, 45-52, 53-59, 60 or older?
	  ○ Which gender do you feel you belong to?
	• Professional position
	  ○ What is your current position at *[company]*?
	  ○ How did you get there?

	○ How long have you been working at *[company]*? ○ How much work experience do you have in your current position in years? Now, I would like to ask you to outline your company and your position. Possible follow-up questions: • How big is *[company]*? • What is the core business? • To which sector would you assign *[company]*?
Block 2: Company Assessment	
Introduction to the Block	Now, I would like to address the topic of digital transformation. What I mean by this is the introduction of digital technologies in companies. This can bring strategic shifts, such as a realignment of business processes, and organizational impacts, such as effects on corporate culture and the way teams work. An example is a restaurant introducing an online ordering system or a retailer launching an e-commerce platform. In this regard, I would like you to assess *[company]* in the context of digital transformation.
Positioning of the Company in the Context of Digital Transformation	Imagine an ideal organization transformed by digital technologies and capabilities that improve processes, engage talent across the organization, and drive new value-generating business models. Please rate *[company]* against that ideal on a scale of 1 to 10. Possible follow-up question: • What factors make you rank *[company]* in this way?
Block 3: Challenges	
Introduction to the Block	Now that you have categorized *[company]* in this context, I would like to explore this further.
Challenges of Digital Transformation	Where do you see barriers and challenges when it comes to digital transformation? Possible follow-up questions: • When you look at your company's overall challenges, where do you place digital transformation? • What are the most fundamental challenges and barriers? • What are the implications of digital transformation in your day-to-day work?
Block 4: Competencies	
Introduction to the Block	Having just talked about the challenges and factors that can hinder digital transformation, I would like to talk about what promotes digital transformation in the form of competencies. By competencies in this context, I mean an accumulation of knowledge (e.g., that AI systems collect and process user data), skills (e.g., the ability to perform specific processes to use digital tools such as MS Teams), and attitudes (certain

	mindsets that influence action, such as openness to new technologies). These can be developed over time.
Digital Competencies	In your opinion, which competencies are crucial for digital transformation and are needed to overcome the named barriers, master the challenges, and take advantage of digital transformation opportunities? Possible follow-up questions: • Which competencies do you, as a manager, rely on for yourself and why? • Which competencies do you consider to be the most important and why? Can you rank them according to their relevance? • How could these competencies be enhanced or developed if they are not yet present?
Block 5: Implications	
Introduction to the Block	I would now like to discuss how these competencies or the acquisition of them are to be placed in a bigger context.
Competitiveness and Resilience	Please describe to what extent you believe these competencies can contribute to a company's resilience and future viability. Possible follow-up question: • Do you believe that these can contribute to your attractiveness as a company and employer?
Learnings	If you examine the Stuttgart region, can you see how this context affects digital transformation in regional companies? Possible follow-up questions: • Are there benchmarks or best practice examples from the surrounding area that are considered pioneers or that you may be following yourself? • Do you see the region as a blocker or a catalyst for digital transformation? • Are there any points others can learn from the Stuttgart economic region?
Block 6: Final Questions	
Introduction to the Block	We have now concluded with the central questions of the interview.
Clarification of Last Questions	Is there anything we haven't covered that you think is crucial to better understanding SMEs' digital transformation, or is there anything else you would like to share with me?
End of Recording	I will stop the recording now. [Stop recording]
Off-topic Matters	Is there anything off-topic that has not been covered yet?
Conclusion *(Sample texts: Please do not read out loud)*	
Announcement of the End of the Interview and Thanks	We have reached the end of the interview. Thank you very much for your time and your valuable insights. You have helped me a lot.

Next Steps and Contact	If you are interested, I would be happy to contact you after the work is completed to send you an excerpt of the results. If you have any further questions or suggestions, please feel free to contact me at any time.
Snowball Recruiting Request	As I am still looking for participants, further contacts for possible interview partners would be very helpful.
Farewell	Goodbye.

Note. Developed by the author

Table 8
Interview Guide (German)

Einstieg *(Muster-Texte: Bitte nicht vorlesen)*	
Begrüßung, Bedanken und Vorstellung	Hallo und vielen Dank, dass Sie sich die Zeit für dieses Interview nehmen. Mein Name ist Leonie Gutemann und ich studiere Strategic Communication and Leadership an der Universidade Católica Portuguesa in Lissabon.
Kontext des Interviews und Umriss des Themas	Dieses Interview ist Teil meiner Masterarbeit, die ich in Kooperation mit dem Unternehmen P3 in Stuttgart schreibe. Wie bekannt, schreiten digitale Technologien immer weiter voran und stellen Unternehmen aller Größen und Branchen vor Herausforderungen. Ich interessiere mich in diesem Kontext dafür, was dies für kleine und mittelständische Unternehmen (KMU) im Raum Stuttgart bedeutet und möchte herausfinden vor welchen Hürden diese stehen und welche Kompetenzen entscheidend sind, um diese zu überwinden. Kurz zur Definition: Als KMU definiere ich Unternehmen mit bis zu 5.000 Mitarbeitern und einem Jahresumsatz bis zu 1 Milliarde Euro.
Beschreibung Dauer und Ablauf	Das Interview wird etwa um die 30 Minuten dauern, in welchem ich Ihnen hauptsächlich offene Fragen stellen werde, damit Sie offen und ehrlich Ihre Standpunkte teilen können. Es gibt keine richtigen oder falschen Antworten, Ihre Erfahrung und Meinung sind mir wichtig.
Bezugnahme auf Einwilligungserklärung	Wie bereits beschrieben, wird das Gespräch aufgezeichnet, um es im Nachgang zur Analyse erneut anhören zu können und zu verschriftlichen. Alle Daten werden vertraulich behandelt sowie Ihre Aussagen anonymisiert und aggregiert, sodass diese nicht auf Sie oder auf das Unternehmen zurückgeführt werden können. Sind sie damit einverstanden und haben die Einwilligungserklärung unterschrieben?
Offene Fragen vorab	Haben Sie vor Beginn des Interviews noch offene Fragen? In diesem Fall können Sie diese gerne jetzt stellen.
Start des Interviews und Tonaufnahme	Dann lass uns anfangen. Ich starte jetzt die Aufnahme. [Aufnahme starten]
Block 1: Hintergrundinformationen zur Person und Organisation	
Einführung in den Block	Bevor wir anfangen, habe ich ein paar Fragen zu Ihnen und zum Unternehmen, in dem Sie arbeiten.

Person und Unternehmen	Zuerst würde ich Sie bitten sich einmal als Person vorzustellen und dann zu Ihrer beruflichen Position überzuleiten.
	Mögliche Rückfragen:
	• Soziodemographie
	  ○ In welcher Altersgruppe befinden Sie sich: 21 oder jünger, 22-27, 28-35, 36-44, 45-52, 53-59, 60 oder älter?
	  ○ Welchem Geschlecht fühlen Sie sich zugehörig?
	• Berufliche Position
	  ○ Wie lautet Ihre derzeitige Position bei *[Unternehmen]*?

	○ Wie sind Sie dort hingekommen? ○ Wie lange arbeiten Sie schon bei *[Unternehmen]*? ○ Wie viel Arbeitserfahrung haben Sie in Ihrer aktuellen Position insgesamt in Jahren? Nun würde ich Sie bitten nach Ihrer Person und Position einmal *[Unternehmen]* zu umreißen. Mögliche Rückfragen: • Wie groß ist *[Unternehmen]*? • Was ist das Kerngeschäft? • Welcher Branche würden Sie *[Unternehmen]* zuordnen?
Block 2: Unternehmensbewertung	
Einführung in den Block	Nun würde ich mich gerne dem Thema digitaler Transformation zuwenden. Was ich damit meine, ist die Einführung digitaler Technologien in Unternehmen. Diese kann strategische Veränderungen, wie eine Neuausrichtung von Geschäftsprozessen, und organisatorische Auswirkungen, wie Auswirkungen auf die Unternehmenskultur und die Art wie Teams arbeiten, mit sich bringen. Ein Beispiel ist ein Restaurant, das ein Online-Bestellsystem oder ein Einzelhandel, der eine E-Commerce-Plattform einführt. Hierzu hätte ich gerne von Ihnen eine Einschätzung von *[Unternehmen]* im Kontext digitaler Transformation.
Einordnung Unternehmen im Kontext digitaler Transformation	Stellen Sie sich ein ideales Unternehmen vor, das durch digitale Technologien und Kapazitäten umgestaltet wird, die Prozesse verbessern, Talente im gesamten Unternehmen einbinden und neue, wertschöpfende Geschäftsmodelle fördern. Bitte bewerten Sie *[Unternehmen]* anhand dieses Ideals auf einer Skala von 1 bis 10. Mögliche Rückfrage: • Welche Faktoren lassen Sie *[Unternehmen]* so einordnen?
Block 3: Herausforderungen	
Einführung in den Block	Nachdem Sie *[Unternehmen]* in diesem Kontext eingeordnet haben, würde ich dem gerne genauer nachgehen.
Herausforderung digitale Transformation	Wo sehen Sie Barrieren und Herausforderungen beim Thema digitaler Transformation? Mögliche Rückfragen: • Wenn Sie die gesamten Herausforderungen des Unternehmens betrachten, wo ordnen Sie digitale Transformation ein? • Wo liegen die grundlegendsten Herausforderungen und Barrieren? • Welche Implikationen bringt digitale Transformation in Ihrem Arbeitsalltag?
Block 4: Kompetenzen	
Einführung in den Block	Nachdem wir gerade darüber gesprochen haben, wo Herausforderungen liegen sowie welche Faktoren hemmend gegenüber digitaler

	Transformation wirken können, würde ich gerne darauf zu sprechen kommen, was digitale Transformation fördert, in Form von. Unter Kompetenzen in diesem Kontext verstehe ich eine Ansammlung von Wissen (z.B., dass KI Systeme Nutzerdaten sammeln und verarbeiten), Fähigkeiten (z.B. die Fähigkeit bestimmte Prozesse ausführen zu können, digitale Tools, wie MSTeams, nutzen zu können) und Einstellungen (bestimmte Mindsets die das Handels beeinflussen, wie beispielsweise Offenheit gegenüber neuen Technologien). Diese werden im Laufe der Zeit entwickelt.
Digitale Kompetenzen	Welche Kompetenzen, sind Ihrer Ansicht nach für digitale Transformation entscheidend und werden benötigt, um gerade genannte Barrieren zu überwinden, die Herausforderungen zu meistern und Chancen digitaler Transformation zu nutzen? Mögliche Rückfragen: • Auf welche Kompetenzen setzen Sie, als Führungskraft, für sich selbst und warum? • Welche Kompetenzen werden von Ihnen als am wichtigsten angesehen und warum? Können Sie diese in Bezug auf ihre Relevanz einstufen? • Wie könnte man diese Kompetenzen stärken oder entwickeln, wenn sie noch nicht vorhanden sind?
Block 5: Implikationen	
Einführung in den Block	Nun würde ich gerne dazu zu sprechen kommen, wie diese Kompetenzausstattung in einem größeren Kontext einzuordnen ist.
Wettbewerbsfähigkeit und Resilienz	Bitte beschreiben Sie, inwiefern Sie glauben, ob diese Kompetenzen in die Resilienz und Zukunftsfähigkeit des Unternehmens einzahlen können. Mögliche Rückfrage: • Glauben Sie, dass diese zur Attraktivität als Unternehmen und Arbeitgeber beitragen können?
Schlussfolgerungen	Wenn Sie die Region Stuttgart betrachten, können Sie erkennen, inwiefern sich dieser Kontext auf die digitale Transformation in den regionalen Unternehmen auswirkt? Mögliche Rückfragen: • Gibt es einen Benchmark oder Best Practice Beispiele aus der Umgebung, welche als Vorreiter gelten oder an welchen Sie sich evtl. selbst orientieren? • Sehen Sie die Region eher als hemmend oder als Katalysator für digitale Transformation? • Und gibt es eventuell Punkte, die andere von dem Wirtschaftsraum Stuttgart lernen können?
Block 6: Letzte Fragen	
Einführung in den Block	Das waren die Hauptfragen des Interviews.

Klärung letzter Fragen	Gibt es etwas, das wir noch nicht abgedeckt haben, von dem Sie aber denken, dass es entscheidend ist, um die digitale Transformation von KMU besser zu verstehen oder gibt es sonst noch etwas, das Sie gerne mit mir teilen möchten?
Ende der Aufnahme	Ich stoppe jetzt die Aufnahme. [Aufnahme stoppen]
Off-topic Themen	Gib es Dinge, die für Sie off-topic noch offen sind?
Abschluss *(Muster-Texte: Bitte nicht vorlesen)*	
Ankündigung Ende des Interviews und Bedanken	Wir haben das Ende des Interviews erreicht. Vielen Dank für Ihre Zeit und Ihre wertvollen Einblicke. Sie haben mir sehr weitergeholfen.
Weiterer Verlauf und Kontakt	Wenn Sie interessiert sind, kontaktiere ich Sie gerne nach Abschluss der Arbeit, um Ihnen einen Auszug der Ergebnisse zu senden. Wenn Sie weitere Fragen oder Anregungen haben, können Sie mich gerne jederzeit kontaktieren.
Schneeball-Recruiting Anfrage	Da ich weiterhin auf der Suche nach Teilnehmenden bin, würden mir weitere Kontakte für mögliche Interviewparter:innen sehr weiterhelfen.
Verabschiedung	Auf Wiedersehen.

Note. Developed by the author

Appendix E: Coding Guide

Table 9
Coding Guide

	Subcategory A	Subcategory B	Definition	Example	Coding Rule
Digital Maturity Stage	Classification	Early	*Text passages in which the interviewee classifies the company's digital maturity stage on a scale of 1-10 in the first third.*	Interview 14 English transcript: p. 12, line 456; German transcript: p. 13, l. 474	*Code text passages that classify the company's digital maturity level on a scale from 1-10 in the first third.*
		Developing	*Text passages in which the interviewee classifies the company's digital maturity stage on a scale of 1-10 in the second third.*	Interview 13 English transcript: p. 3, l. 100; German transcript: p. 3, l. 106	*Code text passages that classify the company's digital maturity level on a scale from 1-10 in the second third.*
		Maturing	*Text passages in which the interviewee classifies the company's digital maturity stage on a scale of 1-10 in the top third.*	Interview 12 English transcript: p. 3, l. 111; German transcript: p. 4, line 118	*Code text passages that classify the company's digital maturity level on a scale from 1-10 in the top third.*
	Factors	Adaptability	*Text passages that refer to an organization's ability to adapt to changes associated with digital*	Interview 10 English transcript: p. 5 ll. 157-165; German transcript: p. 5, ll. 170-180	*Code text passages that discuss the organization's adaptability associated with digital transformation to*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		transformation, outlined to determine digital maturity.		*determine digital maturity.*
	Communication and collaboration	*Text passages that refer to the use of digital tools and strategies that facilitate the exchange of information and teamwork, outlined to determine digital maturity.*	Interview 1 English transcript: pp. 5-6, ll. 193-191; German transcript: p. 6, ll. 203-206	*Code text passages that discuss the use of digital tools that support information sharing and teamwork to determine digital maturity.*
	Processes	*Text passages that refer to digital workflows in an organization, outlined to determine digital maturity.*	Interview 7 English transcript: p. 4, ll. 130-131; German transcript: p. 4, line 138-140	*Code text passages that discuss digital workflows in an organization to determine digital maturity.*
	Strategy	*Text passages that refer to the strategic approach that an organization adopts in the context of digital transformation, outlined to determine digital maturity.*	Interview 14 English transcript: p. 13, ll. 476-478; German transcript: p. 13, ll. 493-496	*Code text passages that discuss strategic initiatives related to digital transformation to determine digital maturity.*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
	Management	*Text passages that refer to the management practices and leadership actions in the context of digital transformation, outlined to determine digital maturity.*	Interview 14 English transcript: p. 16, ll. 587-591; German transcript: p. 16, line 611-616	*Code text passages that discuss management practices and leadership actions in the context of digital transformation to determine digital maturity.*
	People and culture	*Text passages that refer to aspects of organizational culture and employees in the context of digital transformation, outlined determine digital maturity.*	Interview 12 English transcript: p. 4, ll. 147-149; German transcript: p. 5, line 156-158	*Code text passages that discuss organizational culture and employees in the context of digital transformation to determine digital maturity.*
	Technology	*Text passages that refer to the tools and systems that an organization implements in the context of digital transformation, outlined to determine digital maturity.*	Interview 6 English transcript: p. 8, ll. 277-282; German transcript: pp. 8-9, ll. 301-308	*Code text passages that discuss the implementation of tools and systems in the context of digital transformation to determine digital maturity.*
	Products or services	*Text passages that refer to the introduction of new products or*	Interview 20 English transcript: p. 3, ll. 86-90;	*Code text passages that discuss the introduction of new products or*

	Subcategory A	Subcategory B	Definition	Example	Coding Rule
			services through digital technologies, outlined to determine digital maturity.	German transcript: p. 3, line 96-100	*services through digital technologies to determine digital maturity.*
Digital Transformation Challenges and Barriers	Micro	Communication and collaboration	*Text passages that refer to how digital transformation influences the ways in which individuals and teams share information and work together within an organization.*	Interview 10 English transcript: p. 9, ll. 309-312; German transcript: p. 9, ll. 337-340	*Code text passages that discuss how digital transformation influences the ways in which individuals and teams share information and work together within an organization.*
		People	*Text passages that refer to personal attitudes, skills, and behaviors that impact the adoption and implementation of digital technologies within an organization.*	Interview 13 English transcript: p. 4, ll. 134-136; German transcript: p. 4, ll. 143-146	*Code text passages that discuss individual (re)actions, resistance, acceptance, skills, or any personal contributions to or impacts on digital transformation processes.*
	Meso	Expected benefits	*Text passages that refer to the anticipated advantages or improvements*	Interview 3 English Transcript: p. 4, ll. 140-143; German	*Code text passages that discuss anticipated advantages or improvements*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		through digital transformation initiatives.	transcript: pp. 4-5, ll. 155-158	*through digital transformation initiatives.*
	Value creation	*Text passages that refer to an organization's core processes and business and how they relate to the digital transformation in the organization.*	Interview 12 English transcript: p. 16, ll. 606-608; German transcript: p. 18, ll. 667-669	*Code text passages that discuss the connection between the core processes of an organization and the business and digital transformation within the organization.*
	Resources	*Text passages that refer to the availability of financial means, skilled personnel, and time required to support and implement digital transformation within an organization.*	Interview 3 English transcript: p. 15, ll. 568-569; German transcript: p. 17, ll. 624-626	*Code text passages that discuss financial constraints, lack of qualified personnel, time limitations, or other resource constraints that impact digital transformation within an organization.*
	Management and strategy	*Text passages that refer to challenges in corporate leadership and strategic orientation that impact digital*	Interview 20 English transcript: p. 4, ll. 125-127; German transcript: p. 4, ll. 138-141	*Code text passages that discuss challenges in corporate leadership and strategic orientation that*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		transformation within the organization.		*impact digital transformation within the organization.*
	Organizational structure	*Text passages that refer to organizational roles, hierarchies, IT infrastructures, and processes, especially as they relate to the challenges and implementation of digital initiatives.*	Interview 2 English transcript: p. 5, ll. 177-180; German transcript: p. 5, ll. 189-192	*Code text passages that discuss organizational roles, hierarchies, IT infrastructures, and processes, especially as they relate to the challenges and implementation of digital initiatives.*
	Culture	*Text passages that refer to the shared values, beliefs, and practices within an organization that influence its acceptance and implementation of digital transformation.*	Interview 15 English transcript: p. 13, ll. 465-466; German transcript: p.14, ll. 502-504	*Code text passages that contain aspects of the shared values, beliefs, and practices within an organization that influence its acceptance and implementation of digital transformation.*
Macro	Technological advancements	*Text passages that refer to the challenges and experiences related to the pace of technological*	Interview 10 English transcript: p. 23 ll. 854-856; German transcript: pp.	*Code text passages that discuss the challenges and experiences related to the pace of technological*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		change and flood of information.	24-25, ll. 928-930	*change and flood of information.*
	Data protection and cyber security	*Text passages that refer to practices and challenges associated with data security in the context of digital transformation.*	Interview 15 English transcript: p. 8, line 285; German transcript: p.9, ll. 304-305	*Code text passages that discuss data security concerns in the context of digital transformation.*
	Industry and market dynamics	*Text passages that refer to industry and market dynamics as external factors influencing an organization's digital transformation efforts.*	Interview 2 English transcript: p. 10, ll. 346-348; German transcript: p. 10, ll. 372-376	*Code text passages that contain any references to how industry and market specifications impact the organization's approach to and pace of digitalization.*
	Legal and regulatory	*Text passages that refer to legal and regulatory challenges, requirements, or changes that impact an organization's digital transformation.*	Interview 12 English transcript: p. 5, ll. 188-189; German transcript: p. 6, ll. 201-203	*Code text passages that discuss legal and regulatory challenges, requirements, or changes that impact an organization's digital transformation.*

	Subcategory A	Subcategory B	Definition	Example	Coding Rule
Digital Transformation Competencies	Leadership	Guiding employees through digital transformation	*Text passages that describe a leader's role in supporting and guiding employees through the challenges associated with digital transformation.*	Interview 17 English transcript: p. 16, ll. 592-594; German transcript: p. 17, ll. 636-638	*Code text passages that discuss the actions, strategies, or behaviors of leaders in helping employees adapt to and embrace digital transformation.*
		Having a clear vision and strategic orientation	*Text passages that refer to the importance of having a well-defined vision and strategic direction for digital transformation.*	Interview 7 English transcript: p. 4, ll. 145-148; German transcript: p. 5, ll. 155-159	*Code text passages that highlight the significance of clear leadership vision and strategic planning in the context of digital transformation.*
		Encouraging an open error culture	*Text passages that describe the promotion of a culture where mistakes are accepted as part of the learning process.*	Interview 10 see English transcript: p. 12, ll. 458-461; German transcript p. 13, ll. 501-504	*Code text passages that discuss creating an environment where people feel safe to make and learn from mistakes.*
		Leading at eye level	*Text passages that refer to leadership styles that emphasize equality, empathy, and open dialogue*	Interview 12 English transcript: p. 11, ll. 389-392; German transcript: p. 12, ll. 424-427	*Code text passages that describe leadership practices involving trust, empathy, and collaborative decision-making.*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		between leaders and employees.		
	Promoting diversity	*Text passages that highlight the importance of diverse teams in digital transformation.*	Interview 3 English transcript: p. 6, ll. 210-214; German transcript: pp. 6-7, ll. 233-237	*Code text passages that discuss the benefits of demographic, experiential, and cognitive diversity in fostering innovation and problem-solving.*
Self-management	Openness to technological change	*Text passages that refer to the openness to engage with and embrace new technologies.*	Interview 4 English transcript: p. 11, ll. 415-417; German transcript: p. 12, ll. 461-464	*Code text passages that discuss attitudes and behaviors demonstrating openness to adopting new technological solutions.*
	Willingness for lifelong learning about digital technologies	*Text passages that emphasize continuous learning and competence development in digital technologies.*	Interview 10 English transcript: p. 12, ll. 426-443; German transcript: pp. 12-13, ll. 465-485	*Code text passages that highlight the importance of ongoing education and training in digital skills.*
	Flexibility and adaptability in a rapidly changing landscape	*Text passages that describe the ability to adapt to changes and evolving circumstances.*	Interview 14 English transcript: p. 22, ll. 840-849; German	*Code text passages that discuss the importance of flexibility and adaptability in response to digital*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
			transcript: p. 24, ll. 891-901	*transformation challenges.*
	Curiosity and interest in technological innovations	*Text passages that emphasize curiosity and a proactive attitude towards exploring new technologies.*	Interview 15 English transcript: p. 16, ll. 608-612; German transcript: p. 18, ll. 653-658	*Code text passages that describe behaviors and attitudes that encourage exploration and experimentation with new digital tools and technologies.*
	Endurance to keep going	*Text passages that refer to perseverance in the face of challenges and setbacks.*	Interview 10 English transcript p. 21, ll. 805-808; German transcript p. 23, ll. 875-878	*Code text passages that discuss the importance of maintaining effort and determination throughout the digital transformation process.*
Technological	Understanding of technological basics	*Text passages that describe the fundamental knowledge of current technologies and their applications.*	Interview 3 English transcript: p. 10, ll. 360-363; German transcript: p. 11, ll. 397-400	*Code text passages that discuss the need for a basic understanding of digital tools, algorithms, cloud services, and analytics.*
Problem solving	Identifying needs and technological responses	*Text passages that describe the ability to evaluate current processes and identify areas*	Interview 13 English transcript: p. 14, ll. 499-503; German	*Code text passages that discuss recognizing inefficiencies and proposing*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		for technological improvement.	transcript: p. 14, ll. 536-540	*appropriate digital solutions.*
	Creatively using digital technology	*Text passages that describe innovative uses of digital technology to solve problems.*	Interview 7 English transcript: p. 13, ll. 475-477; German transcript: p. 14, ll. 517-520	*Code text passages that highlight creative applications of technology in improving processes or solving challenges.*
	Identifying digital competence gaps	*Text passages that refer to recognizing areas where digital competencies need to be developed.*	Interview 13 English transcript: p. 15, line 539; German transcript: pp. 15-16, ll. 579-580	*Code text passages that discuss identifying and addressing gaps in digital competencies.*
Communication and collaboration	Communication via digital technologies	*Text passages that emphasize effective communication through digital tools.*	Interview 20 English transcript: 290-293; German transcript: p. 9, ll. 328-331	*Code text passages that describe practices for clear and effective communication using digital platforms.*
	Collaboration through digital technologies	*Text passages that highlight the use of digital tools to enhance collaboration within and between teams.*	Interview 12 English transcript: p. 14, ll. 505-507; German transcript: p. 15, ll. 555-558	*Code text passages that discuss methods of using digital tools for teamwork and collaboration.*
	Netiquette	*Text passages that describe*	Interview 9 English	*Code text passages that discuss the*

	Subcategory A	Subcategory B	Definition	Example	Coding Rule
			appropriate behavior in digital communication and collaboration.	transcript: p. 17, ll. 621-631; German transcript: p. 18, ll. 686-696	*importance of digital etiquette and respectful online interactions.*
	Safety	Protecting personal data and privacy	*Text passages that refer to measures and awareness regarding data protection and privacy.*	Interview 19 English transcript: p 14, ll. 517-520; German transcript p. 15, ll. 555-558	*Code text passages that discuss practices and strategies for ensuring data security and protecting privacy.*
		Protecting health and well-being	*Text passages that emphasize the importance of physical and psychological health in digital work environments.*	Interview 4 English transcript: pp. 14-15, ll. 540-544; German transcript: p. 16, ll. 606-610	*Code text passages that discuss maintaining health and well-being in the context of digital work.*
	Promotion of Digital Transformation Competencies		*Text passages that describe methods and strategies for developing and promoting digital competencies within organizations.*	Interview 15 English transcript: p. 19, ll. 697-708; German transcript: p. 20, ll. 751-755	*Code text passages that discuss initiatives, training programs, and resources aimed at enhancing digital skills.*
Implications	Competitiveness and resilience	Overcoming other challenges	*Text passages that describe how digital transformation helps organizations*	Interview 10 English transcript: p. 10, ll. 354-356; German transcript: pp.	*Code text passages that discuss the role of digital technologies in overcoming significant*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		address broader challenges.	10-11, ll. 386-389	*organizational challenges.*
	Adaptability	*Text passages that highlight the importance of adaptability in maintaining competitiveness and resilience.*	Interview 6 English transcript: p. 19, ll. 699-703; German transcript: p. 20, ll. 762-766	*Code text passages that describe how adaptability to digital transformation supports organizational resilience and competitiveness.*
	Stability	*Text passages that discuss how digital transformation competencies contribute to organizational stability and long-term success.*	Interview 15 see English transcript: p. 22, ll. 822-829; German transcript p. 24, ll. 883-891	*Code text passages that highlight the role of digital skills in ensuring consistent and stable organizational performance.*
	Automation and efficiency increase	*Text passages that emphasize the benefits of automation and increased efficiency through digital transformation.*	Interview 3 English transcript: p. 5, ll. 166-168; German transcript: p. 5, ll. 183-185	*Code text passages that discuss how automation and digital tools contribute to operational efficiency and cost savings.*
	Relationship management with stakeholders	*Text passages that describe the importance of digital competencies in managing*	Interview 8 English transcript: p. 17, ll. 636-368; German	*Code text passages that discuss the impact of digital transformation on stakeholder communication*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		relationships with stakeholders, i.e., customers and suppliers.	transcript: p. 19, ll. 701-703	*and relationship management.*
Stuttgart region learnings	Interplay between different company types	*Text passages that describe the interaction between various types of companies in the Stuttgart region and its impact on digital transformation.*	Interview 20 English transcript: p. 10, ll. 381-385; German transcript: p. 12, ll. 431-436	*Code text passages that discuss the dynamics between large corporations, SMEs, and other business types in the context of digitalization.*
	Promoting innovation through regional initiatives	*Text passages that highlight the role of regional initiatives in fostering innovation and digital transformation.*	Interview 1 English transcript: p. 21, ll. 779-788; German transcript: p. 23, ll. 855-866	*Code text passages that discuss the influence of local networks, educational institutions, and political measures on regional digitalization efforts.*
	Regional differences	*Text passages that describe the differences in digital transformation progress between urban and rural areas.*	Interview 14 English transcript: p. 36, ll. 1376-1382; German transcript: p. 39, ll. 1482-1489	*Code text passages that discuss how geographic location affects digital transformation and innovation.*
	Cultural characteristics	*Text passages that refer to the*	Interview 12 English	*Code text passages that discuss the*

Subcategory A	Subcategory B	Definition	Example	Coding Rule
		cultural attitudes and characteristics influencing digital transformation.	transcript: p. 16, ll. 602-607; German transcript: p. 18, ll. 662-669	*impact of conservative, value-focused, and cautious cultural attitudes on digital transformation efforts.*

Note. Developed by the author