The digital transformation of Swiss small and medium-sized enterprises: insights from digital tool adoption

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Abstract

Purpose – The study explores the alignment of Swiss small and medium-sized enterprise (SME) managers’ understanding of digital transformation, with evidence of digital tool adoption in managerial and operative work. This reveals opportunities for more fully realizing the potential of digital transformation for SMEs.

Design/methodology/approach – This multiple-case study, with four theoretically sampled cases, analyzes data from the qualitative answers of 1,593 respondents to a survey of Swiss SMEs about digital transformation. The study draws on a convenience sample of Swiss SME managers.

Findings – The analysis shows little understanding of digital transformation as related to managerial work. However, there are two clear digital tool adoption patterns for managerial work: (1) workflow and workforce management and (2) work-flow and team management. Understandings of digital transformation and operative work focus on the (1) organization of operational work or (2) a combination of organization and changing the way people work. The digital tool adoption in operational work additionally focuses on the digital skills of operational employees.

Research limitations/implications – The study is only able to identify patterns of understanding of digital transformation and digital tool adoption in managerial and operative work. More research is needed to understand why these patterns are observed.

Practical implications – SME managers need to think far more carefully about aligning their vision for digital transformation and the digital tools they adopt in both managerial and operational work, but especially in managerial work.

Originality/value – This is the first empirical study of the digital transformation of Swiss SMEs and their digital tool adoption. Significant potential for alignment is revealed, suggesting potential performance gains are possible.

Keywords Switzerland, Small and medium-sized enterprises, Case study, Digitization, Digital transformation

Paper type Research paper

Introduction

Digital transformation of societies and their economies has brought the ongoing co-evolution of business and technology into stark relief, as firms respond to the emerging opportunities and challenges presented by the strategic digitalization of their activities (Peter et al., 2020). This process of digital transformation of businesses is fundamentally reshaping the role of digital
technologies (combining information, computing, communication and connectivity technologies) (Bharadwaj et al., 2013) in the work carried out by managers and employees in firms across diverse industries. Small and medium-sized enterprises (SMEs) are of particular interest in this respect, due to their important role in the economy of most countries, including Switzerland.

To digitally transform organizations and businesses is a managerial task (Andersson et al., 2018; Andriole, 2017; Berman and Marshall, 2014; Day-Yang et al., 2011; Gimpel et al., 2018; Heavin and Power, 2018; Hrolacher and Hess, 2016; Loonam et al., 2018; Matt et al., 2015; McKeown and Philip, 2003; Moreno et al., 2015; Reddy and Reinartz, 2017) and goes beyond the mere understanding of digital technology. The role of managers and employees is thus widely recognized as central to the successful adoption of digital technologies by SMEs and increasingly the focus of research. Studies have shown the importance of (senior) managerial commitment and support (Ko et al., 2021; Nguyen et al., 2015), the role of boundary-spanning managers in shaping understandings of digitalization and digital transformation (Peter et al., 2020) and need for managerial clarity about the vision for and adoption of information technologies (Nguyen et al., 2015). Additionally, employee skills are a widely noted and discussed aspect of the successful digitalization/digital transformation of SMEs (Eller et al., 2020; Ko et al., 2021).

This paper argues that it is in the integration of digital technologies into the management activities and operational roles of SME employees that digital transformation becomes a manifest phenomenon. Managers and employees need to develop digital skills, which are argued to be supported by the use of digital tools, to collectively develop a digital capability for a specific SME (Proksch et al., 2021; Scuotto et al., 2021). If there is a lack of managerial commitment to and support for the development of digital skills and the adoption of digital tools, then SMEs run the risk of losing their competitiveness (Ko et al., 2021). Furthermore, if there is no clear managerial understanding of the alignment of digital skills and tool usage with the vision for the SMEs’ broader digitalization/digital transformation, the full potential of the adoption of such tools for the competitiveness of SMEs will not be realized (Nguyen et al., 2015). With this managerial perspective in mind, the following research question emerged:

**RQ.** How do Swiss SMEs approach the process of digital transformation from a managerial perspective?

We answer this question by analyzing (1) managerial understandings of the digital transformation phenomenon, (2) the nature of the implementation of digital technologies in managerial and operational work, (3) the associated challenges and opportunities and (4) realized positive change associated with digital transformation of Swiss SMEs.

This study is focused on Swiss SMEs because of their central role in the economic activities in Switzerland, a country widely recognized as one of the most innovative and competitive in the world (IMD, 2021; WIPO, 2020). Switzerland provides a unique context to study SME digital transformation, as advanced forms of digitalization and transformation of SMEs are highly likely, given that Switzerland is ranked highly for the capacity and readiness of the economy to adopt digital technologies (IMD, 2020), is recognized as an innovation leader, has the status of the world’s most resilient economy and is the country with the highest skilled workforce globally (WIPO, 2021). Understanding the digital transformation of SMEs from a managerial perspective is essential, as SMEs represent 99% of all businesses and employ two-thirds of all employees in Switzerland (Swiss Federal Statistical Office, 2021).

The potential for advanced understandings of digital transformation, given the very favorable Swiss context, makes our findings of four different patterns of engagement with digital transformation by Swiss SME managers all the more important, especially given that all four approaches see digital transformation through tool adoption as predominantly an operative and not managerial transformation of work.
The remainder of the paper proceeds as follows: first, we discuss the ongoing cycle of industrial revolutions, the impact on the nature of work and how this manifests in the Fourth Industrial Revolution more generally and specifically in the digital transformation of SMEs. Next, digital transformation, SME strategies, business models and the emergence of new ways of working are discussed, allowing our conceptual model of a managerial perspective of digital transformation to be developed. This is followed by an explanation of the research design, the findings and discussion of the changing nature of work and tool adoption in Swiss SMEs and, finally, a managerial work agenda for SME digital transformation is proposed. The paper concludes with implications for practice, research and a discussion of the study’s limitations.

**SME business management and digital transformation**

Digital transformation is a diffuse concept that needs to be defined before we can progress to take a managerial perspective on its firm-level manifestation in the adoption of specific digital technologies and tools. This perspective is summarized in Figure 1 and explained below.

![Figure 1. Conceptual model of SME digital transformation](source(s): The Authors)
**Defining digital transformation**

Digital transformation is a multidimensional phenomenon that affects all domains of human activity, namely technology, the economy, politics and society. It is for this reason that digital transformation (DT) is often referred to as the Fourth Industrial Revolution or Industry 4.0 (Bharadwaj et al., 2013; Lasi et al., 2014). Each of the major transitions in industrial production, commonly referred to as industrial revolutions, is associated with the emergence of new technologies (Lasi et al., 2014). We argue that, while the emergence of new dominant technologies is important, a deeper understanding of these transformation processes can be gained by focusing on the tools that these new technologies enable and the (changing nature of the) work these tools allow – by managerial and operational employees – to be completed.

Conceptualized as an ongoing transition process, each industrial revolution is a phase in the ongoing evolution of industrial production in response to the emergence of new dominant general-purpose technologies (Gölzer and Fritzsche, 2017); see Table 1. This cycle of new dominant general purpose technologies emerging has driven (1) a shift in the primary source of (new) value creation from the tangible to intangible capital of firms, (2) changes in the technology-human relationship and (3) the evolution of the nature of the tools on which managers and operational employees rely to complete their assigned work.

The Fourth Industrial Revolution is based on an ever-deeper integration of information, communication and emerging connectivity technologies (Bharadwaj et al., 2013), see Table 1. This digital transformation – seen from an economic perspective – increases productivity within the value chain with the aid of technology (Stich and Hering, 2015). The integration of these digital technologies extends the importance of intangible capital, such as information, by further increasing the capacity of employees to gather and process information about the

| Industrial revolution evolution | Time period | Dominant technology | Manifestation in the changing nature of industrial activity | Technology-human relationship | Tools |
|---------------------------------|-------------|---------------------|--------------------------------------------------------|---------------------------|-------|
| 1st Phase                       | 1750–1870   | Steam engine        | Tangible capital                                      | Employees use technology to extend their physical capacity | Task-specific machine |
| 2nd Phase                       | 1870–1960   | Electrification and automation | Tangible capital                                      | Employees compensate for limitations of technology | Assembly line and mass manufacturing |
| 3rd Phase                       | 1960–1990   | Computing; information and communication technologies | Tangible and intangible capital | Employees use technology to expand the capacity of the mind | Computers, software and communication devices |
| 4th Phase                       | 1990–ongoing | Advanced integration of information, communication and connectivity technologies | Intangible capital | Employees use technology to align the extension of the body and the mind | Connected hardware (Internet of things) and (software) applications |

**Source(s):** Synthesized from Bharadwaj et al. (2013), Lasi et al. (2014), Gölzer and Fritzsche (2017) and Dröseln et al. (2017)
activities of the firm through ever-greater automation of business processes and the increasingly networked nature of relationships between employees, customers and machines. This information intensity is also associated with new tools that enable employees to leverage the networked nature of contemporary value creation and the large volumes of information being produced and captured by firms of all sizes, including SMEs (Bauernhansl, 2017). Digital tools are typically software applications and apps that exploit information abundance, computing power availability and connectivity to create new value.

Digital transformation differs from the first three industrial revolutions because it combines an intelligent, horizontal and vertical integration of people, machines and objects (Dröseln et al., 2017). This can be observed in the most influential technological developments associated with digital transformation, such as mobile technologies, social media, analytics and big data, cloud computing and the Internet of Things (IoT) (Châlons and Duffit, 2018). These technologies enable higher efficiency, better connectivity, trust disintermediation and automation (Lanzolla et al., 2020) and allow for "modular, distributed, cross-functional, and global business processes that enable work to be carried out across boundaries of time, distance, and function" in a way that was not previously possible (Bharadwaj et al., 2013, p. 472).

Digital transformation and SMEs

The scholarly interest in SME-focused digitalization and digital transformation has also grown significantly in recent years. A Google Scholar advanced search (all keywords: digitization, digitalization, digital transformation) of highly regarded small business and entrepreneurship journals reveals a growing number of publications in the Journal of Small Business Management (2020: 1 article; 2021: 2 articles), Small Business Economics (2019: 1; 2020: 1 2021: 1), Entrepreneurship Theory and Practice (2020: 4) and Journal of Business Venturing (2020: 1). There were no articles identified in the other highly ranked small business and entrepreneurship journals listed in the Chartered Association of Business Schools Journal Ranking 2021 (CABS, 2021).

These articles reflect the broader pattern of contemporary studies of SME digitalization/digital transformation, focusing on SMEs in specific national industries (Cannas, 2021; Somohano-Rodríguez et al., 2020) and new ventures (Proksch et al., 2021), entrepreneurship (Franco et al., 2021) and entrepreneurial ecosystems (Autio et al., 2018; Torres and Godinho, 2021). Further studies seek to understand how the digitalization/digital transformation of new ventures is impacting their responses to societal grand challenges, such as sustainable development (George et al., 2020) and the recent COVID-19 global health crisis (Kuckertz et al., 2020). Such studies of SME digitalization and digital transformation for the most part seek to explain sources of value creation by adopting firm-level explanations that draw on concepts such as dynamic capabilities (Cannas, 2021), digital capability (Scuotto et al., 2021), digital strategies (Proksch et al., 2021), innovation strategies/performance (Scuotto et al., 2021; Somohano-Rodríguez et al., 2020), product and services digitalization (Proksch et al., 2021) and process digitalization (Proksch et al., 2021).

Several review papers focusing on SME digitalization and digital transformation have also been published recently, complementing more general definitional reviews of digital transformation (Reis et al., 2018; Vial, 2019), often focused on the antecedents (Meier, 2021; Taruté et al., 2018), as well as the technological focus of previous studies (Meier, 2021). These reviews tend to be in the discipline of information systems research (Meier, 2021; Reis et al., 2018; Taruté et al., 2018; Ulas, 2019; Vial, 2019). At the same time, the antecedents and outcomes of SME digitalization and digital transformation have been empirically studied in well-regarded management journals (Eller et al., 2020; Scuotto et al., 2021). Increasingly, empirical studies of SME digital transformation are also confirming the performance effects experienced by SMEs (Eller et al., 2020; Ko et al., 2021).
Empirical research highlights opportunities for research that can show how digital transformation unfolds at the individual level of the SME manager or operational employee. Managers are argued to need to “rework ordinary routines within the work environment” (Cannas, 2021, p. 17), while employee interpretations and understandings of changes need to be understood and managed; managers and employees that feature an open-minded and collaborative mindset and an entrepreneurial attitude are seen as key for success. Proksch et al. (2021) argue that digital strategies are reliant on the digital capabilities of employees, emphasizing the ability to use digital tools such as digital platforms and digital communication channels. However, these skills are generally measured at a firm level. Scuotto et al. (2021) similarly find that SME employees need to develop digital skills in the domains of information, communication and software, as well as problem-solving, in response to a perceived lack of research on employee skills within the context of the digital transformation of SMEs.

The digital skills, when used in the interest of SMEs, are the foundation of a firm-level digital capability (Scuotto et al., 2021). Digital skills are, however, enacted through the use of digital tools, and, to date, there has been no empirical study capturing the degree or nature of the use of digital tools in SMEs. The appropriate deployment of digital skills and the associated use of digital tools, however, remains an open question.

Digital transformation, SME strategies, business models and new ways of working

Traditional business strategies are being fundamentally reshaped by new digital technologies (Banker et al., 2011; Ettlie and Pavlou, 2006; Kohli and Grover, 2008; Sambamurthy et al., 2003; Straub and Watson, 2001), and these strategic changes contribute to the need for managers to find new ways of managing and developing employee digital skills (Proksch et al., 2021; Scuotto et al., 2021).

More specifically, it means to strategically adopt and integrate digital tools “in business processes and working practices” (Peter et al., 2020, p. 161), which ultimately leads to innovation, new business models and value creation (Akpan and Ibidunni, 2021; Bouwman et al., 2019; Garzella et al., 2021). Positive effects are increased operational efficiency, stronger agility, an enhanced firm image, as well as an expansion of the market from a regional to global scale (Akpan and Ibidunni, 2021; Morgan, 2019; OECD, 2021). Hence, digital transformation is of vital importance to SMEs as it ensures the ability to compete with larger businesses and to stay innovative (Akpan et al., 2020; Lee and Runge, 2001), as SMEs in many cases have limited financial and human resources compared to large firms (Bouwman et al., 2019). Moreover, early adoption of digital technology is essential (OECD, 2021).

Managers need to know that their decisions, about which tools to adopt and how to manage their employees’ adaptation to these new tools, changes not only the organization of work (a managerial task) but also the way people perform their work (operational work). Only when managers become aware of their decisions’ impact can SMEs exploit the full potential of digital tools and develop innovative business models and new, competitive products. The role of managers in digital transformation cannot be emphasized enough as there is a “shift from the boundaries of management to the management of boundaries” (Garzella et al., 2021, p. 31) in the digital age.

Under conditions of digital transformation, the responsibility of SME managers thus more than ever spans the boundary of the firm (Garzella et al., 2021; Peter et al., 2020). The management of this boundary and the reliance on external resources to compensate for SMEs’ “ liabilities of smallness” (Pullen et al., 2012) necessitate that SME managers engage in the management of external stakeholders (Albats et al., 2020). Jones et al. (2020) identified potential external stakeholders for SMEs, in relation to improving productivity, namely business associations, accountancy professionals, consultants, customers, natural
environment, family, local government, local community, regional government agencies, society (community), suppliers, technology providers and university researchers. Many of the same stakeholders will be relevant to SMEs’ digital transformation, given the fundamental nature of the process to the SMEs’ value creation efforts. These stakeholders represent not only complementary external resources to the SME undertaking digital transformation, but also potential sources of pressure and ideas for such a transformation process to be effectively achieved.

A proactive approach that SME managers can adopt to realizing the potential of external stakeholders for enabling digital transformation is that of open innovation (OI) (Albats et al., 2020). OI is “a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization’s business model” (Chesbrough and Bogers, 2014, p. 17). In an OI approach to digital transformation, the SME manager will need to manage stakeholders that include incubators, government, investors, large enterprises, other SMEs (that may be competitors), lead users, experts and researchers and universities (Albats et al., 2020).

When done successfully, OI allows SMEs to access ideas, profit from existing knowledge and to use technologies from external stakeholder, and, thus it is an effective strategy for SMEs to reduce costs and compete in an increasingly global economy (Albats et al., 2020). For SME managers that means developing strong relationships with the external stakeholders by implementing an adequate communication, building trust and managing mutual expectations; such boundary-spanning work related to digital transformation has been identified in Peter et al. (2020). Moreover, SME managers must ensure that the acquired resources can effectively and efficiently be integrated into the firm (Grama-Vigouroux et al., 2020).

SMEs can only benefit from a sustainable process of digital transformation when managers understand the importance of this transformation and develop a set of skills to manage the newly available resources and logically (re-)organize their workforce. Managers need to start thinking of digital tools beyond mere supportive technologies (Priyono et al., 2020). This paper thus seeks to better understand digital transformation from a managerial perspective, the micro perspective (see Figure 1), by studying how managers think about digital transformation and the tools adopted in their firms, as well as considering the perceived challenges and instances of sustained positive changes in the SME.

A managerial perspective of SME digital transformation

As the term digital transformation already suggests, the ongoing Fourth Industrial Revolution is a change process, and as such a business/managerial issue. There has been a fundamental shift in the nature of the work carried out in firms with each evolution in the industrial age, how that work is carried out and how the completed work is managed. Arguably, the technological progress has affected all three of these aspects. Clearly, the nature of the specialization of the work carried out by managers and other employees of the firm has changed along vertical and horizontal lines. The vertical and horizontal specialization of employees’ work is clearly associated by a division of roles between those fulfilling what is contemporarily referred to as managerial work and employees with more operational roles (Simon, 1944). A managerial perspective of digital transformation of SMEs is thus two-sided, including the adoption of digital technologies in managerial work and the use of digital technologies that operational employees utilize in their work, associated with the changing nature of the work to be completed.

The nature of managerial work is a long-standing interest of managerial scholars: Laud et al. (2016) have proposed a revised conceptualization that seeks to achieve higher relevance for contemporary managers (Fayol, 2016). This work highlights that there is a general recognition that the roles and the nature of managerial work are time-sensitive and develop
due to technological progress, expansion of knowledge work, social changes, and delayering that occurred as organizations became more horizontal, and workers became more autonomous (DuBrin, 2012; Laud et al., 2016). Digital transformation has been argued to impact the managerially relevant fields of human resources, business efficiency and business process redesign (Nadeem et al., 2017) and requires managerial attention to organizational agility, organizational size and shape, organizational learning, digital innovations and business ecosystems (Kuusisto, 2017).

A contemporary understanding of managerial work needs to recognize these demands on managers and is accommodated by Laud et al.’s (2016) revised model of managerial work. Their model of managerial work identifies four role groupings of the seventeen managerial roles included, and five different engagement categories, from actively disengaged to highly engaged managers. Managers have a leadership role that includes activities like strategic planning, negotiating, motivating, allocating, spokesperson and entrepreneurship. Managers have a workflow management role that includes activities like operational planning, work/task delegation and acting as a figurehead. Managers also have workforce management activities (originally referred to as manpower management activities in Laud et al., 2016) that address staffing and organizing work activities. Finally, the team management role of contemporary managers includes activities related to managing disturbances, solving technical problems, monitoring activities and serving as a team builder and team player. The authors found contemporary managers to be most consistently engaged in their workflow and workforce roles, followed by their team and leadership roles, respectively (Laud et al., 2016, Figure 1). Finally, following a focus on interpersonal skills, mid- and upper-level managers ranked technical and diagnostic skills above conceptual and political skills, potentially reflecting the growing relevance of technology know-how for individuals, and not only for organizations.

From a digital transformation perspective, these findings are important as the workflow, as well as the workforce and team roles, is directly relevant to the adoption of digital tools in both managerial and operational work. Digital transformation is changing not only managerial work, but also the nature of the work that operational employees complete, the way this work is being organized and the way the work is being completed (Dean and Spoehr, 2018).

Advancing from technology decisions to digital tool adoption decisions in SMEs
SME technology adoption has received attention in relation to the emergence and evolution of computerization (Garris and Burch, 1983), information technologies (Malone, 1985), communication technologies (Barba-Sánchez et al., 2007) and, most recently, digitalization (Beatty, 2017). However, technology and its adoption in SMEs is a well-recognized challenge for these businesses (Bucatinsky, 1996). This is especially true when it comes to digital transformation of SMEs: the adoption of digital tools presents SME managers with a new type of adoption decision which reflects the fact that digital tools are a further development in the use of technology to extend the human mind by increasing the connectivity and processing power available to managers. When adopting new digital tools, SME managers are effectively making choices about the degree of information to access and share, and how much computing power is needed in relation to the work they or operational employees need to complete.

SME management challenges and opportunities
The adoption of digital technologies provides, among others, multiple advantages for SMEs, including better access to skills and talents, better access to markets, better access to financing, advanced collaboration, communication as well as product development and reductions in “red tape” (OECD, 2017). New business models that arise from the digitalization or digitization of everything, for example, in the form of pay-per-use models, subscriptions or
peer-to-peer models, are also opportunities that digital transformation provides to businesses (Vasisht and Guitiérrez, 2004). Moreover, efficiencies can be increased overall (Lepping and Palzkill, 2017), and international expansion becomes easier for companies due to communication options and ways to facilitate complex logistics (Hamidian and Kraijo, 2013). However, besides the identified advantages of the adoption of new digital technologies, SMEs also face challenges, including financial, human, organizational and capital obstacles when it comes to implementing ICT and other digital tools. Furthermore, SMEs seem to be skeptical when it comes to the point where they must trust the underlying technology and tools of the digital economy, for instance, topics associated with security and privacy (OECD, 2017).

Leavitt (1965) regards industrial organizations as complex systems that are composed of at least four dimensions – people, technology, structure and task – that are dependent, which means that change in one of the four dimensions will have consequences for the other three dimensions. People need qualifications to perform tasks like producing goods and services. By doing so, they find themselves in structures that regulate dimensions like communication, authority and workflow. Here, technology is understood as a set of tools that help to solve specific problems.

In summary, to digitally transform a business and maintain its competitiveness is regarded as a managerial task that includes the development of digital skills of employees to leverage digital tools. This drives managers to advance from purely deciding on technology adoption to digital tool adoption.

Research design
The qualitative multiple-case study research design (Eisenhardt, 1989; Yin, 2018) of this study is commonly adopted in management and strategy (Gibbert et al., 2008), entrepreneurship and small business/SME (Chetty, 1996; Perren and Ram, 2004) and information systems (Benbasat et al., 1987) research. The focus of this paper on providing a first managerial analysis of SME digital transformation draws on the strengths of this design to generate new insights (Gibbert et al., 2008) and incremental theory building (Eisenhardt, 1989; Ridder et al., 2014). We adopt the design to incrementally develop a managerial understanding of digital transformation in Swiss SMEs.

Digital transformation and Switzerland
Digital transformation of Swiss SMEs represents a unique case. In the latest global innovation study (WIPO, 2021), Switzerland was ranked first in terms of overall innovation strength as well as knowledge and technology outputs. In terms of its economic strength, Switzerland was ranked first as the world’s most resilient economy (Fan et al., 2020), and it benefits from the most highly skilled workforce globally (Desjardins, 2019). In addition, due to its central location in Europe, Switzerland benefits from the proximity to other economically strong countries such as Germany, Italy and France and provides an interesting cultural context with its four official national languages (German, French, Italian, Romansh) and many immigrant languages (Lüdi, 2008). Finally, digital transformation and digital tool adoption are well embedded as an innovation and management concept in Switzerland, as the country is ranked highly for its capacity and readiness of the economy to adopt digital technologies (IMD, 2020).

Multiple-case study design
Respondents to the survey on digital transformation of Swiss SMEs indicated a meaningful difference in the perceived contemporary relevance and degree of progress with digital
transformation for their firms. The perceived managerial relevance and progress with digital transformation are two key criteria for understanding managers’ engagement with and understanding of digital transformation (Eller et al., 2020; Verhoef et al., 2021). These responses thus allowed us to theoretically sample our cases (Eisenhardt, 1989; Yin, 2018) based on the degree of perceived contemporary relevance and degree of progress with digital transformation (see Figure 2). This suggested four cases of Swiss SME digital transformation embedded in the broader context of the contemporary digital transformation of the Swiss economy. As the study analyzes qualitative data, the qualitative multiple-case study research design of Yin (2018) was adopted, which allows such “theoretical sampling” of cases to ensure that cases are appropriate and provide rich examples for the intended analysis (Eisenhardt, 1989; Yin, 2018).

Individual SME managers are the units of data collection for the study, and their responses are allocated to one of the four cases, depending on their individual perceptions of the perceived contemporary relevance and degree of progress with digital transformation at their firm. The respondents are mainly in senior or other leadership roles in Swiss SMEs, namely managing directors (58%), division managers (12%), department managers (7%), project leaders (7%), team leaders (4%), no leadership function (8%) and other (4%). The functional expertise of the respondents includes (multiple responses were possible) marketing (43%), information technology (37%), product management (34%) and finance (32%).

The study has four embedded units of analysis (Yin, 2018): managerial understanding of digital transformation, the domain and priority of digital transformation in firms, the tools used to implement digital transformation, challenges with digital transformation and sustainable and positive business change resulting from digital transformation. This study has a theoretical replication logic, as the responses of Swiss SME managers are expected to differ across the four cases of Swiss businesses’ perceptions of their digital transformation.

**Data collection and organization**

The data analyzed for this study were collected via open questions in a larger online survey of Swiss SME businesses in Switzerland, on their efforts related to the digital transformation of

**Figure 2. Case Study Design**
their businesses. A total of 1,593 completed surveys were received during April and May 2017; data collection was stopped when daily responses slowed to such a degree that significant effort would be required to acquire further completed surveys. While it is a convenience sample, the data collected as part of this study closely correspond to the Swiss STATENT data set (BFS, 2016) that represents the broader Swiss economy. The respondents thus reflect the broader Swiss SME distribution by company size (survey%/Swiss economy %) for medium-sized firms with 50–249 employees (18%/20%), small-sized firms with 10–49 employees (20%/22%) and micro-sized firms with 1–9 employees (26%/28%). As case studies do not seek to generalize to a population, but rather to generalize to theory (analytical generalization) (Yin, 2018), this provided a rich source of qualitative data for analyzing the digitalization of Swiss SMEs.

The use of survey method data, however, requires a careful case study design and justification. This study exploits the potential of the difference between the unit of analysis and the unit of data collection (Yin, 2018) to allocate the data collected by the survey from 1,593 unique respondents to one of the four conceptually specified cases for the study (see Figure 3).

**Validity and reliability of the design**

This study actively integrates design choices to ensure the four criteria used to evaluate the rigor of qualitative multiple-case study research designs are realized, reinforced by as far as possible integrating four different types of triangulation in the study (Yin, 2018). This study primarily relies on data and investigator triangulation to achieve construct validity. Internal and external validity are ensured through a priory construct conceptualization and investigator triangulation. The reliability of the study is ensured through a clear specification of the research design in this chapter, which again benefited from investigator triangulation.

| Total Unique Respondents: 1,593 | Perceived Progress with Digital Transformation of Swiss SMEs |
|----------------------------------|-------------------------------------------------------------|
|                                  | None or Limited Progress | Some Progress | Progress | Significant Progress |
| Perceived Relevance of Digital Transformation to Swiss SMEs | 253 | 273 | 234 | 62 |
| Very Relevant | 15.9% | 17.1% | 14.7% | 3.9% |
| Sensitized Observers (Total: 792 (49.7%)) | | | | |
| Relevant | 148 | 118 | 64 | 13 |
| 9.3% | 7.4% | 4.0% | 0.8% |
| Digital Leaders (Total: 373 (23.4%)) | | | | |
| Digital Transformation to Swiss SMEs | 160 | 69 | 29 | 11 |
| Some Relevance | 10.0% | 4.3% | 1.8% | 0.7% |
| Cautious Observers (Total: 352 (22.1%)) | | | | |
| None or Limited Relevance | 106 | 17 | 19 | 17 |
| 6.7% | 1.1% | 1.2% | 1.1% |
| Voluntary Adopters (Total: 76 (4.8%)) | | | | |

**Figure 3.**
Survey respondents (unit of data collection) distribution by case type
Analytical approach
The qualitative data were analyzed using thematic coding of the qualitative material that relied on clear a priori specification of key constructs (Eisenhardt, 1989; Yin, 2018; Table A1 in the online supplementary materials presents the full codebook for the study. These codes and subcodes were used to analyze the qualitative answers about the respondents’ understanding of digital transformation, the tools adopted by respondents’ SMEs, the challenges experienced and positive change realized from DT.

The coding (Saldaña, 2021) of the data was conducted by a research assistant and under the supervision of the authoring team; the assistant and team reviewed initial coding of the data to ensure accuracy before the full data set was coded (this was repeated for each dimension coded). Based on this coding, two members of the authoring team reviewed the coding and developed the category combinations used to describe respondents’ understanding of digital transformation, the nature of the managerial and operational work and technology combinations used in the analytical tables. A similar procedure was used to categorize the types of challenges and sustained positive changes perceived by respondents.

The resulting coding patterns were then analyzed using a within- and cross-case analytical strategy and a pattern-matching approach adopted for sense-making of the patterns (Yin, 2018). Specifically, the patterns of SME managers’ understanding of digital transformation and the actual digital tools adopted by their firms for managerial and operational work were systematically compared in terms of the nature of the work being done and technologies identified. The challenges experienced and the positive sustained change are described for each case as well to allow their comparison in the cross-case analysis, in addition to the comparison of the understanding of digital transformation and tool adoption analyzes in each case.

Within-case analysis
We now proceed to present the findings for each within-case analysis, focusing on the most important patterns in our analysis.

Case 1: Cautious observers
The first case includes SMEs that perceive the least relevance and progress in responding to digital transformation. Interestingly, even in this case, managers show a clear understanding of digital transformation from an operational work and technological perspective.

Tools adopted in digital transformation. Managers in this case did not address themes related to the four categories of managerial work in 77.8% of descriptions of their understanding of digital transformation; the work of leading was most clearly recognized (9.9%). This contrasts clearly with actual tool adoption that shows 26.4% of SMEs have adopted at least one tool related to workflow and/or workforce management, while 31.3% of SMEs in the case have adopted at least one tool that addresses workflow and team management, with some leadership relevance. This suggests that SME managers are not fully aware of the implications of the associated changes for managerial work. Very few SMEs adopt two or more tools in the managerial work categories.

The explanations of digital transformation by respondents are clearly focused on operational work, with a strong technological emphasis. Understandings of digital transformation focus on the implications for organizing operational work (20.2%) and the related interaction with the changing way people are working (29.5%). Tool adoption is aligned with the understanding of the implications of digital transformation for operational work: 19% of SMEs adopted a single tool related to the changing way people work, 17% adopted a single tool reflecting the relationship between the changing nature of work and the associated different ways of working and a further 11.1% of individual tools additionally included elements of organizing these new ways of working (see Table 2). Interestingly,
20.5% of single tool adoptions were of tools that addressed the changing nature of operational work, its organization and the changing ways of working.

The technological understanding of digital transformation and the tool adoption of SMEs are highly aligned for single tool adoption. Information technology (32.4%) is central to SMEs’ understanding of digital transformation in this case, followed by communication and connectivity technologies, also in combination with information technology. Single tool adoption by SMEs shows 26.1% as focused on information technology, followed by 13.4% focused on communication and connectivity and 12.5% on tools related to information and connectivity technology. Only information technology related tools are adopted in pairs by SMEs to any significant degree (9.1%).

Change management challenges experienced in digital transformation. SMEs in this case did not report clear challenges in responding to digital transformation within the four categories of change management adopted for the study: 66.5% of descriptions of the challenges were not related to any of the four categories of people, technology, structure or task-related challenges. People (8.5%) and technology (5.1%) were the main sources of challenges.

Positive sustained change experienced in digital transformation. Respondents describing the realized benefits, addressed topics that emphasized value creation from realizing more effectiveness in existing activities (14.8%) and a combination of effectiveness- and efficiency-related sources of new value from existing activities due to digital transformation (10.5%). A total of 66.8% in this case, unsurprisingly, reported no sources of new value, and only 0.6% reported new value from innovations related to digital transformation.

Case 2: Sensitized observers
This case represents those SMEs that perceive a high relevance of digital transformation but do not perceive significant progress in the firm’s response at the time of the survey. This is the largest case by number of responses included.
Tools adopted in digital transformation. The understanding of digital transformation in terms of the categories of managerial work shows that in 76.4% of explanations, none of the four categories used in this study were addressed (see Table 3). In 18.1% of explanations, the managerial work of leading was addressed. This possibly suggests that progress with responding to digital transformation is seen as needing managerial leadership, but not impacting managerial work. Interestingly, when firms have adopted single tools, SMEs have adopted those related to workflow management (17.2%), workflow and workforce management (14.5%), workflow and team management (27.1%), or a combination of leading, workflow and team (19.9%) related managerial work. Thus, there is clear evidence that the adopted tools reported by respondents show their relevance and impact on managerial work (see Table 3).

The understanding of operational work and digital transformation is more clearly aligned with the reported single tool adoptions. While the organization of work (24.2%) is important in the understanding of digital transformation, also in combination with understandings of the changing way people work (33.3%), the tool adoption does not directly match these categories of operational work in this case (see Table 3). The adoption of a single tool by an SME is typically associated with different ways of working (28.3%), the changing nature of work and ways of working (20.5%) and, finally, the organization and changing way of working (24.3%). This suggests that in the adoption of digital tools, enabling different ways of working substitutes for a perceived need to organize work differently, possibly limiting the need for change in SMEs. It should also be noted that 33.3% of the single tool adoptions were for tools that were related to all three dimensions of operational work. Digital transformation is again clearly understood as an information technology transformation (34.8%), as some degree of connectivity technologies, as standalone (8.7%) and as information technology (8.3%). This is reflected in 34.2% of single tool adoptions being related to information technology, 30.4% having information and connectivity technology elements and 19.7% include all three digital technologies. Additionally, 14.8% of respondents reported adopting two information technology related tools.

| Managerial Work Category Combinations | UDT 1,2,3 | No. Tools Adopted (%) | Operational Work Category Combinations | UDT 1,2,3 | No. Tools Adopted (%) |
|--------------------------------------|-----------|------------------------|----------------------------------------|-----------|------------------------|
| Leading (L)                          | 18.1      | 0.0, 0.0, 0.0          | Nature of Work (N)                     | 0.5       | 0.0, 0.0, 0.0          |
| WorkFlow (W)                         | 0.3       | 0.0, 0.0, 0.0          | Organisation (O)                       | 24.2      | 0.0, 0.0, 0.0          |
| Workforce (M)                        | 0.3       | 0.0, 0.0, 0.0          | Way of Working (W)                     | 7.7       | 0.0, 0.0, 0.0          |
| Team (T)                             | 0.1       | 0.0, 0.0, 0.0          | N & O                                  | 0.1       | 0.0, 0.0, 0.0          |
| L & W                                | 1.6       | 0.0, 0.0, 0.0          | N & W                                  | 0.3       | 0.0, 0.0, 0.0          |
| W & M                                | 0.0       | 0.0, 0.0, 0.0          | O & W                                  | 33.3      | 0.0, 0.0, 0.0          |
| M & T                                | 0.0       | 0.0, 0.0, 0.0          | No Op. Work                            | 21.7      | 0.0, 0.0, 0.0          |
| L & T                                | 0.3       | 0.0, 0.0, 0.0          | All 3 Included                         | 11.7      | 0.0, 0.0, 0.0          |
| L & M                                | 0.4       | 0.0, 0.0, 0.0          | Digital Technology Category Combinations | 7.6       | 0.0, 0.0, 0.0          |
| W & T                                | 0.0       | 0.0, 0.0, 0.0          | Information (IT)                       | 34.8      | 0.0, 0.0, 0.0          |
| L, W & M                             | 0.0       | 0.0, 0.0, 0.0          | Communication (Com)                    | 3.0       | 0.0, 0.0, 0.0          |
| L, M & T                             | 0.0       | 0.0, 0.0, 0.0          | Connectivity (Con)                     | 8.7       | 0.0, 0.0, 0.0          |
| L, W & T                             | 0.0       | 0.0, 0.0, 0.0          | IT & Com                               | 7.6       | 0.0, 0.0, 0.0          |
| L, W & T                             | 0.0       | 0.0, 0.0, 0.0          | Com and Con                            | 1.6       | 0.0, 0.0, 0.0          |
| No Man. Work                         | 76.4      | 0.0, 0.0, 0.0          | No Digi. Tech.                         | 32.8      | 0.0, 0.0, 0.0          |
| All 4 Included                       | 0.0       | 0.0, 0.0, 0.0          | All 3 Included                         | 2.7       | 0.0, 0.0, 0.0          |
| No Answer Given                      | 0.4       | 0.0, 0.0, 0.0          |                                         |           |                        |

Notes: a) Columns that do not sum to 100 do not include missing answers; b) Understanding of Digital Transformation Significance Key:
- No clear evidence of Relevance
- Partial Significance
- Significant
- Highly Significant

Table 3. Sensitized observers comparison of understanding of digital transformation and tools adopted in Swiss SMEs
Change management challenges experienced in digital transformation. SMEs in this case did report challenges in responding to digital transformation. Within the four categories of change management categories adopted, only 29.0% of descriptions of the challenges were not related to one of the four categories of people, technology, structure or task-related challenges. People (14.0%) and technology (8.7%) were the main sources of challenges, while combinations of people and technology (6.4%) and people and structure (6.3%) were also notable sources of challenges.

Positive sustained changes experienced in digital transformation. Sustained positive changes experienced from responding to digital transformation in terms of value creation showed a clear pattern. The realized benefits emphasized value creation from more effectiveness in existing activities (27.1%) and a combination of effectiveness- and efficiency-related (27.3%) sources of new value from existing activities due to digital transformation. Only 29.2% of respondents in this case reported no sources of new value, while the reported new value from innovations related to digital transformation was again low at 1.8%.

Case 3: Voluntary adopters
This case is arguably one of the most interesting ones. These 76 SMEs perceive themselves to have made significant progress in responding to digital transformation, despite perceiving limited relevance of the phenomenon.

Tools adopted in digital transformation. The explanations of the understanding of digital transformation for these SMEs show very limited awareness of the relevance of managerial work, even in terms of leading (2.6%). At the same time, when SMEs in this case adopt a single tool, they are related to workflow management (21.1%), workflow and workforce management (14.5%), workflow and team management (25.0%) and finally leading, workflow and team management (21.1%). Interestingly, 22.4% of single tool adoptions were relevant to all four categories of managerial work in this case. However, the significant importance of the relationship between managerial work and digital transformation of SMEs does not seem to be recognized by SME managers in this case (see Table 4).

Understanding of digital transformation in terms of operational work is also more balanced around the organization (15.8%), the way people work (15.8%) and a combination of the two (25%). The single tool adoption also shows an even distribution of tools that reflect the changing nature of operational work (18.4%), the changing way people work (25.0%), a combination of the nature and way people work (22.4%) and the organization and the way people carry out operational work (22.4%). Adoption of single tools (31.6%) and two tools (10.5%) that address all three dimensions of operational work is higher, but still contributes to a balanced approach.

The understanding of digital transformation in terms of technologies shows a clear emphasis on information technology (28.9%), with SMEs adopting single (34.2%), two (19.7) and more than two (1.3%) tools related to information technology. Connectivity technologies (6.6%) and a combination of information and connectivity technologies (7.9%) are the next most important tools and matched by respective adoption of a single tool by 18.4 and 21.1% of SMEs, respectively. Additionally, 17.1% of SMEs adopted a single tool integrating communication and connectivity, and a single tool with all three technologies was adopted 19.3% of the time.

Change management challenges experienced in digital transformation. Challenges reported in relation to digital transformation included the categories of people (10.5%), technology (15.8%) and the task (5.3%). For this case, 42.1% of the answers indicated that none of the categories of challenges used in this paper were present.

Positive sustained change experienced in digital transformation. Sustained positive change from responding to digital transformation, in terms of value creation, showed a clear pattern.
The realized benefits emphasized value creation from more effectiveness in existing activities (25.0%) and a combination of effectiveness- and efficiency-related (21.1%) sources of new value from existing activities due to digital transformation. In this case, 43.4% of respondents reported no sources of new value, including no new value from innovations related to digital transformation.

**Case 4: Digital leaders**
The SMEs in this case represent the firms that perceive the most urgency to respond to digital transformation and perceive themselves as having made significant progress. The respondents are a noteworthy group of firms for a better understanding of how SMEs are responding to digital transformation.

**Tools adopted in digital transformation.** The understanding of digital transformation given by SMEs in the digital leaders case clearly shows an emphasis on the management work of leading (12.3%) and leading and workflow management (2.7%). Still, 79.9% of descriptions include no material reference related to the four categories of managerial work used in this paper. The tool adoption, however, shows that managerial work is relevant to digital transformation, with single tools being adopted in relation to workflow management (19.8%), workflow and workforce management (16.6), workflow and team management (29.0%) and leading, workflow and team management (21.2%). In this case, the descriptions of digital transformation by SME managers show that they have not recognized the relevance of the managerial work within the process of digital transformation.

Operational work is recognized most in the descriptions of digital transformation in relation to the organization of operational work (26.8%) and organization and the changing nature of the way work is carried out (36.2%, see Table 5). While in general aligned, the single tool adoption pattern is slightly different from the understanding of digital transformation. The adoption of a single tool is related to the changing nature of work (16.1), the new ways

| Managerial Work Category Combinations | UDT a,b | No. Tools Adopted (%) a Operative Work Category Combinations | UDT a,b | No. Tools Adopted (%) a |
|--------------------------------------|---------|-------------------------------------------------------------|---------|-------------------------------------------------------------|
|                                       | 1       | 2               | 3/4 | Nature of Work (N) | 15.8 | 0.0 | 0.0 | 0.0 |
| Leading (L)                           | 2.6     | 0.0             | 0.0 | Way of Working (W) | 15.8 | 25.0 | 0.0 | 0.0 |
| Workflow (W)                          | 1.3     | 21.1            | 0.0 | W & O             | 1.3  | 0.0 | 0.0 | 0.0 |
| Workforce (M)                         | 0.0     | 9.2             | 0.0 | Nature of W & O   | 0.0  | 0.0 | 0.0 | 0.0 |
| Team (T)                              | 0.0     | 0.0             | 0.0 | O & W             | 22.4 | 0.0 | 0.0 | 0.0 |
| L & W                                 | 0.0     | 2.6             | 0.0 | W & M             | 14.5 | 0.0 | 0.0 | 0.0 |
| W & M                                 | 2.6     | 14.5            | 1.3 | O & T             | 22.4 | 0.0 | 0.0 | 0.0 |
| L & M                                 | 1.3     | 2.6             | 0.0 | W & M             | 9.2  | 0.0 | 0.0 | 0.0 |
| W & M                                 | 0.0     | 0.0             | 0.0 | M & T             | 1.3  | 0.0 | 0.0 | 0.0 |
| L & M                                 | 0.0     | 0.0             | 0.0 | L & M             | 1.3  | 0.0 | 0.0 | 0.0 |
| L & M                                 | 0.0     | 0.0             | 0.0 | L & M             | 1.3  | 0.0 | 0.0 | 0.0 |
| W & T                                 | 0.0     | 0.0             | 0.0 | L, W & T          | 0.0  | 0.0 | 0.0 | 0.0 |
| L, W & M                              | 0.0     | 0.0             | 0.0 | L, W & M          | 0.0  | 0.0 | 0.0 | 0.0 |
| L, M & T                              | 0.0     | 0.0             | 0.0 | L, M & T          | 0.0  | 0.0 | 0.0 | 0.0 |
| No Man. Work                          | 81.6    | 5.3             | 0.0 | L, M & T          | 0.0  | 0.0 | 0.0 | 0.0 |
| All 4 Included                        | 0.0     | 22.4            | 0.0 | No Answer Given   | 10.5 | 0.0 | 0.0 | 0.0 |
| No Answer Given                       | 10.5    | 0.0             | 0.0 | All 3 Included    | 5.3  | 0.0 | 0.0 | 0.0 |

Table 4. Voluntary adopters – comparison of understanding of digital transformation and tools adopted in Swiss SMEs

Notes: a) Columns that do not sum to 100 do not include missing answers; b) Understanding of Digital Transformation Significance Key:

- No clear evidence of Relevance
- Partial Significance
- Significant
- Highly Significant

The realized benefits emphasized value creation from more effectiveness in existing activities (25.0%) and a combination of effectiveness- and efficiency-related (21.1%) sources of new value from existing activities due to digital transformation. In this case, 43.4% of respondents reported no sources of new value, including no new value from innovations related to digital transformation.

Case 4: Digital leaders
The SMEs in this case represent the firms that perceive the most urgency to respond to digital transformation and perceive themselves as having made significant progress. The respondents are a noteworthy group of firms for a better understanding of how SMEs are responding to digital transformation.

**Tools adopted in digital transformation.** The understanding of digital transformation given by SMEs in the digital leaders case clearly shows an emphasis on the management work of leading (12.3%) and leading and workflow management (2.7%). Still, 79.9% of descriptions include no material reference related to the four categories of managerial work used in this paper. The tool adoption, however, shows that managerial work is relevant to digital transformation, with single tools being adopted in relation to workflow management (19.8%), workflow and workforce management (16.6), workflow and team management (29.0%) and leading, workflow and team management (21.2%). In this case, the descriptions of digital transformation by SME managers show that they have not recognized the relevance of the managerial work within the process of digital transformation.

Operational work is recognized most in the descriptions of digital transformation in relation to the organization of operational work (26.8%) and organization and the changing nature of the way work is carried out (36.2%, see Table 5). While in general aligned, the single tool adoption pattern is slightly different from the understanding of digital transformation. The adoption of a single tool is related to the changing nature of work (16.1), the new ways
that work is carried out (29.8%), the changing nature and new ways of working combined (24.7%), organization and changing ways of working (34.9%) and all three types of operational work associated with a given tool (31.9%). Some SMEs adopted two tools in the categories of the changing way operational work is being completed (11.0%) and in combination with the organization of work (8.6%). There were also single tool (31.9%), two tools (11.5%) and more than two tools (1.1%) adopted that related to all three dimensions of operational work.

While the understanding of digital transformation clearly emphasizes information technology (31.9), there is a balanced account of connectivity technologies (7.5%), information and communication technologies (7.8%) and information and connectivity technologies (7.2%). Information technology in single tool (38.6%), two tools (13.7%) and two or more tools (5.1%) is clearly central to the significant progress made by digital leaders. Tools and the understanding of digital transformation, however, also match well for connectivity technology alone and information and connectivity technologies combined. Single tool adoption by SMEs in the case has also focused on communication and connectivity (26.8%), while single tool adoption that incorporates all three technologies is present in 23.6% of SMEs.

Change management challenges experienced in digital transformation. As expected from firms that have sought to achieve a greater degree of digital transformation, the primary sources of challenges in responding to digital technology are people (16.4%) and technology (12.6%), followed by people in combination with technology (7.0%) and structure (6.4%). This is quite a clear pattern of where the challenges for SMEs lie in responding to digital transformation.

Positive sustained changes experienced in digital transformation. The pattern of sustained positive change is a familiar one in terms of new sources of value creation. The realized benefits emphasize value creation from more effectiveness in existing activities (30.3%) and a
combination of effectiveness- and efficiency-related (35.1%) sources of new value from existing activities and due to digital transformation. In this case, only 17.2% of respondents reported no sources of new value, including new value from innovations (2.1%) related to digital transformation.

Cross-case comparative analysis
A comparison of the four cases reveals consistent patterns across the very different four SME cases, based on their perceptions of the relevance of and the progress with digital transformation. There are some variations in the degree, as would be expected given the purposeful theoretical sampling for the cases in the study. But these are nowhere near as large as one may have expected, and the resulting consistencies provide a sound foundation for drawing conclusions about SMEs’ responses to digital transformation from a managerial perspective.

Tools adopted in digital transformation
In the cautious observers, sensitized observers and digital leaders cases, the understanding of digital transformation of managerial work either does not fall into any of the four categories used in this study or it focuses clearly on leading. The voluntary adopters case shows no clear understanding of any one of the four types of managerial work. At the same time, there are two groups of tool adoption patterns that are highly consistent across all four cases for managerial work for single and multiple tool adoption; the first emphasizes workflow and workforce management, and the second emphasizes workflow and team management. Leading and teamwork management combined are often mentioned, but with very low frequency compared to the previous three patterns. The cautious observers case is clearly different in the degree to which these two pattern groups are present. Across the other three cases, the patterns emerge in very similar ways, arguably reflecting the engaged nature of the firms in these cases.

The operational work lens on understandings of digital transformation across the cases is again remarkably consistent, despite the different perceptions of relevance and progress, focusing on the organization of operational work or alternatively on the combination of organization and the changing way people work. SMEs in the voluntary adopters case are an exception – here, the standalone operational work category of the changing way people work is in addition also clearly important in understanding of digital transformation. This may be one part of the explanation for why these SMEs are investing in digital transformation progress when its relevance is perceived as relatively low. Two digital tool adoption patterns also emerge across the cases: the first is specific to the cautious observers case and shows tools adopted that are related to the changing way people work, and the combination of the changing nature of and way that people work, the organization of work and changing way people work, or tools related to all three dimensions of operational work. The cases of sensitised observers, voluntary adopters and digital leaders have the same pattern with the addition that some tools are specifically related to the changing nature of work only. These three cases are distinguished by the degree of tool adoption, with the digital leaders clearly including firms with far more intense tool adoption and little to differentiate the patterns for the other two cases.

These findings suggest that SME managers see the managerial task in digital transformation (Andersson et al., 2018; Andriole, 2017; Gimpel et al., 2018; Heavin and Power, 2018; Loonam et al., 2018) as managing the digital transformation of operational work. The digital tool adoption in operational work points to the focus in the literature on the digital skills of operational employees (Eller et al., 2020; Ko et al., 2021; Proksch et al., 2021; Scuotto et al., 2021). There is thus an indication that managerial work in Swiss SMEs is not being
digitally transformed to the same degree of operational work, as managers are adopting fewer digital tools to support them in leading, managing workflows, workforce and teams.

The understanding of digital transformation in terms of the technologies involved shows the SMEs in the cautious observers case emphasizing information technology or none of the three digital technology categories, while the sensitised observer and digital leaders cases have the same four patterns emphasizing information or connectivity, information and communication, information and connectivity or none of the three technologies. The voluntary adopters case sees a focus on information, connectivity or a combination of information and connectivity technologies, as well as some understandings without any of the three technologies. The actual adoption of single tools by SMEs in the different cases reflects these patterns. SMEs in the cautious observers case adopt tools related to information, information and connectivity, and communication and connectivity. SMEs in the sensitised observers, voluntary adopters and digital leaders cases all adopt tools focused on information, connectivity or information and connectivity technologies, or all three technologies. The voluntary adopters and digital leaders additionally also include SMEs adopting tools that combine communication and connectivity technologies, arguably reflecting their leading roles.

These findings on the understanding of digital transformation and actual technology adoption suggest that Swiss SME managers have far greater clarity on the technological vision and execution of digital transformation. This is a finding that speaks to the insights from Ko et al. (2021), where managerial aspects are found to be far more important than technology to understand differences in performance outcomes for digitally transforming SMEs.

Change management challenges experienced in digital transformation
The primary sources of challenges in responding to digital transformation are people and technology, followed by people in combination with technology and structure, again reflecting the focus of Ko et al. (2021). This is quite a clear pattern of SME challenges and responses to digital transformation. One thing to note is that the SMEs in the cautious observers case are far more likely not to identify the conceptual challenge categories used in this paper, followed by the early adopters case.

Positive sustained changes experienced in digital transformation
Across all cases, a consistent pattern of the realized benefits in terms of value creation can be identified. Digital transformation seems to drive SMEs to, first, seek more effectiveness in existing activities to create new value, followed via a combination of effectiveness- and efficiency-related sources of new value from existing activities. This suggests that Swiss SMEs are not pursuing the perceived advantages of business model innovation associated with digital transformation and digital tool adoption (Akpan and Ibidunni, 2021; Bouwman et al., 2019; Garzella et al., 2021). These findings suggest that digital technologies are still being seen as supportive technologies, despite calls to move beyond this understanding (Priyono et al., 2020). While the pattern may be familiar, the degree of value creation being realized through digital transformation can vary significantly but does reflect the theoretical replication logic. Cautious observers report new value creation least and no new value most. Digital leaders report new value creation, both from greater effectiveness and a combination of greater effectiveness and efficiencies in existing activities of the SMEs. Sensitized observers and voluntary adopters raise new value from greater effectiveness in existing activities to roughly the same degree, but sensitized observers describe more new value creation from effectiveness and efficiency than voluntary adopters. Across all four cases, there is limited evidence to suggest that Swiss SMEs are realizing more new value from innovation activities related to digital transformation.
A managerial work agenda for SME digital transformation

With people in SMEs clearly at the center when it comes to the successful completion of digital transformation, the importance of understanding the role of managerial work in realizing this transformation, as well as the potential of digital tools for enabling this work, is essential. Yet the findings from this study suggest that while the necessary tools are being implemented, the understanding of the role of managerial work in digital transformation of SMEs remains poorly appreciated. The findings of this study, therefore, clearly call for a research agenda that is focused on better understanding managerial work within digital transformation of SMEs, especially in relation to operational work and an ever-evolving technological landscape. This agenda requires shared conceptual categories, and we suggest adopting the four categories of leading, workflow management, workforce management and team management as a contemporary conceptualization of managerial work. Alternatively, scholars could return to the earlier work on which this categorization is built. Secondly, the conceptualization of operational work remains rudimentary, compared to the more coherent and intuitive categories developed for managerial work, and needs to be developed if a productive research agenda is to be set. Our study has incorporated managerial and operational work categories, as well as the digital technologies to analyze adopted digital tools. Here, work is also at its infancy, and there is much potential for developing more nuanced and independent conceptualizations of digital tools. These efforts promise a rich and fruitful research agenda with clear practice implications in realizing digital transformation of SMEs.

Conclusion

The findings about the managerial understanding of SME digital transformation and the alignment of managerial and operative work with digital tool adoption have clear implications for practice and research, while the study does have some limitations.

Implications for practice

The implications of our work for SME owners and managers are the realization that there is a clear coherence and solid insight in their firms on the understanding of digital transformation and digital tools in relation to operational work and different technological alternatives. SME owners and managers, however, need to prioritize their understanding of managerial work for digital transformation of their SMEs to fully benefit from their efforts in transforming operational work in their businesses and ultimately adapt their business strategies and business models to the potential of the new tools. Digital transformation of managerial work will also benefit the ongoing transformation of operational work and make it more likely that the benefits of business model innovation are realized, as this would necessitate the transformation of the way Swiss SMEs are managed.

Implications for research

Digital transformation of SMEs is a complex and multifaceted phenomenon that requires further research into the relationship between managerial work, operational work and the digital tools available to SMEs to realize successful digital transformation of these critical actors in national economies. This exploratory study has only added to the evidence that managerial- and employee-focused research is needed if digital transformation of SMEs is to be fully realized. Research is required to show how understandings of digital transformation and the adoption of technologies can be better aligned, a long-standing theme in SME research (Nguyen et al., 2015); further research is needed to show how managerial understanding and commitment (Ko et al., 2021; Nguyen et al., 2015) can embrace the potential
of business model innovation for new value creation (Akpan and Ibidunni, 2021; Bouwman et al., 2019; Garzella et al., 2021).

Limitations of the study
The data in this study are by now becoming slightly dated, and there is the potential that managers of Swiss SMEs may have changed their understandings and approaches to digital transformation. The study is exploratory in nature and is not conducted in such a manner that it is possible to generalize to the broader population of Swiss SMEs. While data were obtained from Swiss SME only, some limitations in terms of generalizability to other countries and regions exist. However, due to its unique position as an innovation leader, it provides for that reason meaningful insights into digital tool adoption in an innovative economy, and thus possible adoption potentials for other regions. The conceptualization uses general conceptual categories to enable the comparison of a large number of SMEs across common analytical dimensions, given the importance of industry membership to understanding outcomes from digital transformation (Ko et al., 2021); this may obscure more specific patterns for firms in the same industry.

References
Akpan, I.J., Abasifreke, E., Udoh, P. and Adebisi, B. (2020), “Small business awareness and adoption of state-of-the-art technologies in emerging and developing markets, and lessons from the COVID-19 pandemic”, Journal of Small Business and Entrepreneurship, Vol. 34 No. 2, pp. 123-140, doi: 10.1080/08276331.2020.1820185.

Akpan, I.J. and Ibidunni, A.S. (2021), “Digitization and technological transformation of small business for sustainable development in the less developed and emerging economies: a research note and call for papers”, Journal of Small Business and Entrepreneurship, doi: 10.1080/08276331.2021.1924505, in press.

Albats, E., Allen, A., Maral, M., Miller, K. and Post, G. (2020), “Stakeholder management in SME open innovation: interdependences and strategic actions”, Journal of Business Research, Vol. 119, pp. 291-301.

Andersson, P., Movin, S., Mähring, M., Teigland, R. and Wennberg, K. (2018), Managing Digital Transformation, Stockholm School of Economics Institute for Research (SIR), Stockholm, available at: www.hhs.se/contentassets/a3083bb76c384052b3f3f4c82236e38f/managing-digitaltransformation-med-omslag.pdf (accessed 16 August 2019).

Andriole, S. (2017), “Five myths about digital transformation”, MIT Sloan Management Review, Vol. 58 No. 3, pp. 20-22.

Autio, E., Nambisan, S., Thomas, L.D. and Wright, M. (2018), “Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems”, Strategic Entrepreneurship Journal, Vol. 12 No. 1, pp. 72-95.

Banker, R., Hu, N., Pavlou, P.A. and Luftman, J. (2011), “Strategic positioning, CIO reporting structure, and firm performance”, MIS Quarterly, Vol. 35 No. 2, pp. 487-504.

Barba-Sánchez, V., del Pilar Martínez-Ruiz, M. and Jiménez-Zarco, A.I. (2007), “Drivers, benefits and challenges of ICT adoption by small and medium sized enterprises (SMEs): a literature review”, Problems and Perspectives in Management, Vol. 5 No. 1, pp. 103-114.

Bauernhansl, T. (2017), “Die vierte industrielle Revolution – der Weg in ein wertschaffendes Produktionsparadigma”, in Vogel-Heuser, B., Bauernhansl, T. and Hompel ten, M. (Eds), Handbuch Industrie 4.0, Springer Vieweg, Berlin and Heidelberg, pp. 1-31.

Beatty, J. (2017), “How small businesses can increase their digital capabilities”, Harvard Business Review Digital Archives, pp. 1-5, available at: https://hbr.org/2017/07/how-small-businesses-can-increase-their-digital-capabilities.
Benbasat, I., Goldstein, D.K. and Mead, M. (1987), “The case research strategy in studies of information systems”, *MIS Quarterly*, Vol. 11 No. 3, pp. 369-386.

Berman, S. and Marshall, A. (2014), “The next digital transformation: from an individual-centered to an everyone-to-everyone economy”, *Strategy and Leadership*, Vol. 42 No. 5, pp. 9-17.

BFS (Bundesamt für Statistik) (2016), “STATENT. Statistik der Unternehmensstruktur”, provisorische Zahlen 2014, Neuenburg, available at: https://www.bfs.admin.ch/bfs/de/home/statistiken/industrie-dienstleistungen/erhebungen/statent.html.

Bharadwaj, A., El Sawy, O.A., Pavlou, P.A. and Venkatraman, N. (2013), “Digital business strategy: toward a next generation of insights”, *MIS Quarterly*, Vol. 37 No. 2, pp. 471-482.

Bouwman, H., Nikou, S. and Reuver, M. (2019), “Digitalization, business models, and SMEs: how do business model innovation practices improve performance of digitalizing SMEs?”, *Telecommunications Policy*, Vol. 43 No. 9, pp. 1-18.

Bucatinsky, J. (1996), “Technology in small businesses”, *The CPA Journal*, Vol. 66 No. 11, pp. 36-38, 58-60.

CABS (2021), “Academic journal guide 2021”, *Chartered Association of Business Schools Journal Ranking 2021*, available at: https://charteredabbs.org/academic-journal-guide-2021/ (accessed 28 June 2021).

Cannas, R. (2021), “Exploring digital transformation and dynamic capabilities in agrifood SMEs”, *Journal of Small Business Management*, pp. 1-27, in press.

Chálon, C. and Dufft, N. (2018), “The role of IT as an enabler of digital transformation”, in Abolhassan, F. (Ed.), *The Drivers of Digital Transformation. Why There’s No Way Around the Cloud*, Springer Gabler, Wiesbaden, pp. 13-22.

Chesbrough, H. and Bogers, M. (2014), “Explicating open innovation”, in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *New Frontiers in Open Innovation*, Oxford University Press, Oxford, pp. 3-28.

Chetty, S. (1996), “The case study method for research in small-and medium-sized firms”, *International Small Business Journal*, Vol. 15 No. 1, pp. 73-85.

Day-Yang, L., Shou-Wei, C. and Chou, T.-C. (2011), “Resource fit in digital transformation”, *Management Decision*, Vol. 49 No. 10, pp. 1728-1742.

Dean, M. and Spoehr, J. (2018), “The fourth industrial revolution and the future of manufacturing work in Australia: challenges and opportunities”, *Labour and Industry: A Journal of the Social and Economic Relations of Work*, Vol. 28 No. 3, pp. 166-181.

Desjardins, J. (2019), “Which countries are best at attracting high-skilled workers?”, *World Economic Forum*, Vol. 20, March, available at: https://www.weforum.org/agenda/2019/03/which-countries-are-set-to-attract-the-highest-skilled-workers-from-abroad/.

Drösler, J.K., Klünder, T. and Steven, M. (2017), “Der Industrie 4.0-Zyklus. Identifikation und Bewertung digitalisierungs-induzierter Risiken”, *Industriemanagement*, Vol. 3, pp. 68-72.

DuBrin, A. (2012), *Essentials of Management*, 9th ed., South-Western, Mason, Ohio.

Eisenhardt, K.M. (1989), “Building theories from case study research”, *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Eller, R., Alford, P., Kallmünzer, A. and Peters, M. (2020), “Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization”, *Journal of Business Research*, Vol. 112, pp. 119-127.

Ettlie, J. and Pavlou, P.A. (2006), “Technology-based new product development partnerships”, *Decision Sciences*, Vol. 37 No. 2, pp. 117-148.

Fan, I., Holzheu, T., Saner, P. and Gillespie, F. (2020), *Resilience Index 2020: Global Resilience put to the Pandemic Test*, Swiss Re Institute, Zurich.

Fayol, H. (2016), *General and Industrial Management*, Ravenio Books.
Franco, M., Godinho, L. and Rodrigues, M. (2021), “Exploring the influence of digital entrepreneurship on SME digitalization and management”, Small Enterprise Research, Early Online, Vol. 28 No. 3, pp. 269-292.

Garris, J.M. and Burch, E.E. (1983), “Small businesses and computer panic”, Journal of Small Business Management, Vol. 21, pp. 19-24.

Garzella, S., Fiorentino, R., Caputo, A. and Lardo, A. (2021), “Business model innovation in SMEs: the role of boundaries in the digital era”, Technology Analysis and Strategic Management, Vol. 33 No. 1, pp. 31-43.

George, G., Merrill, R.K. and Schillebeeckx, S.J. (2020), “Digital sustainability and entrepreneurship: how digital innovations are helping tackle climate change and sustainable development”, Entrepreneurship Theory and Practice, Early Online, pp. 1-28.

Gibbert, M., Ruigrok, W. and Wicki, B. (2008), “What passes as a rigorous case study?”, Strategic Management Journal, Vol. 29 No. 13, pp. 1465-1474.

Gimpel, H., Hosseini, S., Xaver, R., Huber, R., Probst, L., Röglinger, M. and Faisst, U. (2018), “Structuring digital transformation: a framework of action fields and its application at ZEISS”, Journal of Information Technology, Vol. 19 No. 1, pp. 31-54.

Gölzer, P. and Fritzsche, A. (2017), “Data-driven operations management: organisational implications of the digital transformation in industrial practice”, Production Planning and Control, Vol. 28 No. 16, pp. 1332-1343.

Grama-Vigouroux, S., Saidi, S., Berthinier-Poncet, A., Vanhaverbeke, W. and Madanamoothoo, A. (2020), “From closed to open: a comparative stakeholder approach for developing open innovation activities in SMEs”, Journal of Business Research, Vol. 119, pp. 230-244.

Hamidian, K. and Kraijo, C. (2013), “Digitalisierung – status quo”, in Keuper, F., Hamidian, K., Verwaayen, E., Kalinowski, T. and Kraijo, C. (Eds), Digitalisierung und Innovation. Planung – Entwicklung – Entwicklungsperpektiven, Springer-Gabler, Wiesbaden, pp. 3-24.

Heavin, C. and Power, D.J. (2018), “Challenges for digital transformation – towards a conceptual decision support guide for managers”, Journal of Decision Systems, Vol. 27 No. 1, pp. 38-45.

Horlacher, A. and Hess, T. (2016), “What does a chief digital officer do? Managerial tasks and roles of a new C-level position in the context of digital transformation”, 49th Hawaii International Conference on System Sciences, pp. 5126-5135.

IMD (2020), “IMD World digital competitiveness ranking 2020”, IMD World Competitiveness Center, available at: https://digitalswitzerland.com/wp-content/uploads/2020/10/digital_2020.pdf.

IMD (2021), IMD world competitiveness ranking 2021, available at: https://www.imd.org/centers/world-competitiveness-center/rankings/world-competitiveness/.

Jones, O.W., Gold, J. and Devins, D. (2020), “SME productivity stakeholders: getting in the right orbit”, International Journal of Productivity and Performance Management, Vol. 70 No. 2, pp. 233-255.

Ko, A., Fehér, P., Kovacs, T., Mitev, A. and Szabó, Z. (2021), “Influencing factors of digital transformation: management or IT is the driving force?”, International Journal of Innovation Science, accepted pre-publication.

Kohli, R. and Grover, V. (2008), “Business value of IT: an essay on expanding research directions to keep up with the times”, Journal of the Association for Information Systems, Vol. 9 No. 1, pp. 23-39.

Kuckertz, A., Brändle, L., Gaudig, A., Hinderer, S., Reyes, C.A.M., Prochotta, A., Steinbrink, K.M. and Berger, E.S. (2020), “Startups in times of crisis – a rapid response to the COVID-19 pandemic”, Journal of Business Venturing Insights, Vol. 13, e00169.

Kuusisto, M. (2017), “Organizational effects of digitalization: a literature review”, International Journal of Organization Theory and Behaviour, Vol. 20 No. 3, pp. 341-362.
Lanzolla, G., Lorenz, A., Miron-Spektor, E., Schilling, M., Solinas, G. and Tucci, C. (2020), “Digital transformation: what is new if anything? Emerging patterns and management research”, Academy of Management Discoveries, Vol. 6 No. 3, pp. 341-350.

Lasi, H., Fettke, P., Kemper, H. and Hoffmann, M. (2014), “Industry 4.0”, Business and Information Systems Engineering, Vol. 6 No. 4, pp. 239-242.

Laud, R., Arevalo, J. and Johnson, M. (2016), “The changing nature of managerial skills, mindsets and roles: advancing theory and relevancy for contemporary managers”, Journal of Management and Organization, Vol. 22 No. 4, pp. 435-456.

Leavitt, H.J. (1965), “Applied organizational change in industry: structural, technological and humanistic approaches”, in March, J.G. (Ed.), Handbook of Organizations. Routledge Library Editions: Organizations: Theory & Behaviour, Routledge, London and New York, pp. 1144-1170.

Lee, J. and Runge, J. (2001), “Adoption of information technology in small business: testing drivers of adoption for entrepreneurs”, Journal of Computer Information Systems, Vol. 42 No. 1, pp. 44-57.

Lepping, J. and Palzkill, M. (2017), “Die Chance der digitalen Souveränität”, in Wittpahl, V. (Ed.), IT-Themenabend: Digitalisierung, Bildung, Technik, Innovation, Springer, Berlin, pp. 17-26.

Loonam, J., Eaves, S., Kumar, V. and Parry, G. (2018), “Towards digital transformation: lessons learned from traditional organizations”, Strategic Change, Vol. 27 No. 2, pp. 101-109.

Lüdi, G. (2008), “Mapping immigrant languages in Switzerland”, in Barni, M. and Extra, G. (Eds), Mapping Linguistic Diversity in Multicultural Contexts, Contributions to the Sociology of Language, De Gruyter Mouton, Berlin, Vol. 94.

Malone, S.C. (1985), “Computerizing small business information systems”, Journal of Small Business Management, Vol. 23, pp. 10-16.

Matt, C., Hess, T. and Benlian, A. (2015), “Digital transformation strategies”, Business and Information Systems Engineering, Vol. 57 No. 5, pp. 339-343.

McKeown, I. and Philip, G. (2003), “Business transformation, information technology and competitive strategies: learning to fly”, International Journal of Information Management, Vol. 23 No. 1, pp. 3-24.

Meier, A. (2021), “Systematic review of the literature on SME digitalization: multi-sided pressure on existing SMEs”, in Schallmo, D.R.A. and Tidd, J. (Eds), Digitalization. Management for Professionals, Springer, Cham.

Moreno, J.P., Gera, P., Colangelo, M., Proverbio, M., Skan, J., Busch, W. and Caroll, G. (2015), “The everyday bank a new vision for the digital age”, available at: www.accenture.com/t20150714T065456__w__/sk-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-The-Everyday-Bank-A-New-Vision-for-the-Digital-Age.pdf (accessed 16 August 2019).

Morgan, B. (2019), “7 Examples, of how digital transformation impacted business performance”, available at: https://www.forbes.com/sites/blakemorgan/2019/07/21/7-examples-of-howdigital-transformation-impacted-business-performance/?sh=78692b8d51bb (accessed 28 May 2021).

Nadeem, A., Abedin, B., Cerpa, N. and Chew, E. (2017), “Editorial: digital transformation & digital business strategy in electronic commerce – the role of organizational capabilities”, Journal of Theoretical and Applied Electronic Commerce Research, Vol. 13 No. 2, pp. I-VIII.

Nguyen, T.H., Newby, M. and Macaulay, M.J. (2015), “Information technology adoption in small business: confirmation of a proposed framework”, Journal of Small Business Management, Vol. 53 No. 1, pp. 207-227.

OECD (2017), “Key issues for digital transformation in the G20”, Report Prepared for a Joint G20 German Presidency/OECD Conference, Berlin, 12 January 2017.

OECD (2021), OECD Studies on SMEs and Entrepreneurship. The Digital Transformation of SMEs, OECD Publishing, Paris. doi: 10.1787/bdb9256a-en (accessed 23 June 2021).
Perren, L. and Ram, M. (2004), “Case-study method in small business and entrepreneurial research: mapping boundaries and perspectives”, *International Small Business Journal*, Vol. 22 No. 1, pp. 83-101.

Peter, M.K., Kraft, C. and Lindeque, J. (2020), “Strategic action fields of digital transformation: an exploration of the strategic action fields of Swiss SMEs and large enterprises”, *Journal of Strategy and Management*, Vol. 13 No. 1, pp. 160-180.

Priyono, A., Moin, A. and Putri, V.N.A.O. (2020), “Identifying digital transformation paths in the business model of SMEs during the COVID-19 pandemic”, *Journal of Open Innovation: Technology, Market, and Complexity*, Vol. 6, p. 4, doi: 10.3390/joitmc6040104.

Proksch, D., Rosin, A.F., Stubner, S. and Pinkwart, A. (2021), “The influence of a digital strategy on the digitalization of new ventures: the mediating effect of digital capabilities and a digital culture”, *Journal of Small Business Management*, pp. 1-29, in press.

Pullen, A.J.J., De Weerd-Nederhof, P.C., Groen, A.J. and Fisscher, O.A.M. (2012), “Open innovation in practice: goal complementarity and closed NPD networks to explain differences in innovation performance for SMEs in the medical devices sector”, *Journal of Product Innovation Management*, Vol. 29 No. 6, pp. 917-934.

Reddy, S. and Reinartz, W. (2017), “Digital transformation and value creation: sea change ahead”, *GfK Marketing Intelligence Review*, Vol. 9 No. 1, pp. 10-17.

Reis, J., Amorim, M., Melão, N. and Matos, P. (2018), “Digital transformation: a literature review and guidelines for future research”, *World Conference on Information Systems and Technologies*, Springer, Cham, pp. 411-421.

Ridder, H., Hoon, C. and McCandless Baluch, A. (2014), “Entering a dialogue: positioning case study findings towards theory”, *British Journal of Management*, Vol. 25 No. 2, pp. 373-387.

Saldaña, J. (2021), *The Coding Manual for Qualitative Researchers*, Sage, London.

Sambamurthy, V., Bharadwaj, A. and Grover, V. (2003), “Shaping agility through digital options: reconceptualizing the role of information technology in contemporary firms”, *MIS Quarterly*, Vol. 27 No. 2, pp. 237-263.

Scuotto, V., Nicotra, M., Del Giudice, M., Krueger, N. and Gregori, G.L. (2021), “A microfoundational perspective on SMEs’ growth in the digital transformation era”, *Journal of Business Research*, Vol. 129, pp. 382-392.

Simon, H.A. (1944), “Decision-making and administrative organization”, *Public Administration Review*, Vol. 4 No. 1, pp. 16-30.

Somohano-Rodriguez, F.M., Madrid-Guijarro, A. and López-Fernández, J.M. (2020), “Does Industry 4.0 really matter for SME innovation”, *Journal of Small Business Management*, pp. 1-28, in press.

Stich, V. and Hering, N. (2015), “Daten und Software als entscheidender Wettbewerbsfaktor”, *Industrie 4.0, Zeitschrift für Integrierte Produktionsprozesse*, pp. 8-13.

Straub, D. and Watson, R. (2001), “Transformational issues in researching IS and net-enabled organizations”, *Information Systems Research*, Vol. 12 No. 4, pp. 337-345.

Swiss Federal Statistical Office (2021), *Statistik der Unternehmensstruktur STATENT 2018*, available at: https://www.bfs.admin.ch/bfs/de/home/statistiken/industrie-dienstleistungen/unternehmen-beschaeftigte/wirtschaftsstruktur-unternehmen/kmu.html.

Tarutė, A., Duobienė, J., Klovienė, L., Vitkauskaitė, E. and Varanaitė, V. (2018), “Identifying factors affecting digital transformation of SMEs”, *ICEB 2018 Proceedings*, p. 64, available at: https://aisel.aisnet.org/iceb2018/64.

Torres, P. and Godinho, P. (2021), “Levels of necessity of entrepreneurial ecosystems elements”, *Small Business Economics, Early Online*, pp. 1-17.

Ulas, D. (2019), “Digital transformation process and SMEs”, *Procedia Computer Science*, 3rd World Conference on Technology, Innovation and Entrepreneurship WOCTINE, Vol. 158, pp. 662-671.
Vasisht, P. and Guitiérrez, J.A. (2004), “An investigation of revenue streams of New Zealand online content providers”, *Journal of Global Information Management*, Vol. 12 No. 4, pp. 75-88.

Verhoef, P.C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J.Q., Fabian, N. and Haenlein, M. (2021), “Digital transformation: a multidisciplinary reflection and research agenda”, *Journal of Business Research*, Vol. 122, pp. 889-901.

Vial, G. (2019), “Understanding digital transformation: a review and a research agenda”, *The Journal of Strategic Information Systems*, Vol. 28 No. 2, pp. 118-144.

WIPO (World Intellectual Property Organization) (2020), “Global innovation index 2020: who will finance innovation?”, available at: https://www.wipo.int/global_innovation_index/en/2020.

WIPO (World Intellectual Property Organization) (2021), “Global Innovation Index 2021”, available at: https://www.wipo.int/pressroom/en/articles/2021/article_0008.html.

Yin, R.K. (2018), *Case Study Research and Applications: Design and Methods*, Sage Publications, London.

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| EUA | Primary code | Subcodes | Description |
|-----|--------------|----------|-------------|
| Understanding of DT | Micro | Digital technology | Information technology (IT) | This technology enables collecting, processing, storing and retrieving information, e.g. computer and computer networks |
| | | Communication technology | (CT) | This technology enables and facilitates communication in human to human and/or human to machine communication, e.g. IT plus unified communications (standard protocols), telecommunications, etc. |
| | | Connectivity technologies | | This technology enables and facilitates more convenient or effective connectivity between human(s) with machines and/or machine to machine connectivity, e.g. Internet of things, WIFI, Bluetooth, etc. |
| Technology-human relationship | Micro | Managerial work | Leading | Managers lead through their roles as strategic planner, negotiator, motivator, (resource) allocator, spokesperson and innovation and entrepreneurial effort leadership |
| | | Workflow management | | Managers manage the workflow of a firm in their role as operational (task) planners, (task/responsibility) delegators and internal (task) coordinators |
| | | Workforce management | | Managers ensure appropriate staffing for the firm and organization of staff |
| | | Team management | | This role includes specific human relations activities at the team level, such as disturbance handler, team player and team builder, as well as technical problem solver and monitoring responsibilities |
| Operational work | Micro | Operational work | Nature of work | Digital transformation changes the nature of the tasks that are operational employees’ work |
| | | Organization of work | | Digital transformation is changing the way the work of operational employees is organized |
| | | Way people work | | Digital transformation is changing the way operational employees’ work |
| Implemented tools | | Tools | Information technology in tools | These tools are primarily focused on the collection, processing, storage and retrieval of information |
| | | Communication technology in tools | | These tools enable and facilitate more convenient or effective communication in human to human and/or human to machine communication |
| | | Connectivity technology in tools | | These tools enable and facilitate more convenient or effective connectivity between human(s) with machines and/or machine to machine connectivity |
| Implementation challenges | | Change management | People | Changes that affect the nature of the tasks/work need the skills and attitudes of the affected people to be considered. People may not be able and/or willing to perform new, additional or even established tasks |
| | | Technology | | Technology refers to tools that help to solve specific problems associated with completing the tasks required in work. Challenges arise when technology proves more complex than anticipated, is difficult to integrate into existing systems or has difficulties in its implementation |
| | | Structure | | When people perform tasks, they find themselves in structures that regulate things like communication, authority and workflow, for example. Reorganizing the management and execution of work in response to digital transformation can be a source of challenges for managers |
| | | Task | | Tasks are the activities that need to be completed to allow the firm to achieve its reason for existing, e.g. producing goods and services. The complexity and diversity of these tasks is today more diverse and specialized than ever, and digital transformation only adds to these trends |
| Sustainable positive change | | Value created | Greater value from effectiveness | Increased effectiveness of existing value creation activities, such as being able to market better and increase the willingness-to-pay of customers or achieve more demanding production performance standards |
| | | Greater value from efficiencies | | Increased efficiency of existing value creation activities, which realize the same output for less inputs or more output for the same inputs into the activities of the firm |
| | | New value from innovations | | The realization of new sources of value creation, from innovation, enabled by digital transformation, can include both incremental and more radical innovation of products and services, and processes |