

# DIGITAL TRANSFORMATION TO STRENGTHEN SME RESILIENCE AND COMPETITIVENESS

Insights from the Stuttgart economic region

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## 1. 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.

## 2. 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.<sup>1</sup> 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<sup>2</sup>, and it is known as a process aiming to achieve improvements through the use of various technologies<sup>3</sup>. 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.<sup>4</sup>

However, managing the digital transformation process presents numerous challenges that require careful consideration and strategic action.<sup>5</sup> SMEs, in particular, face unique hurdles compared to larger corporations.<sup>6</sup> These companies are integral to the German economy and significantly contribute to employment, economic growth, and technological progress.<sup>7</sup> Therefore, they must develop competencies, including knowledge, skills, and attitudes<sup>8</sup>, to tackle these challenges and thrive in a constantly changing market environment.<sup>9</sup> Much of the previous research has focused mainly on large companies, leaving the specific difficulties of SMEs largely unexplored.<sup>10</sup> 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.<sup>11</sup> Moreover, the required competencies can vary depending on the context, such as company size and industry.<sup>12</sup> However, empirical validation in practice needs to be improved, as most existing studies have presented challenges and competencies primarily through literature reviews.<sup>13</sup>

<sup>1</sup> Lorch et al., 2023

<sup>2</sup> Trieu et al., 2023

<sup>3</sup> Vial (2019)

<sup>4</sup> Omrani et al., 2022

<sup>5</sup> Gferer et al., 2021; Daugherty et al., 2021; Sweet et al., 2023; Icks & Brink, 2023; Rittmann, 2023

<sup>6</sup> Aldrich & Auster, 1986; BarNir et al., 2003; Li et al., 2017

<sup>7</sup> bpb, 2021

<sup>8</sup> Vuorikari et al., 2022

<sup>9</sup> O'Reilly & Tushman, 2011

<sup>10</sup> Hausberg et al., 2019; Mai et al., 2023

<sup>11</sup> Fonseca & Picoto, 2020; Moroz, 2018

<sup>12</sup> Fonseca & Picoto, 2020; Slimane et al., 2022; Müller et al., 2024

<sup>13</sup> Wolff et al., 2019; Müller et al., 2024

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.<sup>14</sup> 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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<sup>14</sup> Dispan et al., 2023

### 3. 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 ( $\leq 49$  employees and EUR 2 million annual turnover), three medium-sized ( $\leq 499$  employees and EUR 50 million annual turnover), and six upscale SMEs ( $\leq 5,000$  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<sup>15</sup>, enabling systematic and traceable identification of central themes and patterns in participants' statements<sup>16</sup>. Recognized theoretical frameworks<sup>17</sup> placed the empirical data in a broader theoretical context. Throughout the process, great emphasis was placed on adhering to quality criteria and ethical standards.

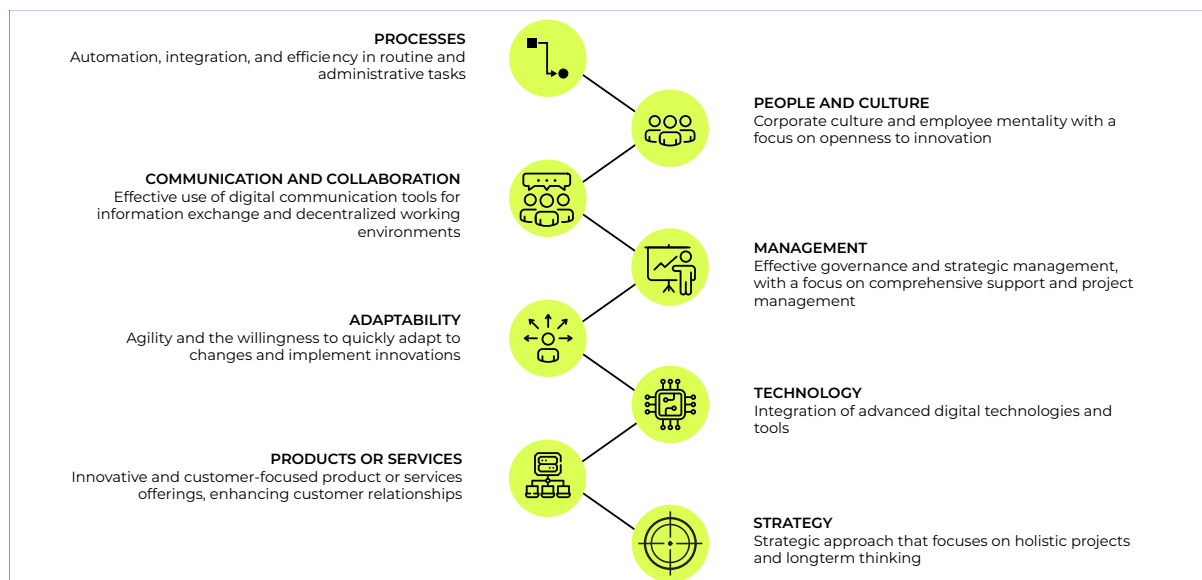
<sup>15</sup> Kuckartz, 2012; Mayring, 2015

<sup>16</sup> Corbin & Strauss, 1998

<sup>17</sup> Geels & Kemp, 2007; Vuorikari et al., 2022

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 constructing	Developing

**Table 1:** Overview of the organizations surveyed, sorted by company size



**Figure 1:** Factors for determining the digital maturity level

## 4. Key Findings

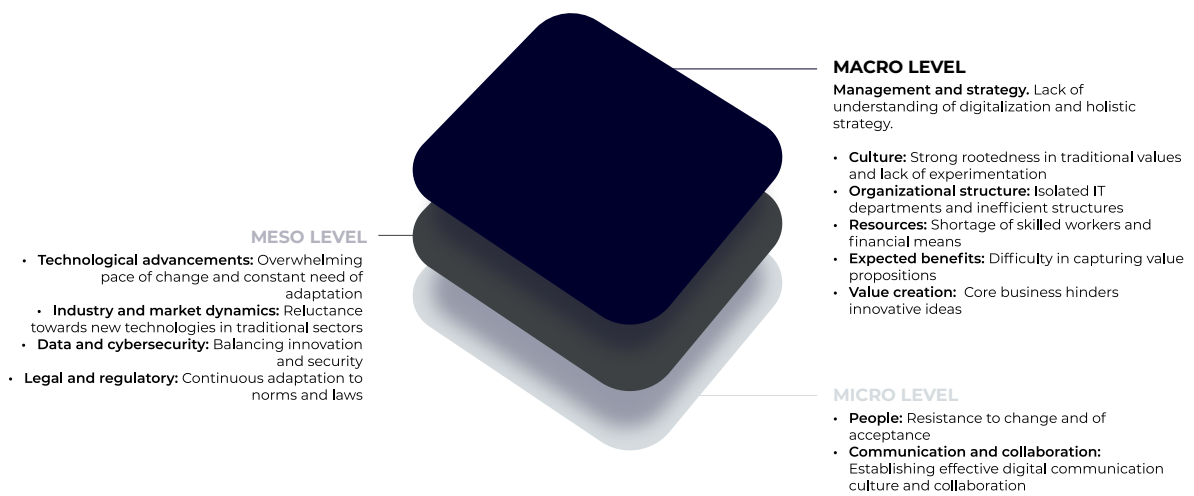
**Challenges in the context of digital transformation were identified at macro, meso, and micro levels (see Figure 2).**

**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 2:** 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 3: 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.



## 5. Practical Recommendations

The findings of this study derived practical recommendations for SMEs, particularly in the Stuttgart economic region and beyond. By implementing these recommendations, SMEs can 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.

## 6. 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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