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INNOVATION IN CRAFT FAMILY SMES IN THE DIGITALIZATION ERA

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Abstract

Digitalization is radically changing production chains in all sectors and the dynamics among producers, suppliers, and end-users. Large as well as small and medium enterprises (SMEs) operating in the craft industry are witnessing a fundamental transition toward digitalization. In Italy, craft SMEs are mostly family managed and owned, and these firms are finding themselves under severe innovation pressure. Through an online self-assessment tool (DigiCheck), this study investigates the current and expected level of digitalization in 100 craft family SMEs in South-Tyrol (Italy). The study offers insights into their attitude towards digitalization, and the opportunities and challenges they face. Four types of digital craft family SMEs emerge: Digital Leader, Digital Oriented, Digital Surrendered, Digital Steady-State. While the results indicate a relatively high willingness to innovate, major challenges prevail that hamper craft SMEs in adopting Industry 4.0 technologies and solutions.

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1. Introduction

The current fast-moving trends of Industry 4.0 and digitalization are fundamentally changing the value chains across industries (Schwab, 2017). In particular, small and medium enterprises (SMEs) must ensure their technological and organizational readiness to implement Industry 4.0 solutions (Matt and Rauch, 2014). The benefits of advanced automation and digitalization will ultimately depend on adopting such technologies, especially in industrial societies worldwide where SMEs are the backbone of many production systems (Andulkar *et al*., 2018). Moreover, craft SMEs are among those that may profit from the Industry 4.0 paradigm (Deutsche Telekom, 2016). Indeed, many are increasingly digitizing their planning, purchasing, production, and logistics (Barthel and Weiss, 2014). In confirmation, the German Central Craftsmanship Association considers digitalization a strategic priority, particularly for craft SMEs (Zentralverband des Deutschen Handwerks, 2018). Compared to large companies, craft SMEs face several challenges in implementing Industry 4.0 concepts in their production context, such as the timely recognition of relevant technological trends (Salatino, 2015), the lack of a clear strategic vision (Schröder, 2017; Rudtsch *et al*., 2014), their limited investment capacity (Dassisti *et al*., 2017), scant IT and technical knowledge (Cerchione and Esposito, 2017; Koska *et al*., 2017), and scarce employee qualifications (Matt *et al*., 2020; Karre *et al*., 2017; Gabriel and Pessl, 2016). Systematic approaches, such as strategic roadmaps, may facilitate craft SMEs in planning their activities to tackle the specific challenges of digitalization (Pessl *et al*., 2017). For this reason, assessing the current and expected digital readiness of firms is essential – prior to any technological implementation and strategic restructuring – to define feasible objectives in line with their current level of digitalization (Rauch *et al*., 2019; Unterhofer *et al*., 2018).

In this sense, the South-Tyrol region in northern Italy is an interesting research setting to assess the digitalization maturity of craft SMEs. Contrary to the declining trend in the total number of craft SMEs registered in Italy, South-Tyrol saw an increase of 2.2% in craft SMEs between 2009 to 2017, and a further increase of 0.7% between 2016 and 2017 (Centro Studi CNA, 2018). In addition, more than 90% of SMEs in South-Tyrol are family enterprises. Family SMEs have particular characteristics in terms of their goals, resources, and power structure, which may result in unique management challenges in relation to digitalization, especially in very traditional and conventional industries such as craftsmanship. Hence, the present research aims to answer the following question: What is the current and expected digitalization level of craft family SMEs in South Tyrol?

The remainder of the paper is structured as follows. First, we provide a comprehensive literature review of family business innovation and digita-

lization. We then present the methodology and our findings. Last, we discuss the implications for both theory and practice, and outline the study's limitations and some future research directions.

2. Literature review

2.1 Family SME characteristics and craftsmanship

In the field of family business, scholars agree that the participation of one or more families in a firm makes the business organization unique (Chua *et al*., 1999; Kotlar *et al*., 2020). In small family enterprises, the overlap between the family system and the business system is particularly high (Sciascia *et al*., 2013). Family firms are generally defined as small or medium sized firms that are owned and controlled by one or a group of families (De Massis *et al*., 2018a). They are further characterized as heterogeneous (Chua *et al*., 2012; Kotlar *et al*., 2014; Wright *et al*., 2014), risk-averse (Duran *et al*., 2016; De Massis *et al*., 2020) and with limited resources (De Massis *et al*., 2018a). In addition, family enterprises are typically long-term oriented (Lumpkin *et al*., 2010) and driven by both financial and non-financial goals (Chrisman *et al*., 2010). Moreover, the firm's survival over generations distinguishes this form of business organization, and the willingness of managers to pass on their knowledge, expertise, and values across generations plays a crucial role (Kotlar and De Massis, 2013).

The quest for a universal definition of craftsmanship in the literature is as demanding as it is fruitless. The Italian Encyclopedia of Science and Arts offers a valuable cue, also referring to the family dimension, defining craftsmanship as "Activities, both artistic and collective, for the production of goods and services, organized mainly on an individual or family basis" (Treccani, 2019). Various data sources regarding different craft SMEs show that in Germany, approximately 17% of businesses can be considered as craft (Deutsche Telekom, 2016). Similarly, in Spain and Italy, craft enterprises account for approximately 20% of national businesses (Deutsche Bank Research, 2014; Camera di Commercio di Piacenza, 2016), and an even larger share of around 50% of all businesses registered in Austria (Austrian Federal Ministry of Science Research and Economy, 2017). Considering the number of employees and the level of turnover, the majority of craft enterprises are SMEs according to the European Commission (2019) definition. Moreover, other aspects that characterize craft SMEs include the predominant local structure of operations, limited technological production endowments, and inseparable ownership and management structure (Craftsman Project, 2011), i.e. the owners are simultaneously leaders of the firm. Moreover, family SMEs are the world's oldest and most common form

of business organization, constituting two-thirds of all businesses globally (De Massis *et al*., 2018b), contributing extensively to economic growth worldwide, and ranking amongst the most innovative firms (De Massis *et al*., 2013; 2018b; Urbinati *et al*., 2017). Although they typically have a lower willingness to engage in innovation, they are paradoxically associated with a greater ability to do so (Chrisman *et al*., 2015).

2.2 Innovation in family SMEs

Although there is increasing academic interest in family firm innovation, current research is still inconsistent, and the relationship between family business and innovation remains unclear (De Massis *et al*., 2013; Duran *et al*., 2016; Rondi *et al*., 2019; Migliori *et al*., 2020). Scholars show that family enterprises are associated with lower innovation inputs (Sciascia *et al*., 2015; Miroshnychenko *et al*., 2019), and thus lower innovation outputs (De Massis *et al*., 2013; Calabrò *et al*., 2018). However, they have a higher ability to convert these limited inputs into higher outputs. Thus, family enterprises are associated with higher levels of innovation (De Massis *et al*., 2013; Urbinati *et al*., 2017). Indeed, their unique family enterprise characteristics – e.g. long-term orientation, non-financial goals, and emotional ties – have a strong effect on how they manage technological innovations (König *et al*., 2013; De Massis *et al*., 2016). De Massis *et al*. (2015a) refer to this as the dual nature of innovation in family firms, as some are more innovative than others. Family SMEs find themselves under severe pressure to innovate. Their liability of smallness (Freeman *et al*., 1983) and resource-related weaknesses (De Massis *et al*., 2018a) make it even more challenging to cope with the emerging digital economy (Loebbecke and Picot 2015; Archibugi, 2017; Schwab, 2017). Yet, many family SMEs are among the most innovative in the world (De Massis *et al*., 2013, 2018a; Urbinati *et al*., 2017; Muñoz-Bullon *et al*., 2019). Their flexibility and fast decision-making allow them to quickly adapt to the ever-faster changing environment but also their long-lasting legacy and tradition shape their innovation (Erdogan *et al*., 2020). Furthermore, their regional embeddedness and strong local relationships are essential to fostering innovation activities (e.g. Classen *et al*., 2014), especially in times of digitalization. The literature also indicates that the family plays a pivotal role in introducing technological innovation in the firm (Bruque and Moyano, 2007; De Massis *et al*., 2013), with an impact on innovation and technology management (De Massis *et al*., 2016). This may help them achieve a competitive advantage and superior innovation capacity compared to their non-family counterparts (Souder *et al*., 2017; De Massis *et al*., 2015b).

2.3 Digitalization in family SMEs

Digitalization combines different technologies (e.g. cloud, sensors, big data, 3D printing) considered a subset of a wider range of technological innovations (Rachinger *et al*., 2018; Nambisan *et al*., 2017; Schmidt *et al*., 2015) including digitalizing processes, products, and business models (Porter & Heppelmann, 2014, 2015; Teece and Linden, 2017). Therefore, digitalization is often considered a paradigm shift that fundamentally changes business environments around the world at an as yet unknown speed and scope (Bounfour, 2016; Rindfleisch *et al*., 2017; Schwab, 2017). Family SMEs have to adapt their processes to remain competitive in this increasingly digital business environment. However, there are strong theoretical reasons to expect that family SMEs may encounter greater difficulties in responding to digitalization (König *et al*., 2013). Family SMEs are constrained by their unique traits, such as smallness, generational involvement, and emotional ties between the family and the business, which may have a significant impact on how family SMEs manage technological innovation and especially digitalization (König *et al*., 2013; De Massis *et al*., 2016).

3. Methodology

3.1 Research setting and approach

The subject of this study is the digitalization of craft family SMEs in South Tyrol. The research setting is appropriate for the purposes of this study for several reasons. First, SMEs represent the overwhelming majority (99.8%) of enterprises in Europe, and particularly in Italy, Portugal, and Spain (EUROSTAT, 2011). Second, craftsmanship is currently facing the greatest transformation in terms of digitalization (Dassisti *et al*., 2017), as new technologies threaten their daily business (Sommer, 2015). Third, more than 90% of craft SMEs in South Tyrol are family firms (WIFO, 2016). The literature indicates that these firms have particular characteristics in terms of their goals, resources, and power structure, which may result in unique management challenges in relation to digitalization, especially in very traditional and conventional industries such as craftsmanship. To examine the intersection between digitalization and family SMEs in craftsmanship, two of the authors of the present research developed (and hold all rights to) an online self-assessment tool (DigiCheck) enabling craft family SMEs to assess their current and expected level of digitalization. This tool was built considering the challenges that craft SMEs face in digitalization and the need to scale existing self-assessment tools to the requirements of SMEs (Brozzi *et al*., 2018). DigiCheck is composed of 23 questions, presented in

the present analysis across five main dimensions, namely D1) Process; D2) Internet connection and data security; D3) Industry 4.0; D4) Collaborators; and D5) Cooperation and support (Table 1).

Tab. 1: DigiCheck structure

Label	Dimension	Question	Typology
D1	Process	Use of digital devices in the company	Likert
		Importance of new technologies	Likert
		Use of technologies related to I4.0	Likert
		Typology of sales channels	Likert
		Flexibility of products/services	Likert
		Degree of digitalization of processes	Likert
		Expected impact of I4.0 (company organisation)	Likert
		Expected impact of I4.0 (competition, market demand)	Likert
		Use of software to analyse and collect data	Likert
		Importance and utilization of collected data	Likert
D2	Internet connection and data security	Purpose to use the internet	Likert
		Quality of internet connection	Likert
		Data security	Likert
D3	Industry 4.0	Perception of digitalisation	Likert
		Level of knowledge regarding I4.0	Likert
		Importance of I4.0 for the company	Likert
		Allocated resources for digitalization (EUR)	Numerical
		Perceived advantages of I4.0	Multiple choice
		Perceived challenges of I4.0	Multiple choice
D4	Collaborators	Adequacy of skills of employees	Likert
D5	Cooperation and support	Collaboration with other institutions on I4.0 projects	Likert
		Support provided by craftmanship association	Multiple choice
		Fields in which support to SMEs is required	Multiple choice

D1 shows the average digitalization level of craft family SMEs in terms of processes. It comprises all the activities to acquire new technologies and implement them in the production system, the digital commerce channels used for selling products and offering services, how digitalized the management of processes is, and the extent to which firms use, collect, and analyze data for business purposes. D2 describes the internet connection and how important data security is for firms, indicating how often they use the internet, how important it is for the business, and whether it is used for different activities, also in relation to the production or distribution of goods, and not only administration. D3 concerns the Industry 4.0 topic, capturing the firm's conceptualization of digitalization and what they already know about this topic. It also describes the level of importance of Industry 4.0 for craft SMEs and how the challenges and opportunities influence their adoption of Industry 4.0 devices and methods. D4 depicts the level of adequacy

of the knowledge and skills of employees on the topic of 4.0 digitalization and crafts. Finally, D5 describes the level of cooperation with other firms, organizations, associations, or research institutes with regard to the Industry 4.0 topic. The rating system is distributed along a five-level Likert-type scale, which enables respondents to assess the perceived current (today) and expected (in five years) digitalization level with respect to a specific question. The 5-year timespan fits well with the present research, as any time point further in the future might not be assessed accurately today given the ever changing digital environment. Descriptions of the lowest and highest rankings are provided through specific examples to facilitate compiling the firm's current and expected digitalization level (Table 2).

Tab. 2: Examples ranking the current and expected digitalization level

Question: To what extent are production processes digitalized?
Level 1: Most of the processes are paper-based.
Level 5: Resource planning, customer management, and other tasks are completely digitalized.

The scale of possible responses ranges from 1 to 5, with 1 indicating a low level and 5 a high level of digitalization. The combination of mean values ($\bar{x}$) of the current and target digitalization level enables identifying patterns referring to the overall position of craft family SMEs with respect to the digitalization topics.

3.2 Data collection and sample

The data collection was conducted through the online DigiCheck tool developed on behalf of the South Tyrolean Craftsman Association (lvh.apa) according to Brozzi *et al*. (2018) to map the digitalization level of craft businesses in South Tyrol. It was launched on 7 May 2018 and distributed via an email newsletter and traditional means (e.g. information events, press releases, newspaper articles) on 23 May 2018. Of the 209 craft family SMEs that showed willingness to take part in the survey,100 completed it, resulting in a response rate of 47.85%. Thus, the final sample consists of 100 South Tyrolean craft family SMEs operating in different sectors and adhering to the following criterion: privately owned SMEs controlled by one family or group of families (De Massis *et al*., 2018b). All firms in our sample are located in South Tyrol, a mainly German speaking minority in Italy. Due to its central position in Europe and similar historical background to Austria, Germany, and Switzerland in terms of culture, language, and business routines, the sample bears resemblance to typical so-called German Mittelstand firms, that is a "subset of owner-managed small- and medium-sized enterprises (SMEs) in Germany" (De Massis *et al*., 2018a, p. 126;

Matt *et al.*, 2016). The sampling method for this study was random, since the firms completed the DigiCheck survey on their own initiative following the announcement. Table 3 shows the distribution of the sample firms among the different sectors.

Tab. 3: Structure of the sample

Sector	Frequency	Percent
Timber	31	31%
Construction	19	19%
Installation	19	19%
Metal	12	12%
Media	8	8%
Food	3	3%
Textile	3	3%
Transport	3	3%
Arts	2	2%

3.3 Data analysis

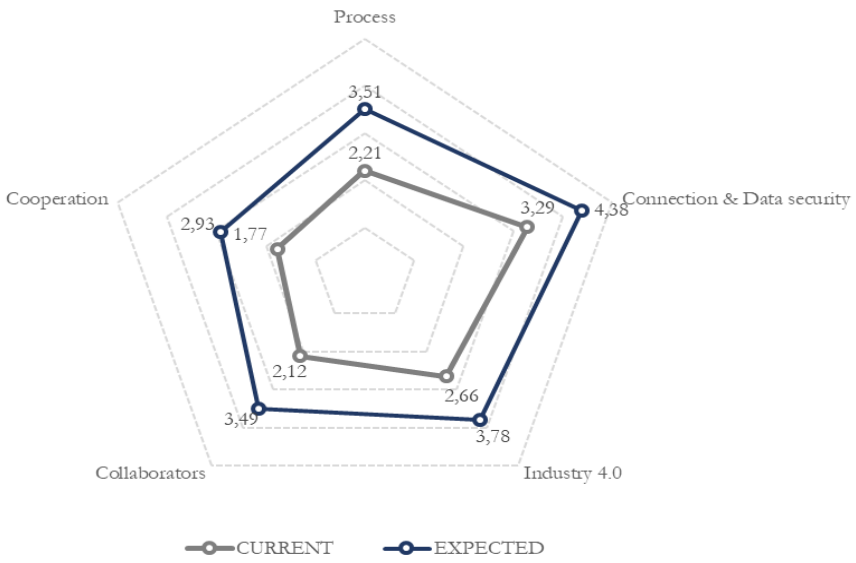
Our dependent variable is measured by the average value of the firm's expected level of digitalization. We constructed this measure by taking first the mean of all values in 5 years. We measured our independent variable by computing the average of the firm's current level of digitalization or the digital status quo. For the data analysis, we used the statistical software STATA 14.0 to compute both the current and expected mean values for each observation (i.e. for each firm), transformed from discrete into continuous variables. Hence, we created and used the two variables 'current' and 'expected' level of digitalization for the linear regression model. Since we are interested in identifying both the current and expected digitalization level of family SMEs operating in the craftsmanship sector in South Tyrol, we analyzed the average current values over the average expected values in relation to the DigiCheck questions. Therefore, the basic model describes the relationship between the average expected and the average current level of digitalization.

4. Findings

4.1 Aggregate level

A first analysis shows how the current and expected digitalization levels are distributed across the 5 considered dimensions for the entire sample. The general trend indicates that respondents expect a higher digitalization level in the future compared to the firm's current level (Fig. 1). Relatively lower average values in the perception of the current digitalization level are signaled in the degree of cooperation ($\bar{x}$=1.77) and digital skills of the workforce ($\bar{x}$=2.12). Conversely, respondents rated the quality of the internet connection and data security ($\bar{x}$=3.29) with higher values.

Fig. 1: Results: aggregated level



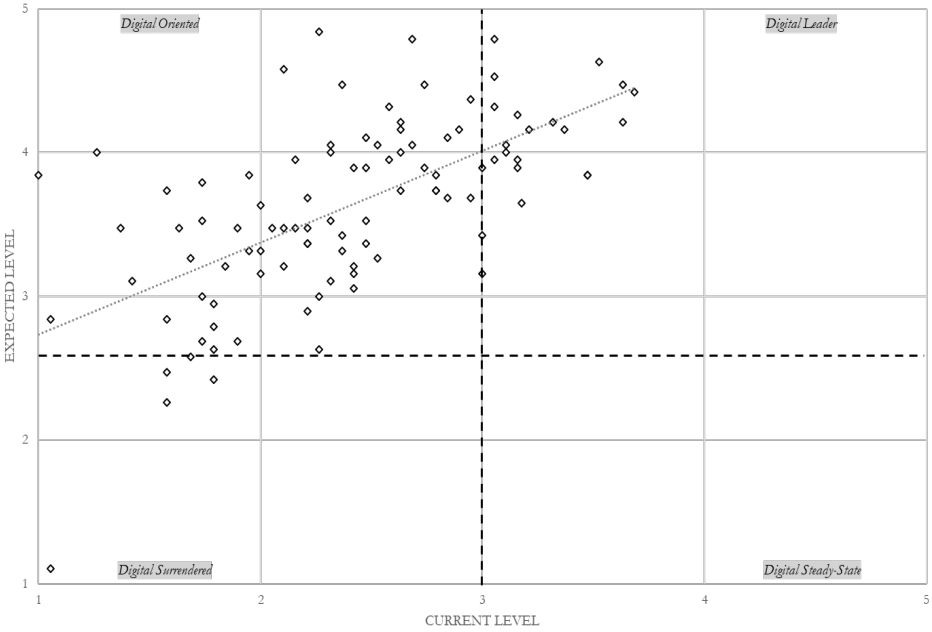
The main dimensions considered pivotal to increasing the future digitalization level are internet connection and data security ($\bar{x}$=4.38), Industry 4.0 ($\bar{x}$=3.78), production and organizational processes ($\bar{x}$=3.51). Instead, increasing the degree of cooperation in the future ($\bar{x}$=2.93) is not deemed a dimension to be strengthened. The analysis of the questions offered valuable insights for the interpretation of the results in terms of increasing the expected level of digitalization of the various dimensions. With respect to internet connection and data security, 50% of respondents rate their data security as weak. Limited investment capacity (15.92%), security and data protection (15.02%), competences and qualifications of employees (13.21%) are considered the main challenges in the introduction

of Industry 4.0. Conversely, respondents do not perceive the degree of interest of customers in digital applications as an obstacle to digitalization. In general, 60% of respondents consider Industry 4.0 highly relevant in the future. In this regard, the most frequently indicated advantages are time saving (21.15%), better work organization (15.63%), improved logistics and storage (12.87%). More efficient productivity (12.41%) and higher quality of goods and services are also indicated as important advantages of digitalization for craft family SMEs. A further analysis across the entire sample of respondents underlines that firms require greater assistance in terms of research and development (16.77%) and in the adoption of new technologies (13.66%). Cyber security (12.11%), data analytics (11.80%), and cloud technologies (11.49%) are also issues where firms indicated the need for stronger support from local stakeholders, such as, for instance, the South-Tyrolean craftsmanship organization. From a general viewpoint, a noticeable difference in all dimensions between the average current and expected level of digitalization is found. Almost all the surveyed firms expect further developments in all 5 digitalization dimensions, while only a few expect to remain at the same level.

4.2 Individual level

To map each craft family SME individually and analyze their digitalization attitude, we created a two-axis diagram (Fig. 2), where the horizontal and vertical axis identify the current and expected level of each craft family SME in our sample. The graph shows a positive correlation between the average of questions regarding the current and expected level of digitalization. As the average for the firm's current level increases, the average for the expected level increases, but at a descending rate (less than proportional). In the future perception, the entire sample is willing to increase the level of digitalization. From the results, we developed a taxonomy in which we classify the craft family SMEs into four different types. Firms positioned in quadrant I (upper-right) have on average a relatively high digitalization level and are willing to at least maintain such level in the short-term. Accordingly, these firms have a current average level of digitalization higher than or equal to 3, and an expected average level of digitalization higher than or equal to 2.5. Thus, companies in this quadrant can be considered Digital Leaders.

Fig. 2: Four types of digital craft family SMEs: Digital Leader, Digital Oriented, Digital Surrendered, Digital Steady-State.



Quadrant II (upper-left) identifies those firms with a relatively low current level of digitalization (below 3), but expecting to increase the level in the future to higher than or equal to 2.5. Such firms acknowledge their relatively low current level of digitalization, and are aware of the need to increase it in the future, thus classified as Digital Oriented.

Conversely, companies in quadrant III (bottom-left) exhibit a general low level of digitalization considering both the current and expected level, indicating an actual average level of digitalization below 3 and an expected level of digitalization below 2.5. Therefore, firms positioning in this quadrant are considered Digital Surrendered, namely with a relatively low current level of digitalization but not highly interested in increasing it in the future.

The final group of companies in quadrant IV (bottom-right) have relatively high and low measures in terms of current and expected levels of digitalization respectively. Companies in this quadrant have a present level of digitalization above 3 and an expected average level of digitalization below 2.5, thus classified as Digital Steady-State firms, since their digitalization status is deemed high and they consider future digitalization upgrades as not strictly necessary in terms of their production and organization. None of the firms in our sample are in this Digital Steady-State quadrant, meaning that all firms are motivated to further improve and invest in digitalization and Industry 4.0.

The Digital Surrendered category includes four firms that still operate in analogue mode, and do not plan to improve much in the future. Hence, they have a wait-and-see attitude and do not see many advantages in digitalization, they fear new technologies, see their employees' competencies as lacking, and claim that the costs of investing in digitalization are too high. The Digital Leader category includes 22 family SMEs in our sample. These firms have a good level of digitalization and are very ambitious, hence with a proactive attitude. The main advantages of digitalization mentioned by these firms are better communication and sense of togetherness (50%), cooperation advantages (50%), higher customer benefits (50%), fewer employees (50%), fewer misunderstandings (77%), better logistics and storage organization (77%), lower costs (45%), low environmental impact (27%), higher productivity and physical relief (59%), higher quality (77%), real time and physical proximity (5%), more regulated and controlled processes (5%), time saving (100%), and better work organization (82%). They also mentioned some disadvantages of digitalization: bad internet connection (45%), lack of employee competencies (45%), fear of new technologies (36%), high investment costs (50%), lack of experience (23%), lack of organizational skills (18%), lack of technical skills (14%), IT-security and data protection (45%). The Digital Oriented category is divided into two subgroups: analogue craftsmen with an expectant attitude, and digital novices with a proactive attitude. Analogue craftsmen (22 firms of the sample) have a lower current level of digitalization but intend to improve in the near future. Digital novices (52 firms of the sample) have a higher current level of digitalization and a proactive attitude regarding future investments in digitalization.

5. Discussion

Given our contextual research setting, this study has implications for both theory and practice.

The findings of our study show that the digitalization of South Tyrolean craft family SMEs has gained momentum, and investments in Industry 4.0 will increase dramatically over the next years. Building on our findings, we first contribute to research on digitalization (e.g. Nambisan *et al*., 2017; Schwab, 2017). Through the implementation of the DigiCheck tool, our analysis offers insights into five different dimensions of digitalization: (D1) process, (D2) internet connection and data security, (D3) industry 4.0, (D4) collaborators, (D5) and cooperation and support. Indeed, these five dimensions are essential for firms to assess their status quo but also to evaluate in which dimensions they are ready to compete and in which they are lagging behind. In addition, to our best knowledge, this is the first study to inves-

tigate digitalization in craft family SMEs by clustering their digitalization level into four types: Digital Leader, Digital Oriented, Digital Surrendered, Digital Steady-State. We investigate the four different digital profiles that emerge in the course of digitalization and shed light on the challenges that family SMEs face today, thus offering a better understanding of these firms' specific efforts to overcome such challenges for a bright digital future. Research on digitalization has thus far largely focused on the technical aspect of specific technologies and the related effects on society and economic development. However, the digitalization of processes and operations in firms is far from clear from a management perspective, especially in the context of family business, where digitalization is no longer solely an IT topic but concerns the entire firm and requires management adaptation.

A second contribution relates to the family business literature. We observe that family SMEs are generally innovative (De Massis *et al*., 2013; Urbinati *et al*., 2017; Rondi *et al*., 2019). Furthermore, we show that at the current level, two innovation approaches prevail (De Massis *et al*., 2015a): some family SMEs are already highly innovative and digital, whereas others are still more conservative with a wait-and-see attitude. However, our entire sample is willing to increase the level of digitalization and innovation in the near future. We show that family SMEs can be highly innovative, and that the two innovation approaches (De Massis *et al*., 2015a) will become increasingly blurred. Furthermore, speculating on our findings, South Tyrolean craft family SMEs show a high willingness to invest in digitalization in the near future. While some indicate a low level, others show a relatively high level of digitalization in relation to the status quo depending on several internal and external factors. Some highly digitalized firms admit that digitalization is not an easy path, entailing a great deal of time, money, testing, and errors before digital devices and software are implemented in a satisfactory way. Other less digitalized firms expressed their awareness that digitalization is unavoidable in the future and implies significant challenges, including resource constraints, lack of skills and knowledge, and requiring some support in identifying the appropriate technologies and their implementation. Current research on family firm innovation shows that family firms tend to have a lower willingness to engage in innovation projects, since these are associated with potential risks and could thus threaten their wealth, which is highly concentrated in the family business – from both a financial and emotional perspective (De Massis *et al*., 2013). Paradoxically, family firms are associated with a greater ability to engage in innovation, since the outcome of innovation projects is relatively higher than in non-family firms (De Massis *et al*., 2013). This ability and willingness paradox following Chrisman *et al*. (2015) is especially observed in the scope of discontinuous technological innovation, which typically involves fundamentally new processes, new product or service features, or even

new business models (König *et al*., 2013). However, contrary to this paradox, our sample of firms shows a high willingness to invest in digitalization, albeit a lesser ability to do so due to idiosyncratic family SME characteristics, such as resource constrains, smallness, and lack of skills. We also believe that this could be due to the sector under study, namely craftsmanship, which is very traditional, conventional, and highly dependent on products. However, future digitalization expectations indicate substantial improvements and changes in relation to Craft 4.0, imperative for the survival of this form of business organization.

Third, we contribute to the innovation literature by combining the digital innovation spirit of family SMEs with their idiosyncratic characteristics especially in craftsmanship, which is of great importance for economies world-wide. Indeed, craftsmanship is currently seeing its greatest innovation transformation (Dassisti *et al*., 2017) with new technologies threatening their daily business (Sommer, 2015), requiring especially craft SMEs to boost their readiness to adopt Industry 4.0 concepts (Matt *et al*., 2020). According to Zentralverband des Deutschen Handwerks (2018), digitalization is a critical topic for SMEs. Our findings provide insights into how South Tyrolean craft family SMEs cope with game-changing innovation such as digitalization. We show that even though family SMEs have some characteristics that hamper their innovation progress associated with lower innovation inputs (Sciascia *et al*., 2015), and thus lower levels of innovation outputs (De Massis *et al*., 2013, Calabrò *et al*., 2018), they may make use of their conventional craftsmanship knowledge and experience gained over generations and combine it with new innovative technologies to outperform non-family enterprises and gain an edge in this ever-changing environment.

This promising intersection between digitalization and family SMEs contributes not only to the family business literature and theory, but the implications are also manifold for practitioners, especially for decision makers in family firms. In particular, in the current turmoil among business leaders and senior executives over this digital phenomenon (McKinsey, 2016; PwC, 2017), practitioners can draw important conclusions from this study. First, craft family SMEs can gain insights on the importance of digital technologies and their sensitization to Craft 4.0. Second, for managers, this study highlights the impact of family involvement on digitalization in the firm. Finally, this study also advocates the need for craftsmanship associations to offer appropriate services with regard to the digitalization topic.

6. Conclusion, limitations, and future research

Digitalization is a widely discussed and relevant topic, especially in relation to craftsmanship and SMEs. Although digitalization research has developed over the years, remaining unclear from a management perspective, especially in the context of family business, are the factors that might influence the adoption of digitalization and the challenges as well as advantages for firms. This study attempts to contribute to the literature by enhancing knowledge of the current and expected digitalization level of craft family SMEs in South Tyrol, and how small, financially weak family SMEs lacking skills can successfully overcome the challenges of digitalization. A relevant research question for future studies concerns the dynamics that characterize family firms and how they embrace digitalization. The current research does not explore family firm heterogeneity in terms of family involvement and influence on the digitalization process, limiting the possibility to search for significant differences and similarities in the innovation dynamics across the family SMEs in our sample, and thus unable to provide an evidence-based response to this question. However, we believe that this could be a great opportunity for future studies. In addition, a larger sample, including a more detailed categorization of family firms in terms of their characteristics could provide more representative results. Against this background, the present research can be considered explorative, showing the main emerging relationships between digitalization in craft family SMEs and acknowledging the complexity of studying innovation dynamics in this field for future impactful research. Finally, focusing only on one industry further limits the study, and thus extending the scope to more industries would be desirable. Nonetheless, with this study we hope to inspire future scholars to examine this promising intersection more in depth, as we have only started to scratch the surface of the fascinating digitalization topic.

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