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Company capabilities and implementing real-time activities

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Abstract

This chapter focuses on the capabilities required for the successful implementation of real-time activities within a manufacturing company. Operating in real time is one of the important digitally enabled activities in manufacturing companies, and it has been suggested that a digital business strategy combined with specific digital capabilities must be in place to make it happen. Executing an effective digital business strategy requires managerial and operational capabilities. Developing and supporting the digital capabilities requires trained personnel, collaboration, technical expertise, and innovation. This research compares companies where digitality has enabled real-time operation to companies where it has not. The goal is to discover if company capability differences are the cause, and if so, what those differences are. The results show that achieving successful real-time operation requires a strong digital business strategy with robust managerial and operational capabilities combined with competent human and collaboration capabilities.

Keywords: real-time activities, digital business strategy, digital capabilities, manufacturing

3.1 Introduction

With a rapid expansion in the number of businesses, real-time activities are becoming crucial to address the developing demands of remotely located business units such as manufacturing sites, retailers, and service centers (Oyekan *et al.*, 2017). Here, real-time activities are defined as different tasks that can be handled via the collaboration of geographically separated individuals in actual time. Real-time inventory is one example of real-time activity in manufacturing companies that ensures the sufficiency of stock on hand by continually monitoring stock levels (Büyükozkan and Göçer, 2018). Monitoring production processes remotely, providing maintenance and repair with remote access, as well as offering online products and services are all examples of real-time

company activities (Lenka *et al.*, 2017; Lerch and Gotsch, 2015; Parida *et al.*, 2015). However, there is a lack of information about what capabilities are needed for companies to successfully operate in real time.

This study contributes to filling that research gap by examining the capabilities needed to implement real-time activities within a manufacturing company. To make the right decisions, the right information must be available at the right time for the right person in the right format (Zhang *et al.*, 2012). This is made possible by determining appropriate resources, strategies, and capabilities (Büyüközkan and Göçer, 2018; El Sawy *et al.* 2016 ; Matt *et al.* 2015; Wu *et al.*, 2010). In this study, therefore, both digital business strategies and digital capabilities have been presented as influential factors to achieving real-time operation. A digital business strategy encompasses managerial capabilities and operational capabilities (Liu *et al.*, 2013; Li *et al.*, 2018; Ukko *et al.*, 2019). Digital capabilities comprise human capabilities (Khin and Ho, 2019; Lenka *et al.*, 2017), collaboration capabilities (De Oliveira *et al.*, 2019; Lenka *et al.*, 2017), technical capabilities (De Oliveira *et al.*, 2019; Khin and Ho, 2019; Lenka *et al.*, 2017; Parida *et al.*, 2015), and innovation capabilities (Khin and Ho, 2019; Parida *et al.*, 2015). The results show a statistically significant difference in the mean of digital business strategy (managerial and operational capabilities) and two of the digital capabilities (human and collaboration capabilities) for the manufacturing companies that consider their level of real-time activity as high.

The remainder of this chapter is structured as follows. This introduction is followed by the theoretical framework and research model, which investigates the understanding of digital business strategy and digital capabilities, the importance of each of those to real-time activities, and the research model. The next section describes the experimental examination of real-time simulation including data collection, descriptive results, and statistical analysis results. The last section presents conclusions, which summarize the research findings and the theoretical and managerial implications, as well as limitations and possible further research.

3.2 Theoretical framework and research model

3.2.1 Theoretical framework

Digital business strategy

The study defines managerial capabilities and operational capabilities (Li *et al.*, 2018; Ukko *et al.*, 2019) as the components of a digital business strategy. Managerial capabilities refer to the competencies with which companies and entrepreneurs in contemporary operation and business environments develop, extend, and modify the way they operate their businesses (Gauthier *et al.*, 2018). In other words, managerial capabilities refer to the characteristics of a manager's behavioral abilities to be able to organize and manage resources and people (Welter *et al.*, 2013). Generally, managerial capabilities describe different types of behaviors that differentiate effective from ineffective performance. They can include motives, beliefs, and values (Anzengruber *et al.*, 2017; McLagan, 1996). Gauthier *et al.* (2018) presented that entrepreneurs' managerial capabilities can be classified in three categories: managerial human capital, managerial social capital, and managerial cognition. Srećković (2018) argued that managerial capabilities comprise a company's skills, knowledge, and expertise to operate with complex and challenging production- and management-related tasks (Choi and Shepherd, 2004) and its capability to efficiently identify operations for the production and distribution of products and services (Collins, 1994). For example, managerial capabilities of IT executives can be defined as capabilities arising from a deep understanding of company operations and its business environment and from excellent general management skills (Heart *et al.*, 2010; Bassellier and Benbasat, 2004).

At the general level, and based on previous literature, the operational capabilities of a company are its competencies that help the operations management system address the challenges of greatest interest to the company and to its critical stakeholders (Wu *et al.*, 2012; Flynn and Flynn, 2004; Dosi *et al.*, 2003). According to Wu *et al.* (2012), in the field of operations strategy, managers introduce operational change initiatives and allocate resources to develop new practices and capabilities to build and support competitive advantage. In other words, operational capabilities are considered a "secret ingredient" needed to develop and maintain a company's competitive

advantage (Wu *et al.*, 2010). Operational capabilities make it possible to integrate and to direct both resources and operational practices. According to Wu *et al.* (2010), operational capabilities encapsulate both explicit elements, such as resources and practices, and tacit elements, such as expertise and leadership, that companies must apply to find solutions for different challenges. As such, the operational capabilities of the organizations draw on the operational practices and resources to produce outputs and value to stakeholders in a designed manner. They can also be considered a company-specific set of individual routines, processes, and skills that are implemented and operationalized in everyday workflow to promote business and build value through operational resources and practices.

Digital capabilities

Digital capabilities can be defined as the set of company capabilities needed to support digital world activities (De Oliveira *et al.*, 2019). A variety of competencies are needed to successfully develop the requisite digital capabilities including human capabilities (Khin and Ho, 2019; Lenka *et al.*, 2017), collaboration capabilities (De Oliveira *et al.*, 2019; Lenka *et al.*, 2017), technical capabilities (De Oliveira *et al.*, 2019; Khin and Ho, 2019; Lenka *et al.*, 2017; Parida *et al.*, 2015), and innovation capabilities (Khin and Ho, 2019; Parida *et al.*, 2015) in the companies.

Human capabilities, specifically the digital skills of a company's personnel, is essential to the integration of digital technologies (Khin and Ho, 2019). Substantial investment in developing the digital skills and readiness of the workforce are required to reach a digital-competency maturity level (El Sawy *et al.*, 2016; Lerch and Gotsch, 2015; Parida *et al.*, 2015).

Collaboration should also be a primary goal for any organization in the current connected world where the competition for the acquisition of opportunities, resources, and various capabilities is fierce. Fruitful collaboration can occur by sharing knowledge, resources, and work practices to facilitate coping with the challenges of building a digital presence to support organizational capabilities (El Sawy *et al.*, 2016; Lenka *et al.*, 2017; Lerch and Gotsch).

Technical capabilities are the backbone of a company's digitality (De Oliveira *et al.*, 2019; Khin and Ho, 2019; Lenka *et al.*, 2017), which enables the integration of product and services and borderless activity (El Sawy *et al.*, 2016). Without the necessary technical capabilities, a company will find it challenging to operate in real-time with up-to-date services (Parida *et al.*, 2015).

And finally, innovation capabilities are key to transforming the traditional way of doing business and modernizing it with new business solutions, processes, and infrastructures (Sia *et al.*, 2016; Xue, 2014). Digitality offers opportunities to develop new services, which foster innovation capabilities and result in a better ability to meet market needs (Parida *et al.*, 2015).

Digital business strategy and real-time activities

Several researchers define managerial capabilities and operational capabilities as the key dimensions to a digital business strategy (Liu *et al.*, 2013; Li *et al.*, 2018; Ukko *et al.*, 2019). Dynamic and informed managers may recognize the potential of novel technologies and encourage their introduction, a prerequisite for a successful digital business strategy (Chatterjee *et al.*, 2002; Li *et al.*, 2018). Ukko *et al.* (2019) claimed that company managers must be (1) familiar with existing digital tools, applications, and solutions; (2) must have a clear vision of how to utilize the digital technologies now and in the future, and (3) must build a management culture that supports the utilization of digital technologies. This can be accomplished, for example, by introducing real-time/online sales channels, where the only diversification into the digital world is to make products available via digital channels (Hess *et al.*, 2016).

According to Hess *et al.* (2016) real-time digital activities can be fully integrated into the firm's core business, and they mostly affect production processes and to some extent product and service offerings. Operational capabilities in digital business strategies reflect a company's proficiency in adopting and implementing digital tools and solutions and using them as a natural part of business processes (Peng *et al.*, 2008; Benitez *et al.*, 2018; Ukko *et al.*, 2019). In other words, in digitalized business environments, operational capabilities reflect the planned ability to effectively execute substantive daily operations such as manufacturing, logistics, and sales (El Sawy and Pavlou, 2008; Zawislak *et al.*, 2018), and to efficiently monitor/develop these operations online.

Matt *et al.* (2015) argued that the scope of digital transformation strategies is more broadly designed and explicitly includes digital activities, such as digital technologies as part of the end-user product, at the interface with or fully on the side of customers. They considered this meaningful in comparison to process automation and optimization, since digital activities as strategic steps go beyond the process paradigm and include changes to and implications for products, services, and business models.

In summary, the managerial and operational capabilities of a digital business strategy seem to be important to the successful implementation and utilization of real-time activities. Therefore, the evidence from prior studies supports the formation of the following proposition:

P1. The extent of a company's real-time activities is a function of the strength of its digital business strategy.

Digital capabilities and real-time activities

Real-time data tracking is crucial for contemporary companies. It makes it possible to optimally manage production and related operations by ensuring that the correct information is provided to the correct person at the correct time, and in the correct form (Zhang *et al.*, 2012). Therefore, as a crucial operative level competency for any company operating with that type of digitalized business model, digital capabilities may play a significant role in the number of real-time operations that a company can develop and sustain.

Human processes are considered one of the important capabilities for a company's digitalized business model (Arendt, 2008; Bouncken *et al.*, 2019). The rise of digitality calls for a workforce with greater complexity, abstraction, and problem-solving skills (Lerch and Gotsch, 2015). One example is the autonomously operating production system, which demands high-level human capabilities to control those systems and/or be directed by them (Fischer and Pöhler, 2018). Furthermore, Ramaswamy and Ozcan (2018) reveal that different types of digital interfaces enable personnel to engage remotely in real-time system environments thereby eliminating issues related

to a geographically dispersed workforce. These digital interfaces are also changing human work experiences (Ramaswamy and Ozcan, 2018). Compared to traditional work, real-time operation requires different capabilities.

In addition to in-house expertise, companies must be able to acquire knowledge via external collaboration to effectively digitalize operations (Bouncken *et al.*, 2019). In the context of digitalized product service systems, there must be tight collaboration among manufacturing firms and their equipment providers and customers (Lerch and Gotsch, 2015). Similarly, Mahesh *et al.* (2007) propose a model for distributed collaborative manufacturing, where all interacting companies benefit from resource sharing and task redistribution.

Technical readiness is also a requirement for operating in a digitalized real-time environment. To adopt a digitalized business model, a company must be able to utilize digital technologies comprehensively in all its operations – value creation, value capture, and value proposition – not just for certain company activities (Bouncken *et al.*, 2019). One example of technical readiness offered by Lerch and Gotsch (2015, p. 45) is “equipping products with intelligent digital systems that allow the products to operate independently of human intervention and communicate with other machines”. Accomplishing this type of real-time, remotely controlled activity requires a sound and reliable technical infrastructure (Lerch and Gotsch, 2015).

Finally, innovation is at the center of the digital business model, because its successful implementation demands novel technological and organizational innovation (Bouncken *et al.*, 2019).

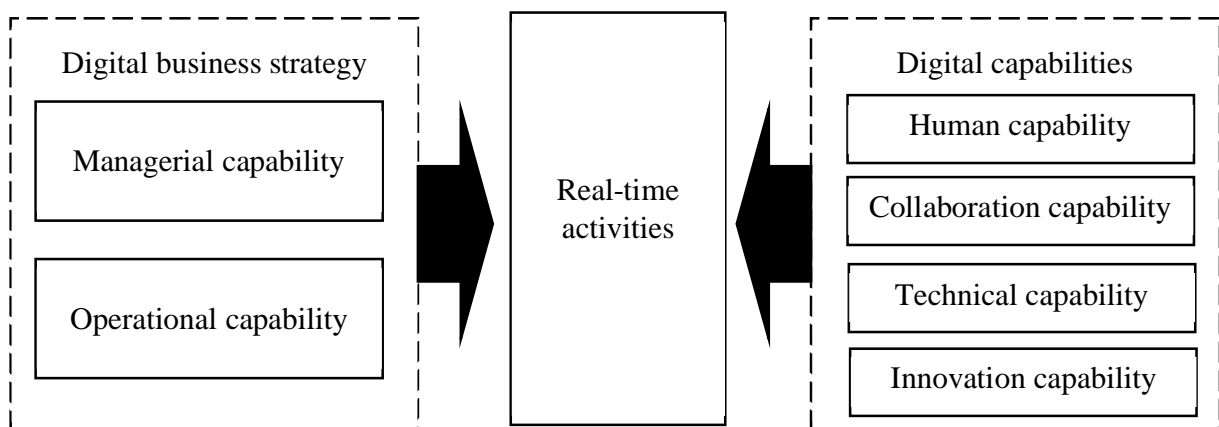
To summarize, a company’s real-time activities may require the utilization of digital capabilities in terms of its in-house expertise, its level of collaboration, its technical readiness, and its ability to innovate. Therefore, the following proposition is suggested.

P2. The extent of a company’s real-time activities is a function of the strength of its digital capabilities.

3.2.2 Research model

The research model was developed based on the reviewed studies in the context of company real-time activities. Operating in real time is considered one of the important digitally enabled activities in manufacturing companies, which makes it crucial to study the capabilities required to implement real-time activities. As demonstrated in Figure 3.1, survey results revealed that a manufacturing company must have a digital business strategy and the necessary digital capabilities to successfully carry out real-time activities. The digital business strategy must include two determinant capabilities: managerial and operational. The digital capabilities must include human expertise, collaboration, technical ability, and innovation.

Figure 3.1. Research model: capabilities affecting the contribution of manufacturing companies considering digital as real-time activities



3.3 Empirical examination of real-time simulation

3.3.1 Data collection and sample

The data were gathered using a survey questionnaire of SMEs that operate in the manufacturing sector in Finland. The questions were addressed to managers. As shown in Table 3.1, real-time activities were scored based on a seven-point Likert scale, in which 1 corresponds to “strongly disagree” and 7 corresponds to “strongly agree”. The respondents were also asked if “In our company, digitality refers to operation in real-time”.

Table 3.1. Survey items

Themes	Items	Scale	References
Digital business strategy			
Managerial capabilities	Our company's management is familiar with digital tools.	From 1 to 7 (strongly disagree to strongly agree)	Liu <i>et al.</i> , 2013; Li <i>et al.</i> , 2018; Ukko <i>et al.</i> , 2019
	Our company's management has a clear vision of utilizing digitality in the future.		
	Our company's management supports the utilization of digitality in our company.		
Operational capabilities	Utilizing digitality in internal processes has become an important part of our business.	From 1 to 7 (strongly disagree to strongly agree)	Benitez <i>et al.</i> , 2018; Hess <i>et al.</i> , 2016; Peng <i>et al.</i> , 2008; Ukko <i>et al.</i> , 2019
	Digitality is a natural part of our business.		
	Digitality enhances our business.		
Digital capabilities			
Human capabilities	Digital skills development is supported and promoted in our company	From 1 to 7 (strongly disagree to strongly agree)	El Sawy <i>et al.</i> , 2016; Khin and Ho, 2019; Lerch and Gotsch, 2015; Parida <i>et al.</i> , 2015
	Our employees are well trained in digital tools usage.		
	Digitalization of the operating environment is easily accepted by our employees.		
Collaboration capabilities	Digital cooperation is made with other companies.	From 1 to 7 (strongly disagree to strongly agree)	El Sawy <i>et al.</i> , 2016; Lenka <i>et al.</i> , 2017; Lerch and Gotsch, 2015;
	Digital channels are used to share information with other companies.		
	Digitality transforms the shape of social relationships in our business.		
Technical capabilities	Digitality increases the value of our products or services.	From 1 to 7 (strongly disagree to strongly agree)	De Oliveira <i>et al.</i> , 2019; El Sawy <i>et al.</i> , 2016; Lenka <i>et al.</i> , 2017; Parida <i>et al.</i> , 2015
	Digitality enables the integration of products and services into our company.		
	Digitality enables up-to-date, location-independent services for our customer.		
	Digitality allows us to work across boundaries of time, place or activities.		
Innovation capabilities	Digitality enables innovations and new ideas in our company.	From 1 to 7 (strongly disagree to strongly agree)	Khin and Ho, 2019; Parida <i>et al.</i> , 2015; Sia <i>et al.</i> , 2016; Xue, 2014
	Digitality forces us to develop new solutions.		
	Digitality helps to produce new products and services.		
Real-Time-Activities	In our company, digitality refers to operation in real-time.	From 1 to 7 (strongly disagree to strongly agree)	Lerch and Gotsch, 2015; Parida <i>et al.</i> , 2015

An effective digital business strategy must include managerial capabilities and operational capabilities. Each of these were measured based on the three items listed in Table 3.1. Four digital capabilities are also essential. As shown in Table 3.1, these include human capabilities (3 listed items), collaboration capabilities (3 items), technical capabilities (4 items), and innovation

capabilities (3 items). Respondents were asked to assess the degree to which they would agree or disagree with the each of the statements listed in the table by selecting a number from 1 to 7 (1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = agree, or 7 = strongly agree).

3.3.2 Descriptive results

Responses were received from 116 companies. Of these, 64 percent were small (less than 49 employees) and the rest (36 percent) were medium-sized (between 50 to 249 employees). Two-thirds of the respondents had less than 50 years of experience in their business. One-fourth had over 50 years of experience. The majority of respondents (93 percent) were business-to-business firms. The remaining seven percent were business-to-consumer.

Figure 3.2 illustrates the degree to which the surveyed manufacturing companies emphasize real-time activities. A high percentage (66 percent) were companies that believe digitality means operating in real time (mean of 6 – 7 on the 1 – 7 scale). Only 34 percent believe that digitality has not resulted in real-time activities within the company (mean of 1 – 5.99 on the 1 – 7 scale).

Figure 3.2. Manufacturing emphasis on real-time activities

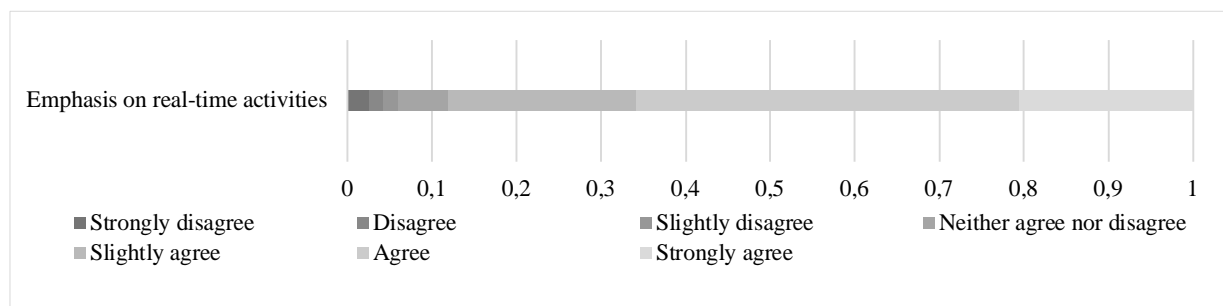
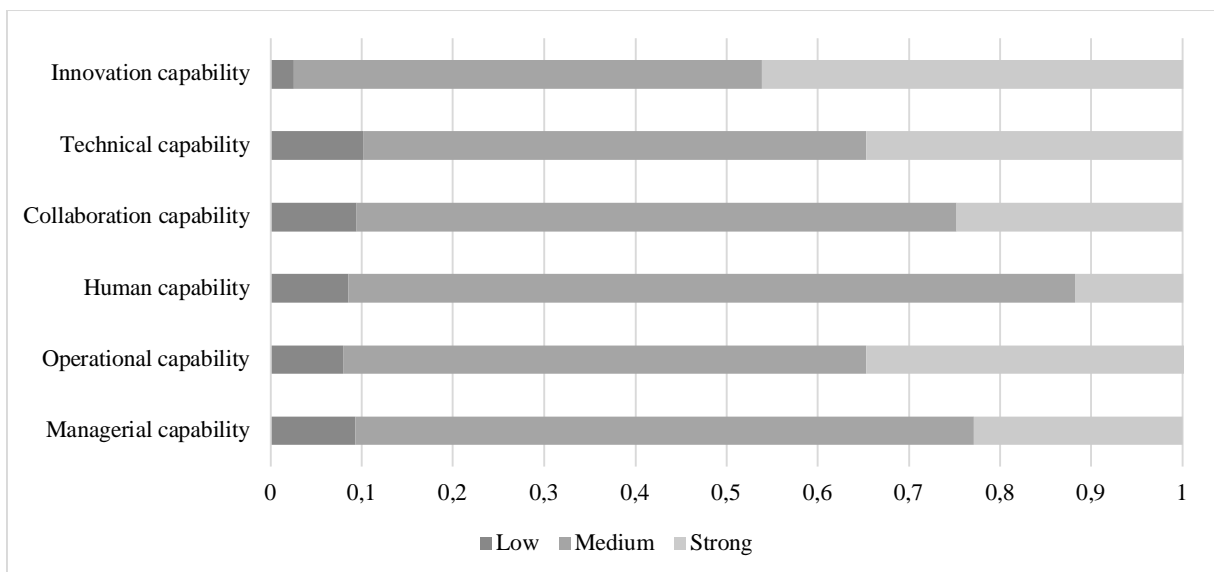


Figure 3.3 illustrates the level of capabilities established by the results for the surveyed Finnish manufacturing companies. Three levels have been defined including low (mean of 1 – 3), medium (mean of 3.01 – 5.99), and strong (mean of 6 – 7). For managerial capabilities, 9 percent of companies came in at the low level, 68 percent were at the medium level, and 23 percent were

strong. For operational capabilities, 8 percent came in at the low level, 57 percent were at the medium level, and 35 percent were strong.

In terms of human capabilities, 9 percent of the surveyed Finnish manufacturers came in at the low level, 80 percent at the medium level, and 12 percent at the strong level. A similar 9 percent of companies scored low level for collaboration. However, 66 percent came in at the medium level, and 25 percent were at the strong level. For technical capabilities, 10 percent of the surveyed manufacturing companies fell into the low level tier, 55 percent were at the medium level, and 35 percent claimed a strong-level capability. Finally, a small 3 percent came in at the low lever for innovation. Over half, 51 percent were at the medium level, and 46 percent were at the strong level. Based on the survey results, the capabilities essential to real-time operations seem to be available at a good level in Finnish manufacturing companies. Innovation, technical, and operational capabilities received the highest marks.

Figure 3.3. Level of capabilities in manufacturing companies



3.3.3 Statistical analysis results

A variance analysis was used to discover if the level of real-time activity at the surveyed manufacturing companies is a function of their capabilities. Both their digital business strategies and digital capabilities were examined.

For digital business strategies, statistically significant differences were found in both managerial and operational capabilities, which means that the makeup of each company's digital business strategy affects how well they can operate in real time. In other words, manufacturing companies with strong managerial and operational capabilities also enjoy a high level of real-time activity. In contrast, companies with relatively weak managerial and operational capabilities struggle to support real-time operations. These results are summarized in Table 3.2.

Table 3.2. The role capabilities in considering digital as real-time activities among manufacturing companies (N = 116).

			Mean	F
Digital business strategy	Managerial Capabilities	Non-Real-Time	4.5083	13.798*
		Real-Time	5.2814	
	Operational Capabilities	Non-Real-Time	4.6417	11.311*
		Real-Time	5.3860	
Digital-related capabilities	Human Capabilities	Non-Real-Time	4.2583	9.647*
		Real-Time	4.8831	
	Collaboration Capabilities	Non-Real-Time	4.5250	6.476*
		Real-Time	5.1272	
	Technical Capabilities	Non-Real-Time	4.6688	4.564
		Real-Time	5.2110	
	Innovation capabilities	Non-Real-Time	5.2667	4.424
	Real-Time	5.7127		

Sign. * $p \leq 0.01$

In terms of their digital capabilities, also as summarized in Table 3.2, human and collaboration capabilities (two of the four digital capabilities surveyed) demonstrate a statistically significant effect on the level of real-time activities in Finnish manufacturing. The manufacturing companies that have a high-level of human expertise and collaboration capabilities are able to operate

effectively in real-time. Technical and innovation capabilities do not have a substantial effect on the level of real-time activities in manufacturing companies.

3.4 Conclusions

The aim of this chapter is to contribute empirically to the implementation of real-time activities in manufacturing companies. In this regard, the chapter examined the capabilities needed to implement real-time activities within a manufacturing company. Therefore, this chapter contributes to previous literature by revealing the roles both a strong digital business strategy and digital capabilities play in supporting a company's real-time activities. Furthermore, this study reveals which capabilities are most important.

Theoretical implications

First, this chapter reflects on prior research by introducing managerial and operational capabilities as the required capabilities to realize a digital business strategy for real-time operations. The results confirmed prior research (Liu *et al.*, 2013; Li *et al.*, 2018; Ukko *et al.*, 2019) that concluded that managerial and operational capabilities are key to realizing a digital business strategy. Moreover, the results also revealed the statistically significant effect of a sound digital business strategy on real-time activities at manufacturing companies. These real-time activities are mainly related to conducting every task (from designing to delivering products or services) remotely in actual time (Büyükoğkan and Göçer, 2018; Lenka *et al.*, 2017; Lerch and Gotsch, 2015; Parida *et al.*, 2015). Successful real-time operation depends on having access to the right information at a right time in the right format (Zhang *et al.*, 2012). An effective digital business strategy that includes the necessary managerial and operational capabilities enables this required access to the right information for manufacturing companies.

Second, the chapter also supports previous research by reaffirming that human expertise, collaboration, technical ability, and innovation are crucial digital capabilities for real-time activity. Previous studies confirmed the important role played by human capabilities (Khin and Ho, 2019; Lenka *et al.*, 2017), collaboration capabilities (De Oliveira *et al.*, 2019; Lenka *et al.*, 2017),

technical capabilities (De Oliveira *et al.*, 2019; Khin and Ho, 2019; Lenka *et al.*, 2017; Parida *et al.*, 2015), and innovation capabilities (Khin and Ho, 2019; Parida *et al.*, 2015) in forming digital capabilities.

Furthermore, the results showed the statistically significant effect of human and collaboration capabilities, two of the four digital capabilities, on a company's real-time activities. Real-time activities transform the working environment (Ramaswamy and Ozcan, 2018). In this regard, employees, as an important element in manufacturing companies (Arendt, 2008; Bouncken *et al.*, 2019) should develop their capabilities, including digital skills and mindsets, for a real-time system environment. Additionally, collaboration plays an important role in successful real-time operations such as offering digitalized product service systems (Lerch and Gotsch, 2015). In this regard manufacturing companies can benefit and learn from each other by sharing their experiences.

Managerial implications

This chapter gives evidence for managers of SMEs in the manufacturing sector to help them understand how important a sound digital business strategy and a strong digital capabilities are in establishing and supporting real-time activities. Because of its statistically significant level of importance to real-time activity, managers of manufacturing companies should work to make their digital business strategy more compatible with achieving real-time operation. Furthermore, this study verified how important human and collaboration capabilities are to successfully implementing and sustaining real-time activities. Therefore, SME managers should ensure that these digital capabilities are present as well.

Limitations and further research

This research was conducted in single country and analyzed based on a survey of 116 manufacturing companies, so the results come with some limitations. The results also present research opportunities. The limitations include a possible lack of reliability and validity. This limitation has been addressed by carrying out a different statistical test at every step, from data collection to data interpretation. The main opportunity is the possibility for other researchers to

further develop this research in multiple countries with multiple respondents. Also, because the cross-sectional nature of the data might limit visibility to issues that develop gradually over time, future studies could further develop this research by collecting longitudinal data and conducting in-depth research on other capabilities influential to real-time activity.

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