The interplay of digital transformation and employee competency: A design science approach

Christine Blanka a,*, Barbara Krumay b, David Rueckel b,c

a Institute for Entrepreneurship, Johannes Kepler University Linz, Altenberger Straße 69, 4040 Linz, Austria
b Institute of Business Informatics - Information Engineering, Johannes Kepler University Linz, Altenberger Straße 69, Linz 4040, Austria
c Department Computer Science, University of Applied Sciences Technikum Wien, Hochschulstraße 6, 1200 Vienna, Austria

ARTICLE INFO

Keywords:
- Digitalization
- Digital transformation
- Intrapreneurship
- Employee competency

ABSTRACT

Businesses and academia alike agree upon the significant influence of digitalization on the business world. Hence, digital transformation is a very topical issue. While researchers underline that the movement toward digitalization is a challenge influencing various dimensions, studies to date have largely focused on the technological and organizational aspects of digitalization. Consequently, there is a gap in digital transformation concerning the role of human resources and employee competency. This paper adopts a human-centered view of digitalization at the intersection of digital and human transformation. Drawing on design science research (DSR), we developed a framework as an artifact that takes into account individual employee competency related to an organization’s level of digital transformation. As suggested by DSR, the framework was developed in iterations and refined after evaluation by various domain experts in academia and business. The final framework illustrates the interplay between the individual and organizational levels; in particular, employees’ transformation competency (intrapreneurial and digital competencies) driving digital transformation. Our findings suggest that the development of intrapreneurial competencies is dynamic. Based on an intrapreneurial journey, employee competencies function as triggers to reach the next level of digital transformation. As such, employee competency is crucial in enabling an organization’s transformation toward digitalization.

1. Introduction

Businesses have faced numerous challenges in integrating new technologies, so the importance of information technology (IT) and information systems (IS) has been widely researched (Legner et al., 2017; Martínez-Caro et al., 2020; Venkatraman, 1994). While the use of new technologies has been a perennial challenge, the impact of IT integration on business and its growing influence on almost all business dimensions is unique (Martínez-Caro et al., 2020). Digitalization has historically received a great deal of attention in IS research (e.g., Hess et al., 2016; Legner et al., 2017; Matt et al., 2015; Parviainen et al., 2017; Stolterman and Fors, 2004), and other disciplines, such as management research, have been catching up by emphasizing the technological dimension and its effect on business (e.g., Baraldi & Nadin, 2006; Kamalaldin et al., 2020; Øiestad & Bugge, 2014) or human resources (Gekara & Nguyen, 2018; Krzywczinski, 2017; Mizzi & Ramirez, 2003; Shakina et al., 2021; Van Laar et al., 2018). Prior research has noted that digitalization is a transformation rather than a technological challenge (Kane et al., 2015) and thus has focused on the process by which organizations transform toward digitalization (e.g., Annarelli et al., 2021). Digital transformation alters companies in a lasting way (Hess et al., 2016; Legner et al., 2017; Matt et al., 2015) and implies shifts in strategies, work processes, and employment (Aubert-Tarby et al., 2018; Elia et al., 2020; Yeow et al., 2018). The rapid development of technology forces established organizations to simultaneously foster the technological and strategic dimensions of digitalization and maintaining a competitive edge depends on both adopting the right digital technology and nurturing employee competencies to apply the technology.

Since employees convey both digital knowledge and the strategies for utilizing it, researchers have recognized human capital as an increasingly valuable resource in the context of digitalization (Colbert et al., 2016). Accepting employees as key actors changes their roles (Vial, 2019) and underlines that employees must possess far more than basic knowledge of computers. As digital transformation calls for “different mindsets and skill sets than previous waves of transformative technology” (Fitzgerald et al., 2014, p. 6), digital knowledge and the
The importance of the integration of competencies into strategy should therefore be researched further, with a particular focus on the companies' competencies. In addition, we offer a human-centered perspective on the competencies that are required for the transformation process. As already stated, the management literature has just begun to discuss digitalization (e.g., Sousa & Rocha, 2019b) and although a broad body of knowledge on this topic already exists in the field of IS research (e.g., Andal-Ancion et al., 2003; Legner et al., 2017; Parvaiinen et al., 2017; Vial, 2019), research so far has not linked employee competencies to strategic management and digitalization. Our work narrows the gap by shedding light on the link between human capital (in the form of competency) and transformation and is positioned at the intersection of digitalization and management. We identify human capital as a crucial resource in any firm and examine employee competencies. By providing an in-depth literature review from IS research and management, we build a base for designing a framework that combines both fields.

By applying DSR, our research goal is to build and evaluate a framework that takes into account individual employee competency in the context of an organization’s digital transformation. The questions of how to define digitalization and digital transformation, which individual employee competencies exist, and what roles those competencies play in the context of digital transformation, guided our research. We incorporated them into our overarching research question: “Which individual employee competencies enable the digital transformation of companies?” Based on previous research on the competencies required for digital transformation (Kohtamäki et al., 2020), we propose that employees can be enabled to apply their knowledge and hence influence the transformation. In contrast to previous research, which has concentrated on the influence of digitalization on employees, we focus on the role of employee competency in enabling digital transformation. Hence, we follow a different direction of effect and take into account a specific transformation competency that integrates intrapreneurial competency with generic digital competency. The contributions of this research are threefold. First, our research offers a human-centered view of digital transformation and provides insights into employees’ digital competencies. Second, based on a DSR approach (Iverson et al., 2004; Peffers et al., 2007), we have developed a framework at the intersection of digitalization and human capital. This framework is the main contribution of this research, as it closes the gap between digitalization and human resources by integrating digital and intrapreneurial competencies. Third, through evaluating our framework based on interviews with various domain experts in research and practice, we offer a holistic perspective. By demonstrating how employee competency can drive organizations’ transformation, we narrow the gap on employee competencies in the context of digital transformation and point out the interplay of human and digital transformation.

The remainder of this paper is structured as follows. First, we provide an overview of the main concepts and existing frameworks in the relevant domains. In addition, we offer a human-centered perspective on digitalizing business, and discuss the intersection of employees’ intrapreneurial competencies and digital transformation. Next, we illustrate our research approach and methodology. This is followed by a presentation of our findings, which is divided into a description of our initial framework and the expert evaluation that resulted in the redesigned framework. We conclude by discussing the theoretical contributions and practical implications of our research, its limitations, and our suggestions for future research.

2. Literature review

2.1. Digitalization, digital transformation and the business context

As the digitalization concept is anchored in various disciplines (Legner et al., 2017) such as IS, communications engineering, computer science, management, and even economics and political science, the use of the term varies (Rattan, 1984; Vial, 2019; Waldigolz, 2017). From the IS perspective, Hess (2019) categorized diverse interpretations of digitalization, depending on whether the (technical) process or procedure of converting analog into digital objects (Goblick & Holsinger, 1967; Tilsen et al., 2010) or “the manifold sociotechnical phenomena and processes of adopting and using […] technologies in broader individual, organizational, and societal contexts” (Legner et al., 2017, p. 301) are considered. While digitalization is employed to convert analog information into digital objects, digital transformation goes further and refers to the application of new digital technologies to grow, improve, or expand a company. Consequently, such activities lead to transformations in corporate structure or key business functions and processes (Hess et al., 2016; Matt et al., 2015; Verhoef et al., 2021). As these involve different levels of business functions and may lead to substantial changes, Matt et al. (2015) and Andal-Ancion et al. (2003) argued that transformations on different levels of abstraction should be operationalized through a digital transformation strategy, and hence integrated into a holistic managerial concept.

Although the utilization of innovative technologies was key to all phases of industrialization, awareness of the necessity of transformation is a more recent phenomenon. Venkatraman (1994) was among the first to use the term transformation when presenting a type of maturity model consisting of different levels of IT-enabled business transformation. He describes the lower stages of the model as evolutionary and the higher stages as revolutionary, pointing to substantial changes. Therefore, technologies influence the development of companies, but conversely, companies and their choice of business model also influence how technologies are monetized (Annarelli et al., 2021; Baden-Fuller & Haefliger, 2013). From this point of view, the digital transformation process is an inductive framework (Vial, 2019) that identifies relationships between the use of digital technologies, disruptive phenomena (Karimi & Walter, 2015), and the response of organizations to digitalization (Verhoef et al., 2021).

Originally based in the technological realm and the IS field, research on digitalization has extended into the field of management as evident from a large number of special issues, e.g. in the fields of general management (Lanzolla et al., 2020), human resources (HR) (Holland & Bardol, 2016) or entrepreneurship (Berger et al., 2021), and from current calls for papers in various academic journals such as Technological Forecasting and Social Change, and the Strategic Entrepreneurship Journal. Taking the alignment of IT and business strategies (Henderson & Venkatraman, 1993) as a starting point, research has adopted an organizational perspective on the challenge of digitalizing businesses and the influence of digital technologies on companies. The existing literature is wide, ranging from digital value creation or digitalized products such as smart homes and platform issues (Huuberg et al., 2019; Nambisan, 2017), to research addressing the impact of digital issues (e.g., IT infrastructure, digital servitization, digital culture) on various business outcomes, such as business relationships, business models and value creation (Baraldi & Nadin, 2006; Kamalaldin et al., 2019).
2.2. Human-centered perspective on digitalization

The research mentioned above expands the understanding of how digital technologies influence organizations. Complementing this perspective, research focusing on the individual level investigates the influence of digitalization on human resources. It has become apparent that skills attributed to the use of ICT (information, media, and technology skills) have gained in importance. Subsumed as digital skills (e.g., OECD, 2016; Sousa & Rocha, 2019b; Van Laar et al., 2017) those skills complement the use of digital technologies, and together contribute to sustainable competitive advantage (Shakina et al., 2021). However, researchers stress that digital knowledge alone is not enough: the ability to apply it and understand possible opportunities is also crucial (Frank et al., 2019; Miozzi & Ramirez, 2003). Therefore, the development of human resources is central (Kohtamäki et al., 2020) as employees require a mix of skills to exploit the full potential of ICT. By transmitting digital knowledge and—through empowerment (Martínez-Caro et al., 2020)—contributing ideas to realize digital opportunities, employees’ roles (Vial, 2019; Watson, 2017) and also their required human capital, have changed.

Accordingly, digital skills “do not go far enough to explain the skills an individual must possess to exploit the full potential of ICT” (Van Laar et al., 2017, p. 578), and thus the spotlight is on the broader concept of employee competency. The main challenge in the field derives from the absence of a well-established definition of competency, leading to inconsistent use of the terms competence, competency, and skills (e.g., Mitchelmore & Rowley, 2010). We follow a behavioral approach, using the term competency to define various factors that characterize individual behavior (Le Deist & Winterton, 2005). Rooted in the work of McClelland (1973) and Boyatzis (1982), competencies are situationally defined, can change over time, and include elements such as traits, skills, knowledge, and motivation (Bird, 1995). In the last few decades, multidimensional competency approaches (Cheetham & Chivers, 1996) have gained in importance, as “a holistic typology is useful in understanding the combination of knowledge, skills and social competences that are necessary for particular occupations” (Le Deist & Winterton, 2005, p. 39). Consequently, we define competency as a construct describing individual behavior that integrates skills and knowledge, and results in superior performance.

As digitization is of strategic interest, both the distribution and the range of competencies within companies have changed. Whereas in the pre-digital era, it was primarily low-level employees in the relevant departments who used IT, CEOs today encounter digital technologies on a daily basis (Martínez-Caro et al., 2020). Top-level management required to recognize and evaluate the value of digital technologies and possible competitive advantage should possess at least basic digital competencies (Horlacher & Hess, 2016; Tumbas et al., 2017; Walchshofer & Riedl, 2017). Further, the range of vital competencies is broad, as employees should possess more general rather than specialist competencies to “overcome the narrow fragmentation of knowledge and nurture competences across disciplines” (Miozzi & Ramirez, 2003, p. 75). The limited research addressing digitalization and competency management (Butschan et al., 2019) shows that, in addition to cognitive competencies (which are crucial in dealing with change and innovation), process-based competencies are also prominent: proactiveness, self-responsibility, organizational thinking, and a global view of decision-making are integral to the call for more business-related issues and autonomy based on digitalization. The finding supports our assumptions that employees take an active role, and therefore will require competencies to complement digital ones.

Applying appropriate knowledge and skills in the business context (Man et al., 2002) in addition to digital expertise, justifies the central role of employees (e.g., Kane et al., 2015). Although IT is the main enabler of digitalization, the people involved are the key to its successful realization (Legner et al., 2017; Sambamurthy et al., 2003). Employee competencies merge digital knowledge and strategic issues (Colbert et al., 2016; Martínez-Caro et al., 2020), thus forming a crucial resource (Penrose, 1995; Peteraf, 1993; Wernerfelt, 1984). We also recognize a different direction of effect: Previous research in both the IS and management fields has largely emphasized technology as an enabler (e.g., Kane et al., 2015) and has investigated the influence of digitalization on human resources. In contrast, we assume that individuals are not only affected by digitalization but can actively shape it. The mix of digital and application-oriented competencies enables employees to take a proactive role in promoting digital transformation. In applying a human-centered perspective, we center our research on the human capital retained by individuals (Butschan et al., 2019; Sousa & Rocha, 2019b) and investigate the role of employee competencies in the context of digital transformation.

2.3. Intrapreneurial competency and digital transformation

To manage transformation, individuals “with a high willingness to learn, superior problem-solving capabilities, openness to change and the right expertise in dealing with digital transformation issues” (Butschan et al., 2019, p. 18) are a prerequisite for tackling the challenges evolving. The need for such competencies is not new and entrepreneurial thinking is required within existing organizations (Ámo, 2010; Antoncic & Hisrich, 2003). The idea that innovative employee behavior can influence company performance (Kuratko & Audretsch, 2013; Parker, 2011) underlines the central role of entrepreneurial employees or intrapreneurs (Martiarena, 2013; Moriano et al., 2014; Pinchot, 1985). Characterized by thinking across organizational boundaries, behaving proactively, promoting corporate strategies, and supporting attaining competitive advantage (Blanka, 2019; Guerrero & Peña-Legazkue, 2013; Pinchot, 1985; Zhu et al., 2014), they are initiators of activities (Ámo & Kolvereid, 2005; Rigterling & Weitzel, 2013; Sinha & Srivastava, 2013) and might therefore also fulfill an important role in the context of digital transformation.

Although the importance of intrapreneurs is undisputed, few studies have addressed their competencies (Vargas-Halabí et al., 2017). Research on intrapreneurial competency has to date reported the similarities between entrepreneurs and intrapreneurs (Bager et al., 2010; Martiarena, 2013) and in reducing the difference between the two to the work context (Baruah & Ward, 2015; Camelo-Ordaz et al., 2012), mainly made use of the entrepreneurial competency field. Numerous authors provide a broad basis for a range of entrepreneurial competencies (Loué & Baronet, 2012): Chandler and Jansen (1992) originated a well-established and often-used typology of entrepreneurial competency: entrepreneurial; managerial; and technical-functional. Entrepreneurial competency calls for an ability to recognize business and market opportunities, while the managerial form demands conceptual and interpersonal skills, and the technical form requires an ability to apply field-specific tools and procedures (Mitchelmore & Rowley, 2010). Similarly, the practice-oriented literature defines various competencies. Rae (2007), for instance, listed management competencies and corresponding entrepreneurial competencies; the latter being personal organization, interpersonal interaction, investigating opportunity, applying innovation, strategic planning, and market development. Like researchers, policymakers have recognized the great potential of an entrepreneurial workforce. The European Commission established the EntreComp framework (Bacigalupo et al., 2016) to enhance human capital and address future challenges. The EntreComp framework was designed as a proposal for a conceptual model and mainly reflects government policy agendas. It defines entrepreneurial competency as necessary for value creation in various contexts, including intrapreneurship. Overall, this line of research provides a foundation for intrapreneurship competencies but does not narrow the existing research gap. Therefore, we also have to draw on entrepreneurial...
competencies—those not related to being an entrepreneur, but more general to entrepreneurial thinking and action—to focus on the required employee competencies for digital transformation.

Only a few studies have dealt with intrapreneurial competency. Vargas-Halabi et al. (2017) developed a scale to measure intrapreneurial employee competency, and emphasized the following factors in characterizing intrapreneurs’ competency: promoting opportunities; proactivity; flexibility; drive; and risk-taking. Those factors have certain parallels with the entrepreneurial competencies mentioned above, such as recognizing opportunities, taking the initiative, and innovativeness (Mitchelmore & Rowley, 2010). We assume that not only are general digital competencies necessary, but also intrapreneurial ones, not only to manage the effects of digitalization but also to proactively shape the associated transformation. More specifically, as digitalization requires new processes and strategies, the process of digital transformation calls for flexibility, continuous exchange and proactivity, and opens organizational boundaries (Venkatraman, 1994). Employees are thus asked to step outside of their original roles (Moriano et al., 2012; Yeow et al., 2018) and engage in additional tasks and processes beyond pure digital expertise. That requirement indicates the importance of digital competency in transferring digital knowledge and implementing innovations. Nevertheless, specific competencies are necessary to actively contribute to transformation. Gekara and Nguyen designated those additional competencies: “critical thinking, creativity, problem solving and analytical skills, mathematics, verbal communication and interpersonal skills, plus an overall digital awareness and mind-set” (Gekara & Nguyen, 2018, p. 222). That perspective is consistent with our focus on linking digital and application-oriented competency and underlines employee competency, and emphasized the following factors in characterizing intrapreneurs—those not related to being an entrepreneur, but more general to entrepreneurial thinking and action—to focus on the required employee competencies for digital transformation.

3. Methods

3.1. The design science research approach

We developed a conceptual framework based on IS and management research using an approach revolving around designing and evaluating. By relating digital transformation and employee competencies, and conducting interviews with various domain experts to evaluate, redesign, and refine the framework, we adopted the design science research (DSR) method that originated in IS research and was first described by Hevner et al. (2004). DSR has become a widely-accepted approach in many disciplines (Carvalho et al., 2017; Sarantopoulos et al., 2016; Van Aken, 2005) and recently in management research too (Berglund et al., 2020; Romme & Dimov, 2021; Romme & Reymen, 2018). DSR can answer the calls for research producing output relevant for practice (Van Aken & Romme, 2012) and has become an established scientific method (Cash, 2018; Straub & Ang, 2011; Van Aken, 2004). Accordingly, we combined the IS and management fields in both theory and methodology to design our framework.

A central aspect is the iterative design of knowledge-containing artifacts that relies on phases of building and evaluation (design cycle) and aims to maximize its utility (Hevner et al., 2004; Peffers et al., 2007; Vom Brocke et al., 2020). Fig. 1. shows that DSR encourages iterations in both the design cycle and two related cycles (Hevner, 2007; Hevner et al., 2004). The rigor cycle grounds research in the existing body of knowledge, theories, and experiences, while the relevance cycle integrates business needs and evaluates the rigorously-designed artifact (Hevner, 2007; Hevner et al., 2004). Targeting discovery and creating solutions, DSR often directly evolves from real-world problems and the application or lack of artifacts (Hevner, 2007; Vom Brocke & Maedche, 2019). We combine theory and practice (Holmström et al., 2009) by building on existing knowledge out of IS and management research and designing a solution that is “field-tested and grounded” (Van Aken, 2004, p. 231) and thus adds to the existing body of knowledge (Hevner, 2007).

The term artifact has a broad connotation in the DSR context that includes artifacts in the form of a construct, model, method, or instantiation (Hevner, 2007; Peffers et al., 2007; Romme & Dimov, 2021). There is an ongoing discussion over what constitutes an artifact. Iivari (2015) elaborates on two different strategies for DSR, one focusing on conceptual IT meta-artifacts (with no physical representation such as hardware), the other driven by a real-world problem experienced by a specific client, and the artifact being built to solve it. Accordingly, DSR is often seen as a more applied approach than existing qualitative research approaches, which focus more on theory development (Hevner, 2007; Peffers et al., 2007). Following Peffers et al. (2007), identifying and motivating this problem constitutes a problem-centered approach to developing an artifact that has some value. This also relates to the adoption of DSR in disciplines beyond IS, where artifacts are also “management practices, tools, constructs, models, (research) methods, conceptual frameworks, and design principles” (Romme & Dimov, 2021, p.12), considered to solve a real-world problem (Gregor & Hevner, 2013; Hevner, 2007; Kuechler et al., 2009; Peffers et al., 2007; Romme & Dimov, 2021). When designing our artifact, we considered certain business needs based on a lack of applications and challenges in the context of digital transformation, and integrated existing scientific

![Fig. 1. Applied research approach based on the DSR of Hevner et al. (2004).](image-url)
knowledge into our framework design. Given that we identified a lack of research combining digital transformation and HR, we based our artifact on research on digital transformation and intrapreneurial competency. We identified the relevant real-world challenge and defined our phenomenon sphere as covering individual competencies of employees and the level of digital transformation of the organization. The knowledge base in our state-of-the-field phenomenon sphere covers literature on digital transformation and intrapreneurial competencies. We referenced existing literature to develop our initial artifact and tested it in the phenomenon sphere, resulting in a refined artifact (both artifacts are described in the findings section). To link practical and academic knowledge, we invited experts from business and academia into our phenomenon sphere. Hence, in addition to following the design cycle in our applied research context and leaving the starting point of the process open. As activities, Romme and Dimov (2021) view the DSR process in the Peffers et al. (2007) is rooted in the IS field and therefore assumes fixed models coincide.

3.2. Applied DSR activities

The DSR methodology follows a widely-accepted process consisting of six activities: (1) problem identification; (2) definition of solution objectives; (3) design and development; (4) demonstration; (5) evaluation; and (6) communication (Peffers et al., 2007). By identifying certain business needs in the context of digital transformation, we designed a framework that links IS and management research. Our competency framework artifact was then subjected to expert evaluation and refinement. Regarding the path from problem to solution to evaluation (Vom Brocke & Maedche, 2019), we followed the phases suggested by Romme and Dimov (2021), starting with theorizing (reviewing the literature and established models), followed by framing a problem-solution avenue and creating an artifact in iterations, and finally validating through demonstration and evaluation of the designed artifact. While the work of Peffers et al. (2007) is rooted in the IS field and therefore assumes fixed activities, Romme and Dimov (2021) view the DSR process in the management context and leave the starting point of the process open. As we have opted to start with theorizing, however, the activities of both models coincide.

Starting the DSR process, we identified the business needs evolving from a real-world challenge (i.e., digitalization) and the lack of information in the literature regarding employee competency and organizational levels of digital transformation. We began by examining the existing literature in a structured way and considered various case studies on digital transformation. We found that the competencies required in the digital transformation process to be unclear and, therefore, difficult to manage and assess (activity 1). Although we found several models and frameworks describing digital transformation in the relevant academic literature, none focused on employees’ intrapreneurial competencies. We thus defined a key objective of our artifact as addressing these competencies in the digital transformation process within one framework (activity 2). We engaged three additional researchers to control for possible biases in selecting existing knowledge for the further design process. We identified relevant foundations in theory (state-of-the-art knowledge and existing concepts) and built upon the existing knowledge to construct the framework as an artifact. Subsequently, we demonstrated the initial design of the framework to experts in academia and the business world. Conducting qualitative interviews with experts from academia and practice meant we could test and evaluate the framework to refine the artifact and contribute to the knowledge base in research and the real world (activities 3-5 in iterations). The current study’s three author convened author workshops to assess the existing data and arrive at a consolidated stage of the framework collaboratively. These iterations resulted in a redesigned framework based on both the experts’ evaluation and the author workshops. Fig. 2 demonstrates the applied steps and how the inputs (i.e., the body of knowledge and interviews) were used throughout the different stages of the DSR process. Because the artifact is knowledge generated from the DSR, the initial framework and the evaluation and redesigned framework are essential parts of the solution (Romme & Dimov, 2021; Vom Brocke et al., 2020) and are therefore presented in the findings section.

We conducted interviews that followed guideline to ensure the rigor of our research and evaluated our framework (see Fig. 2). The main goal of the interviews was to evaluate our framework or obtain an expert review, relying on a limited set of experts (Gregor & Hevner, 2013) to gain a broad evaluative view of our designed framework. Following the principles of DSR, we selected experts from diverse disciplines in academia and practice (Romme & Dimov, 2021). Hence, the academic experts were engaged in research on digitalization, and the practitioner experts were involved in business issues related to digitalization. Following a two-stage process, we first conducted evaluative interviews in domains that are internal prerequisites for digital transformation in organizations. We conducted six interviews with experts in the fields of IS, strategic management, and HR, who were engaged in research (i.e., academics) and practice (e.g., HR manager, CEO). In the second iteration, to integrate more stakeholders involved in digital transformation (Vom Brocke & Maedche, 2019), we organized interviews in the fields of the technical and internal drivers of digital transformation to access a broad view on digital transformation. We therefore spoke with experts in innovation management and organizational development involved in research and practice. This procedure resulted in a total of 10 interviews, which generated insights into various domains linked to digital transformation and enabled us to evaluate the framework both from academic and practical perspectives (Holmström et al., 2009). The setting ensured saturation was reached and additional data revealed no new insights (Creswell, 2014).

During the interview process, we followed the “generate-test-cycle” (Hevner et al., 2004) in DSR, and performed a stepwise evaluation during the iterations by taking remarks from earlier conversations stemming from the first iteration into account in discussions in the second iteration. This ensured the capture of minor iterations and the integration of upcoming topics in the ongoing evaluation. The

---

Fig. 2. Data sources used in the DSR process, following Peffers et al. (2007) and Romme & Dimov (2021).
interviews comprised two parts: a semi-structured interview (Bryman, 2012) and an evaluation of the framework (Gregor & Hevner, 2013). In the first part, we developed an interview guideline to gain a deeper understanding of digital transformation in the context of the relevant domain. In the second, we revealed and explained the framework to the interviewees and asked them to share their opinions, thoughts, and impressions to evaluate criteria such as validity, utility, quality, and efficacy (Gregor & Hevner, 2013; Romme & Dimov, 2021; Romme & Reymen, 2018). All interviews were conducted in the native language of the interviewers and interviewees and took place between November 2018 and June 2019. The results of the content analysis and the relevant quotes were later translated into English and cross-checked to ensure accuracy. A short overview of the interviewees and interview process is presented in Table 1. As the interviews focused on the demonstration and evaluation of a previously-developed artifact (Peffers et al., 2007), the sampling was focused and purposeful (Palinkas et al., 2015). Interviewees were selected from companies operating in sectors with a relatively high pressure to automate, such as manufacturing companies (I4, I8), construction (I2), energy provision (I6) and warehousing and storage (I10). Furthermore, we focused on companies that had published a digitalization strategy or whose media coverage reported their digitalization (I10). Furthermore, we focused on companies that had published work in their own domain on digitalization, projects in their companies. Experts from academia were selected based on their having published work in their own domain on digitalization, such as smart manufacturing, digitalization of core processes, or improvement of internal communication through the adoption of new technologies. All interviewees had experience of digitalization projects in their companies. Experts from academia were selected based on their having published work in their own domain on digitalization, the exception was the academic expert from the IS domain, who had published work in the context of strategic management.

The interviews were digitally recorded, transcribed, and analyzed using the MAXQDA software. Using the general inductive approach (Thomas, 2006) achieved ambedextrous coding: the more general upper-level categories were deduced by evaluating the framework, and the lower-level categories, which emerged from the raw material, followed an inductive approach allowing for open coding (in vivo coding). In the course of data analysis, and based on the idea of general inductive coding, we constructed a coding system that was guideline-driven but also permitted new codes to emerge from the raw data. To avoid bias and ensure reliability (Bryman, 2012; Creswell, 2014), each interview was coded by an interviewer, and a consistency check was performed by an author not involved in the interview. An in-depth evaluation was not intended, given the scope of this research; the interviews carried out with domain experts aimed to discuss employee competency in the context of digital transformation and, in particular, to evaluate the proposed framework. As is commonly recommended, we tested inter-coder and intra-coder reliability using Holst’s method (Neuendorf, 2016), which resulted in values of 0.76 (the average among all three authors) and 0.97, respectively.

4. Findings

The following section shows two iterations of the DSR process: (1) the design of the initial framework (activities 1-3); and (2) the evaluation process and the iteratively refined framework (activities 3-5).

4.1. Initial framework design

To design a competency framework in the context of digital transformation, we drew on the fields of IS and entrepreneurship to identify the relevant foundations for digital transformation and required competencies, respectively. Activities 1-3 (problem identification and motivation, define the objectives for a solution, design, and development) as suggested by Peffers et al. (2007), are based on a literature review of the field of digitalization in general and digital transformation in particular but also by the challenges evolving in the real world. We constructed a knowledge base for the transformation process based on the literature and identified various existing frameworks.

In addition, we included relevant entrepreneurial competencies already established in the entrepreneurship field. Research reveals a large number of definitions of entrepreneurial competencies (e.g., Ahmad et al., 2010; Costin et al., 2019; Mitchelmore & Rowley, 2010), many of them building on the work of Bird (1995). We follow Man et al. (2002) and define entrepreneurial competencies as a construct that can be displayed by an individual’s adequate behavior in specific situations. As the context of digital transformation calls for mixed competencies, we included cognitive and non-cognitive competencies (Costin et al., 2019). Following the DSR approach of combining theory and practice, we used diverse source types (Romme & Dimov, 2021) to include various perspectives on entrepreneurial competency: a literature review to obtain an overview and a kind of meta-analysis of the existing research (Mitchelmore & Rowley, 2010), a handbook of practice-oriented literature (Rae, 2007), and an EU-designed framework to integrate the policy perspective (Bacigalupo et al., 2016). We pooled competencies from three sources (Bacigalupo et al., 2016; Mitchelmore & Rowley, 2010; Rae, 2007) representing the different source types and obtained a competency list that was thematically analyzed and clustered via inductive coding. As the identified and chosen literature review of Mitchelmore and Rowley (2010) is already a decade old, we checked additional references (Ahmad et al., 2010; Bird, 2019; Costin et al., 2019; Man et al., 2002) to ensure that we were considering competencies from well-established and state-of-the-art research. Although the sources focused on entrepreneurial (and hence founders’) competencies, we argue that these competencies, as intrapreneurial competencies, are also important at the employee level. Hence, established competencies such as organizing (Man et al., 2002) and strategic competencies (Costin et al., 2019) have been included, but have been modified to fit the employee context. Existing firms have recognized the need to be innovative and entrepreneurial to gain competitive advantage in turbulent environments (Antoncic & Hisrich, 2003; Kuratko & Audretsch, 2013).

Table 1

<table>
<thead>
<tr>
<th>Iteration</th>
<th>Interviewee</th>
<th>Domain</th>
<th>Field</th>
<th>Length</th>
<th>Interviewer</th>
</tr>
</thead>
<tbody>
<tr>
<td>First iteration</td>
<td>11</td>
<td>SM</td>
<td>Academia</td>
<td>56 min.</td>
<td>A, C</td>
</tr>
<tr>
<td>12</td>
<td>SM</td>
<td>F42.9 - Construction of other civil engineering projects</td>
<td>77 min.</td>
<td>A, B</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>IS</td>
<td>Academia</td>
<td>46 min.</td>
<td>B, C</td>
<td></td>
</tr>
<tr>
<td>14*</td>
<td>IS</td>
<td>C17.1 - Manufacture of pulp, paper, and paperboard</td>
<td>67 min.</td>
<td>A, B</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>HR</td>
<td>Academia</td>
<td>58 min.</td>
<td>A, C</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>HR</td>
<td>D35.1 - Electric power generation, transmission, and distribution</td>
<td>46 min.</td>
<td>A, B</td>
<td></td>
</tr>
<tr>
<td>Second iteration</td>
<td>17</td>
<td>INM</td>
<td>Academia</td>
<td>48 min.</td>
<td>B, C</td>
</tr>
<tr>
<td>18</td>
<td>INM</td>
<td>C25.9 - Manufacture of other fabricated metal products</td>
<td>42 min.</td>
<td>A, B</td>
<td></td>
</tr>
<tr>
<td>19*</td>
<td>OD</td>
<td>Academia</td>
<td>40 min.</td>
<td>B, C</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td>OD</td>
<td>H52.1 - Warehousing and storage</td>
<td>51 min.</td>
<td>B, C</td>
<td></td>
</tr>
</tbody>
</table>

SM = Strategic Management; IS = Information Systems; HR = Human Resources; INM = Innovation Management; OD = Organizational Development

* Interview via Skype
As the possession of dynamic capabilities (Konlechner et al., 2018) at the organizational level and the fostering of intrapreneurial behavior boost strategic renewal, and therefore growth (Dess et al., 2003; Veenker et al., 2008), employees, and in particular their human capital, play a significant role in firms’ success (Guerrero & Peña-Legazkue, 2013).

Following an author workshop, the selected competencies were modified to fit the situation of employees and clustered. The six competency categories based on entrepreneurship research and their short descriptions are presented in Table 2. The first category concentrates on competencies rooted in strategic management (e.g., planning, coping with uncertainty, personal organization, and mobilizing necessary resources). Considering the employee perspective and the fact that employees can only partially influence strategic management decisions, we labeled this category management insight, which also highlights the intrapreneurial characteristics of these employee competencies. The proactiveness category incorporates all competencies related to taking the initiative and going above and beyond one’s role; those being motivation, self-awareness, learning by experimentation, and sustainable thinking. The third category, idea generation, concentrates on competencies of value in generating ideas, being creative, and identifying opportunities. The competencies required for idea assessment and the recognition of options arising from opportunities are contained in the opportunity evaluation category. The interpersonal mobilization category incorporates abilities around interacting with others, building consensus, and collaborating. The competencies necessary for identifying current market niches and emerging customer needs and future markets fall under the category of market foresight. We chose the label for that category because forward-oriented expertise, as opposed to traditional market knowledge, must be at the forefront of innovation in the context of digital transformation.

The derived competency categories were then implemented in an existing artifact: a digital transformation framework from the work of Venkatraman (1994). The framework was selected based on a two-step approach. First, we evaluated several frameworks independently, including those aimed at various target groups (e.g., OECD, 2016) or developed for consulting purposes (Andal-Ancion et al., 2003; Venkatraman, 1994; Venkatraman, 2017). To select a framework appropriate for our requirement to design a framework with high utility in research and practice (Vom Brocke et al., 2020), we identified five criteria as preconditions: (1) understandability without prior IS knowledge; (2) well-known and stable content; (3) considering phases of transformation; (4) focus on business and technology content; and (5) transformation process as central focus of the framework. Based on these five criteria, we researched suitable frameworks, and decided on three (Andal-Ancion et al., 2003; Venkatraman, 1994; Venkatraman, 2017).

Second, to avoid possible bias in the choice of a framework as the basis for our artifact, we consulted three researchers from the IS field. Without exposing the three pre-selected frameworks, we asked about their awareness of attempts to explain digital transformation. We learned that all three researchers were familiar with the framework developed by Venkatraman (1994). Other approaches, including frameworks and studies (Andal-Ancion et al., 2003; Hess et al., 2016; Kane et al., 2015; Legner et al., 2017; Matt et al., 2015; Venkatraman, 2017), were familiar to at least one of the researchers. Next, we showed the researchers the three frameworks selected based on the five criteria mentioned above (Andal-Ancion et al., 2003; Venkatraman, 1994; Venkatraman, 2017) and asked for their assessment of each regarding the criteria; they came to the conclusion that Venkatraman’s framework (1994) was the best fit for purpose.

Consequently, we focused on Venkatraman’s (1994) framework to support our initial artifact development describing five different levels of IT-enabled business transformation in relation to their potential benefits: (1) localized exploitation; (2) internal integration; (3) business process redesign; (4) business network redesign; and (5) business scope redefinition. The first level of this maturity model (referring to the axes “range of potential benefits” and “degree of business transformation”)
describes the necessity to understand that “no single IT application—however powerful—is strategic in its generic form” (Venkatraman, 1994, p. 76). Integrating systems is key to utilizing IT strategically. This integration leads to level two, wherein integration must be realized on both the technological and process levels. This realization may in turn lead to level three (the redesign of business processes) if a company’s current practices are not able to fully realize the possible benefits of IT. Whereas levels one to three transform a single company at the (information) technological and business tiers, level four modifies how companies act both within and outside their boundaries, capturing companies’ interactions with their suppliers, customers, and stakeholders to maximize their potential. Finally, level five is driven by the question of “what role […] does IT play in influencing business scope and the logic of business relationships” (Venkatraman, 1994, p. 83) and considers how the rules of the game can be redefined by reconfiguring IT. Venkatraman (1994) argued that the first two levels are evolutionary, as they require only minimal changes, while levels three to five are revolutionary because they require fundamental changes to organizational routines. Although the framework is not new; it has not lost value, as recent publications (e.g., Wang et al., 2016) and working papers (e.g., Ismail Abdelaal et al., 2018) in the field indicate. We used this framework as the basis for a workshop on collaborative modeling involving all three authors of this paper, where we assigned and rearranged competencies among the corresponding levels until we reached a consensus.

The initial framework (Fig. 3) unifies organizational- and individual-level perspectives on digital transformation. It considers an organization’s levels of digital transformation from evolutionary to revolutionary, and the necessary employee competencies. During the design process, we integrated three additional researchers from the field to control for possible biases in clustering competency categories and assigning them to the levels of digital transformation. Our framework reflects Venkatraman’s (1994) work and comprises two dimensions and five levels of transformation. The results of the author workshop also led to a relabeling of the two dimensions; so, degrees of business transformation was replaced with level of digital transformation, and range of potential benefits was replaced with benefit of digital transformation. These two dimensions are the underlying axes of the artifact, and the five levels of digital business transformation represent the framework’s organizational focus. In contrast to the original model, we excluded the dividing line between levels two (internal integration) and three (business process redesign) but incorporated the general idea of evolutionary and revolutionary levels in the dimensions of the framework. Furthermore, we included the competencies in the artifact, as we argue that specific employee competencies are relevant to reaching the next level of digital transformation. We integrated the generated clusters of intrapreneurial competencies on one side (read from bottom to top in the framework) and digital competencies on the other. We assumed that digital competencies (in the form of information, media, and technology skills) are crucial throughout the digital transformation process, whereas the intrapreneurial competencies of employees are especially important from the level of internal integration onwards, and thus particularly important at the revolutionary levels.

4.2. Framework evaluation and redesign

In a subsequent step, we evaluated and redesigned the frameworks iteratively, based primarily on the interviews but also considering other sources (see Fig. 2). This reflects activities 3-5 as described by Peffers et al. (2007). However, we mainly report the findings from the interviews, as they provided the most valuable insights. All interviewees, regardless of expertise, emphasized that digital transformation impacts nearly all aspects of a business. Since all areas of a company are affected, various resource types are relevant. In addition to technical resources, the interviewees also emphasized the importance of human resources, the strategic and dynamic competencies of the company (dynamic capability), and implementation resources. In particular, implementation resources were seen as crucial by both academics and practical experts. These resources range from the capacity to implement new technologies within the company or analyze the business environment, to the ability to recognize how business opportunities can be realized through digitalization and how these activities can ultimately be embedded in a company-wide strategy:

“The recognition of being able to assess at an early stage, but also to recognize that I implement this accordingly […] how do I implement this in an organization […] the ability to implement it internally as well.” (I5)

“If you understand digital transformation as a corporate strategy, it is not about achieving the same with less, but about using the logic of the digital world in such a way that you can achieve other things with the same, or the same differently, and thus better.” (I7)

The interviewees considered human resources played a central role in the context of digital transformation. At the beginning of the
interview, the experts were asked to highlight various competencies relevant at the individual level. The idea of this step was to ensure that competencies reported by the interviewees, and thus seen as necessary in practice, were considered in our framework. Applying an open coding approach for the analysis of the interviews, competencies were identified and clustered based on their characteristics, resulting in seven clusters: systemic (integrated understanding of digitalization, awareness of different perspectives); analytical-conceptual (analytical thinking, problem-solving orientation, evaluative skills); entrepreneurial (entrepreneurial thinking, endurance); adaptive-reflective (willingness to learn, ability to reflect, out-of-the-box thinking); social-communicative (leadership, social skills); prospective (future-oriented thinking, visionary power); and digital (openness to technology, technical skills, deducing opportunities). Next, we compared the interview results against existing knowledge in the field. This comparison shows that the competencies mentioned by the interview partners correspond in terms of content to the competencies in the literature, yet in practice different terms are used. Therefore, to remain consistent in the scientific discourse, the competence categories developed from the knowledge base (Table 2) were used when designing the framework. Some experts classified digital competencies as a kind of meta-competency, identifying basic digital knowledge, general openness to digitalization, and recognizing the potential of digitalization as crucial to the overall transformation process. The competencies named by the experts essentially cover established generic and entrepreneurial competencies, and at the same time confirm the need for a mixed set of intrapreneurial and digital competencies. In addition to the employee-level competency clusters, the interviewees further acknowledged the need for organizational framework conditions that facilitate digital transformation. In particular, organizational conditions that foster the ability to recognize opportunities and identify innovative impulses from the bottom up were viewed as crucial.

The evaluation process ultimately led to the redesigned digital transformation competencies framework (the DigiTransComp framework) depicted in Fig. 4. Similar to the initial framework, the DigiTransComp framework provides an overarching view of the phenomenon of digital transformation. The levels of company transformation are illustrated based on Venkatraman’s (1994) five levels, which show a somewhat linear, process-based relationship. However, this stage model is supplemented by the corresponding employee competencies, which are again interrelated. This relationship is somewhat dynamic and rooted in iterative cycles that evolve based on the competency clusters of intent, action, and implementation. Both organizational and individual dimensions are thus taken into account at the analytical level.

The redesigned framework details four essential refinements based on the expert evaluation. First, the relevance of digital competencies (information, media, and technology skills) increases as digital transformation progresses. To meet the challenges of the different levels, from localized exploitation to business scope redefinition, the dissemination of digital competencies is necessary. The broad distribution of at least basic knowledge of digital technologies is seen as a critical factor. When companies transform digitally, basic technical understanding and knowledge of applications must be present at almost all levels. Individuals with basic technical knowledge can recognize the potential of digital transformation and associated future developments. In turn, such individuals can exploit innovation advantages and create business opportunities from digitalization. Therefore, the vertical dissemination of digital competencies is crucial. In contrast to traditional models, where technical knowledge is usually bundled into particular departments (e.g., IS or IT), a fundamental digital understanding is now a necessity on the higher organizational hierarchy levels. Digital transformation fulfills a strategic function and should therefore be integrated into any overall company strategy (Krumay et al., 2019). Basic digital knowledge, including at the management level, thus facilitates important strategic decision-making with digitalization competency.

Second, our evaluation showed that the development of individual transformation (intrapreneurial) competencies is not linear but is a dynamic, iterative, and cyclical process. To visualize this, intrapreneurial competencies were mapped using three cycles. Similar to the concept of the entrepreneurial journey (Cha & Bae, 2010), our framework illustrates the individual transformation competency based on an intrapreneurial journey. Reviewing the theory and our evaluation lead us to propose that the three competency clusters in the framework follow a logical three-step flow in the context of digital transformation: (1) creating awareness of opportunities based on proactiveness and management insights to evoke intent; (2) identifying, evaluating, and seizing opportunities based on the competencies of idea generation, opportunity evaluation, and interpersonal mobilization to evoke action; and (3) implementing opportunities in a future-oriented manner based on market foresight to evoke implementation. The category of action requires employees to have both a proactive attitude and insight into
management decisions. In the context of digital strategies and technologies, the action category enables employees to adopt new ideas and business opportunities. The evaluation of different options and their overall fit with firm-specific strategy and the possible mobilization of colleagues are the elements of this competency cluster. The focus of implementation is not only on market knowledge, current customer needs, and corporate strategies, but also on the recognition of future trends and upcoming market developments. The framework shows that the intrapreneurial journey starts at the level of internal integration, which leads to the phasing out of localized exploitation. Intrapreneurial competencies thus play a crucial role in the revolutionary levels of the model and contribute to the enhancement of capabilities, “which aims to create strategic capabilities for future competition” (Venkatraman, 1994, p. 85).

Third, in the course of the intrapreneurial journey and the associated development of competencies, learning takes place and represents the human transformation. Therefore, in the evaluation process, the domain experts discussed the organizational conditions that foster learning but also the creation of a failure culture. Since many companies are unfamiliar with digitalization and associated opportunities, learning at both the individual and organizational levels is an essential source of knowledge and implementation competency. Based on the intrapreneurial journey at the individual employee level, learning and competency development take place at the specific levels of digital transformation. Applying the competencies mentioned above also enhances the whole organization from one level of digital transformation to the next. For this reason, the dynamic perspective on the competency clusters in the framework fosters learning not only at each level but also from one level of digital transformation to the next.

Fourth, based on the combination of digital and intrapreneurial competency with organizational transformation, our framework highlights major learning effects as relevant in achieving the next level of digital transformation. Intrapreneurial competencies at the employee level and organizational learning (resulting in capability) throughout the transformation process are both crucial in generating competitive advantages based on digital transformation. Although competency as a resource is rooted in people within various organizational entities, it must ultimately be integrated at the organizational level (Grant, 1996b). Applying intrapreneurial competency to firm-specific contexts (Miozzi & Ramirez, 2003) fosters human capital and enables learning. Individual learning should be returned to the organization as knowledge (Grant, 1996a), as only then can the entire organization dynamically adapt to new circumstances and achieve a long-term competitive advantage (Helfat & Peteraf, 2003). Our framework thus integrates organizational learning, which is based on dynamic competency development at the individual level but follows a somewhat linear path from one level of transformation to the next.

As a DSR approach requires both rigor and relevance, we presented the proposed framework to the experts to enhance our understanding of the phenomenon. The expert review revealed that the framework represents an extended understanding of digitalization and human capital. The experts expressed this in different ways in their assessments of the framework. In general, all regarded the framework as easy to understand and found that it provided an accurate overview of the relationship between digital transformation and employee competencies. All experts expressed the need for such a framework to establish a common understanding of employee competency and digital transformation. The business experts found the framework useful in assessing the current status of their firm’s journey to digital transformation. They also found it beneficial when discussing the competencies required for digital transformation with the board of directors and current governance structures for HR in the context of digital transformation and as an overall model to guide further steps. All respondents considered the framework would be helpful in developing a program to identify gaps in employee competencies. Two experts (12, 16) were even able to pinpoint their current status within the framework and thus identify the next steps needed to support digital transformation. Two business experts (16, 18) mentioned that they would use the framework “for developing a digitalization strategy related to employee learning” (16). Furthermore, they found it a good starting point for identifying current employee competency levels beyond technical knowledge. Three experts expressed the opinion that their companies would never reach the highest level of the framework in terms of penetration of employee competencies on all levels; nevertheless, they found it helpful to be aware of the possibilities. All experts adjudged the framework useful (utility) and usable (ease of use) and said that the developed artifact demonstrated practical relevance.

5. Discussion

Digitalization is a phenomenon that impacts a business’s entire system; its IT, strategy, and employees. Researchers agree that technology is functional and that digitalization is thus a transformational challenge. However, previous work investigating digitalization has emphasized technological challenges (e.g., Kane et al., 2015) and the organizational perspective on digital transformation (Baraldi & Nadin, 2006; Kamaladin et al., 2020), ignoring the role of human resources (Legner et al., 2017). Only a few researchers (e.g., Aubert-Tarby et al., 2018; Miozzi & Ramirez, 2003; Shakina et al., 2021; Van Laar et al., 2018) have concentrated on the individual level and focused on how digitalization affects employee tasks and employability. In contrast, our study investigated which employee competencies enable digital transformation, linking research on IS (digital transformation) and management (employees as human resources). By applying a human-centered view, we considered the role of individual employee competencies in the context of an organization’s digital transformation to answer our research question. Using a DSR approach, we developed a framework that reflects both employees’ digital and intrapreneurial competencies, thereby narrowing the gap between digitalization and HR. Artifacts, in particular IT artifacts, developed based on DSR are mainly considered to be constructs, models, methods, and instantiations (Hevner et al., 2004; March & Smith, 1995). However, frameworks have commonly been developed as an artifact (Offermann et al., 2010) to demonstrate components and the relationships between them so as to delimit or explain a certain problem space (Abbasi & Chen, 2008; Chung, 2006; Offermann et al., 2016; Prat et al., 2015). The framework we designed, was evaluated by selected experts, and contributes to both academia and practice. It provides insights into employees’ intrapreneurial competencies in the context of digital transformation and thus contributes to the discussion in several ways.

First, our research extends an existing framework (Venkatraman, 1994) and illustrates the changing requirements for competencies in the context of digital transformation. This is necessary, as new challenges and demands accompany digitalization within companies, which have not been reflected so far. As the transformation to enhance digitalization affects almost all business dimensions over a rather short period of time, employees as human resources have a marked influence on a company’s ability to transform (Butschan et al., 2019; Colbert et al., 2016). In the context of digitalization, knowledge and skills are highly important, but so is the ability to apply them to specific contexts—hence the concept of competency. Our research supports previous findings on changes to competency requirements resulting from digitalization (Kohtamäki et al., 2020). The range of competencies has increased as a result of the immediate and holistic impact of digital transformation on a company. Employees’ active roles in realizing digital opportunities and their empowerment (Martinez-Caro et al., 2020) have resulted in the need for new competencies (Kohtamäki et al., 2020; Miozzi & Ramirez, 2003). Therefore, intrapreneurial competency (Butschan et al., 2019; Gekara & Nguyen, 2018) is also necessary for employees to engage in tasks and processes beyond digital expertise. Moreover, digital transformation calls for the dissemination of digital competency. Basic knowledge of technologies, digital skills, and an understanding of the potential of digitalization are relevant in various departments, and thus a horizontal
dissemination of digital competencies beyond the IT department is necessary. Based on our results, we assume the focus should be on employees’ ability to access and apply digitalization to foster transformation. However, since a company’s digital transformation is linked to strategic considerations (Yeow et al., 2018), a vertical dissemination of digital competencies is also necessary. A basic digital understanding and the ability to apply that knowledge are relevant even at the management level (Martínez-Caro et al., 2020), enabling leaders to make corporate decisions with an understanding of digitalization and its effects on the company. As the DigiTransComp framework shows, the required competencies differ depending on the level of digital transformation, but also in their impact on the benefit of digital transformation (Venkatraman, 1994). However, as our research showed, companies must already have reached a certain level of digital maturity to gain competitive advantage from employees’ transformation competencies.

In addition, this paper complements previous research on digital transformation by focusing on human transformation. In combining the constructs of competency and transformation, we applied a human-centered view to digitalization. Although we did not empirically measure the relationship between the dimensions of digital transformation and HR, we designed an artifact that integrates both. The DigiTransComp framework takes into account the interplay between the individual and organizational dimensions, as suggested by Verhoeft et al. (2021), by combining intrapreneurial competency and levels of transformation. Employees undergo a human transformation by gaining required knowledge and developing relevant competencies. We characterize the intrapreneurial journey primarily by the fact that employees acquire certain knowledge through the development of individual competencies in the cycles of intent-action-implementation. This enables employees to become familiar with the challenges of the different levels of digital transformation and meet them appropriately. Owing to their intrapreneurial competencies, employees in particular can contribute to revolutionary levels of transformation. The organization can complement those contributions by engaging in technological transformation. The evaluated framework highlights how human transformation is crucial, and we propose that intrapreneurial competency is the foundation of an organization’s ability to manage digital transformation.

Further, our research demonstrates the interplay between individual competency and organizational capability when implementing digital transformation. The DigiTransComp framework recognizes learning at both the individual and organizational levels as a key enabler of digital transformation. Organizational learning addresses how previous outcomes are memorized and how organizations adapt their actions in response to environmental changes (Levitt & March, 1988). Although this theory dates from the early 1960s (Cyert & March, 1963), there is still no common understanding of organizational learning (Easterby-Smith et al., 2006; Fiol & Lyles, 1985; Levitt & March, 1988). Organizational learning can be broadly defined as “a change in the organization that occurs as the organization acquires experience” (Argote & Miron-Spektor, 2011, p. 1124). In general, researchers agree that individual and organizational learning are related (e.g., Matthews et al., 2016) and that organizational learning mediates the relationship between organizations’ dynamic capabilities and competitive advantage (Giniuie and Jurkien, 2015). Research on dynamic capabilities has also stressed the relevance of learning and capability development over time (Vogel & Güttel, 2013) and reflects how resource changes follow companies’ transformations (Helfat & Peteraf, 2003; Yeow et al., 2018). Resource access, knowledge exchange, and learning foster organizations’ dynamic capabilities and thus their competitiveness through transformation (e.g., Teece, 2007). A company’s ability to adapt to new challenges is thus rooted in its employees. Companies benefit from individual competencies by using such competencies to develop necessary organizational competencies (Hsu & Fang, 2009). Learning is therefore an important process in the context of digital transformation and takes place at all transformation levels.

Nevertheless, our refined framework demonstrates an interplay of both dynamic and more linear developments: intrapreneurial competencies develop dynamically among employees; employees’ individual learning at diverse levels of transformation leads to the creation of certain bases for relevant competencies; and the first learning cycle focuses on those competencies that develop employees’ awareness of digitalization and its associated opportunities. The second focus is on a competency cluster which, based on the preceding competencies, promotes the identification and seizing of digital opportunities: idea generation; opportunity evaluation; and interpersonal mobilization. The third builds on the cycle of intent and action and aims to instill a visionary attitude among employees.

The DigiTransComp framework reinforces how individuals’ intrapreneurial competency is a crucial pillar of the transformation process. We propose that human transformation has a twofold effect. In addition to taking place on the specific levels of transformation and gaining basic knowledge, learning also occurs on the organizational level. Similar to the concept of entrepreneurial self-efficacy (Douglas & Fitzsimmons, 2015), employees’ self-efficacy leads to the strengthening of competencies necessary to elevate a company from one level of transformation to the next. In contrast to the development of competency through cycles, reaching the next level of transformation is relatively linear in nature. Based on the evaluation of the framework, our research contributes to theory by proposing that intrapreneurial competencies are not only built at the individual level but also serve as an important foundation for the dynamic capabilities of the whole organization. Based on their dynamic characteristics, fostering and applying employee competencies can help organizations reach the next level of digital transformation. In line with this, organizational learning offers possibilities in the light of digital transformations. More recent research has addressed digital learning in connection with digital transformation. Sousa and Rocha (2019b) investigated the skills required for the digital transformation of organizations, defining digital learning as a phenomenon that “happens spontaneously and unconsciously without any prior stated objectives regarding learning outcomes, but it has the potential to prepare to think critically and solve complex problems, work collaboratively, communicate efficiently and has more autonomy independence in the learning process” (Sousa & Rocha, 2019a, p. 328). Learning in the digital transformation context also highlights that individual learning, in creating knowledge, is integrated at the organizational level.

This research has various practical implications. In particular, the combined view of human capital (competency) and organizations’ digital transformation offers valuable practical implications. Our findings based on the evaluation of the designed framework indicate that digital transformation calls for a developmental process at both the individual and organizational levels. Owing to the technical background of digitalization, technologies and digital knowledge are typically the main focus of research. However, rather than focusing exclusively on technical aspects, researchers should also consider employees and their development, and organizations should be aware of the crucial role of human resources in the context of digital transformation. As our model shows, firms require both skilled individuals and organizational technology to progress from one level of digitalization to the next. While companies provide the necessary (digital) technology and organizational capabilities, it is employees who exploit opportunities to generate competitive digitalization-based advantages through their internal, interteam, and interfirm competencies. Firms should also consider the specific characteristics of digitalization. Unlike other changes, digitalization is a transformational process and a cyclical, rather than stepwise, development. Organizational support in the form of, for instance, an adequate failure culture is relevant to ensuring the benefits of learning cycles.

Although companies have had to adapt to new requirements and meet unprecedented challenges in the past, digital transformation is somewhat unique in terms of speed. In the modern dynamic business
environment and in the light of rapidly changing technologies, digitalization happens relatively fast. Companies that do not actively manage this phenomenon run the risk of being overwhelmed by it. Digitalization represents a completely new market logic, and thus directly affects companies’ strategic orientations. An approach based on muddling through, as used in the context of other developments (e.g., internationalization), is not feasible. Digitalization has a substantial impact on a company, and future developments are difficult to assess. Bearing that in mind and maintaining an awareness of the key role of human resources will ensure that companies are well-equipped to pursue digital transformation.

6. Conclusion, limitations, and future research

The significant influence of digitalization on the business world is indisputable. This situation challenges companies in various ways, forcing them to follow the fast pace of technological development and struggle to overcome their inertia around adoption. Challenging the organization means challenging all parts of it, including IT, strategy and employees. To summarize our research, applying a human-centered approach to digital transformation means it addresses those challenges in several ways.

First, by combining IS and management studies, this research applied a competency analysis to digital transformation. In utilizing established theories and existing frameworks from both research disciplines, we provided an integrated perspective and contributed to theoretical developments. We add to the knowledge base by designing a framework (Gregor & Hevner, 2013) that offers a holistic perspective. In particular, we identified the role of employees in general, not only individuals at the management level, as important resources. By focusing on competency rather than skills (considering the application of knowledge) and transformation competency (digital and intrapreneurial) rather than digital competency, our work supports previous research on the range and dissemination of competencies in the digital transformation context. Further, our framework is a DSR artifact that includes the previously-mentioned employee competencies at an individual level and integrates them at the levels of digital transformation. Therefore, our study complements previous research on transformation and integrates the human dimension. Further, the integration of experts’ views in the design process ensures the rigor and relevance of research. Evaluating the designed framework illuminated the interplay between the individual and organizational levels and identified employees’ intrapreneurial journeys as being dynamic and the transformations as a linear development.

Nevertheless, the findings of this research should be interpreted with its limitations in mind. Having linked competency with digital transformation, our research concentrated on design science by developing a framework that incorporated employee competency and the levels of digital transformation. Although this framework design contributes to the field, it represents the first attempt to apply a human-centered lens to the transformation phenomenon. Consequently, more empirical research would be required to obtain deeper insights into digital transformation and fine-grained results on the role of human capital. Qualitative research approaches could be used to test the explanatory power of the designed framework and examine the relevance of the integration of competencies into business strategy. Furthermore, empirical research would be necessary to investigate the role of IT as the primary enabler of digital transformation, and employees and human capital as the transmitters of digital strategies. In terms of thematic limitations, we focused on the role of employee competency as a human resource. Nevertheless, we reflected on the general idea that organizational constructs are also related to digital transformation. Future researchers might conduct studies that more specifically examine the role of organizational learning and dynamic capabilities in the transformation process. Such research could provide detailed insights into how organizational learning occurs and how organizations can reach the next level of transformation. The relationship between organizational capabilities and individual competency should also be thoroughly investigated, as we propose that both are key to any successful digital transformation. Furthermore, our research did not address how context influences digital transformation. Future research focusing on (for instance) the role of organizational structure (e.g., company size) and features (e.g., main tasks or industry) would facilitate a deeper understanding of how context influences competency and digital transformation.

CRediT authorship contribution statement

Christine Blanka: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – review & editing, Visualization. Barbara Krumay: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – review & editing, Visualization. David Rueckel: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – review & editing, Visualization.

Declarations of Competing Interest

None.

Acknowledgments

We are indebted to the reviewers for their valuable suggestions during this research. Moreover, we appreciate the input from our interview partners who evaluated our designed framework and the three researchers who help us to avoid possible bias in the design process.

References


Christine Blanka: Christine Blanka is a postdoctoral researcher at the Johannes Kepler University, Linz, Austria, Institute for Entrepreneurship. Her research interest is on entrepreneurial strategies in established organizations, including topics such as intrapreneurship, innovative employee behavior and transformation processes. Her research activities are positioned on the individual-level perspective and its intersection with organizational phenomena. In particular, she is focusing on the role of intrapreneurial employees in contexts such as digitalization and digital transformation.

Barbara Krumay: Barbara Krumay is Professor at the Johannes Kepler University, Linz, Austria, Institute of Business Informatics - Information Engineering. Her research activities are in the field of information management and digital transformation, in particular, investigating influence of digitalization on society from companies' point of view. The focus is on the power of information systems (IS) to tackle social and environmental challenges and the role of businesses in this context. The main goal is to investigate how companies can apply IS in a responsible and efficient way to measure, manage and reduce their impacts as well as how companies’ may manage digitalization.

David Rueckel: David Rueckel is Head of Competence Center 'Digital Enterprise & UX' at the University of Applied Sciences Technikum Wien, Department Computer Science, and Lecturer at the Johannes Kepler University, Linz, Institute of Business Informatics - Information Engineering. He teaches courses on strategic information systems (IS) management, digitalization and digital transformation, IS project management, IS performance measurement and related subjects such as requirements engineering. His research interests are digitalization and digital transformation and its impact on organizations; he is focusing on the (changing) role of strategic IS management against the background of digital transformation.