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Unveiling micro-foundations of digital transformation: Cognitive models, routines, and organizational structures in agri-food SMEs

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ABSTRACT

The consequences of digital transformation are becoming more visible and pervasive. Despite extensive research on the technological side of the transformation, emphasizing its discontinuous nature, little is known about how managers reframe their cognitive models, reshape routines, and exploit novel organizational structures to implement digital transformation initiatives. We abductively characterize the micro-foundational elements of cognitive, routines, and organizational structure pillars by building on an integrative theoretical framework and looking at how twenty-four Italian SMEs in the agri-food sector pursue digital transformation. Significant differences emerge between SMEs with high and low levels of technological integration, leading to relevant theoretical and managerial implications on how SMEs can successfully navigate digital transformation. Finally, we open up new avenues for future research.

1. Introduction

Recent studies have shown that the impact of digital transformation on companies is pervasive and has the potential to significantly influence their operations and value generation (Appio et al., 2021; Han and Trimi, 2022). Companies that have successfully embraced digital transformation have been able to optimize their manufacturing processes (Tsikriktsis et al., 2004) and design new business models (Verhoef et al., 2021). However, this process of adaptation can be challenging for companies, requiring a holistic approach that embraces the "comprehensiveness of actions" (Warner and Wäger, 2019) necessary to transform their businesses while avoiding potential threats (Singh and Hess, 2017).

For example, Fitzgerald et al. (2014) argue that digital transformation is not only about the introduction of new digital technologies (e.g., social media, analytics), but also the opportunities and challenges they bring, such as streamlining operations, and creating new business models. Volberda et al. (2021) also emphasize the importance of digital technologies for digital transformation in terms of opportunities, highlighting "how they enable company-wide change by involving the reframing of cognitive models of management, the building of novel routines,[1] and the implementation of new organizational forms for creating and appropriating new value in an established or new ecosystem" (2021: 3). The shift towards digital transformation has been increasingly viewed as a managerial issue rather than a technical one (Tabrizi et al., 2019; Volberda et al., 2021) with the potential to affect companies at multiple levels (Appio et al., 2021). Business owners must not only integrate digital technologies with existing business processes but also be open to develop new ways of conducting their business (Li et al., 2018).

It is therefore not surprising that management scholars are increasingly focusing on this aspect of digitalization and how companies may respond to it (Tabrizi et al., 2019; Verhoef et al., 2021; Volberda et al., 2021). In a recent article, Volberda et al. (2021) assessed earlier studies on the subject and advanced an integrative framework for digital transformation. They found that at the organizational level, embarking

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[1] According to Volberda et al. (2021: 6): "Digitally mature firms (Kane et al., 2017) are incorporating more and more digital technologies into their operational routines, with the effect that the difference between routines and capabilities may vanish, since routines based on digital technologies are very easily adaptable (Hanelt et al., 2021). These routines mobilize resources to address digital needs and seize opportunities and allow a firm to capture value from doing so (Vial, 2019)."

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on digital transformation initiatives frequently requires a collective abandonment of the company's current mindsets, culture, and identity in order to create new ones that are suitable for the digital environment. Furthermore, the authors emphasized that digital transformation efforts must cross current organizational boundaries. This is because companies in the digital age are compelled to expand and alter the scope of their operations quickly and are interconnected with one another. To effectively manage digital transformation activities, companies must simultaneously pursue the attainment of new cognitive models, routines, and organizational structures, both internally and externally (Volberda et al., 2021). While we know that these three elements are key to successfully implement digital transformation, there has been little research on their micro-foundations, which limits managers' understanding and, as a result, hampers their decision-making process (Vial, 2019). Indeed, while new cognitive models are required to sense digital opportunities, novel routines are also necessary to enable the organization to capitalize on those opportunities, by reconfiguring the resource base and extracting value from it (Ceipak et al., 2021). Changing or rearranging the organizational structure is also essential to profit from digital transformation because it allows companies to align their internal processes and structures with their digital strategy and goals (Volberda et al., 2021).

The challenges of digital transformation are further intensified for companies that are not "born digital" (Cozzolino et al., 2021). These companies may struggle to adapt their processes and strategies to new technologies due to outdated technological endowments, old cognitive models, and rigid organizational structures. Additionally, literature on digital transformation often focuses on large companies and "born digital" companies such as Amazon and Google (Fernandez-Vidal et al., 2022; Letmathe and Rößler, 2022; Sjödin et al., 2022), which may have an advantage in navigating digital transformation.

SMEs, on the other hand, face significant challenges in embracing digital transformation (Bouwman et al., 2019). Despite their ability to drive economic growth, create jobs, and support social integration (European Commission, 2018; Boumediene et al., 2022), only 17 % of European SMEs are highly digitalized. This is due to various barriers such as inadequate capabilities and limited resources to develop and maintain digital operations, limited information technology skills, low customer or supplier usage, and short planning horizons (Jones et al., 2014; Mazzarol, 2015). Additionally, SMEs may struggle to adopt new mental models, change their routines, and modify their organizational structure (O'Connor and Kelly, 2016; Annosi et al., 2019; Ates and Acur, 2022; Battistoni et al., 2023), hindering their ability to create and capture value. Despite the potential benefits of digital transformation for SMEs, such as improved efficiency and effectiveness, cost reduction, productivity growth, customer satisfaction, and competitive advantage (e.g., Pfister and Lehman, 2023), there appears to be a lack of guidance for SMEs to understand the micro-foundations that inform the implementation of digital transformation initiatives (Leso et al., 2023). This highlights the need for more research to help SMEs navigate the digital landscape and to unlock the full potential of digital transformation.

By taking into account these gaps, our primary research question is: *What are the key micro-foundational elements in cognitive models, routines, and organizational structures that are necessary for SMEs to effectively navigate digital transformation?*

To answer this research question, we build upon Volberda et al.'s (2021) integrative framework applying it to a sample of twenty-four Italian SMEs operating in the agri-food sector. SMEs in the agri-food sector face unique challenges in implementing digital transformation initiatives. One of the main challenges is the lack of resources, both financial and human, to invest in digital technologies and digitalization processes (Jones et al., 2014; Mazzarol, 2015). SMEs in the agri-food sector also often have limited access to digital technologies and digital skills, which makes it difficult for them to adopt new technologies and digital business models (Bouwman et al., 2019; Ates and Acur, 2022). Another challenge that SMEs in the agri-food sector face is the lack of trust in digital technologies and digital platforms (O'Connor and Kelly, 2016; Annosi et al., 2022). This lack of trust can make it difficult for SMEs to adopt digital technologies, as they may be hesitant to share data and collaborate with other organizations. Additionally, these SMEs may face challenges as they often incorporate a traditional, less flexible, organizational structure, which can make it difficult for them to implement digital transformation initiatives (Silvestri et al., 2023; Battistoni et al., 2023). These are the reasons that make the agri-food research setting interesting for our study. From the methodological point of view, we use a qualitative abductive analysis (Van Maanen et al., 2007; Timmermans and Tavory, 2012; Mantere and Ketokivi, 2013) to characterize an existing integrative framework using novel primary data. Furthermore, we compare cases with high levels of technological integration (HTI hereafter) and low levels of technological integration (LTI hereafter), providing a more nuanced picture of the impact of digital transformation initiatives in SMEs with different technological foundations.

With this paper, we contribute to existing research on the digital transformation (Appio et al., 2021; Volberda et al., 2021) in the context of SMEs (Annosi et al., 2022; Ates and Acur, 2022) as well as literature on how SMEs can adapt to technological change (Han and Trimi, 2022; Troise et al., 2022). By providing a thorough characterization of the Volberda et al.'s (2021) integrative framework for digital transformation, we provide a micro-foundational view of this phenomenon. In particular, our research adds to the growing literature on managerial cognitive models in the context of SMEs by highlighting the importance of workforce management and collective decision-making in driving digital transformation. While existing studies (e.g., Li et al., 2018) have focused on individual managers and their cognition, our findings demonstrate the crucial role of involving the entire workforce, stimulating collective decision-making, and promoting a culture of curiosity and learning about new technologies. Furthermore, we contribute to the understanding of organizational structures in SMEs by demonstrating how successful companies dynamically assign tasks, collect and disseminate new information, and motivate employees to adopt new technologies. Our findings reveal the importance of collaborative relationships between managers and employees and structured interactions that facilitate knowledge transfer. This contrasts with previous research that has primarily emphasized the role of external collaboration in coping with resource constraints (e.g., Han and Trimi, 2022). Finally, our study advances the literature on routines in the context of digital transformation by identifying specific knowledge creation, alliance, and collaboration routines that SMEs employ to integrate new technologies. By connecting our findings to the broader concept of dynamic capabilities (Eisenhardt and Martin, 2000), we demonstrate how SMEs combine internal and external knowledge to reconfigure resources and adapt to market changes.

Additionally, our findings offer several key implications for SME managers aiming to successfully navigate digital transformation. We suggest they should: cultivate an open-minded attitude towards new technologies and actively seek information from different ecosystem actors to identify growth opportunities and maintain competitiveness; engage proactively in the innovation process, as merely adopting new technologies may not be enough to create value in today's digitally-driven environment; encourage collaboration, both internally and externally, to harness diverse competencies and technical skills, thus undertaking informed decisions about technology adoption and integration; and adopt long-term strategic planning when considering technology adoption in order to align investments with company goals and create sustainable value.

This paper begins with a review of the prior studies, which helps connect the concepts of cognitive models, routines, and organizational structures in the context of digital transformation. It then provides an overview of the research setting and characteristics of the abductive qualitative method. We articulate our empirical findings and conclude by discussing what this means for theory and managerial practice, also

offering recommendations for future research.

2. Literature review

2.1. The importance of a holistic approach to digital transformation

The phenomenon of digital transformation is multifaceted (Appio et al., 2021; Hanelt et al., 2021). Depending on how well a company adapt to this new competitive environment, it could flourish or go out of business. Lot of companies fail as a result of concentrating primarily on the technological side of the digital transformation. Precisely, companies often prioritize technology and overlook: i) the need for a supportive organizational culture that face resistance to change, leading to failure in the digital transformation process (Besson and Rowe, 2012); ii) the importance of aligning this latter with the company's overall strategy and goals, resulting in misallocated resources and missed opportunities (Tarafdar and Qrunfleh, 2017); iii) the need to train employees on how to use and adapt to new systems, resulting in inefficiencies and poor adoption of new technologies (Kontoghiorghes, 2016); iv) customer needs, thus struggling to retain and attract customers, which can ultimately lead companies to failure (Lemon and Verhoef, 2016).

If we look closely at the definitional aspects, recent research refers to digital transformation as "the use of new digital technologies to enable major business improvements such as enhancing customer experience, streamlining operations, or creating new business models" (Fitzgerald et al., 2014: 2). Indeed, digital transformation is a multifaceted and dynamic concept with a plethora of definitions in academic literature, illustrating diverse viewpoints and scopes (Reis et al., 2018; Appio et al., 2021). Some interpretations emphasize a narrower focus, accentuating the adoption and implementation of innovative technologies that facilitate remote connectivity, virtual operations, and data analysis (Zhu et al., 2021). In contrast, other definitions adopt a more comprehensive perspective, perceiving digital transformation as an all-inclusive process involving alterations in business models, customer experiences, operational processes, and organizational culture, all driven by digital technologies (Kraus et al., 2021; Volberda et al., 2021). By recognizing the wide range of definitions and their diverse scope, our research aims to contribute to a more extensive understanding of digital transformation by investigating its various dimensions and their interactions within the context of small and medium-sized enterprises (SMEs). Recently, scholars have investigated the impact digital transformation has on companies, and how companies can incorporate such transformation into their strategies and business models to be successful and gain a competitive advantage (Tabrizi et al., 2019; Cennamo et al., 2020; Verhoef et al., 2021).

Such a challenge necessitates companies approaching digital transformation initiatives holistically. In a recent study, Volberda et al. provide a definition based on an integrative framework, defining digital transformation as "the use of new digital technologies to enable company-wide change (evolutionary versus transformative), involving the reframing of cognitive models of management (by envisioning new digital business models), the building of novel routines (for the seizing of digital opportunities), and the implementation of new organizational forms (for setting up and integrating digital operations) for creating and appropriating new value in an established or new ecosystem" (2021: 3). The few contributions calling for a more holistic approach to digital transformation (Tekic and Koroteev, 2019; Li, 2020) resonate better with the need to consider the digital technologies as a necessary (though not sufficient) means to enable digital transformation initiatives. The holistic approach emphasizes the importance of viewing digital transformation as a managerial issue rather than a technical one (Besson and Rowe, 2012; Tabrizi et al., 2019; Volberda et al., 2021), potentially affecting companies at multiple levels (Appio et al., 2021), and requiring business owners to integrate digital technologies with existing business processes or invent new ways of doing business (Li et al., 2018).

This holistic approach clearly contends that adopting new technologies is necessary but not sufficient for a company to transform for today's digital world (Volberda et al., 2021). Simply choosing and implementing the appropriate digital technologies is unlikely to result in success (Furr and Shipilov, 2019; Kane et al., 2019; Tabrizi et al., 2019). In order to uncover the crucial mechanisms that determine the success or failure of digital strategies, research must take into account the cognitive components of new ways of doing models, together with routine-centered and organizational notions (Volberda et al., 2021).

Strong routines are necessary for companies to succeed in the digital age, but determining the right routines for creating and capturing value and how to implement them effectively are strongly related to other cognitive aspects. Additionally, these processes take place within organizational hierarchies that must deal with challenges and opportunities brought on by digital technology. Since new technologies are becoming easier and easier to obtain, the technology itself might not offer a long-term benefit. Instead, what gives companies a competitive edge is how the technology is entwined with a certain organizational context made up of cognition, routines, and structure (Volberda et al., 2021). Although management research (Gavetti, 2005) has strong roots in the need of jointly taking into account the three major parts of cognition, routines, and organizational structure, this has generally not been given the proper consideration in the newly emerging study on digital strategy (Volberda et al., 2021; Hanelt et al., 2021).

2.2. Digital transformation in SMEs

According to the World Bank, digital transformation is vital for SMEs, playing a significant role in economies and generating employment and GDP. SMEs represent more than 90 % of businesses and over 50 % of global employment (European Commission, 2018). The SME landscape has experienced considerable change due to digital technologies (Bayo-Moriones et al., 2013; Boumediene et al., 2022), presenting both opportunities and challenges. Key drivers of digitalization for SMEs include the need to stay competitive in the market (Chan et al., 2020; Khurana et al., 2022). Digital technologies allow SMEs to reach new markets, improve efficiency, reduce costs, and address crises. Utilizing digital tools like e-commerce and social media helps SMEs expand their customer base and increase sales and revenues. Additionally, digital technologies enable SMEs to automate processes, lower operational costs, and enhance productivity (Ulas, 2019; Gartner et al., 2023). Another driver of digitalization is the changing customer demands, as digital technology usage shifts expectations and behavior. Customers now expect businesses to maintain an online presence and offer digital services, such as online ordering and payment (Denicolai et al., 2021; Matarazzo et al., 2021). To meet these evolving customer demands, SMEs must embrace digital technologies. Additional drivers for SMEs adopting digital technologies include government support in the form of grants, subsidies, and tax incentives, which provide necessary funding and resources (Ulas, 2019). Furthermore, digital technologies like data analytics and Business Intelligence (BI) tools enable SMEs to monitor and analyze data, make data-driven decisions, improve operations, identify new opportunities, and make better-informed decisions, increasing the scalability of their businesses (Chan et al., 2019; Han and Trimi, 2022).

Despite the benefits of digitalization, SMEs face barriers such as lack of knowledge and skills among owners and employees, hindering their ability to effectively adopt digital technologies and realize their benefits (Eller et al., 2020; Malodia et al., 2023). Another barrier is the lack of funding and resources, making it difficult for SMEs to invest in digital technologies and remain competitive in the market (Madrid-Guijarro et al., 2009; Horváth and Szabó, 2019). Additional barriers include resistance to change, with many SMEs hesitant to adopt digital technologies due to a lack of understanding of the benefits or the perception that these technologies are complex and difficult to implement (Oni and Papazafeiropoulou, 2014; Dwivedi et al., 2023).

Although studies have explored some of the above-mentioned drivers

and barriers, what is lacking is a holistic view (Volberda et al., 2021) of the micro-foundational elements that simultaneously lead to the achievement of digital transformation in SMEs. Investigating the micro-foundations of digital transformation allows to: i) identify the specific factors that influence the adoption and implementation of digital technologies in SMEs; ii) understand the unique challenges and opportunities that SMEs face in relation to digital technologies; iii) identify the specific strategies and actions that SMEs can take to overcome barriers and to leverage opportunities related to digital technologies; iv) pinpoint the specific outcomes that SMEs can expect from the adoption and implementation of digital technologies.

Our study takes the stance of the Volberda et al.'s (2021) holistic approach and build upon its three major parts: cognitive models, routines, organizational structure. We review the academic debate surrounding the key components of Volberda et al.'s (2021) framework, which we will characterize with our research. To the best of our knowledge, no study exists that characterizes the micro-foundational elements of the holistic framework proposed by Volberda et al. (2021), and this represents a valuable research gap that needs to be filled with empirical research.

2.3. Cognitive models

In the digital era, companies face challenges in processing vast amounts of data from various organizational nodes for decision-making. Although digital technologies can broaden attentional focus, poor implementation may create conflicting signals and cause organizational paralysis (Davenport and Wasterman, 2018; Kane et al., 2019).

Research suggests incumbents are more likely to use digital technologies incrementally to extend or improve operations than to create new business models (Foss and Saebi, 2018; Warner and Wäger, 2019). Radical transformation involving digital technologies, changing customer expectations, and competition dynamics can be challenging (Chesbrough, 2015). Studies on technology adoption show that cognitive barriers may hinder the process (Volberda et al., 2021), as for example dominant business logics may prevent employees from embracing new ideas (Chesbrough, 2015). Adopting digital technologies involves experimentation, trial-and-error learning, and discovery (Kellogg, 2022; Andersen et al., 2022; Rummel et al., 2022). Also, overcoming cognitive barriers requires access to high-quality information, strategic human resources, competencies, and training (Blanka et al., 2022; Gfrerer et al., 2022).

For SMEs, overcoming cognitive bias and successfully leading digital transformation is a recent research focus (Li et al., 2018). SME entrepreneurs may experience 'cognitive inertia' (Messner and Vosgerau, 2010), struggle to understand digital technologies' potential benefits (Chong et al., 2016), and over-rely on past non-digital experiences (Santarelli and D'Altri, 2003). Li et al. (2018) found that SME entrepreneurs can shed outdated beliefs and adopt new ones through iterative learning and reflective practices. Bourdeau and Vieru (2020) argue that SMEs must develop not only technical skills but also cognitive and socio-emotional elements to be 'digitally fluent.' Annosi et al. (2019) emphasize the importance of managerial cognition during technological change in SMEs, especially during uncertain times (Walsh, 1995). Cognitive knowledge, skills, and attitude are crucial for SMEs to capitalize on digital transformation initiatives (Bourdeau and Vieru, 2020).

2.4. Routines

Navigating the digital transformation requires cognitive change and the implementation of novel routines (Wenzel et al., 2021). Digital processes facilitate real-time analysis, improved decision-making, and better engagement with stakeholders like consumers, suppliers, and employees. Digitally mature companies are incorporating digital technologies into operational routines, making them easily adaptable and allowing them to seize opportunities (Vial, 2019). Dynamic routines, such as rapid prototyping and strategic agility, are needed to address the increased speed, scope, and scale of changes in digital contexts (Volberda et al., 2021).

The digital era calls for a more fluid decision-making process, with broader and adaptable routines (Khanagha et al., 2018). Innovation methods must also be reevaluated as companies increasingly collaborate and co-create value with external partners (Chesbrough, 2003; Van Haverbeke et al., 2008). Companies can speed up the innovation process by searching for novel techniques outside their boundaries or contacting external change agents.

The literature emphasizes the need for reexamining managerial responsibilities, decision-making, coordination, and motivation in the context of digital transformation (Iansiti and Lakhani, 2020). Introducing new management practices, such as lean, agile, or scrum techniques, is essential for transitioning from traditional principles focused on alignment to new ones emphasizing speed and complexity (Ghezzi and Cavallo, 2020; Perkin and Abraham, 2021).

Research on digital transformation and novel routines in SMEs is limited. Castagna et al. (2020) argue that digitalization affects knowledge management strategies and necessitates new knowledge management systems (Centobelli et al., 2019). Digital innovation creates fluidity in innovation processes and forces businesses to reconsider routines for exploring and exploiting knowledge flows.

Chen et al. (2014) suggest that reconfiguring routines in SMEs is necessary to deconstruct operational inertia, reposition strategic intent, and rejuvenate flexibility and innovation. They argue that the adoption of e-commerce solutions requires companies to eliminate their inability to implement internal change, replace previous ambitious goals with new ones, and restore the ability to tailor digital solutions to customer preferences. Dressler and Paunovic (2021) found that the acceptance of new routines in wineries has been low, but digitalization can help by promoting work tasks routines and bridging the digital divide. They identified ways in which digitalization can aid in changing the nature of work by implementing tools that promote routine work tasks, reducing stress levels caused by the unstructured nature of manufacturing procedures. Canhoto et al. (2021) contend that routine reconfiguration is of utmost importance to achieve digital strategy alignment in SMEs. They argue that it is necessary to develop the ability to change company processes and routines, leverage resources in novel ways, gain access to new resources to fill previously identified gaps, and release resources to achieve optimal combinations.

In conclusion, navigating digital transformation requires cognitive change and the development of novel routines. Companies must adapt their decision-making processes, managerial practices, and innovation methods to the rapid pace of change in the digital era. Embracing more flexible and adaptable routines allows companies to better cope with the challenges of digital transformation, while reevaluating innovation methods enables them to explore and exploit knowledge flows more effectively.

In the context of SMEs, the implementation of digital solutions can lead to significant shifts in organizational routines and processes, particularly in areas like knowledge management and e-commerce. These changes can help companies overcome operational inertia, refine their strategic focus, and enhance their flexibility and innovation capabilities. By adopting digital solutions, SMEs can better manage the increasing amounts of data and information, and tailor their products and services to meet evolving customer preferences. Moreover, it is essential for organizations to invest in digital skills and competencies, ensuring that employees are well-equipped to navigate the new digital landscape. This may involve offering training programs, encouraging continuous learning, and fostering a culture of experimentation and adaptation. In addition to internal changes, companies should also consider collaborating with external partners to drive innovation and value co-creation. By establishing relationships with customers, suppliers, competitors, and other stakeholders, organizations can tap into a wider pool of knowledge and resources, ultimately accelerating their

digital transformation journey. Furthermore, organizations must be prepared to address the potential tensions and conflicts that may arise during the digital transformation process. By fostering a culture of open communication, transparency, and trust, companies can better navigate these challenges and ensure a smoother transition to a more digitally mature state.

2.5. Organizational structure

Digital transformation has led to the emergence of new organizational models, such as agile management (Ghezzi and Cavallo, 2020; Perkin and Abraham, 2021), holacracy (Robertson, 2015), and self-organization. Enabled by digital technologies, these models allow companies to become more adaptive (Hanelt et al., 2021) and develop new business models (Marcon et al., 2022; Tian et al., 2022). Traditional hierarchical structures can limit companies' ability to adopt digital business models, necessitating modifications or redesigns (Foss et al., 2009; Yoo et al., 2012).

Many SMEs are now run by small, flexible teams that collaborate through networks of platforms and workers (Volberda et al., 2021). Silvestri et al. (2023) emphasize the importance of business networking for SMEs to benefit from joint R&D initiatives and embrace digital transformation. Also, Han and Trimi (2022) suggest that SMEs can benefit from Industry 4.0 digital technologies if standardization efforts are implemented. They offer a roadmap for adopting digital technologies, enhancing collaboration capabilities, and building trustworthy relationships with partners, as well as a data science platform for efficient big data analysis.

Troise et al. (2022) maintain that SMEs need to be organizationally agile to survive in the competitive environment marked by volatility, uncertainty, complexity, and ambiguity. They propose a model where organizational agility mediates the relationship between innovation, relational, and digital technological capabilities, and financial performance, process innovation, and product innovation.

In conclusion, digital transformation has led to new organizational models that enable companies to be more adaptive, flexible, and innovative. SMEs should leverage business networking, digital platforms, and Industry 4.0 technologies to enhance their capabilities and remain competitive in the face of digital transformation.

3. Methodology

3.1. Research design

In our research, we adopt a multiple case study approach (Eisenhardt and Graebner, 2007) that is rooted in a qualitative abductive analysis (Van Maanen et al., 2007; Timmermans and Tavory, 2012; Mantere and Ketokivi, 2013). Specifically, we rely on a "comparison logic" (Bansal et al., 2018: 1190) based on polar types (e.g., high or low performing, as in Eisenhardt and Graebner, 2007), rather than focusing on an extreme exemplar. This method is line with our aim to compare multiple cases with an existing integrative framework (Volberda et al., 2021) that builds upon yet adds to it by providing novel theoretical insights (Peirce, 1935; Locke, 2007). An abductive methodological approach allows the "cultivation of anomalous and surprising empirical findings against a background of multiple existing sociological theories and through systematic methodological analysis" (Timmermans and Tavory, 2012: 169), and is being increasingly recognized as a valid approach to study management phenomena (Behfar and Okhuysen, 2018) and generate theory (Van Maanen et al., 2007; Timmermans and Tavory, 2012; Sætre and Van de Ven, 2021). We specifically develop our analysis- rather than "tabula rasa" (Glaser and Strauss, 1967) - with Volberda et al.'s (2021) theoretical background and examined our data to find interesting, fine-grained insights within their established conceptualisation with the aim to unveil the micro-foundations of the cognitive, routines, and organizational structure pillars for the investigated SMEs. We opted to employ an abductive qualitative methodology (Van Maanen et al., 2007; Timmermans and Tavory, 2012; Mantere and Ketokivi, 2013) as navigating digital transformation may require to enact different mechanisms, and for SMEs it may be key to understand how they unfold, rather than what outcomes they may determine or which drivers may trigger them.

To explore the micro-foundations necessary for SMEs to navigate digital transformation, we engaged in a constant comparison between the owner-managers of HTI and LTI SMEs (Strauss and Corbin, 1994), until we reached theoretical saturation (Glaser and Strauss, 1967; Bowen, 2008).

3.2. Research setting

In contemporary economies, digital transformation represents an important growth path for SMEs, especially in the agri-food sector which is dominated mostly by SMEs (European Commission, 2018). SMEs in agri-food are increasingly impacted by innovation both in terms of products and processes. The growing call for food products of greater quality and the need to improve processes have induced companies to adopt new technologies and to have at their disposal adequate tools to deal with these newly adopted technologies (Omri, 2020). As such, the agri-food sector is characterized by an extensive use and growing rate of technology adoption (Burke, 2010; Eiriz et al., 2019; Cane and Parra, 2020). We focused on Italian companies due to the key role played in Italy by the agri-food sector which is the number one driving force behind the Italian industry (Coldiretti[2]). Importantly, in Italy, where other sectors experienced on average a drop in revenues of 13 %, companies operating in the agri-food sector did not register any drop in revenue in 2020 compared to 2019.[3] The success of the agri-food sector is mostly due to Italian agriculture's supremacy in various aspects (i.e., the 'greenest' in Europe with 297 PDO-PGI certified specialties, 415 DOC-DOCG certified wines, over 60,000 organic farms, increased biodiversity, etc.). Agri-food faces key challenges as it uses an important amount of land and plenty of fresh water; it sprays excessive toxic pesticides; and leads to unhealthy and unsustainable diets by wasting one-third of the total food. Some reports[4][5] suggest that technological change – and in particular – digital technologies are pivotal tools for surmounting these massive challenges.

Our research is based on a sample of twenty-four SMEs in the Italian agri-food sector. Despite the benefits agriculture 4.0 provides to large enterprises, SMEs face a number of challenges as a result of the continuous development of innovations and technologies (Zambon et al., 2019). Recent articles on agriculture 4.0 describe the difficult process of digital transformation and environmental attentiveness to which SMEs are subjected (Huh and Kim, 2018; Belhadi et al., 2021). As a result, we chose to investigate SMEs in the agri-food sector. Indeed, the significant challenges these companies face in adapting to the digital transformation make them an appropriate setting for our analysis.

There is not a unique definition of a SME. Although the definition varies by country, it frequently depends on the amount of employees, assets, or sales turnover (Ongori and Migiro, 2010). For the purposes of this study, the authors agree to the generally accepted definition of SMEs as companies with less than 250 employees as set forth by the European Union (EU) (Bayo-Moriones et al., 2013; Saridakis et al., 2018).

The SMEs were identified with two criteria in mind: 1) the availability of selected companies to participate in the study; 2) the priority of reducing the impact of confounding factors. We first sent the invitation to a random sample of SMEs from across the country

[2] https://www.coldiretti.it/

[3] https://www.italian-feelings.com/category/market/

[4] https://www.ceps.eu/wp-content/uploads/2019/12/Digitising-Agrifood.pdf

[5] https://www.oecd.org/agriculture/topics/technology-and-digital-agriculture/

(geographically stratified by North, Center, and South) by relying on the official database from the Italian National Institute of Statistics.[6] Out of the 30 companies that accepted to be involved in the study, 24 were concentrated into a single territory, specifically the Marche Region, located in the centre of Italy. By focusing on small and medium companies operating in the same industry and same geographical area, we reduced the risk of unobserved heterogeneity due to differences in company size and industry and contextual factors due to diverse geographical territories of SMEs in our sample. Indeed, in order to avoid the influence of confounding factors and unbalanced comparison, we decided to analyze only those 24, excluding the remaining 6 spread in the North (2) and the South (4) of Italy.

Also, ISTAT measures the digital intensity of companies based on certain activities carried out in this area, such as the use of social media, IoT, cloud, online sales, artificial intelligence, etc., using the DESI (Digital Economy Society Index). Therefore, we were able to choose SMEs which were already engaged in the process of digital transformation, as proven by the adoption of specific digital technologies, but we also made sure we included SMEs that showed different levels of digital transformation adoption and implementation. In particular, we followed a "polar type" sampling logic (Eisenhardt and Graebner, 2007) with respect to the degree of digital innovation implemented. Companies showing radical use of digital technologies (e.g., Company 7 in Table 1) were categorized as high technology integrated (HTI) companies, while companies showing low or incremental use of digital technologies (e.g., Company 2 in Table 1) were categorized as low technology integrated companies). Specifically, 13 companies were included in our sample as HTI and 11 as LTI. In particular, what distinguishes the two groups of LTI and HTI is that the LTIs make use of digital technologies only to a limited extent and uniquely when it comes to the administration (e.g., the use of Office suite, which we refer to as 'management software'; simple sensors that detect for example how much water a plant is storing, which we refer to as 'remote control'; simple online databases that are updated manually). The second group, HTIs, has significant exposure to digital technologies, showing a significant usage both in the area of administration and production (e.g., HTIs rely on drones, automatic robots, software with embedded functionalities, decision support systems, smart sensors, and oftentimes these technologies are integrated and work as a coherent whole). This sample allowed us to conduct in-depth within and cross-case analysis and to achieve a good understanding of the phenomenon under study. Table 1 below shows relevant details of the companies in the sample. The following types of applications of 3.0 and 4.0 technologies in the agri-food sector are considered innovative digital technologies in this work: (i) management software (ii) decision support system; (iii) GPS semi-autonomous driving system; (iv) remote control processes; (v) online order platform; (vi) traceability software; (vii) drones; (viii) milking robot; (ix) smart sensors; and (x) big data.

3.3. Data collection

We collected primary data by combining insights coming from interviews and direct field observations. Specifically, we performed in-depth semi-structured interviews (Kumar, 2005) with SMEs owner-managers. In some cases, we also had the opportunity to interview employees in order to compare the answers given by the owner-managers. Once signed a confidentiality agreement, reassuring about the anonymity of the company as well as of the informants, we carried out the interviews and had the opportunity to record them. Each interview, performed in 2019, lasted from a minimum of 30 min to a maximum of 2 h. For each interview we adopted the same protocol which consisted of several open questions covering the broad aspects of how the business operations were organized and expanded to integrate the usage of relevant digital technologies. So doing we secured that the general information regarding our research areas was addressed while enabling us to collect relevant topics that emerged during the interview. The interview protocol (available as an Appendix A) was structured into two parts. In the first part, informants were asked to describe the latest innovative digital technologies adopted. Herein, they openly explained how the digital technologies in question worked – and was integrated into – which section of the organizational process: administration, production, or both. In the second part, the interviewees were guided by an open-ended questionnaire through different topics related to the management of technological change related to the digital transformation.

Specifically, in the second part of the interview protocol, the remaining questions allowed us to cluster several main thematic areas centred on potential cognitive barriers experienced in adopting and using digital technologies, on routines used to organize around technology adoption and implementation, and on the organizational structures including the companies' connections with several actors outside company's boundaries and the configurations used to share and diffuse information and to make decisions. During each interview, notes were taken separately and later confronted with the interview transcripts. Within each selected case, informants were selected for face-to-face interviews based on their direct knowledge about the companies' activities, performances and objectives.

The primary data were also supplemented with direct field observations and with publicly available documentation. Ninety-four percent of the participating owner-managers allowed the researcher to visit their manufacturing sites. Before and after each interview, it was possible to observe how the above-mentioned digital technologies improved the efficiency of the operations by visiting both plants and offices. It was also possible to talk to the employees who were working with those digital technologies. At each visit and during the talks, field notes were taken; the 24-hour rule to construct detailed memoranda of the visits was used.

The sampling process ended when we reached the point of theoretical saturation point, a condition in which a newly added unit of analysis does not provide any additional relevant information (Bowen, 2008). Thirty-three interviews reached the saturation point for the twenty-four SMEs. Interviews were transcribed, and consistent with Yin (2003) and Schweizer (2005), in order to reduce the effect of subjective bias, results were triangulated, increasing construct validity, by using the secondary sources such as company documentations and interview notes. By leveraging on detailed case study protocol and by implementing transcription standards as presented in Schweizer (2005) we tried to ensure reliability for our results. Also, focusing on multiple companies and analysing comparative findings with the usage of polar cases (Schweizer, 2005; Yin, 2003; Eisenhardt, 1989), we tried to ensure external validity.

3.4. Data analysis

Our data analysis aimed to make sense on how SMEs navigate digital transformation (Gioia et al., 2013), by comparing and confronting polar cases. Our process of data analysis started with initial participant observations and then continued with a finer qualitative analysis of interview data, which allowed us to explore the micro foundations for SMEs to successfully navigate digital transformation. In particular, we used an iterative and cyclical coding process between the data collected, the selected literature, and the categories of concepts emerging from the analysis. Our research question guided the data analysis as the research themes we took from Volberda et al. (2021) framework were progressively refined through the process, by moving continuously back and forth from the data to the selected conceptual framework. This reflective process contributed to interpret each re-reading of the data, and was consistent with the abductive approach we decided to adopt (Dubois and Gadde, 2002).

[6] https://www.istat.it/it/censimenti-permanenti/imprese

Table 1
Sample characteristics.

	Name	Productive Sector	Income (M €)	N. of people employed	N. of informants	Type of digital technology adopted
Low Technology Integrated (LTI) SMEs	C 1	Wine, oil, crops	0,15	14	1	Management software, online database
	C 2	Wine	0,26	3	1	Management software
	C 3	Wine	0,60	17	1	Management software
	C 4	Fruit	1,00	50	1	Management software; the weather station
	C 5	Oil	0,04	3	2	Management software
	C 6	Pasta	3,00	18	1	Management software
	C 8	Bread and sweet	3,00	30	1	Management software
	C 9	Milk and dairy product	3,80	18	1	Management software
	C 10	Oil	0,05	4	1	Management software
	C 21	Bread, sweets, and pasta	7,00	50	2	Management software with ERP
	C 13	Pasta	1,20	13	1	Management software
High Technology Integrated (HTI) SMEs	C 14	Milk and dairy product	0,35	5	1	Automatic milking robot
	C12	Milk	1,30	6	1	Management software and sensors for heat detection of cows
	C 15	Crops	2,00	15	2	Drones, GPS driving system, management software with cost calculation app
	C 16	Crop contracting and biogas production	2,50	12	1	GPS semi-autonomous driving system, smart sensors, remote control of biogas production facility; management software
	C7	Animal Feed	5,50	7	1	Management software and remote control of production process
	C 17	Mill (flour production)	4,50	13	1	Remote control production processes, management software, traceability software
	C 18	Wine and cereals	1,50	22	1	Management software with Decision Support System (DSS), smart sensors, GPS semi-autonomous driving systems
	C 19	Fruit	2,00	5	1	Management software, the digital platform for communication
	C 20	Wine	12,00	60	2	Management software with decision Support System (DSS), smart sensors
	C 11	Wine	5,00	25	2	Management software and remote control of production process with sensors
	C 22	Red Meat	7,00	11	3	Management software for digital traceability, Management software, online order system
	C 23	Cereals	3,50	4	1	Management software for digital traceability and ERP
	C 24	Processed Meat	27,00	60	3	Management software, traceability software, online order platform

Data analysis also leveraged on a number of techniques (Yin, 2011) consistent with other cases studies on digital capabilities (Warner and Wäger, 2019) including the use of open, axial and selective coding to identify relevant themes and making sense of the data. With open coding we mean "the analytical process through which the components are identified and their properties and dimensions discovered in the data" (Strauss and Corbin, 1994: 101). Axial coding allowed us to link the identified categories with other categories and subcategories, while the selective coding revolved around theory integration with the emerging categories and theory refinement (Strauss and Corbin, 1994).

Data analysis also drew on Eisenhardt and Graebner (2007) and Miles and Huberman (1994). We used for our analysis transcripts and notes that allowed us to determine emerging categories and build related codes. The three researchers worked independently to build the categories, then they compared the results and discuss the main differences in a way to secure an accurate and effective data analysis. These regular meetings also allowed us to identify patterns across cases and within cases (Eisenhardt and Graebner, 2007). We identified empirical themes representing strategic activities and directly connecting to the overarching dimensions of the Volberda et al. (2021) framework. We combined similar empirical themes across cases into a set of second-order categories (Gioia et al., 2013) that represent the micro-foundational elements of the aggregate dimensions (i.e., cognitive, routines, and organizational structure) underpinning digital transformation. Finally, we triangulated the second-order categories and empirical themes with supplementary data to boost our model (see Table 2).

4. Findings

Our results suggest how SMEs respond to the challenge of digital transformation by developing specific micro-foundational elements related to cognitive, routines, and organizational structure pillars. To this aim, we developed an integrated perspective on the micro-foundations involved in the digital transformation process. The sections that follow illustrate our findings, which are organized by aggregate analytical dimensions and second order dimensions. Our model (shown in Fig. 1) accurately illustrates our findings, depicting the distinct micro-foundational elements supporting SMEs to effectively navigate digital transformation initiatives. The framework summarizes the empirical themes, second-order categories, and aggregate dimensions.

4.1. Cognitive pillar

4.1.1. Managerial attention to new market and technological opportunities

Our analysis revealed a notable distinction between the managerial approaches of HTI and LTI SMEs concerning the pursuit of new market and technological opportunities. In the case of HTI SMEs, we observed that managers and owners were proactive in seeking information and exploring novel opportunities to enhance or grow their businesses through the adoption of new technologies:

> I look for ways to gather information from other people, magazines, or peers in order to evaluate some factors that will allow me to make a managerial decision [about technological adoption]. (C24 HTI)

Conversely, LTI managers exhibited a lack of deliberate efforts to stay informed about emerging technological opportunities in the market:

> I participate to expositions and get informed but not the ones that are about technologies or digital products. (C1 LTI)

Our analysis highlights the problem-solving capabilities of HTI managers, who actively monitor and engage with available

Table 2
Coding of empirical material.

Cognitive pillar	
Second-order categories	Empirical themes
Managerial attention to new market and technological opportunities	**Managers and employees acknowledge potential issues and gather information to undertake decisions** *There are technologies of any kind […], I am an early adopter. […] I inform myself, I read through websites or specialized press about software solutions, new software, new hardware ideas; then with a group of "nerd" friends like me, some of them are doing this a job, it is easy to trigger this type of competitions in terms of who is the first one to know about the last cool technological tool available […].* (C24 HTI) *I try to stay informed in a general sense, I look at strategy and business textbooks. I think it all started with Toyota Quality Management system of in the 60's–70's, so technology was used mainly to optimize quality. It has evolved throughout the years, but the Toyota methodology has pioneered the aim of reaching a total quality by keeping adequate prices [by means of technology].* (C13 LTI)
Managerial perception of the potential and impact of new technologies	Managers are knowledgeable about the importance of technology advancement in the industry and how it may help their business grow *There is the discussion around the new markets we have opened and that should be developed, nurtured… In particular, this new market we have opened helped us realize that we lack some tools to manage our inventory, so let's say that technology plays a key role to improve our performance, is fundamental today.* (C22 HTI) *In terms of production we are talking about companies that are 50 % based on handmade work, and so the human factor is really important. In our field, technological innovation matters at 50 % as the other 50 % is still, luckily, represented by the human factor.* (C21 LTI)
Managerial problem solving and reasoning in the context of technology implementation	Managers deal with data and information around their past operations and performances to effectively think how to integrate new technology *So you perform a quite attentive analysis, you confront yourself with consultants, friends, even if you do such confrontations in a quite private way. But anyway you look for information and suggestions to choose the appropriate quality/price relationship, on the basis of company's needs.* (C11 HTI) *All the things we did in terms of digitalization, we did it only in the moment we had to. That is particularly from a fiscal point of view, because we were forced to do something [use digital tehcnologies], even if we are a small company.* (C2 LTI) Managers have a clear reasoning paths on how to facilitate the integration of new technologies within the companies *Technological innovation has always to be encrusted with the activity you are doing at that moment. Specifically, if you have some needs, you need some answers, you need to understand whether for example that technology perhaps work in another company but provides less results in your company. But in particular, you need to understand if this kind of investment [in technology] will provide you not only immediate benefits, rather economic long-time benefits, as that is what counts in the end. Saving time is an economic benefit, avoid stress in the workplace is an economic benefit, improving quality, packaging, transportation, logistics, is an economic benefit.* (C18 HTI) *You always evaluate the quality of oil, the percentage in terms of performance of olives. That is an element that you have to constantly evaluate, a machine needs to allow you to keep certain levels of performance, of quality, then obviously the costs, how much you gain in terms of costs. But before everything, you need to consider whether oil quality and production time are improved.* (C1 LTI)
Managerial social abilities to overcome organizational inertia	**Managers overcome people difficulty to handle the introduction of new technology** *In terms of technologies I have set them in a way that they can be used in a very easy way, such as a smartphone. Everything is touchscreen, so you only need to access it, and then when someone has explained you how the system works it's not so complicated.* (C7 HTI) *To understand all the implications of technologies 4.0 I should have another degree, in addition to the one that I already have. You need to be interested [in technologies] and you need to want to look for information. However, in my opinion, generally speaking our industry still lacks such interest, and this lack of interest in technology means they we do not go and look for information.* (C21 LTI) **Managers create a culture fostering employees' interest and curiosity into the new technologies** *I raised my collaborators to respect me, as I respect them. Also, I raised them to feel at the same level I am. Or, if that collaborator knows more about one technology which I or other employees do not know about, he is always keen to share its knowledge. That guy is able to tell me whether a particular technology I have adopted is not effective or is a very innovative product.* (C19 HTI) *I have been taught that when something does not work, who leads is responsible, but then I haven't been able to let my employees understand the importance of technologies, of having new technologies within a company. New technologies not only mean tangible things, also mean a different way of reasoning, a different attitude, being more flexible, more available, more curious. And unfortunately I hadn't been able to share this kind of attitude with my employees, in my company.* (C8 LTI) **Managers discuss about the opportunities behind new technologies' adoption** *[With my employees and collaborators] I have quite a continuous, regular relationship. For example E. is passionate about technologies, so he gets me involved, sometimes he tells me 'why don't we do this, why don't we do that' (…). It's not an unilateral relationship where I have to stimulate him, he is really involved in several technological activities and share his ideas with me.*

(*continued on next page*)

Table 2 (*continued*)

Cognitive pillar	
Second-order categories	Empirical themes
	(C24 HTI) *I do not get in contact with my employees or collaborators, but simply because we are an agricultural company, so usually you employ day laborers and unskilled workers who are not sources of technological or innovation knowledge.* (C5 LTI) **Managers prepares their workers to make them ready to integrate the new technologies into the operations** Training is going well, [we offer training] ahead of the different certificates that we are asked to have (in accordance to the rules and norms). For example, when we buy a specific machine, or technology, we always include in the contract a set of training hours, thus [technicians and employees] have to both read and study the operating manual and follow these training courses, in a way to be knowledgeable about the machine before they start using it. (C15 HTI) We have some training courses, but more on hygiene and similar things. Lately, for update training on olive oil mills there is not much to train about, as they already have the experience, actually some of them can teach us. If you hire a new worker, then you have to explain him/her everything, and sometimes you just explain the 3–4 things that he/she needs to do his/her job, and that's it (…) while if you rely on a worker who has been there for 35 years, then he/she knows every little detail of the machine. (C10 LTI)

Structure pillar	
Second-order categories	Empirical themes
Collaboration-based interactions between employees and managers	**Collective problem solving** *Clearly we meet with each other. Then (during these meetings) it depends on what is the technology use, if we are talking about a software that is new for the commercial department, then we would talk with the commercial director, analyze the problem with him, evaluate the software, conduct a cost-benefit analysis, and then we would decide whether to adopt that software or another one. Surely it is not a decision undertaken by a single person, of course IT department would be involved (if we talk about a software IT is obviously involved), then I would be involved as the responsible, then the department that asks for the software would be involved, then we would also contact the general direction, that would have to confirm the final decision of spending X amount of money to obtain present or future benefits.* (C14 HTI) *It is me who decide what to acquire and adopt [in terms of technology] and then I explain to my employees how it works. I decide because my employees have no experience about it, they often are young are young workers that do not know much about technologies.* (C3 LTI) **Diffused Information sharing through less vertical hierarchical structure** *If I don't share my ideas with others or they don't understand them, they cannot follow me. To follow me, they have to share and understand my vision, my ideas, my day-to-day way activities, even the easy ones. And often, if you see that someone around you knows better, is more experienced, then you rely on him/her.* (C14 HTI) *Each worker has specific tasks, so you have to merely 'tell them what to do' and that's it, it is not a job where you can give room to undertaking decisions.* (C5 LTI)
Democratic decentralization of opportunities evaluation, and central control over adoption decisions	**Collective decision making process** *Then, when we confront each other, and always with the employees, never alone, we go and leave together, whether at fairs, events, or not. Because it is through sharing that we gain strength. Because I can go see and do it, but you must retransmit it. But if I put together the critical eye of one, of the other, each with his/her own identity, each seeing more or less the defect or the value, you've already done a good screening.* (C16 HTI) **Managers undertake final decisions after initial consultation with their employees** *Management is a bit at 360 degrees in a small company like this. My brother and I decide whether to implement a particular type of technology and then present it to Stefano, the owner. This is governance.* (C11 HTI) *I don't understand anything about technology, so is the others who must bring new ideas. Then, when they had brought them [new ideas] at the time, it had been a drama. Internal training is therefore essential; something has been done, but more needs to be done, if we want to keep up with new technologies.* (C6 LTI)
Companies' social embeddedness in the network of suppliers and technological providers	**Managers and employees interact with other actors and participate to fairs and events to learn about new digital machines and products available in the market** *In any case, in addition to being a cooperative, we are a member of the organic Marche consortium, which is in charge of presenting projects to institutions. Yes, we are a part of it along with other cooperatives such as Company 6, let's say that the approach is certainly like this, it is not an individual approach.* (C23 HTI) *Honestly I do not interact with others. Because the various oil mill associations lag behind technology, it's pointless; sometimes I know more than they do, so you can't rely on them at all. I contact the vendors of these programs or the experts on specific digital systems directly. I don't even have informal relations with others.* (C10 LTI)

Routine pillar	
Second-order categories	Empirical themes
Centralized guidance on the adoption of new technologies	**Specific resources allocated to companies' products, having enough knowledge to foresee the needed changes** *It is, in my opinion, an ongoing process. We follow annual cycles in the sense that we are organized as campaign* 2018, *campaign 2019, so every year we may introduce some innovation, but in general it is a process that is constantly re-discussed and applied with reference to a specific campaign.* (C23 HTI) *We don't have a calendar; we discuss the needs that exist within the company, such as production needs, if there is a need for machinery, which is now almost entirely technological, and both in terms of technologies and other aspects we have only* ad hoc *meetings. We have no meetings scheduled. There are some meetings with commercial companies, meetings with companies from different sectors, and as a food company we have to do all those meetings for safety, everything concerning food security. But is are not planned and rather informal meetings.* (C21 LTI) **Clear and centralized decision-making process about the adoption of new technology** *"[…] thanks also to these projects, in the last year we have had formal meetings to discuss issues related to technology on a regular basis. Let's say that activity in 2019 is at a halt for the time being, but we will most likely resume it in the future. Last year, we did them on a regular basis, which allowed us to implement these new things, as I told you, then always with the goal of reaching 10 and getting 5. But as the consultant said, in small steps, that is, we are here, we have to get here, and we do not settle for a low result. We want to get to xml data; in the meantime, we're at pdfs, but there has been significant growth in comparison to paper. We do formal internal meetings attended by the various stakeholders and the consultant."* (C23 HTI) *[Technology adoption] is evaluated based on the problem or situation that we need to solve in that specific moment. These meetings [to evaluate technological adoption] are very casual. At the operations level, it's just me and my brother, and then we have this lady who practically helps us out in the fields or in here because we also do packaging and favors.* (C2 LTI) **Usage of clear criteria about the decision to adopt a new technology** *A cost-benefit analysis is performed. Not in depth, but in my opinion, you should consider how much time it [a specific technology] saves you and whether it improves your workplace safety and reduces certain risks. What I know is that there is a risk of explosion [in the use of technologies], which is significant in my opinion. But, above all, technology must reduce working hours and personnel.* (C7 HTI) *Adoption of new technologies accounts for 20 % of the value in my opinion. It is critical, even if, as I previously stated, this is a fixed percentage, if we do not want to lose the craftsmanship of our products and… I always say that we cannot compete with Company Y, a company that manufactures all of the products in Umbria, making everything inside these plastic things and automating everything.* (C8 LTI) **Existence of a clear digital innovation strategy** *Ah, we basically have to avoid all paper documents and bring all data in digital format, and as I previously stated, we could greatly improve performance. In any case, we also make these data processable, that is, we currently have a portion of data that is, let's say, manageable, like actual data, the famous pdfs that I mentioned earlier, remain there, they are in digital format but they are stationary, and I was wondering with my consultant whether it was possible to somehow make them data available, exploitable. I'll give you an example: when we go to the company, we say we collect crop data, such as hectares, but they remain stuck in an excel file or a checklist. If we could process these data over time, in the sense of having a crop rotation for a specific plot of land, this can be very useful. Also, [it can be useful] to make speeches on the quality of the product based on crop rotation, or if you have data relating to production, average yields, the trend of average yields over the years, we could construct historical series, or data relating to samplings, which we currently cannot do.* (C23 HTI) *Decisions in our small businesses are made gradually. Perhaps you will innovate in one product this year, another the following year, and so on.* (C3 LTI) **Selection criteria to identify technology providers** *We chose them [technology providers] based on the outcomes they achieved with the people I am in contact with, and with whom I share opinions and exchange information. It's a bit – yet not completely - thanks to others, as there are also larger companies that test these machines first. So my strategy is: if I don't have sound bases to make a decision, I run some tests with everyone, focusing on names that have influenced the history of the field in some way.* (C11 HTI) *But, for the time being, I would say we don't have any technological partners, aside from those who provide us with the entire IT system. Why? Because before we were with another manager, I believe it was X, we got word of mouth because some competitors, they had Team System, they spoke highly of it to me, I was also at several Team System-organized conferences, and we decided to use this software.* (C8 LTI)
Incremental change to facilitate the absorption of external knowledge	**Developing planning around new technological adoption and leveraging interaction with employees to improve performance** *I make plans for the next couple of years. And to consider whether to adopt an innovation is take into consideration its implementation operational effort, its implementation risks, the costs associated with the purchase of software, hardware, or whatever, and implementation costs incurred as a result of man-hours generated within the company. That is, you must create a small business plan, a SWOT analysis or rather a cost/benefit analysis, thanks to which you try to isolate the beauty of what you expect with the costs you must incur to achieve it, rather than how frequently you check or review the strategic decisions you make* (*continued on next page*)

Table 2 (*continued*)

Routine pillar	
Second-order categories	Empirical themes
	in relation to new technologies. (C24 HTI)
	We don't move before others, we actually always arrive just in time. For example, the barcode, which we will also have to do sooner or later, should be planned as soon as possible because it has a significant cost, in short. (C6 LTI)
	Incremental introduction of new technologies to learn from their intermediate effect on performance effects *We are constantly being directed towards new technologies; my belief is that the future is about adopting all of the best available technologies […]. We are constantly on the lookout for new technologies. The adoption, and thus the introduction of technology within the company, is done step by step, taking into account the market availability of certain technologies.* (C15 HTI)
Purposive use of external actors to catch opportunities to innovate	**Involving customers and partners to learn about technological use and getting their feedbacks around past innovation decisions** *The observation of how my client buys has resulted in the design of a user interface that responds to his needs for speed, without annoying him, by acknowledging and respecting the work that he does, that has indeed pushed for the adoption of this specific technology.* (C24 HTI)
	Customers can have an impact, particularly on the product offered. As far as I know, we discuss issues in terms of products. In general, the end customer does not consume the product you give him right away; he/she may put it on sale and then it may be that some time passes before it is sold. Maybe he/she notices a deterioration, a problem with the product that is due to technological means, so it made us think that having a bottling machine that puts nitrogen inside the bottles could be important because when the oil stays a year on a bottled shelf with nitrogen inside it is better than having normal air. (C5 LTI)
	Working in collaboration with actors of the social context to develop broad innovative projects that go beyond the boundaries of a company's specialization *One thing we've always had is a desire to learn about other people, but more importantly, the ability to identify who we believe are the opinion leaders or, in any case, the most important companies, or the people from whom to learn, and there are many. So we started engaging in tours, visits, which allowed us to meet important entrepreneurs, good technicians, and collaborate with English agronomists, for example, who changed our perspective, our approach to work, and our culture. So, let's say there is a continuous exchange, many people come to visit us, and we are always available, just like when you go to other companies. Today, perhaps a little bit more, because in Italy, we are beginning to meet new people, and so there is the possibility of exchange, as well as curiosity from others about what we do. We exchange primarily technical information and those related to market issue and opportunities.* (C24 HTI)
	So sincerely, we don't rely much on local or regional institutions, in the sense that we don't ask for anything, funding, or even care about them. Sometimes the Region organizes fairs, they send you an invitation, you evaluate it, you say yes or no, and it ends there, then it's not like there are many sincere relationships. No funding is available. Every now and then, there was something, but we often didn't take advantage of them because, well, if there is a need to buy a car, maybe if there is some financing, otherwise you don't go looking for them, also because I was taught that you must need the machinery, you must have the ability to buy it, and then if there is financing, it is fine, otherwise, if you do it for financing, sooner or later you will end up badly, because if you don't get the money right away. (C10 LTI)
	Establishing relationship with institutions to be able to translate technological novelties into company's opportunities *I am proactive towards institutions, and I already participate to some tables, have direct contact with issues that are both local and possibly regional, and so on. My approach is to prompt them to pay attention to certain dynamics that could potentially be improved, and their approach to me is to ask questions about this.* (C22 HTI)
	As a result, the relationship with the institutions is not excellent. We get lost as adoption facilitators… There's the bureaucracy that kills you… It makes you die… (C6 LTI)
Engagement in a regular exposure to others to collect ideas/stimuli for innovation	**Having regular exchange of Information exchange with actors outside the company to develop effective ideas to implement novel solutions and problem solving approaches** *[We engage with] companies that allow you to develop, expand, and modify software, traceability, and plant management without any problems (…) We always have a fixed [external] person overseeing production, which is useful because the software does not see if something breaks or if there is a hole in an air pipe, but with one person, you manage the entire system.* (C7 HTI)
	I am unaware of the outcomes obtained by companies that have used this technology, so I have no basis for comparison. That is, I don't know if this company using this technology has managed to increase yields or product quality; these are details I would like, and hope, to be able to choose. A good bearer of information, in my opinion, is the manufacturing company; it should be the first interested in having to sponsor the results of new technology, or even the company that has used this technology could also exploit… However, the manufacturing company has a tendency to exaggerate the results, and I also require an objective viewpoint. (C5 LTI)

technological opportunities to address challenges and achieve their strategic objectives:

> When you have an issue, and you want it to be solved, at least you start gathering documents to understand if there is anything in the world that could help you solve that issue. So, you go around and look for a new technology… Technologies must be sought, as today there are so many things and potential tools that perhaps you do not know about. So you are actively searching for information about it, every day, as every day you get new stimuli and also because – after evaluating that technology – it can take long time to acquire that and put them concretely into use. (C14 HTI)

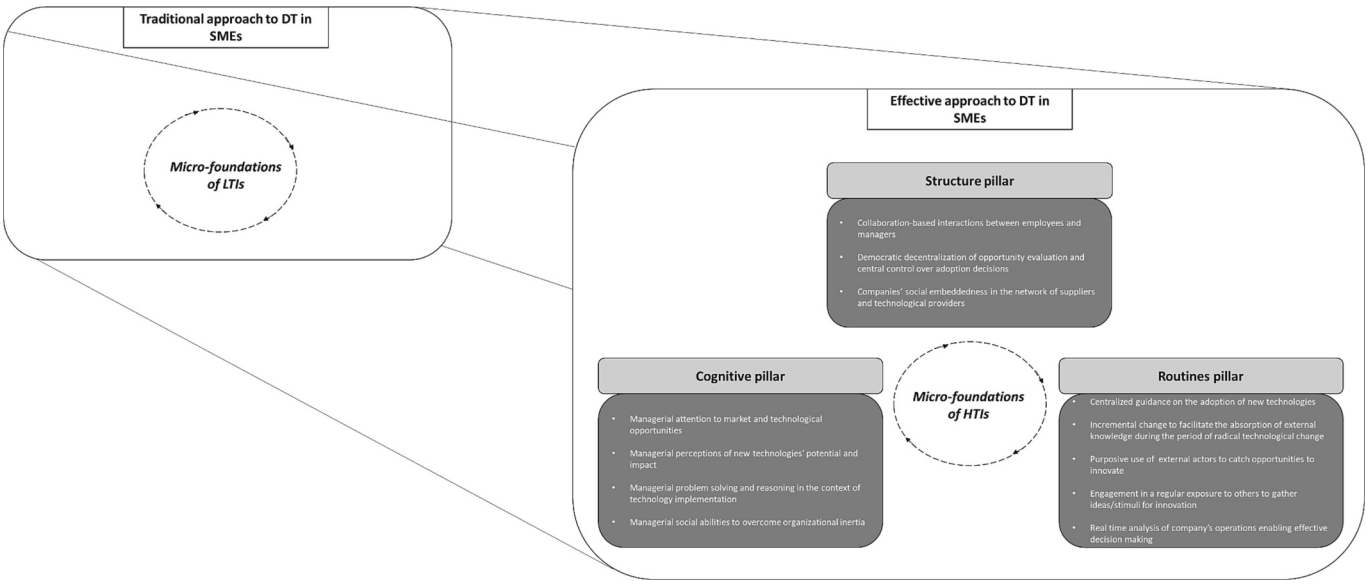

Fig. 1. Micro-foundations to effectively implement digital transformation initiatives in SMEs (adapted from Volberda et al., 2021).

4.1.2. Managerial perceptions of the potential and impact of new technologies

Our analysis reveals a notable difference in the outlook of managers/owners in HTI SMEs and LTI SMEs concerning the implications of technology for their businesses. These perspectives were shaped by their subjective experiences or feelings resulting from the integration of technologies into their daily operations.

LTI managers shared valuable insights on the challenges of substituting human labor and the necessity of complementing technology usage with prior knowledge:

> In terms of production we are talking about companies that are 50% based on handmade work, and so the human factor is really important. In our field, technological innovation matters at 50% as the other 50% is still, luckily, represented by the human factor. (C21 LTI)

On the other hand, HTI SMEs' managers acknowledged the importance of continuously adapting their business in tandem with technological advancements, reflecting a strong managerial intent to steer the strategic shifts required due to the technology's evolution:

> I believe that technological innovation is critical to the success of a company like mine. You can't go back; you have to look forward, even if it means making sacrifices and incurring debts on top of debts (…). However, today [failure to invest in technological innovation] means failure. If you want to grow your business, you must invest in technological innovation; otherwise, I would advise you to stop everything, retire, and focus on other activities. For example, we look at the future and have invested in biogas, but we are already considering how we can move that forward even further. In that sense, other actors stimulate us and inform us about current events. (C15 HTI)

4.1.3. Managerial problem solving and reasoning in the context of technology implementation

In the context of technology implementation, managerial problem solving and reasoning played a significant role. Managers in HTI SMEs displayed pertinent cognitive capacities, which influenced their decision to initiate strategic changes within their organizations. Evidence of their "successful intelligence" was apparent in their adept use of reasoning and problem solving processes, particularly crucial when swift action was needed to address challenges that emerged during the integration of technologies into company operations.

A more analytical investigation reveals that HTI SME managers allocated additional resources towards training and supplier relationships, thereby enabling employees to better absorb technological complexity. As one manager (C18 HTI) stated,

> If you adopt a new technology that is difficult to manage, you can turn to the provider of the technology to assist you in integrating and developing it. As an example, if you hire the wrong person to manage technology, you can buy the best system, the most functional and innovative one, but the person who has to manage that technology will blame you night and day because it cannot be used properly. However, if you can explain how it works to that person or refer them to someone who knows how to manage it, things will become much easier. I confer with my technicians to determine who is best suited to deal with the situation. (C18 HTI)

Furthermore, the primary distinction between HTI and LTI SME managers lies in their perception of new technology implementation within their companies. HTI SME managers adopt a gain-oriented approach, rather than focusing on potential losses. By demonstrating rational thinking and constructing reasoning based on previously learned knowledge or procedures, they maximize the benefits of technology adoption. HTI SME managers are capable of calibrating the usage level of specific technologies, enabling them to consider future consequences before taking action. One manager (C16 HTI) explained,

> We use indicators, benchmarks, and market data. Clearly, when we adopt new technologies, we say that the reference is our historical data; that is, if we used a certain process to carry out a specific operation and had a cost of 100, but by optimizing with the new technology, we have a cost of 90, then the latter becomes the new benchmark. (C16 HTI)

4.1.4. Managerial social abilities to overcome organizational inertia

A key characteristic distinguishing managers in HTI SMEs is their capability to empathize with their employees' perspectives and subsequently offer guidance and training for enhancing performance and knowledge. For instance, in order to mitigate resistance stemming from insufficient understanding of a technology's implications, managers may request their technological suppliers to conduct an in-depth field demonstration of the technology in question:

> Training is going well; [we provide training] ahead of the various certificates that we are required to have (in accordance to the rules and norms). For example, when we purchase a specific machine or technology, we always include a set of training hours and demonstrations in the contract, so [technicians and employees] must read and study the operating manual as well as follow these training courses in order to be knowledgeable about the machine before they begin using it. (C16 HTI)

In a broader context, these managers strive to counter organizational resistance to change by fostering a culture of curiosity and ongoing engagement:

> Our employees are curious, passionate, have subscriptions to sector-specific magazines (magazines about technologies) […] (C15 HTI)

Regarding verbal communication, all information pertaining to digital technologies, such as advancements, challenges, and general experiences, is conveyed to the owner-managers by employees through informal daily conversations during work hours:

> Informal talks, I go looking for them during the lunch break, or maybe we take a coffee together, and we talk. […] Also, while we are working together […], we exchange opinions about technology. (C19 HTI)

On the organizational workforce level, the majority of HTI managers equip employees with targeted training, ensuring comprehensive utilization of new digital technology and reducing barriers to implementation. All interviewees mention that their employees engage in various training activities to different extents:

> In the hiring contract, we always include several hours of training, and our employees are obliged to read and study the manuals of the adopted technology. (C16 HTI)

Furthermore, HTI managers underscore the significance of maintaining a steady influx of relevant knowledge within the company for their employees. They acknowledge the necessity of rapid and continuous renewal and enhancement of digital technologies:

> Constantly, always, continuously. […], I tell you, new trainings are done constantly, every time there is one (training) available, we do it. (C19 HTI)

The manager of Company 19 emphasizes the value of attending seminars focused on specific technologies, adding that at least one company member should participate in these events to guarantee continuity in the organization's knowledge acquisition process:

> Sometimes I go on my own, not because my employees aren't interested, but because there isn't enough room for everyone or because the Company is so busy that we have to pick and choose who goes. If no one else can go, I will. (C19 HTI)

Overall, our analysis uncovers the differing cognitive capacities and strategies of HTI and LTI SME managers in pursuing new market and technological opportunities, perceiving the potential and impact of new technologies, and engaging in problem-solving in technology implementation contexts.

HTI SME managers proactively seek information and explore novel opportunities for business growth through technology adoption. In contrast, LTI SME managers display limited efforts to stay informed about emerging technological opportunities. HTI managers also demonstrate superior problem-solving capabilities, actively engaging with available technological opportunities to address challenges and achieve strategic objectives.

Divergent managerial perspectives on technology's implications for business operations are evident. LTI managers emphasize the challenges of substituting human labor and the need to complement technology usage with prior knowledge, while HTI SME managers stress the importance of continuous adaptation to technological advancements and driving strategic shifts resulting from technology's evolution.

Regarding technology implementation, HTI SME managers exhibit advanced cognitive capacities, effectively using reasoning and problem-solving processes to address challenges arising from technology integration. They allocate additional resources for employee training and supplier relationships, enabling better absorption of technological complexity. HTI SME managers adopt a gain-oriented approach, maximizing the benefits of technology adoption by applying rational thinking and constructing reasoning based on prior knowledge or procedures.

In addition, HTI SME managers exhibit strong social abilities to overcome organizational inertia by empathizing with employees and offering guidance and training. They foster a culture of curiosity and continuous engagement and maintain a steady influx of relevant knowledge within the company, understanding the need for rapid and continuous renewal and enhancement of digital technologies.

Overall, the analysis underscores the importance of cognitive capacities, resource allocation, and gain-oriented perspectives for HTI SME managers in successfully navigating technology implementation and digital transformation.

4.2. Structure pillar

4.2.1. Collaboration-based interactions between employees and managers

In our analysis of interview data, we observed a difference in the nature of interactions between employees and managers/owners in HTI and LTI SMEs. Within HTI SMEs, relationships were characterized by a collaborative approach. These collaboration-based interactions were structured to enable managers/owners to maintain close and frequent communication with their employees, promoting the exchange of various types of information, such as tacit and proprietary knowledge pertaining to the enhancement of internal operations. Company 14, an HTI SME, exemplifies this collaboration-based relationship, with employees providing managers insights into the progression of current operations and the influence of new technology on the company's landscape. The focal manager elaborated on this relationship:

> Every day, I exchange information and communicate with my employees. I'm either there in person or on the phone with them (…). So, perhaps, if they have any difficulties or problems, communication is immediate, in the sense that if there is an issue with the milking system, my employee calls me, and if I can help by myself, I do so; otherwise, I call someone who can help solve the problem. (C14 HTI)

Differently, LTI SMEs exhibited limited interactions between managers and employees, focusing primarily on resolving emergent issues and engaging specific resources (services or goods). Respondents in LTI SMEs expressed a preference for maintaining this type of interaction. For instance, a manager from an LTI SME articulated his intention to establish relationships with employees solely to clarify their responsibilities:

> If you ask me how many times we meet and talk about new technologies and the company's organization, I tell you that we should meet more, to train our collaborators and employees better, and walk them towards the next steps. (C4 LTI)

4.2.2. Democratic decentralization of opportunity evaluation and central control over adoption decisions

Our analysis revealed a democratic decentralization of opportunity evaluation and central control over adoption decisions in SMEs. In LTI companies, managers aimed to minimize dependence on employee knowledge and perception, opting for short-term relationships centered on addressing operational issues, and refraining from involving employees in critical decisions such as new technology adoption. This is evidenced in a quote from a manager in an LTI company:

> [To undertake decisions] I interact a little bit with my brother, more rarely with my employees. I undertake the majority of decisions by myself (…). Then I control what my employees do [in terms of performance], even if I don't use evaluation schemes. (C4 LTI)

Conversely, our analysis identified reciprocity and interdependence in the exchange of information related to significant company decisions in HTI SMEs. The nature of recurring interactions between employees and managers in these companies reflected mutual interests, with reciprocity emerging as a condition governing the achievement of shared benefits. One participant shared,

> Typically, my employees who work with the machines advise me, saying that they prefer that machine over another. Before doing anything, we request a trial run, so that we are going to try a GPS driving system for precision seeding next week. (C15 HTI)

Company 15 illustrates how reciprocity serves as a vital coordinating mechanism in collaborative relationships. Managers endeavored to attain mutual benefits, as exemplified by one manager's statement:

> Let's say that first and foremost, I consider the employee's health, specifically the employee who works directly with the machines (with digital tools). So, first and foremost, I consider the employee's safety, and then I consider all of the other factors, such as the machine's lifespan, […], the initial cost, how many times the machine could fail, and so on.. Let's say I evaluate a little bit of every aspect. (C15 HTI)

Moreover, managers in HTI SMEs engaged with employees to gather diverse inputs about the advantages and disadvantages of new technologies:

> Before adopting a new technology, I always consult with my employees and conduct some relevant adoption evaluations with them (…) I have very open-minded employees who are always coming up with new ideas to try and learn about new available technologies. (C15 HTI)

In contrast, relationships between employees and managers in LTI SMEs lacked both reciprocity and interpersonal trust. The managers' commitment to building relationships with their employees was weak in these companies, as one manager explained:

> There is certainly transparency [in terms of information exchange], but I cannot accommodate every request. I understand that not everyone agrees with me, but the entrepreneur and owner should always be listened to and followed, even if you disagree with him or her. It is normal for the owner to take responsibility for the company's decisions; these decisions can then be shared or not, but as long as there is an owner in charge, he or she will take the lead and make decisions. (C13 LTI)

4.2.3. Companies' social embeddedness in the network of suppliers and technological providers

Focusing on the social embeddedness of companies in their networks of suppliers and technological providers, our analysis reveals a more complex landscape. HTI SMEs' owners and managers, as per our interviews, extend their connections beyond merely engaging with company employees who provide and relay pertinent information. These individuals also establish links with other external stakeholders, such as peers, suppliers, and technology providers. Such interconnectedness emerges as a prevailing trend in HTI SMEs.

Respondents from these organizations appreciate the knowledge inflow generated through interactions with external actors, which they believe can assist them in attaining their goals. This sense of connectedness is further reinforced by a strategic intention to capitalize on the shared knowledge and is accentuated by the degree of proximity with external parties.

For instance, a respondent from Company 15 highlights the benefits of maintaining close relationships with some technology providers, allowing them access to information on the latest advancements:

> When it comes to machines, the first phone call that the most important sellers make is to us. Last week, Company X called and asked us to attend this fair in Perugia. Supplier Y called me last week to test a new product. Let's say that, because my company is a best practice, there is interest in contacting me to allow me to test the new product or technology. (C15 HTI)

This exemplifies how fostering such connections can provide valuable insights and opportunities for HTI SMEs.

Overall, our findings highlight key differences in the structure pillar between HTI and LTI SMEs, with implications for the nature of interactions and decision-making processes. In HTI SMEs, a collaborative approach prevails, characterized by close communication and information exchange between managers and employees. This enables the sharing of valuable knowledge, such as tacit and proprietary information, enhancing internal operations. In contrast, LTI SMEs display limited interactions, focusing on resolving emergent issues and engaging resources, with a preference for maintaining such relationships.

Moreover, our findings reveal a democratic decentralization of opportunity evaluation and central control over adoption decisions in SMEs. LTI companies minimize dependence on employee knowledge and perception, while HTI SMEs exhibit reciprocity and interdependence in the exchange of information related to significant decisions. Relationships between employees and managers in HTI SMEs reflect mutual economic interests and shared benefits, while LTI SMEs lack reciprocity and interpersonal trust.

Lastly, our analysis emphasizes the importance of social embeddedness in the network of suppliers and technological providers, particularly for HTI SMEs. These organizations benefit from fostering connections with external stakeholders, resulting in valuable insights and opportunities. Overall, these findings shed light on the structural nuances that differentiate the approaches of HTI and LTI SMEs, informing potential strategies for effectively navigating digital transformation.

4.3. Routines pillar

4.3.1. Centralized guidance on the adoption of new technologies

Our interview data revealed that HTI SMEs aim to achieve prompt and uniform responses to emerging technological opportunities by capitalizing on their experience and employing a swift, centralized decision-making process. This process is facilitated by delegating distinct and acknowledged responsibilities to managers or owners:

> I am responsible for everything. I enjoy discussing certain issues with my family members, but in the end, I am the one who makes the final decision. (C14 HTI)

> Final decisions are made by X, the Company's owner, but all final project decisions concerning the design and implementation of our production line are made by myself, in collaboration with a consultant […]. (C17 HTI)

The centralized decision-making process and well-defined roles within the organization enable management to preserve uniformity in decisions, as they can maintain a singular interpretation of existing decisional criteria and procedures. Furthermore, we observed a well-defined digital strategy in HTI SMEs, accompanied by a high degree of rigor in applying decision-making processes from assessing technological needs to selecting technology providers, which ensures alignment with the organization's long-term view:

> Obviously, the cost-benefit analysis must be positive; the second aspect is the feasibility of adopting the technology in question in our

company; in other words, the time required to adopt it must not be excessive; otherwise, yes, we have a very positive cost-benefit analysis on paper, but we lack the necessary competencies to realize its full potential. (C20 HTI)

Regarding the utilization of internal resources during the decision-making process for adopting new digital technology, HTI SMEs tend to rely on individuals possessing a holistic understanding of business processes. This allows them to foresee the potential implications in different application areas within the organization:

In terms of vineyard management, I've grown over the years and now have a daily discussion with the owner-manager, so I let him know about any issues that might be of interest to him […]. When it comes to decision-making, I try to work transparently and with a lot of autonomy (technological investment). I also manage all supplier relationships, solicit and evaluate commercial proposals, and conduct hiring colloquia, so you could say I do a little bit of everything. In addition, when decisions need to be re-evaluated, I notify the owner-manager, and we decide what to do. (C20 HTI)

At this point in my life, I have been in this area for so many years that I know everything, every characteristic of each land; therefore, perhaps the customer is only paying attention to the costs that I charge to work his land with the current, technologically advanced machine, and he is dissatisfied with the high costs. But, as I see it, slightly higher costs yield a much better result […]. (C15 HTI)

In contrast, LTI SMEs' management does not employ a specialized process for deciding on the adoption of new digital technologies, as they do not consider such decision-making tasks crucial or even necessary:

We don't have a calendar; we discuss the needs that exist within the company, such as production needs, if there is a need for machinery, which is now almost entirely technological, and both in terms of other aspects of programs and so on… But we don't have specific meetings scheduled, and the ones we have are mostly informal. There are meetings with commercial companies, meetings with various sectors of companies, and the food company has all those meetings we do for safety, food security. (C21 LTI)

4.3.2. Incremental change to facilitate the absorption of external knowledge

Our analytical examination reveals that HTI SMEs effectively integrate digital tools into their daily operations and maintain flexibility when interacting with diverse stakeholders from both inside and outside the organization during the planning for new technology adoption. Specifically, managers in HTI SMEs incrementally implement new technologies through continuous interaction with their employees, engaging in daily discussions to determine the subsequent steps for enhancing their companies' performance:

Every day, I review operations, try to understand what employees are doing, and, of course, look at the results. Because, as a small company, when there is a need, we interchange, we help each other, but everyone has his/her own sector, of course, and thus clearly I check if there are specific problems that can arise in that sector because the problem occurs regardless of each one's ability or will. (C22 HTI)

In contrast, LTI SMEs do not exhibit the same level of incremental and controlled integration of new technologies. While they also engage in planning for technology adoption, their approach lacks the constant, routine strategizing observed within HTI SMEs. Consequently, their innovation process unfolds at a slower pace, involving managers who eventually decide to adopt a technology and replace an outdated one only when necessitated by industry and environmental factors:

In short, no, we always arrive a little close, come on. The Barcode, which we will also have to do sooner or later, should be planned as soon as possible because it has a significant cost, in short. (C6 LTI)

4.3.3. Purposive use of external actors to catch opportunities to innovate

In the context of SMEs, the decision-making process around adopting new technologies and planning innovative processes often hinges on external actors, who can offer financial incentives and support to help HTI SMEs integrate new technologies into their everyday operations. By forging relationships with external entities like national and local institutions, HTI SMEs gain the flexibility to choose whether or not to adopt new technologies and to do so expediently, as these actors may provide resources and opportunities for acquiring or planning the acquisition of innovative tools to enhance company performance:

We have a very intense and close relationship with local institutions because agriculture is heavily supported by Rural Development Plans, which are redefined every six years and call for various measures to support agriculture. (C22 HTI)

On the other hand, SMEs that utilize digital technologies often lack such institutional connections, and the absence of dialogue with crucial external actors may impede their ability to seize potential opportunities for technological adoption or planning. As our informant's statement highlights, LTI SMEs managers reveal that their lack of agility in interacting with external actors leads to a failure to capitalize on technological innovations and opportunities:

Look, there are no institutional contacts! You're then completely defeated… I asked so many questions that we never got around to answering them. My perception is that we, as small businesses, are heavily penalized because we lack opportunities, even if we want to grow technologically. However, because of our small size, we are sometimes forced to make sacrifices, resulting in a very slow pace [technologically speaking]. (C2 LTI)

The integration of HTI SMEs into their social context is another vital factor in the routine pillar of their digital transformation orientation. These businesses are more likely to step away from innovation practices developed strictly within the company's confines, opting instead to involve various actors in the process of adopting new technologies and capturing unique opportunities. By interacting and collaborating with customers, partners, and competitors within the ecosystem, HTI SMEs can discuss past challenges related to specific technological adoption and derive lessons from such exchanges in the realm of value co-creation:

Customers' feedback certainly influences technological adoption decisions; however, it is dependent on the customers and who they are. If we listen to wine advice, everyone will have an opinion, and the situation will become chaotic. However, if an important company offers you advice, we will listen to it, consider it, and decide what we can do about it. Because it can provide you with feedback about the product while also providing you with tools to improve it. (C18 HTI)

Collaborative practices and routines with various partners enable HTI SMEs to expand their technological knowledge and initiate innovative projects in conjunction with actors such as universities. By exploring their social context and partnering with entities operating beyond traditional company boundaries, these SMEs can develop innovative management techniques and introduce new routines:

So we formed partnerships with University A, with whom we are collaborating on this innovation project, and with University U. (…). They have been organizing an advanced training course in organic farming in collaboration with us. As part of my training, I also took that course (…). Without a doubt, extensive collaboration with universities exists. (C23 HTI)

Conversely, LTI SMEs do not prioritize value co-creation and innovation collaboration with social context actors, as they remain entrenched in traditional practices and interaction processes. They lack the relational capital and resources to engage in meaningful discussions

around technologies and collaborations that could accelerate their innovation pace:

> Collaboration with technological partners still needs to be improved. It is not always the fault of service providers; it may be our own fault, as adapting to new technologies takes time and people. We require valuable collaborators who have firsthand experience with these technologies. However, there are some gaps, and we lack an appropriate approach to technological services. (C4 LTI)

Moreover, LTI SMEs tend to stay within their specialization boundaries, missing out on the cross-fertilization benefits that other partners and companies could provide in terms of technology and innovative practices to implement in their business activities. Instead, LTI SMEs rely on established relationships with actors capable of delivering specific services, contrasting with HTI SMEs, which embrace their social context and collaborate with diverse actors embedded within it:

> No, I do not work with any service companies to develop technology. Each company specializes in a specific branch, and I search for the specific supplier based on what I need, but I do not have a company that creates a product tailored to me, also because the problems in the agricultural field are the same among the companies, and it then depends on how much you want to spend and find the solution. I basically hire computer scientists to build a website and graphic designers to design a label. (C3 LTI)

Engagement in a regular exposure to others to collect ideas/stimuli for innovation.

Our analysis reveals that HTI SMEs adopt novel routines to facilitate digital transformation, which includes regularly engaging with other stakeholders to gather new information, enhance complexity, and deepen knowledge about emerging technological tools and opportunities. These SMEs consistently interact with companies and actors experienced in utilizing novel technologies, thereby learning about the advantages and potential drawbacks of integrating digital tools into their business operations:

> So now we're adopting [a technology], and in this case, you clearly get information from those who are already using it, "look at me, this program is solving all these problems for me," and there's clearly an exchange of information with companies at that point (partners or not). (C22 HTI)

In contrast, LTI SMEs do not exhibit the same inclination to engage in dialogue with partners or other stakeholders to comprehend the potential of certain innovations and the opportunities that may arise from embracing new digital technologies. These companies seem to lack the openness towards partnerships and collaborations that can lead to a mutually beneficial exchange of knowledge, often distrusting the information provided by their peers about the performance of new machines:

> There is not much collaboration [with partners or associations] when deciding to adopt new technologies. If you go around and ask to your peers, they tell you the opposite of what is happening. For example, you ask 'how is this machine performing?', they answer 'it works well!', and then you discover that in reality it gave them a lot of problems… So there is no collaboration. (C10 LTI)

4.3.4. Real time analysis of company's operations enabling effective decision-making

The analysis of real-time company operations enables effective decision-making processes. HTI SMEs leverage cutting-edge technologies to establish routines centered on comprehensive data collection and advanced data analysis. This approach allows managers to make informed decisions based on accurate data and real-time insights, integrating digital tool-driven information with the expertise and knowledge of on-site employees:

> Technology assists us in making decisions (…). For example, consider the DSS debate (decision-support systems). These tools do not replace us, but they are useful partners with whom we can interact. Sometimes we acknowledge that we think in the same way as DSS, and sometimes we notice that we don't. And the DSS is frequently correct. For example, in the vineyard, DSS is a nice toy to have, it provides us with predicting models, that are computed based on weather forecasts, [telling us things like] "in three days there could be an infection". So you intervene if you are not covered or prepared to face that. There is no need for intervention if you are all set. Otherwise, how does technology come into play? (C18 HTI)

LTI SMEs, instead, do not adopt technology-driven routines, as their managers exhibit skepticism towards innovative processes and perceive technology as something that cannot be harmonized with the skills and knowledge ingrained in traditional industry practices. These companies fail to recognize the advantages of collecting and utilizing extensive data through modern technologies. LTI SMEs believe that value creation arises from the regular work and knowledge of employees who prefer manual labor over technologically advanced solutions:

> We are not keeping up with the times, there is actually a general tendency to go backwards [in terms of technological innovation], and I believe this is actually understandable [given the industry we belong to]. Thanks God there is still the farmer that, instead of feeding animals inside the barn, is able to lead them outside and do the transhumance, God bless him! For that farmer starting to use WhatsApp is already an innovation, so it is easy to understand that in this industry is useless pushing for innovation. (C9 LTI)

Overall, this findings section highlights the differences in decision-making processes, incremental change, engagement with external actors, and real-time analysis of operations between HTI and LTI SMEs. HTI SMEs emphasize centralized decision-making with clear roles and responsibilities for managers, allowing uniformity and efficiency in decision-making. In contrast, LTI SMEs lack specialized processes for adopting new technologies and prioritize informal discussions. HTI SMEs employ incremental change, integrating digital tools into daily operations and maintaining flexibility when interacting with stakeholders during the planning of new technology adoption. LTI SMEs, however, lack such constant strategizing and adopt new technology at a slower pace. HTI SMEs collaborate with external actors to gain access to resources and opportunities for technological adoption, leading to enhanced company performance. LTI SMEs, on the other hand, fail to capitalize on technological innovations due to their lack of agility in interacting with external actors. HTI SMEs are more likely to involve various actors in the process of adopting new technologies and capturing unique opportunities, while LTI SMEs remain entrenched in traditional practices and interaction processes. HTI SMEs engage in regular exposure to others to collect ideas and stimuli for innovation, while LTI SMEs do not show a similar inclination towards partnership and collaboration. Finally, HTI SMEs use real-time analysis of company operations for effective decision-making, while LTI SMEs exhibit skepticism towards innovative processes and rely more on traditional methods and manual labor.

In summary, the findings reveal that HTI SMEs are more proactive, agile, and open to collaborations when it comes to adopting new technologies, engaging with external actors, and fostering innovation compared to LTI SMEs. This difference in approach contributes to the disparities in their digital transformation orientation and overall performance.

5. Discussion

In this paper, we build upon existing literature on digital transformation in the context of SMEs (Appio et al., 2021; Volberda et al.,

2021) and how SMEs can adapt to technological change (Annosi et al., 2022; Han and Trimi, 2022; Matarazzo et al., 2021; Troise et al., 2022; Battistoni et al., 2023). Our study aims to contribute to this field by advancing a characterization of the integrative framework for digital transformation proposed by Volberda et al. (2021) and providing a micro-foundational view of this phenomenon within SMEs.

In particular, as reported in our model (see Fig. 1) our findings show that to effectively implement digital transformation initiatives SMEs can rely on specific micro-foundational elements underpinning companies' cognitive models, routines, and organizational structures. First, in cognitive terms, SMEs need their managers to be able to recognize if there is potential for their companies to adopt new technologies and, by incorporating them into their daily operations, generate additional value for the company. Also, managers need to channel their attention to the opportunities available in the market, and be open to recognize whether any technological tool available in the external environment is worth to be adopted within their companies. Additionally, managers in SMEs need to show a problem solving approach when it comes to technological implementation, employing data and information to develop clear and rationale plans about how to make the best out of a novel technology that can be incorporated within the company. Finally, a cognitive model oriented towards digital transformation requires SMEs to overcome the organizational inertia that may stuck employees and actors within them on obsolete ways of operating: to do so, managers in SMEs can leverage their social capabilities and involve collaborators and employees in technological discussions and ad-hoc trainings.

Second, novel routines call SMEs to develop a centralized guidance about technological adoption, that is yet informed by the engagement with several actors (both within and outside the company) to collect technological opportunities and stimuli for innovation. Also, in terms of routines, SMEs need to design accurate plans regarding new technological adoption, plans that involve incremental steps based on a regular monitoring of technological performance. Finally, our evidence suggests that routines that can provide the basis of an effective and informed decision-making call SMEs to gather constant data and perform real-time analyses of their operations.

Third, to successfully navigate digital transformation, our findings show that SMEs need to create a more flexible and horizontal organizational structure, able to ensure collaborations between managers and employees, with a flow of information, expertise, and knowledge that can allow for a decentralization of problem-solving and decision-making. In this sense, SMEs managers first actively engage with their employees in a daily exchange that can allow them to make more informed evaluations and get insights about potential technological opportunities, and then undertake the final decision about technological adoption. Finally, SMEs that are driven towards digital transformation show a significant embeddedness in a complex network of external partners, that involves other companies and technological manufacturers, as well as suppliers.

We also provide a set of managerial recommendations for managers operating in SMEs to guide them to leverage cognitive models, routines, and organizational structure in their efforts to fully and efficiently embrace digital transformation. To the best of our knowledge, this is the first study to offer such a detailed examination of the Volberda et al.'s (2021) framework in this context.

5.1. Theoretical contributions

We believe that our findings may inform and advance theory in different ways. First, our study contributes to research on managerial cognitive models in the context of SMEs, which has only recently begun to investigate the cognitive models of SMEs' entrepreneurs who successfully deal with digital transformations. Similarly to our study, Li et al. (2018) examines the role of SME entrepreneurs in the digital transformation process, and argue that they play a crucial role as they lead the process of identifying and implementing new digital technologies in their organizations. The authors also provide a theoretical framework for understanding the capabilities that SME entrepreneurs need to possess in order to successfully lead digital transformation in their organizations, mainly underlining for them the relevance to learn and to reflect also through the establishment of external ties and digital platforms. However, unlike Li et al. (2018), our findings show not only the importance of acquiring and seeking new information as distinguishing factors between HTI and LTI managers (confirming the findings reported in Matarazzo et al., 2021), but also the importance of managerial cognitive aspects more related to organizational workforce management that can contribute to reducing organizational inertia, resistance to change, and other barriers to digitalization. In line with Bourdeau and Vieru's (2020) suggestion that SMEs' managers should focus on the complementary nature of their employees' cognitive, social, and technological dimensions of digital fluency, our findings highlight the importance of managerial actions to help employees overcome the challenges of managing the introduction of new technology, to create a culture that fosters employees' interests and curiosity about new technologies, and to discuss about these latter with employees. Thus, building on Bourdeau and Vieru's (2020) discussion of managerial actions in SMEs towards employees, we identify concrete recurring actions that SMEs managers must take to improve employees' digital fluency in SMEs.

In line with Annosi et al. (2019), who investigated the role of managerial cognition in the decision to invest in new technologies, our findings confirm that managerial perception of the importance of technology for the company and its growth distinguishes LTI SMEs from HTI SMEs. However, unlike Annosi et al. (2019), our study does not consider the perception of environmental support as a relevant antecedent of the decision to adopt. One explanation could be that our study, rather than focusing on the adoption decision, takes a broader approach, identifying the micro-foundations that influence digital transformation adoption and implementation in successful SMEs. While Annosi et al. (2019) focused on a limited set of variables centered on the managerial characteristics and cognitive aspects of successful SMEs, our study provides a more comprehensive and holistic view of the elements companies need to incorporate to navigate digital transformation.

Differently from other studies examining digital transformation in SMEs, our findings do not indicate that managerial decisions and cognition are the primary drivers of decision-making processes, and we do not see dynamics capabilities (e.g., sensing, searching, and selecting the right source of digital knowledge) as residing with the owner or shared with a small group of collaborators (Goerzig and Bauernhansl, 2018; Garbellano and Da Veiga, 2019). Rather, we demonstrate a broader set of managerial cognitive capabilities with the goal of involving the entire workforce, stimulating collective decision making, and encourage feedbacks from different actors, allowing for a collective analysis of the opportunities that digital technologies can bring to SMEs. Our findings suggest that a diverse set of actors with different knowledge and perception of digital technologies is required to fully understand the impact of digital technologies' adoption on SMEs operations.

When it comes to the findings on the structure pillar of digital transformation, we contend that in HTI SMEs, relationships between employees and managers/owners are characterized as collaborative, with structured interactions that facilitate the transfer of different types of information, including tacit and proprietary knowledge related to internal operations. We found that successful managers work with their employees to gather a variety of relevant inputs and to achieve mutual benefits. While previous research has highlighted the importance of SMEs collaborating with external actors to cope with resource constraints (Han and Trimi, 2022; Silvestri et al., 2023; Troise et al., 2022), our findings highlight the importance of the ability to easily integrate new knowledge from both inside and outside the company "into a collective system to deploy the new configurations of operational capabilities" (Pavlou and El Sawy, 2011: 245) and orchestrate and deploy

new tasks and resources within the daily routines of employees. Our findings also point to managers' leadership role in promoting employee commitment and the dissemination of relevant information. Furthermore, we emphasize the importance of a decentralized opportunity evaluation of new technologies while keeping the relevant decision in the hands of a few people in the company. In terms of the need for collaboration with external partners, our research finds that behind the decision to connect with others is the need for SMEs to gain access to relevant resources such as information and specific expertise in order to obtain funds from regional or national institutions.

Further to that, previous studies have overlooked how SMEs execute digital transformation to avoid obsolescence (Loonam et al., 2018; Müller et al., 2018; Del Giudice et al., 2021; Peter et al., 2020). Our findings provide insights on the organizational design forms that are better suited to deal with the rapid evolution of technology and the relevant cognitive divide of employees in SMEs. Indeed, we clearly show how SMEs organize their organizational structure in order to dynamically assign tasks, collect and disseminate new information, and motivate employees to act in the direction of new technology absorption. According to some studies, agility is an antecedent for the adoption of digital technologies (Björkdahl, 2020), it has a causal influence on digitalization (Fachrunnisa et al., 2020; Del Giudice et al., 2021), and SMEs should be supported by solid, robust organizational structures that allow them to effectively address changes and external risks (Kelly and Amburgey, 1991). However, research has not yet examined in depth the configuration and choices in organizational design that can lead to successful technology integration within the company.

Regarding the routines pillar of our framework, we have illustrated the routines underpinning organizational capabilities to perform a particular activity in a reliable and at least minimally satisfactory manner, in line with recent studies that investigate how companies incorporate digital transformation into their strategies, operations, and business models to be successful and gain a competitive advantage (Tabrizi et al., 2019; Verhoef et al., 2021). Scholars have distinguished between different categories of organizational capabilities, namely "operational capabilities" and "dynamic capabilities" (Collis, 1994; Helfat and Winter, 2011; Schilke et al., 2018; Soluk and Kammerlander, 2021), with the latter viewed as an expression of a company's ability to both adapt to changing exogenous circumstances and shape the external environment to their advantage (Teece, 2007). Building on the concept of dynamic capabilities, Lavie (2006) argues about the relevance to understand "how these configurations are likely to change" (Lavie, 2006: 153). In the case of the digital transformation, past studies have focused more on the category of dynamic capabilities, demonstrating how they can be critical for well-established companies to survive and succeed in the long run in the face of digital transformation (Warner and Wäger, 2019; Matarazzo et al., 2021). The concept of dynamic capabilities has also significantly informed the debate about how companies in various industries can benefit from digital transformation (Li et al., 2018; Canhoto et al., 2021; Cannas, 2021; Matarazzo et al., 2021; Jafari-Sadeghi et al., 2022; Zahoor et al., 2022). However, the significant proportion of the related literature has focused on dynamic capabilities in the act of sensing and seizing, with less emphasis on routines for resource reconfiguration within companies. For example, Cannas (2021), in a study focusing on the agri-food Sardinian industry, shows how companies adopt and exploit digital technologies through distinctive dynamic capabilities: specifically, companies' sensing, seizing and transforming capabilities (Teece, 2007). In a similar vein, Dressler and Paunovic (2021) discuss the importance of sensing technologies and technology adoption strategies for digital transformation in SME wineries. Canhoto et al. (2021) discuss the importance of digital strategy alignment in SMEs from a dynamic capabilities perspective. Furthermore, Matarazzo et al. (2021) focus on the role of dynamic capabilities in fostering digital transformation in SMEs, identifying sensing and learning capabilities as critical for SMEs to capitalize on the potential of digital technologies. However, dynamic capabilities include routines that have been the subject of more extensive empirical research. For instance, according to Eisenhardt and Martin (2000: 1107) dynamic capabilities are "the firm's processes that use resources—specifically the processes to integrate, reconfigure, gain and release resources—to match and even create market change. Dynamic capabilities thus are the organizational and strategic routines by which companies achieve new resource configurations as markets emerge, collide, split, evolve, and die". We demonstrate the routines that SMEs use to combine internal and external knowledge in order to advance the integration of new technologies within the company. We identify knowledge creation routines, for example, when managers and employees extend their thinking within the company. We also include routines related to alliances and collaboration with other actors that bring in new resources from the outside world. Indeed, our findings show how SMEs rely on: i) information exchange with both internal and external actors; ii) internal translators and relationships with institutions that can help them absorb new knowledge and realize their innovation potential; iii) expanding internal knowledge through exposure to new, external sources.

Finally, we have reported resource combination routines such as those for supplier selection and evaluating new technology criteria. As a result, we have provided more ground for both research and management application.

5.2. Implications for managers

Our findings offers several implications to managers of SMEs who aim at successfully navigating digital transformation. First, the imperative for them should be to be open-minded towards the possibility to incorporate in their company novel tools and machines, and at the same time attentive to the technological stimuli and opportunities existing in the external environment. Such openness to opportunities, willingness to seek and evaluate information coming from different actors of the ecosystem is key for SMEs to identify potential areas for growth and stay competitive in today's fast-paced business environment.

Second, our findings suggests that managers can do more than passively embracing technological change and digital transformation. We suggest that SMEs may benefit and navigate digital transformation when managers configure themselves not only as adopters, rather as actors that undertake a proactive approach towards innovation. Indeed, being cautious and acting on innovation only when called upon it (i.e., when it is absolutely needed in the company), may not represent a value creating strategy for SMEs in today's environment, which is digitally evolving at an exponential pace.

Third, managers in SMEs should seek for a collaborative approach with both their employees (i.e., internally) and external actors. Such exchange of information, knowledge, feedbacks is pivotal for SMEs to keep up with technological change. Indeed, the adoption of technologies often requires companies to have diverse competencies and technical skills that can be mastered by different actors within and outside the company. This means that, when managers need to undertake decisions about technological adoption, it is key to rely on a pool of information and knowledge from sources that can be competent about different aspects of that technology and provide diverse suggestions about how to at best incorporate such technologies in company's processes and activities.

Fourth, and in accordance with most studies investigating the factors that can enable companies to create sustainable value, we suggests that managers in SMEs engage in a long-term planning when considering technological adoption. Only a planning that is strategically devised and forward-looking can give managers a sense of what could be the real benefits of a specific technology, as they can compare it to its adoption and implementation costs in the short term, and can balance these latter out with the advantages (and monetary gains) they could bring in the long-term.

6. Limitations and future research

This research is not without limitations. To begin with, we are concerned about the transferability of our findings to a broader research contexts as our findings are grounded in observations emerging from the experiences of digital transformation in agri-food sector. Future studies could study if the emerged micro-foundations can be applied also to a wider populations of companies in other industries and markets. Secondly we relied on qualitative research to identify the micro-foundations of the main dimensions of Volberda et al., (2021)'s framework. To advance our understanding about the effect of the micro-foundations identified, we recommend to proceed with survey research operationalizing in quantitative terms the developed framework. Future researchers can also launch additional research initiatives to investigate the extent to which the micro-foundations of cognitive models, routines, and organizational structure may evolve over time ad to analyze the contextual factors affecting their evolution.

Another limitation of this study is the lack of homogeneity in the sample of SMEs, particularly when the nature of the business and the size of the organization are considered. Organizations operating in the agricultural sector (i.e., food production) may be able to implement different micro-foundational mechanisms than those operating in the food sector (i.e., food processing). Furthermore, the margin of earnings per unit sold in the agricultural sector is typically lower than in the food sector. A lower turnover can have an impact on how investments in digital technologies are made and how the digital transformation is managed. Furthermore, despite the fact that we limited our research to SMEs in the Italian agri-food sector, the sample's weakness is related to the size of the organizations. For example, Company 10 employs four people and has a 0.05 M turnover, whereas Company 11 employs twenty-five people and has a 5 M turnover. Both of these businesses are classified as SMEs, but their requirements for digital technologies and digital transformation differ significantly. Future research can attempt to use larger and more homogeneous samples, which may result in better identification of digitalization patterns, allowing researchers to develop a more refined micro-foundational investigation.

Also, we acknowledge that our study does not assess the success or failure of the firms involved in digital transformation initiatives. Rather, it focuses on understanding the micro-foundational elements in cognitive models, routines, and organizational structures that are necessary for SMEs to effectively navigate digital transformation. One limitation of our study is the lack of performance-related measures to evaluate the implications of low technological integration (LTI) and high technological integration (HTI) on the success of these firms in their digital transformation efforts. Future research could build upon our findings by incorporating performance indicators such as financial performance, market share, or customer satisfaction to assess the effectiveness of digital transformation initiatives in SMEs. Such an approach would provide a more comprehensive understanding of the factors contributing to the success or failure of digital transformation initiatives and allow for the identification of best practices that can be adopted by SMEs seeking to embrace digital transformation. Additionally, future research could explore the temporal aspects of digital transformation, investigating how the performance implications of LTI and HTI evolve over time as firms adapt and learn from their digital transformation experiences.

Finally, we acknowledge that our investigation does not tackle dynamics of influence between the cognitive, routine and structure pillars; upcoming studies can examine what are the relationship unfolding between these three different pillars, and if there is any interdependency between the specific micro-foundations identified, also trying to understand if any of these latter should be prioritized in order to provide for SMEs an even smoother navigation and leveraging of digital transformation initiatives.

CRediT authorship contribution statement

Annosi: Discussion; Findings.

Capo: Findings; Implications for managers; Limitations and directions for further research.

Appio: Introduction; Literature review; Methodology.

Data availability

Data will be made available on request.

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Appendix A. Interview protocol

Part 1

Information about the organization:

Industry	Industry type	
Size of the company	Number of employees	
	Production (how much is produced?)	
	Number of hectares	
	Price per unit of the main product produced	
	Turnover (year)	
Patents	Does the organization own any patent?	
Market	How big is the market in which the organization operates?	
	How much of the product is exported?	
Personal Information about the owner/manager	Gender	M/F
	Degree/qualification	M/D/L
Web site		Present/absent

Part 2

1. What kind of innovative digital technology have you adopted in your organization so far? For which purpose did you decide to adopt it?
   Community

2. Are you part of a formal or informal community (e.g., I pay a fee or I filled in an application form or "my usual circle," my group of friends, my trusted colleagues, my neighbors) with whom you discuss about decisions related to the adoption of digital technologies?

- If so, do you prefer to ask the formal or informal community?
- Why did you join them?
- How big is the community?
- Do you have some preferential contacts in your community? If so, why?
- How often do you have contacts with them?
- Do you connect to them to discuss innovations, changes, or events? How? Could you tell me more about that?
- Do you go to fairs/events/presentations/workshops together and discuss what you have learned? How often? Could you tell me more about that?
- Do you share your information with them? Why? How often? Could you tell me more about that? Which information?
- Do they ask you for any advice? Which type of advice? Could you tell me more about that?

Suppliers, customers, technology providers

3. Do you have business partners? Which type? Why? Could you tell me more about your business partners?

- Based on your experience, which contacts have been more fruitful for your business? Could you tell me more about that?
- Which benefits do you get from each of your contacts? Could you tell me more about that?

4. What is your strategy for the selection of your contacts? Are you using your old contacts? Could you tell me also about your experience with the contacts you had? Was there any problem with them? Did they meet your expectations?
5. What would you improve in the strategy of the selection of your network of contacts? Could you tell me more about that?
6. Do you have a fair relationship with your partners/colleagues? Which are the conditions for having fair relationships with partners and peers in your communities?

People within the company

7. Are you the only owner-manager or do you have an associate/peer/managerial team? Please, could you describe the governance of your company to me? Who is making the decisions and who is responsible for what?
8. Internally in your company, which meetings are held to discuss business matters? How often do you meet? Are these informal or formal meetings?
9. Please, could you describe how you connect with your employees for advice on business decisions?
10. Could you describe the mechanisms (formal/informal) you use to interact with your employees (e.g., meetings)?
11. How do you communicate with them? How often do you speak with them? What information are you giving them and what information are you taking from them?
12. Could you also describe your informal meetings with them? What do you talk about? Do you inform them about the business decisions? When?
13. How do you monitor their performance and their behavior?
14. Could you describe the relationships with the employees in terms of your openness to collect their suggestions on business decisions? If so, do you solicit them, or do they do it spontaneously? Could you give us an example?
15. What are your thoughts about the acquisition of relevant knowledge to accomplish the organizational tasks? Could you tell me about how you train your employees or get their knowledge updated? What is the direction you follow regarding their training?

Owner/Manager Characteristics and post-adoption performance

16. How much time do you take to plan your business? Do you have plans for the next 3,5, 7 years? Or less/more?
17. What are the factors you take into account before deciding whether to adopt a new digital technology?
18. How often do you check on/revise your strategic choices?
19. How do you evaluate the performance of your company? Do you use a formal evaluation criteria or specific indicators? Are you satisfied with it?
20. Which were the relevant factors that justify the success/failure of the process of digital transformation of your company? Could you tell me more about that?
21. How do think the performance of your organization should be improved?
22. Do you think technological innovation can improve the overall performance of your organization? More generally, what do you think is the role of technological innovation for the prosperity of a business such as yours? To what extent does technological innovation matter for you?
23. How do you think digital technology can help your company?
24. Are you a technology adopter? Could you describe your recent experience in adopting new digital technologies?
25. How do you nurture your knowledge of newly available technologies?
26. Do you look proactively for information? What information do you proactively collect? Which channels do you specifically use for that?
27. Do you attend workshops or fairs or conferences? How do you get to know about these events? Do you find them useful? Which information do you hope to find? What are the criteria that you use to select where to go?
28. What information are you still missing with respect to technological innovation? Who could be a good carrier of information for that?
29. Do you have the necessary competence to understand all the technological options? Could you tell me your strategy to survive with the lack of knowledge resources?
30. Have you ever adopted a technology following a competitor move?
31. Have you ever adopted a technology following a colleague/work-related friend suggestion?
32. Do you share your information and competence with colleagues/work-related friends?
33. Do you collect customer feedback? What do you think about the customer's involvement?
34. Does customer feedback influence your business decisions? Did it happen in the past?

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