

INNOVATION MANAGEMENT AND TECHNOLOGICAL CAPABILITIES AS A SOURCE OF COMPETITIVE ADVANTAGE

Matej Lahovnik

University of Ljubljana, Faculty of Economics, Slovenia
matej.lahovnik@ef.uni-lj.si

Lidija Breznik

University of Ljubljana, Faculty of Economics, Slovenia
lidija.breznik@ef.uni-lj.si

Abstract:

The purpose of our paper is to propose a model of technological capabilities and to investigate in more detail the potential differential impact of technological capabilities model on sustainable competitive advantage in the global industry. We want to contribute to the recent pool of knowledge the theory about firms' dynamic capabilities, and to introduce innovation capability as one of the most important dynamic capabilities that represent the dominant source of competitive advantage, focusing on a case of one of the largest home appliance world producers. We present how combinations of capabilities and resources can be developed, deployed and protected to achieve and sustain competitive advantage. Scholars argue that we need fine-grained case studies of firms which have been able to sustain a competitive advantage over time in dynamic environments. That is why we decided to examine and apply our theoretical approach of dynamic capabilities on a case study. We introduce a case study of a successful Slovenian firm Gorenje that is the largest exporting firm in Slovenia.

Keywords: Competitive advantage, innovation, resources, technological capability

1. INTRODUCTION

Innovations have always been essential for a firm's long-term survival and growth. Santos-Vijande and Álvarez-González (2007) argued that "innovations play a crucial role in the firms' future by following the rapid pace of markets' evolution" and, further, by being able to adapt to radical technological changes. It is no surprise that the management of technological innovation is one of the most demanding challenges today (Dodgson et al., 2008). The purpose of our paper is to propose a model of technological innovation capabilities and to investigate in more detail the potential differential impact of a technological innovation capabilities model on sustainable competitive advantage in the global industry. We want to contribute to the recent pool of knowledge, the theory about firms' dynamic capabilities, and to introduce technological innovation capability as one of the most important dynamic capabilities that represents the dominant source of competitive advantage, focusing on a case of one of the world's largest home appliance producers. We present how combinations of capabilities and resources can be developed, deployed and protected to achieve and sustain competitive advantage through technological innovation capability. The paper outlines empirical evidence from a single case study that was conducted in summer 2012.

A literature review on dynamic capabilities (e.g. Baretto, 2010) reflects the youthfulness of the approach, but also creates confusion that might hinder any more effective progress within the field. In addition, we have noticed a range of conceptual elaborations about dynamic capabilities, although empirical studies are limited. One difficulty might arise from the apparent dominance of quantitative studies, which might infer the presence of dynamic capabilities by examining a firm's performance outcomes. Danneels (2008) and Ambrosini and Bowman (2009) argue that we need fine-grained case studies of firms which have been able to sustain a competitive advantage over time in dynamic environments. Accordingly, we decided to examine and apply our theoretical approach to dynamic capabilities in a case study. We introduce a case study of the successful Slovenian firm Gorenje that is the largest exporting firm in Slovenia, and one of the eight biggest manufacturers of home appliances in Europe. The paper is organised as follows. The next section introduces a literature review covering issues addressed in the paper. The following section briefly presents the methodological approach we employ. We then present the case study, the main characteristics of the firm under study and the results of our research. Finally, we close with a conclusion. At the end, we discuss some limitations and possible future avenues of research.

2. LITERATURE REVIEW

The dynamic capabilities view has emerged as an attempt to untangle the complex problem of sustainable competitive advantage in today's dynamic environment (Eisenhardt & Martin, 2000; Teece et al., 1997). The underlying assumption is that firms which are able to sense and then seize new opportunities, and further, reconfigure their resources and capabilities in line with recognised opportunities and environmental change can create and sustain competitive advantage (Teece, 2009). Smith and Prieto (2008) argue that the premise of most dynamic capabilities research is that firms must use and renew their tangible and intangible resources and capabilities to achieve and sustain a competitive advantage. Cepeda and Vera (2007) argue that knowledge management processes lie behind the development and use of dynamic capabilities. We agree with Lopez (2005) that the knowledge-based view and the resource-based view as strategic management approaches are still essentially static in nature. In sum, knowledge equals a resource and hence it should be transformed into a capability (Shih-Chia et al., 2007). Namely, the literature is clear that capabilities are some kind of processes that affect resources which alter the resource base. Dynamic capabilities arise from learning mechanisms of knowledge and experience accumulation processes (Zollo & Winter, 2002). In line with that, dynamic capabilities could be the real sources of sustained competitive advantage in today's competitive world.

Rothaermel and Hess (2007) maintain that dynamic capabilities facilitate not only the ability of an organisation to recognise a potential technological shift, but also its ability to adapt to change through innovation. Innovation is the engine of economic development. Innovation requires a search for new information outside the existing knowledge base, generally in areas unrelated to current operations. Since innovation plays a key role in survival and growth, developing an innovation strategy is one of the most important strategic issues (Camison & Villar-Lopez, 2012; Francis & Bessant, 2005). Innovation studies have developed rapidly in the last 20 years, although there has still been no attempt to construct a coherent theoretical-empirical framework (Castellacci et al., 2005).

Nevertheless, today innovation represents a basis of competitive advantage and plays a dominant role in a firm's success. The ability to continuously generate innovations is one of the most critical capabilities in today's business environment (Elonnen et al., 2009).

Firms want to sustain their competitive position they have to develop and deploy their innovation capability through technological aspects. Specifically, firms need to upgrade their innovation capability for developing and commercialising new technologies through their products and services to attain and sustain a competitive position (Wang et al., 2008). In line with that, we can introduce technological innovation capability. In addition, technological innovation capabilities represent a dominant part of the innovation cycle (Gulrajani, 2006), thus their interwovenness and correlation is unquestioned. Burgelman et al. (2004) define technological innovation capability (TIC) as comprehensive characteristics that facilitate and support an innovation strategy (Wang et al., 2008). An innovation strategy is the basis for the firm's overall strategy (Dodgson et al. 2008). It further represents the link between customers' needs and the needs satisfied by a firm's products. Establishing and nurturing such link is primarily what defines technological innovation (Pratali, 2003). Technological innovation capability is the composition of the resource base that includes technology, product, process, knowledge, experiences and organisation (Karagouni & Papadopoulos, 2007). However, merely generating technological innovation does not guarantee business success (Teece, 2010). Developing and deploying technological innovation capability have to be implemented as core capabilities referring to innovation (Karagouni & Papadopoulos, 2007) from the dynamic capabilities perspective. Indeed, only firms which are able to deploy their resources and capabilities upon the dynamic capabilities framework can create and sustain a competitive advantage (Teece, 2009).

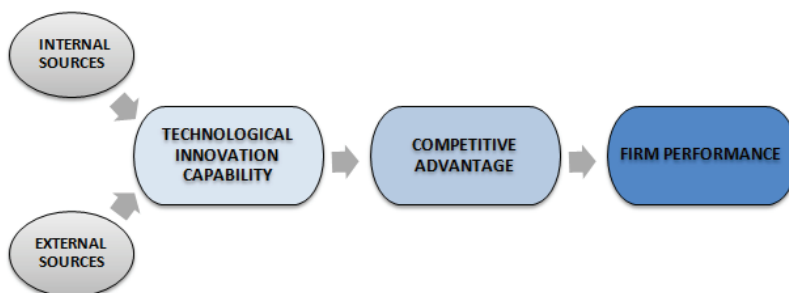
3. METHODOLOGY

The purpose of our paper is to apply evidence that technological innovation capabilities, as one of the dynamic capabilities, are dominant sources through which firms can achieve a sustainable competitive advantage and business performance. Therefore, the main hypothesis is that a firm's technological innovation capability is a dominant source of its competitive advantage. Based on the main hypothesis and literature review, we developed the following three subsidiary research questions (RQ1, RQ2 and RQ3).

- RQ1: Can we recognise technological innovation capability as one of the most relevant dynamic capabilities as a source of a firm's competitive advantage?
- RQ2: Can we identify relevant internal and external resources of technological innovation capabilities as sources of a firm's competitive advantage?

The Gorenje case from the home appliance industry is a suitable context to create and validate our research model because this global industry, which so far has received little attention (Worren et al., 2002), is a prototypical high-technology industry with characteristics that are identical in other high-tech domains. Our contribution is directed at an emerging theory on dynamic capabilities, focusing on identifying the components of technological innovation capabilities and validating a model of technological innovation capabilities relevant to firms competing in the global market. Based on the conceptual framework of technological innovation capabilities and the relationships between competitive advantage and a firm's business performance, the following operational model can be presented (Figure 1).

Figure 1: Operational model of the influence of innovation capabilities on competitive advantage and the firm's business performance



The model in Figure 1 follows from the theoretical background and shows our perception of how technological innovation capability, competitive advantage and firm performance may be interlinked. The technological innovation capability is a result of internal and external sources. Since the importance of different sources of technological innovation capability varies by industry, as Dodgson et al. (2008) acknowledge, we therefore want to identify which internal and external sources are relevant for firms operating in the home appliance industry.

- RQ3: Can we define key technological innovation capabilities as a source of a firm's competitive advantage?

Our paper is a combination of theoretical and empirical parts. By using a deductive process we develop a conceptual model on the basis of the literature review and previous empirical studies. In order to introduce the case study, in-depth interviews with key respondents in the case-study firm were made. The empirical part is based on an inductive approach. The reasons for employing a qualitative method and an inductive approach are the following. First, the research topic concerns complex constructs that are new, divergent and inadequately defined. For example, dynamic capabilities as a relatively new approach have initiated much debate with different research results pointing in divergent directions. Second, innovation and innovation success cover many perspectives, levels of analysis and objectives. Third, the concept of technological innovation capability is still in its infancy and technological innovation capabilities as a construct have seldom been determined. Therefore, the inductive approach enables a thorough understanding of the research context. Due to the exploratory nature of our research, the case study approach is considered a suitable research methodology (Yin, 2009). We would like to gain a richer understanding of the context of the research. Case study research has a considerable ability to generate answers to the questions what, why and how (Myers, 2009; Silverman, 2011). We use the extended case method where the primary focus is not to build a completely new theory but to integrate and extend existing theory (Danneels, 2002).

4. THE CASE OF GORENJE

4.1 Introduction to the Gorenje company

The Gorenje Group is ranked among the leading European manufacturers of home appliances and boasts a history of more than 60 years. It produces and sells technologically perfected, superiorly designed and energy-efficient household appliances under the brand names of Gorenje, Atag, Asko, Pelgrim, Mora, Etna, Körting, Sidex and Upo. Gorenje is currently ranked among the eight largest manufacturers of household appliances in Europe. It desires to be placed among the leading five. The current market share in this fragmented household appliances industry in Europe is 4 percent. The company's average annual growth rate before the onset of the financial crisis was 9 percent. With the onset of the crisis, the organic growth has slowed and been partially replaced via acquisitions of other companies in the market. Gorenje is trying to configure its activities globally. It has been very active as an acquirer in the consolidation process in the home appliance industry. In 2005, it acquired Mora Moravia, a cooking appliances producer from the Czech Republic. In 2007 it acquired ATAG, a well-established European home appliance producer. In 2008, it opened a new refrigerator and freezer plant in Valjevo, Serbia (www.gorenje.com). The Gorenje company's current market consists of 70 countries around the globe. The bulk of its products is sold in European markets primarily in Germany, Austria and Russia. In 2012, Gorenje employed more than 11,000 employees and generated EUR 1.5 billion in sales revenue. Its main global competitors are Electrolux, Bosch Siemens, Whirlpool and Beko.

The creation of new products and product lines always includes a measure of innovation in terms of both technology and design. The company Gorenje works with world renowned figures from the world of design and innovation such as Ora-Ito and Pininfarina, as well as with its own research and development team and an in-house design studio. Such cooperation is necessary to achieve attractive and unique solutions fully tailored to the consumer. In recent years, consumers have become increasingly demanding with regard to the technology, price and design of the products. Therefore, the replacement period of the introduced products is significantly shorter than it was, for example, 10 years ago. In the past, the company launched new products on average every 8–10 years and every 3 years with a new conceptual renovation. Nowadays, a new series of products is introduced every 2 years with a conceptual renovation. Completely new products are introduced every 4–5 years. The company's main orientation is to reduce the development time from idea to product. For example, in the past the company needed more than two years for the development of a new condenser. Yet in

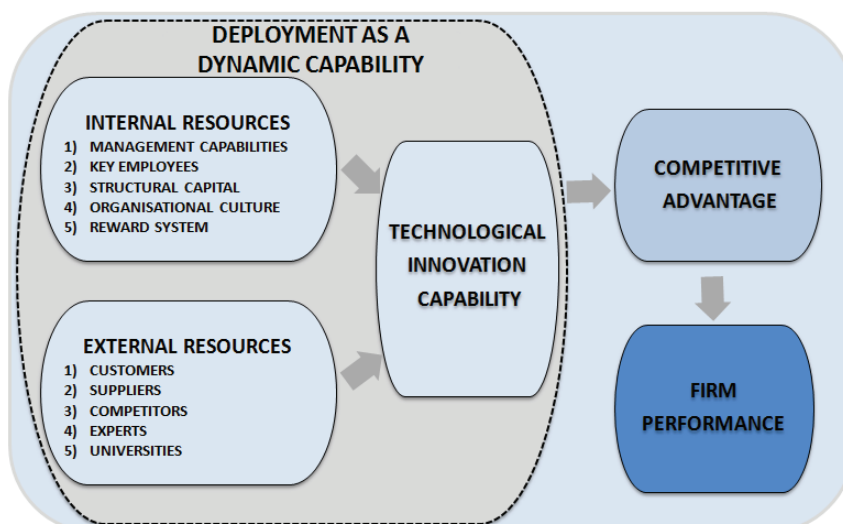
more recent times it has only needed one year. Investments are directed in particular at the interfaces for communication equipment with users and networks in new materials, allowing for easier cleaning, greater ecological acceptability and reduced energy consumption. In some areas Gorenje is still a market follower, while in certain others already in step with the competition or even ahead of it as a market leader. In our analysis, we wanted to determine which of the technological innovation capabilities (and skills) needed in the various processes contribute to the competitive advantages of individual strategic business units and the company as a whole.

4.2 Technological innovation capabilities of the firm

Gorenje develops and deploys technological innovation capabilities such as abilities for conceptualising, combining and using ‘the right’ resources, methods, processes and techniques. Technological innovation capabilities include additional and specific resources needed for the design and management of technical skills, knowledge and experience, as well as institutional structures and links. The company provides the basis for the development of in-house innovation and creates competitive advantage by reshaping skills and structures within the organisation. The technological innovation capability derives primarily from the knowledge, the organisation itself and the key employees. Three areas of expertise form an integral part of the technological innovation capability of the firm. First, the ability to understand new trends in science and technology, manage R&D projects and generate useful new technologies. Second, the ability to design and produce useful products and services that generate measurable competitive advantages. Third, a thorough understanding of customer needs and requirements. The focus of developing the core technological innovation capabilities in Gorenje should meet the following criteria: the ability to provide potential access to a variety of markets, they should contribute to value perceived by the customers who purchase the product and, third, the competition should find them difficult to imitate.

The high degree of complexity in the business processes where the company develops technological innovation capabilities is important. It is only in such a case that the competitors will be unable to easily imitate them. If the ability of the company does not refer to a single strategic unit but to the company as a whole, it will be very difficult for the competitors to imitate. The firm has recognised that its important capabilities are primarily not based on the knowledge of its individuals but mainly on the knowledge cooperation and integration of individuals, departments and units. In this case, they form part of the firm’s structural capital. However, it is important to acknowledge that the integration of knowledge resulting in innovation activities involves a cluster of internal and external sources. The following have been recognised as the most important internal sources of technological innovation capability: (1) management capabilities; (2) key individuals; (3) structural capital; (4) organisational culture; and (5) the reward system. In addition, the following have been recognised as the most important external sources of technological innovation capability: (1) customers; (2) suppliers; (3) competitors; (4) experts; and (5) the established institutions of knowledge in the economic environment (universities and other research institutes) (Figure 2).

Figure 2: Internal and external sources of the technological innovation capability in Gorenje



We discovered that in the home appliances field Gorenje has developed three strategic technological units (Tables 1 and 2): (1) the strategic technological unit of washing machines and dryers; (2) the strategic unit of refrigeration appliances and freezers; and (3) the strategic unit of cooking appliances. We determined the necessary technological innovation capabilities for each of the recognised strategic technological units within the home appliances field. This procedure includes the identification of the skills required for each part of the production process as well as the identification of those parts of the process which are the most important for meeting customer needs and the definition of the core technological innovation capabilities. The result of the internal and external analysis is a matrix that primarily summarises the existing technological innovation capabilities and the areas in which these capabilities have been applied (Table 1). The value of this matrix lies not only in the firm's statutory technological innovation capability, but in the definition of the potential capabilities and areas in which the company may expand with its current expertise and with the knowledge it is able to develop. When a firm determines the current and potential technological innovation capabilities and the areas of application, it can choose the sequence of activities that indicate its innovation strategy. The choice of activities enables the company to focus on those technological innovation capabilities and applications that are suitable for investments.

Table 1: Matrix of the existing technological innovation capabilities and potential technological innovation capabilities for the future

TECHNOLOGICAL INNOVATION CAPABILITIES		STRATEGIC TECHNOLOGICAL UNITS				
		Current			Potential	
		Washing machines and dryers	Refrigeration appliances and freezers	Cooking appliances	Dishwashers	Automatic vending machines
Current	»Lean« production	✓	✓	✓	✓	✓
	Design	✓	✓	✓	✓	✓
	Acoustic	✓	✓*		✓	
	Electronics	✓	✓*	✓	✓	✓
	Thermodynamics	✓	✓	✓		✓
	Electrodynamics	✓			✓	✓
	Enamel			✓		
	Vacuuming		✓			
Potential	Managing plastics	✓				

*Less important for a specific strategic technological unit

Each of the recognised strategic technological units has specially organised functions of production, technology, development, preparation of production, planning and logistics of material as well as the technical preparation of production. In addition to these functions, which are organised within each strategic technological unit, Gorenje has developed some common activities. These activities include design, acoustics, a prototype activity and electronics (Table 2). All of these shared activities are crucial in the development stage of a product.

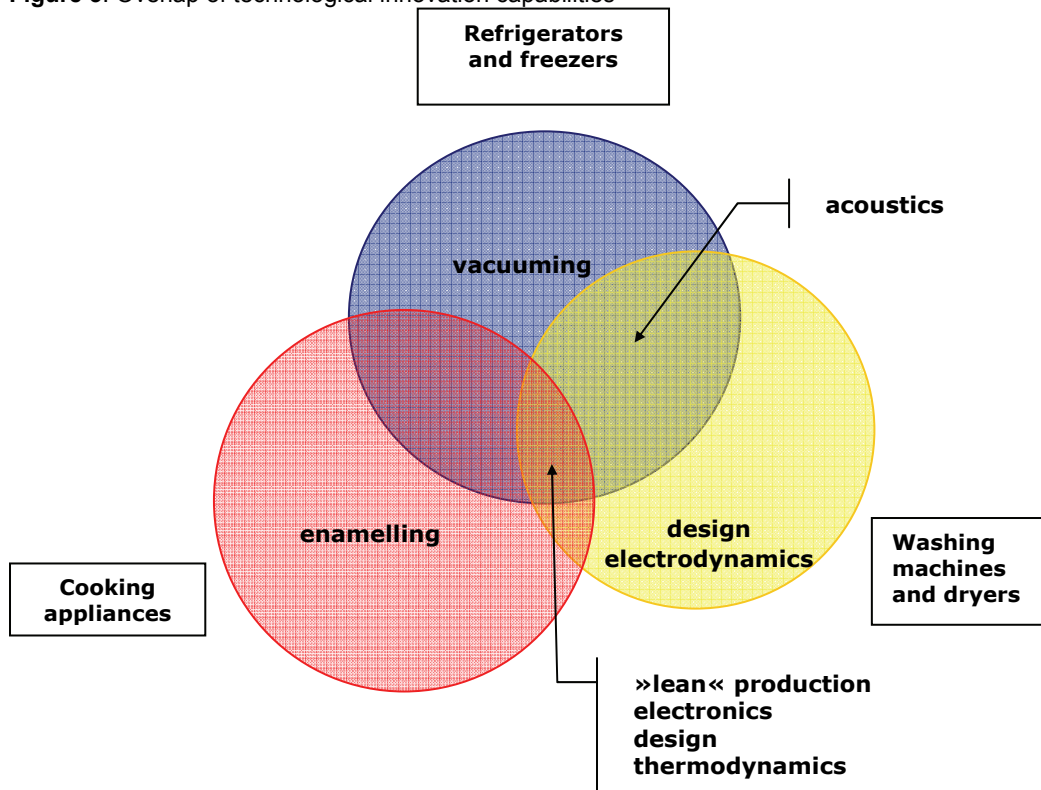
Table 2: The importance of joint development activities for each strategic technological unit

SHARED DEVELOPMENT ACTIVITY	STRATEGIC TECHNOLOGICAL UNITS		
	Washing machines and dryers	Refrigeration appliances and freezers	Cooking appliances
Design	4	2	1
Prototype	1	3	3
Acoustic	3	1	4
Electronics	2	4	2

1 – the most important; 4 – the least important

Some key technological innovation capabilities are common to all three strategic technological units. This could be an advantage for the company because these capabilities can be used and applied in several areas (a 'spillover' effect). Technological innovation capabilities that are common to all three strategic technological units are: 'lean' manufacturing; electronics and design. The strategic technological unit of washing machines and dryers on hand and the strategic technological unit of refrigeration appliances and freezers on the other have common knowledge of acoustics. Enamelling is crucial for the strategic technological unit of cooking machines. Control of electrodynamics is essential for the technological units of washing machines and dryers. In the case of the strategic technological unit for cooling machines and freezers, it applies knowledge of vacuuming and cooling systems which is typical for this unit only. The final result of the existing technological innovation capabilities of the various strategic technological units is presented in Figure 3.

Figure 3: Overlap of technological innovation capabilities



5. CONCLUSION

The main purpose of this paper was to identify that technological innovation capability is the dominant source of competitive advantage and thus underpins a firm's performance. Our study contributes to the growing interest in the dynamic capabilities field. First, we introduced the core ideas of the dynamic capabilities perspective as the latest approach in the theory of strategic management, and presented the relevance of continuous innovation in today's environment. Second, we extended the importance of deploying technological innovation capability as a dynamic capability in a global dynamic environment such as the home appliance industry. We developed three main research questions which synthesise and demonstrate the potential relationships between technological innovation capability (as a dynamic capability), competitive advantage and firm performance. Third, through an inductive approach to a selected case study we recognised technological innovation capability as the dominant dynamic capability and identified the main internal and external sources of technological innovation capability. Further, we confirmed that the development and deployment of dynamic capability can lead to a sustainable competitive advantage and hence to a long-run business performance. Finally, we present the model of how technological innovation capabilities can be formulated and implemented. In addition, we presented a matrix as a result of the internal and external analysis that summarises the existing technological innovation capabilities and the areas in which these capabilities have been applied, the potential technological innovation capabilities and the areas

in which these capabilities can be applied in the future. When a firm determines its current and potential technological innovation capabilities and the areas of application, it can choose a sequence of activities that indicates the innovation strategy upon which the firm's overall strategy depends. Further, the choice of activities enables a company to focus on those technological innovation capabilities and applications that are suitable for investment. Our results show that technological innovation capability can be broken down into several technological innovation capabilities. Linking the recognised technological innovation capability with the recognised strategic technological units revealed that some technological innovation capabilities can be used and applied in several areas (a 'spillover' effect). These core technological innovation capabilities have the ability to provide potential access to a variety of markets. They contribute significantly to the value perceived by a company's customers and increase the likelihood that it is not easy to imitate them. Our study discusses the relationship between technological innovation capability and firm performance. Future research should seek to examine the relationships and interactions of other dynamic capabilities, for example marketing capability, and their influences on performance. We suggest that additional research should be conducted as a cross-case analysis in the home appliance industry among major European and world companies. The future studies should be longitudinal to show the real relationship between technological innovation capability as the most important dynamic capability, competitive advantage and firm performance.

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