CHAPTER 8

Reframing Technological Innovation Capabilities: Empirical Evidence and a Framework for Study

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8.1 Introduction

Gaining competitiveness requires departing from the existing knowledge base. Recent studies have suggested that a firm's technological innovation capabilities must support strategic expertise at all levels of the firm in order to promote competitiveness (e.g., Joo, Seo, & Min, 2018; Shafia, Shavvalpour, Hosseini, & Hosseini, 2016; Yu, Zhang, Lin, & Wu, 2017).

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The ability to control and improve firm competitiveness is the result of fully realizing these capabilities (Mortazavi Ravari, Mehrabanfar, Banaitis, & Banaitienė, 2016; Saunila & Ukko, 2012). Traditionally, technological innovation capabilities are defined as a varied number of firm features that enhance and support the firm's technological innovation strategies (Burgelman, Maidique, & Wheelwright, 2004). These capabilities allow firms to adapt to rapidly changing environments, enhancing their competitiveness (Mortazavi Ravari et al., 2016). Thus, technological innovation capabilities are formed when a firm has strategic expertise and practices aimed at more competitive technologies and processes.

Prior studies on technological innovation capabilities have concentrated on firm-level capabilities for innovation, including resource capability, R&D capability, learning capability, manufacturing capability, organizational capability, financial capability, marketing capability, and strategic planning capability (Chen, Wang, & Huang, 2019; Shafia et al., 2016; Wang & Zhang, 2018). This literature also discusses the role of distinct external and internal resources in these capabilities' development. Other studies only focus on a specific type of innovation, such as product or process innovation (e.g., Burgelman & Siegel, 2007), instead of generic technological innovation capabilities. Thus, the existing literature does not adequately represent all of the distinct perspectives and levels of the phenomenon needed to understand the relationship between technological innovation capabilities and a firm's competitiveness, which includes more than just product competitiveness. The micro-foundations of this topic especially require further research. This chapter builds on prior research by defining technological innovation capabilities at both the individual and firm levels and clarifying their relationship to firm competitiveness. Departing from the previous studies that concentrated primarily on determinants (e.g., Lau & Lo, 2019; Liu and Jiang, 2016) or implications (e.g., Camisón & Villar-López, 2014; Joo et al., 2018; Yam, Lo, Tang, & Lau, 2011) of technological innovation capabilities, this study contributes to the research by integrating several different level capabilities within a unifying framework in SME context.

First, we present a conceptual framework that illustrates the dimensions required for building competitiveness through technological innovation capabilities. We argue that this framework needs to be reflected in certain dimensions of both human behavior and firm capabilities.

Second, the framework is tested with empirical data. The research question is as follows: How do technological innovation capabilities generate competitiveness?

The chapter is structured as follows. First, prior research on technological innovation capabilities is presented as the foundation for the conceptual framework. The empirical case and methodology are also described. Next, the results are presented to connect the conceptual framework to empirical data. This section is followed by the conclusions, implications for research and practice, explanations of the study limitations, and suggestions for further studies.

8.2 Defining Technological Innovation Capabilities

8.2.1 Definition

The success of a firm's innovation system and performance is dependent on its different innovation capabilities (e.g., Aljanabi, 2017; Razavi, Nargesi, Hajihoseini, & Akbari, 2016; Siallagan, Silaban, & Ali, 2019; Yam et al., 2011). Indeed, technological innovation capability is one of the most fundamental areas of study in the field of technological innovation management (Mortazavi Ravari et al., 2016). In this regard, the authors Razavi et al. (2016) draw attention to research related to technological innovation capability that has been carried out in manufacturing firms in order to develop a framework describing the relevance of these capacities and their economic outcomes.

The evolution of the concept of technological innovation capability began with the asset approach (Liu & Jiang, 2016; Rahim & Zainuddin, 2017). Liu and Jiang (2016) claim that the authors Adler and Shenhar (1990) first discussed technological innovation capabilities, defining it in four dimensions: technological assets, organizational assets, external assets, and projects. In accordance with Razavi et al. (2016), Lall (1992) was the first to present a framework for technological innovation capabilities, classifying them in three categories: investment capacity, production capacity, and link capacity. Later, Christensen (1995) categorized technological innovation capabilities into four classes: scientific research assets, process innovation assets, product innovation assets, and aesthetic design assets (Liu & Jiang, 2016; Razavi et al., 2016).

The second step in the evolution of technological innovation capabilities was the process approach. Chiesa, Coughlan, and Voss (1996) developed a model to check a firm's capacity for technological innovation using process assessment and performance examination (Razavi et al., 2016). Later, the framework proposed by Chiesa and Manzini (1998) incorporated additional significant elements to support technological innovation, such as learning, organization, and strategic planning (Liu & Jiang, 2016). Next, Burgelman et al. (2004) proposed a five-dimensional framework integrating technological innovation capabilities: availability and resources allocation, ability to understand innovative competition strategies and industrial evolution, ability to understand technological developments, strategic management capacity, and structural and cultural context (Razavi et al., 2016).

More recently, the functional approach of innovation capabilities has gained prominence. Yam et al. (2004) propose a seven-dimensional framework related to the technological innovation capacity of firms: learning capacity, R&D capacity, resource allocation capacity, production capacity, marketing capacity, organizational capacity, and strategic planning capacity. This framework proposed by Yam et al. (2004) includes both the capacity perspective and the performance perspective (Liu & Jiang, 2016). This definition from Yam et al. (2004) has been widely used in the subsequent literature on technological innovation capabilities (Chen et al., 2019; Lin, 2014; Rahim & Zainuddin, 2017; Razavi et al., 2016; Shafia et al., 2016; Strand, Wiig, Torheim, Solli-SÆther, & Nesset, 2017; Yam et al., 2011).

Other literature categorizes the capacity for technological innovation into two fields: innovations in products and processes (Aljanabi, 2017; Camisón & Villar-López, 2014; Purwanto & Raihan, 2016; Razavi et al., 2016; Razavi, Talebpour, Azimzadeh, & Mohammadkazemi, 2019; Shafia et al., 2016; Yu et al., 2017). Additional literature uses patent analysis to present an approximation of technological innovation capabilities (Fan, Liu, & Zhu, 2017; Qiu & Yang, 2018). Also, the study of Fan et al. (2017) proposes three dimensions of technological innovation capabilities: relative growth rate, relative patent position, and revealed technological advantage.

Regarding the above approaches, it is important to note that there is no consensus in the literature on the definition of technological innovation capabilities, since the concept covers a great diversity of resources, making it complex and multidisciplinary (Chen et al., 2019; Ince, Imamoglu, &

Turkcan, 2016; Razavi et al., 2016). Thus, technological innovation capabilities are a multidimensional concept (Chen et al., 2019; Ince et al., 2016; Razavi et al., 2016; Shafia et al., 2016; Strand et al., 2017; Yu et al., 2017) that has been analyzed using different models (Razavi et al., 2016), including resource-based view (e.g., Aljanabi, 2017; Camisón & Villar-López, 2014; Joo et al., 2018; Lin, 2014; Rahim & Zainuddin, 2017; Razavi et al., 2016), distinctive skill, dynamic capability (e.g., Shafia et al., 2016), and knowledge-based view (e.g., Yu et al., 2017).

Building on the work of the previously mentioned authors, we propose that technological innovation capabilities can be defined as a set of advantages generated from the integral characteristics of firms (Lin, 2014) or a series of management activities (Bao & Chen, 2019) facilitating technological innovation strategies. These capabilities allow firms to respond to the needs of a changing and competitive market (Ince et al., 2016; Mortazavi Ravari et al., 2016; Rahim & Zainuddin, 2017; Shafia et al., 2016; Siallagan et al., 2019), create value for the customer (Joo et al., 2018), generate an innovative culture (Rahim & Zainuddin, 2017), and use new knowledge to drive growth (Siallagan et al., 2019).

Moreover, there is a growing trend of research in the literature analyzing the effects of technological innovation capabilities on a firm's competitive advantages and performance (Rahim & Zainuddin, 2017). Previous studies reveal that technological innovation capabilities generate greater competitiveness in firms (Aljanabi, 2017; Camisón & Villar-López, 2014; Chen et al., 2019; Joo et al., 2018; Ince et al., 2016; Liu and Jiang, 2016; Mortazavi Ravari et al., 2016; Purwanto & Raihan, 2016; Rahim & Zainuddin, 2017; Razavi et al., 2016, Shafia et al., 2016; Siallagan et al., 2019; Strand et al., 2017; Yam et al., 2011).

8.2.2 Driving Forces and Barriers

Resource configuration and firm characteristics can expand or restrict the development of technological innovation capabilities. A review of studies related to this subject shows that driving forces and barriers emerge at the individual and firm levels. First, research related to the effects of knowledge, skills, experience, creativity, leadership, and motivational techniques at the individual level of technological innovation capabilities will be analyzed. Second, organizational learning, absorption capacity, innovation strategy, business cooperation, and organizational factors will be analyzed as key factors affecting technological innovation capacity.

8.2.2.1 Individual Level

From an individual perspective, human capital has a significant effect on the technological innovation capabilities of a firm (Razavi et al., 2019). Therefore, it is essential to promote knowledge, skills, expertise, experience, creativity, leadership, and motivation in the firm's human talent to generate effective innovation processes (Dasgupta, Gupta, & Sahay, 2011; Razavi et al., 2019). In this context, incentive and reward schemes are important mechanisms to get employees to share knowledge with each other and value teamwork (Dasgupta et al., 2011).

Likewise, firms must promote learning processes at the individual level to develop technological innovation capabilities (Lau & Lo, 2019; Liu & Jiang, 2016; Yu et al., 2017). In this sense, firms must effectively manage tacit knowledge and individual empirical knowledge (Dasgupta et al., 2011; Liu and Jiang, 2016). Firms must also cultivate the organizational conditions necessary for developing learning processes at the individual level (acquisition, assimilation, transformation, and exploitation), considering these processes improve the innovative performance of firms and promote the consolidation of technological innovation capabilities (Lau & Lo, 2019). Because training and staff development programs are among the most effective mechanisms to generate technological innovation capabilities (Dasgupta et al., 2011), they are essential to achieving these ends.

8.2.2.2 Firm Level

First, much of the academic literature analyzes the relationship between organizational factors and the development of technological innovation capabilities. A firm's environment and work culture must be conducive to open communication and learning in order to encourage the development of technological innovation capabilities (Dasgupta et al., 2011). Furthermore, firm innovation must support these goals (Camisón & Villar-López, 2014) through flexible organizational structures openly communicating with one another and quickly responding to innovations (Dasgupta et al., 2011). Therefore, a highly centralized administrative structure making decisions with full autonomy under a rigid and conservative leadership is a barrier to the development of technological innovation capabilities in firms (Dasgupta et al., 2011). In contrast, implementing information technologies and systems contributes to the development of technological innovation capabilities and the successful performance of projects (Yang & Huang, 2016).

Second, the literature shows that organizational learning is an important mechanism for developing and increasing technological innovation capabilities (Aljanabi, 2017; Dasgupta et al., 2011; Ince et al., 2016; Yu et al., 2017). Beyond its role in technological innovation (Yu et al., 2017), organizational knowledge can also help develop other intangible resources for the firm (Aljanabi, 2017). In addition, knowledge absorption capacity has a positive impact on technological innovation capabilities and innovative performance because it enables the transfer of knowledge necessary for the development of firm processes (Dasgupta et al., 2011; Ince et al., 2016; Lau & Lo, 2019; Wu & Wang, 2018; Yam et al., 2011).

Third, the literature discusses cooperation and collaboration as important factors for the development of technological innovation capabilities (Ince et al., 2016; Wu & Wang, 2018; Yam et al., 2011). Thus, in their interaction with the environment, firms acquire new knowledge to improve all of their capabilities (Ince et al., 2016; Yam et al., 2011). Firms can accomplish this goal through partnerships or research and development processes within the framework of open innovation (Wu & Wang, 2018). They can also achieve these ends through formal and informal networks of internal and external knowledge (Dasgupta et al., 2011; Yam et al., 2011).

Fourth, the literature discusses why an innovation strategy and the resources associated with it are important to the development of a firm's technological innovation capabilities (Dasgupta et al., 2011; Liu & Jiang, 2016; Wang & Zhang, 2018). On this topic, Dasgupta et al. (2011) state that successful management of technological innovation requires effective resource allocation to achieve technological change. As a result, firms should align their organizational factors and innovation strategies to favor innovation capabilities and competitive advantages.

Finally, the literature uses the model proposed by Yam et al. (2004) to highlight the capabilities that significantly promote the development of technological innovation. On this topic, the works of Yam et al. (2011) and Razavi et al. (2016) emphasize the importance of learning ability. Some studies also discuss the effect of marketing capacity on technological innovation (Razavi et al., 2016; Strand et al., 2017). In addition, Razavi et al. (2016) describe the importance of R&D capacity and resource allocation, and Strand et al. (2017) endorse organizational and production capacity in the development of technological innovation capabilities.

8.3 The Conceptual Framework and Its Propositions

A conceptual framework (Fig. 8.1) was constructed based on the previously reviewed research. The goal was to present an overall framework of technological innovation capabilities. Thus, the framework did not take into account individual firm characteristics such as size or industry. Instead, the framework focused on the role of industry attributes, which are connected to the turbulence of the market or technology, including its overall competitive intensity. These industry attributes include changes and trends occurring in the industry. In determining the technological innovation capabilities important to a firm, the framework also prioritizes the focus of operation inside the firm. This concept includes the internal territory or function of the firm. The role of these issues is discussed later in this section. First, the conceptual framework and its propositions will be explained.

Traditionally, technological innovation capabilities are defined as a varied number of firm features that enhance and support the firm's technological innovation strategies (Burgelman et al., 2004). In this paradigm, technological innovation capabilities are shaped by expertise and practices that contribute to developing more competitive technologies and processes. Prior research divides technological innovation capabilities in multiple ways, but several individual-level and firm-level factors can be identified. For example, Lall (1992) considers skills and knowledge to be the crucial technological innovation capabilities. Guan and Ma (2003) refer to technological innovation capabilities as a special asset of a firm, incorporating product, process, technology, organization, knowledge, and experience. Firm-level technological innovation capabilities also include resource capability, R&D capability, marketing capability, financial capability, manufacturing capability, organizing capability, and strategic planning capability (Chen et al., 2019; Shafia et al., 2016; Wang & Zhang, 2018) among others. Based on these studies, the impacts of human experience, skills, and values on technological innovation should be highlighted, as should the impacts of firm-level technological innovation capabilities. The joint interaction between these two types of capabilities shapes the overall technological innovation capabilities of the firm. Thus, the first proposition focuses on the multilevel nature of technological innovation capabilities.

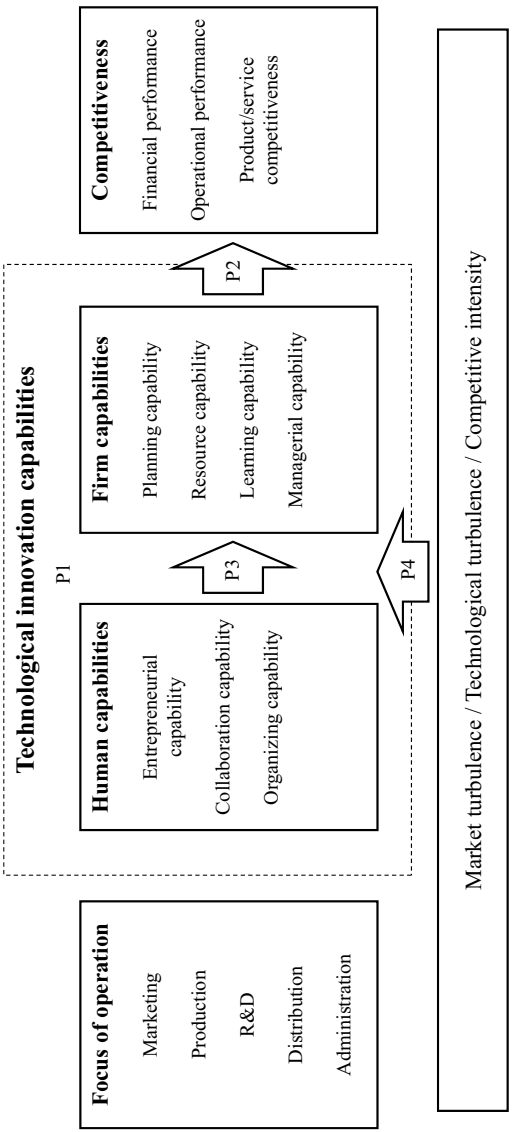

Fig. 8.1 The implications of technological innovation capabilities: the conceptual framework (*Source* Figueiredo and Ferreira [2019])

P1. Technological innovation capability is impacted by individual-level and firm-level capabilities.

Recent studies have suggested that a firm's technological innovation capabilities depend on strategic expertise that has the potential to affect its competitiveness (e.g., Chen et al., 2019; Joo et al., 2018; Shafia et al., 2016; Yu et al., 2017). Firm competitiveness can be described as the ability of a firm to successfully design, generate, and launch products in comparison to its competitors (D'Cruz & Rugman, 1992). Human resources, strategic management, technology management, and operations management are all involved in gaining competitiveness (Ajitabh & Momaya, 2004). All of these processes drive technological innovation capabilities, both at the individual level (e.g., Liu & Jiang, 2016; Razavi et al., 2019; Yu et al., 2017) and the firm level (e.g., Camisón & Villar-López, 2014; Dasgupta et al., 2011). Thus, technological innovation capabilities determine the progress and competitive ability of a firm. Only with robust technological innovation capabilities can firms gain a competitive advantage and improve their competitiveness. For these reasons, we propose that:

P2. Technological innovation capabilities drive competitiveness.

The prior argument is that firm-level competitiveness is shaped by a set of complex capabilities. Previous research shows that both individual-level and firm-level capabilities are crucial to competitiveness. The first of these characteristic refers to the capability of the humans to create, diffuse, and use innovations that provide value to the firm, ultimately contributing to the firm's human knowledge. Since human knowledge is considered to be one of the firm's unique resources (Wernerfelt, 1984; Wright, Dunford, & Snell, 2001), related capabilities can enhance the firm's unique firm-level capabilities and consequently increase the chances of gaining a competitive advantage (Joo et al., 2018; Shafia et al., 2016; Yu et al., 2017). Individual-level capabilities affect both the types and levels of the firm's capabilities. One can assume that firms possessing a high level of human knowledge in technological innovation are more likely to adjust their firm-level capabilities in relation to the operating environment and obtain favorable responses from the market. Those favorable responses can be turned into higher levels of competitiveness. This paradigm highlights the twofold role of firm-level capabilities: as a factor shaped by individual-level capabilities and as a crucial determinant of competitiveness. As a result, the third proposition relates both individual-level and firm-level capabilities to the establishment of competitiveness.

P3. Individual-level capabilities influence competitiveness by facilitating the exploration of firm-level capabilities.

A firm's technological innovation capabilities may depend on certain contextual factors. There is evidence that innovation capability may differ based on the focus of the operation, for example in terms of what unit the individuals work for (Saunila, Mäkimattila, & Salminen, 2014) or the position of individuals (Saunila, 2017). Thus, different operations will require different experience and skills. These factors are preconditions that need to be taken into account when enhancing innovation capability, especially in situations where they will be difficult to change.

The external environment also shapes firm composition and operation (Li & Liu, 2014; Quinton et al., 2018; Shafia et al., 2016). In other words, the environmental features of a firm influence the relationship between its technological innovation capabilities and competitiveness. As the external environment is impacted by diverse types of turbulence and competition, utilizing technological innovation capabilities can help manage such conditions. Under conditions of high turbulence and competition, customer demands will vary (Jaworski & Kohli, 1993). As a result, a firm that does not develop its technological innovation capabilities is likely to lose customers to competitors, which in turn will lower the firm's competitiveness. Thus, a firm must evaluate its external environment and develop technological innovation capabilities to maintain its competitiveness. The discussion above suggests that:

P4. Technological turbulence, market turbulence, and competitive intensity affect the extent to which individual-level and firm-level capabilities drive competitiveness.

8.4 Case Study

A case study was used as the basis for this research. Following a process described by Yin (1994), the aim was to examine a contemporary phenomenon in its real-life context by using single-case design. This strategy was chosen for the rich insights it made possible. The empirical evidence concerned a case study of a media firm in southern Finland. The firm has a number of business units with independent and common functions. For example, the firm manages printed newspapers, online news, and radio. Its support units include printing, distribution, IT, and administration. The firm is also part of a larger corporation, and the number of employees vary depending on the situation since a large portion of them

Table 8.1 Interviews

Interviewee	*Position*	*Interview duration*	*Form of data*	*Analysis*
1	Innovation manager	35 min.	Recorded and transcribed	Qualitative content analysis
2	Product manager	62 min.	Recorded and transcribed	Qualitative content analysis
3	Sales manager	40 min.	Recorded and transcribed	Qualitative content analysis
4	Production manager	60 min.	Recorded and transcribed	Qualitative content analysis
5	Web producer	60 min.	Recorded and transcribed	Qualitative content analysis
6	Production manager	47 min.	Recorded and transcribed	Qualitative content analysis

work part-time. Like its competitors, the firm faces common challenges in a changing business environment due to the rise of online media. Cutting costs is not the solution for its long-term competitiveness.

The data consisted of semi-structured personal interviews with six interviewees (see Table 8.1 for further information). Each interviewee was selected based on their roles and responsibilities in the firm. Leadership or hands-on experience with innovation development was necessary for each interviewee. Interview questions were defined in advance, but the interviews followed an informal procedure that allowed complementary questions from the interviewers. In addition to the recorded and transcribed interview data, notes, and observations during the interview were used for analysis. The interviews covered the current situations and challenges related to innovation projects, the implementation of innovations to solve these challenges, and the outcomes to be achieved. A qualitative content analysis was used to investigate the firm's technological innovation capabilities in light of the conceptual framework presented in the previous section.

8.5 Results—Application of the Framework

In this section, empirical evidence from the case study is provided. The results are provided at three levels described in the conceptual framework: Individual-level capabilities, Firm-level capabilities, and Competitiveness.

The following sections discuss and elaborate upon these findings. The key results are summarized in Table 8.2.

8.5.1 Individual-Level Capabilities

The case study evidence reveals that a firm must balance strict practices and policies with opportunities for innovation. The interviewees confirmed that both characteristics are necessary in the work environment to facilitate technological innovation. In particular, the case study evidence supports the point that individuals' personalities and approaches toward innovation are foundational to the successful utilization of individual-level capabilities. Employees whose work is entrepreneurial and regenerative are especially essential for developing technological innovation. The interviewees also stated that open communication between employees encourages them to participate in innovation activities and helps them recognize their role in innovation. Individuals with this type of entrepreneurial capability are the key to technological innovation. The interviewees stated:

> *Through that kind of free ideation, we can kind of create something new for that activity. (Interviewee 2)*

> *… the group structure, some combination just doesn't work. There has to be a little forward-looking and outward-looking activity, not that its purpose is just to frustrate everyone. (Interviewee 6)*

> *And if they [employees] doesn't have that activity, if their bosses don't have that activity, then the whole process leaks out. This is not a one person thing. (Interviewee 1)*

This type of human collaboration can motivate employees to generate technological innovation through innovative action. The case study evidence supports the view that opportunities for employees to collaborate among different departments and with people of different skills and personalities are important to technological innovation. Acquiring knowledge and ideas from outside the firm is also important in developing technological innovation. This external collaboration can occur through interactions with customers, suppliers, and competitors. Thus, collaboration capability is essential to technological innovation.

Table 8.2 Summary of the case study

Proposition	*Case evidence*
P1. Technological innovation capability is impacted by individual-level and firm-level capabilities	Technological innovation capabilities are determined by several individual-level and firm-level capabilities The actions towards technological innovation capability development should be developed in parallel at the individual and firm levels in order to gain positive effects
P2. Technological innovation capabilities drive competitiveness	Technological innovation capabilities possess the potential to reduce costs and enhance profitability Increasing sales of existing services and creating sales from novel services were potential factors in reaching targets Technological innovation capabilities development could also result in negative consequences, such as extra costs
P3. Individual-level capabilities influence competitiveness by facilitating the exploration of firm-level capabilities	*Individual-level capabilities* Entrepreneurial capability helps build dialogue over the development of technological innovation Organizing capability assists in balancing the different needs for the distinct development phases of technological innovation Collaboration capability can motivate employees to generate technological innovation through innovative action *Firm-level capabilities* Planning capability establishes limits on the technological innovation activities through multiple phases and threshold points before being commercialized Resource capability facilitates technological innovations as they do not succeed by accident and without sufficient resources throughout the innovation development process Learning capability allows for both radical and incremental innovations to emerge when learning is supported throughout the firm Managerial capability increases cooperation among employees and involvement in innovation development through successful management initiatives

(continued)

Table 8.2 (continued)

Proposition	*Case evidence*
P4. Technological turbulence, market turbulence, and competitive intensity affect the extent to which individual-level and firm-level capabilities drive competitiveness	Variety in a firm's capabilities is necessary for technological innovation development since contexts and markets change External environment turbulence requires a balance between tight practices and policies and employees' freedom to be creative External environment turbulence generates puzzles in technological innovation development due to distinct requirements in exploitation and exploration Technological innovation capabilities may also assist in adjusting to the rapidly changing business environment

The interviewees also stated that changing even one person in the innovation development group opened possibilities for very different outcomes. As a result, it is clear that human knowledge determines the outcomes of innovation activities. More employees were involved in the development of technological innovation than in the core innovation development group. Thus, an ability to motivate others to participate in innovation activities, provide ideas, and drive the overall development was highlighted. Technological innovation requires a firm to possess organizing capability, as different phases of the innovation process can create different needs. These ideas were discussed by the interviewees in the following quotes:

> *You should guide it [innovation activities] through the actions and shape the initiatives and measures accordingly. (Interviewee 4)*

> *I think it has clarified [the innovation activities] that idea has an owner, who takes care of the fact that it's going forward. And then if that single person is named for it, who's responsible for producing a product for it within a certain timeframe, I think it has clarified quite a bit of the job. (Interviewee 2)*

8.5.2 Firm-Level Capabilities

The case study showed that competitiveness cannot be determined simply by paying attention to individual-level capabilities. In addition, competitiveness requires firm-level capabilities such as learning, resources, planning, and management. There were multiple activities in the case study related to firm-level capabilities. Firm-level capabilities also represent better processes for doing something, otherwise known as planning capability. A firm's planning capability includes the boundaries it puts around technological innovation activities. For example, the case study firm developed a procedure through which innovations were developed toward commercial ends. This focus reduced the amount of unsuccessful innovations in the market and the time spent on the development of innovations. Interviewee 1 made the following point:

> *If you do not have a clear pattern, a frame to carry them on [innovation activities], then the result would be worse. (Interviewee 1)*

Among the interviewees, goal orientation was emphasized, because prosperous results, such as novel products or services, do not transform into commercial ends overnight. They are developed through several distinct phases before being commercialized and distributed. In addition, careful planning of technological innovation imperatives reduces the need to cease the development of promising ideas, especially when support and resources have been provided to those ideas over a long period of time. This type of resource capability is important, as technological innovations do not succeed by accident and without sufficient resources throughout the innovation development process. Interviewees stated the following:

> *Do we have the resources, do we have the right people to do things, do we have time to do it by a certain deadline, who will commit to it… after figuring these out, we will start getting our projects through. (Interviewee 4)*

> *Our group [innovation development group] is still going. One big challenge is to give people enough time to do these things. (Interviewee 1)*

Another firm-level responsibility is to support learning aimed at innovation development. Initial ideas from individuals or groups of employees were provided to an innovation development group. The group was responsible for providing an initial assessment of the idea's suitability

and, if appropriate, advancing the idea further. Feedback was provided to the individual or group, who were sometimes allowed to present a revised version of the concept. This type of learning capability has allowed both radical and incremental innovations to emerge. Learning capabilities within the firm, especially when supported by digital systems, was a key ingredient in technological innovation development. Interviewees revealed the following:

> *I do not believe that we have been able to unravel this very far, because the presence of an outsider in a way then completely dismantles our internal order of command. (Interviewee 4)*

> *The benefit of that [external input] is that you get comments, with a little bit of new perspectives, ways of looking things, something like that. (Interviewee 5)*

> *It's not enough that those members of the management team know, you need to know that at grassroots level. (Interviewee 2)*

Management support was one of the most crucial aspects of technological innovation development. While reflecting on managerial capability, interviewees discussed the importance of the working climate and enhanced functioning of operational processes. Increased collaboration and involvement in innovation development was seen as the result of successful management initiatives. In the case study, decision-making responsibilities were spread throughout the firm, creating obstacles for moving innovations forward. This problem was overcome by forming an innovation management group who offered support for idea developments and simplified the interactions between strategic management and everyday innovation activities. This approach was also seen as a way to align strategic innovations. The interviewees supported the innovation management group's role in furthering innovation processes and saw it as a proper protectant against issues between managerial capability and technological innovation. On this topic, the interviewees stated the following:

> *What role anyone has in it [innovation activities], where they can find support and where they can put ideas, who decides what and who implements it. Clarifying these things in this organization and giving instructions, that's*

one big, very important thing. And the way that these things are carried forward and how they are being coordinated, they are a big deal. (Interviewee 1)

First you have to let people talk and think, let them innovate more on that, to give employees the feeling that, hey, "I have an influence on this." I think it develops that sense of being together, I can influence things. (Interviewee 4)

8.5.3 Competitiveness

After analyzing the case study, it has become clear that technological innovation capabilities possess the potential to reduce a firm's costs and enhance its profitability. Technological innovation seems to be a major factor in improving sales. According to the above interviews, increasing sales of existing services and creating new sales from novel services are both important for reaching a firm's targets. Systematic technological innovation development enables these possibilities for additional business.

Despite these positives, the interviewees did point out some negatives as well. One interviewee stated the following:

…from a sales point of view, then it's too soon. In a way, what is the time window for innovation that we do, so it feels like we're too short-term all the time, we can't see over a sufficient time. (Interviewee 3)

Other interviewees pointed out that the development of technological innovation capabilities could result in negative consequences, such as extra costs. For these reasons, the majority of the interviewees emphasized that capabilities development should be systematic: the procedures toward capability development should be developed in parallel at the individual-level and firm-level in order to generate positive results.

8.6 Conclusions

This study contributes to technological innovation management research by emphasizing the essential capabilities of technological innovation and their role in building competitive advantages. Although not exhaustive, the literature review offered an extensive basis for constructing a conceptual framework for technological innovation capabilities. The framework

was then examined in the context of SMEs to understand the interplay between technological innovation capabilities and competitiveness. The following processes were discussed: the formation of technological innovation capabilities, and the establishment of competitiveness through technological innovation capabilities. In this chapter, we established that individual-level capabilities are essential determinants for realizing firm-level capabilities in technological innovation actions. Further, the external environment plays a role in shaping the relationship between a firm's technological innovation capabilities and firm competitiveness.

8.6.1 Theoretical Implications

In regards to theory, this chapter offers multiple implications for further studies on the technological innovation management research of SMEs. First, by exploring the role that technological innovation capabilities play in developing competitiveness, this study contributes to prior research by proposing that technological innovation capabilities enable individual firms to build competitive advantages by developing their individual-level and firm-level capabilities. Of the individual-level capabilities affecting a firm's technological innovation capabilities, entrepreneurial, organizing, and collaboration capabilities seem to determine the extent to which individuals contribute to technological innovation. In addition, firms need to motivate employees by providing necessary planning, resource, learning, and managerial capabilities for technological innovation development.

Few studies besides this one have explored multilevel technological innovation capabilities as a contingency. Prior studies concentrated primarily on determinants (e.g., Lau & Lo, 2019; Liu & Jiang, 2016) or implications (e.g., Camisón & Villar-López, 2014; Joo et al., 2018; Yam et al., 2011) of technological innovation capabilities without taking into account the micro-foundations of the phenomena. This study's results indicate that the contingency role of technological innovation capabilities determines the extent to which SMEs attain a competitive advantage.

Finally, this study enriches the literature by integrating several different level capabilities within a unifying framework in SME context. Regarding the conceptual framework, the case study evidence highlights the importance of developing both individual-level and firm-level technological innovation capabilities in order to establish and maintain a competitive advantage. The propositions and conceptual framework for technological

innovation capabilities detailed in this chapter open up possibilities for further research.

8.6.2 Managerial Implications

From a practical point of view, these conclusions about the interplay between firm competitiveness and technological innovation capabilities at the individual and firm levels offer insights regarding how the managers of SMEs can promote technological innovation to attain competitive advantages. Specifically, managers must strive to develop individual-level and firm-level technological innovation capabilities in conjunction with each other to make their firms more competitive. Individual-level capabilities can assist firms in accessing new knowledge and capabilities related to new technologies, and firm-level capabilities can cultivate processes aimed at improving their competitiveness. Thus, individual-level and firm-level technological innovation capabilities cannot be viewed as separate activities. Instead, they should be pursued simultaneously, with consideration given to the conditions of the external environment. Furthermore, the essential capabilities that shape technological innovation capabilities in SMEs identified in this chapter must be known to policymakers before they choose an innovation policy.

8.6.3 Limitations and Further Research Directions

The study has two main limitations. The first limitation is the conceptual focus of the chapter. The research builds on one case and, although the results support the conceptual framework and its propositions, more research on the conceptual framework is necessary to strengthen and expand the theoretical conclusions. The second limitation is the chapter's focus on intra-organizational capabilities. Few firms operate alone, and innovation is increasingly created in collaboration with several firms. Thus, extending the research focus to inter-organizational relationships would be valuable. While none of the elements and capabilities recognized in the framework are truly new, they have never been explored in an SME setting or the media business context before, and this focus is the novelty of this study. Further studies on technological innovation capabilities will only add to this chapter's conclusions on the interplay between different level capabilities, as well as their drivers and barriers.

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