ABSORPTIVE CAPACITY AND INNOVATIVENESS IN TECHNOLOGICAL ENVIRONMENTS: AN ANALYSIS IN THE LIGHT OF THEORY

ABSTRACT

This paper presents an analysis in the form of a theoretical essay that approaches absorptive capacity as a promoter of organizational innovativeness in which all of the many different activities involved in knowledge management should be capable of promoting intra-organizational innovation. From this perspective, it is considered that absorptive capacity is related to market orientation and to the capacity to innovate. In other words, when an organizational environment has a greater degree of absorptive capacity, market-oriented behavior can stimulate innovative activities that will be valued and utilized by customers, thereby validating the whole process of knowledge transformation that is part of absorptive capacity (Lane & Lubatkin, 1998; Tsai, 2001; Yli-Renko, Autio & Sapienza, 2001; Zahra & George, 2002; Chao et al., 2011). Absorptive capacity is therefore the result of organizational management mechanisms that are capable of identifying new values for the organization. The concept synthesizes the process that starts with knowledge absorption and extends through to the exploitation of knowledge to generate innovation-oriented organizational capabilities, in a process of appropriation of external knowledge and its transformation into new knowledge.

Keywords: Absorptive Capacity; Innovativeness; Sustainability; Innovative environments

1. INTRODUCTION

One opportunity for development of strategies for the management of innovative environments arises from assessing absorptive capacity as a driver of the creation of an organizational environment that “fosters” innovation within firms.

Firms may be able to achieve innovativeness by creating strategies focused on the applied utilization of resources and capabilities, considering the processes of acquisition, transformation, assimilation and exploitation of knowledge.

Within the context of theoretical and empirical research into technology parks, this article contributes to the debate by considering an intangible variable that is extremely important to firms that have established themselves in these environments, i.e. generation of knowledge and innovations.

With relation to theory, both Brazilian and international research has demonstrated that there is a relationship between absorptive capacity and innovativeness in environments of organizational integration (Zahra & George, 2002; Lane, Koka & Pathak, 2006; Lichtenhaler & Lichtenhaler, 2009; Fiates et. al., 2010; Serra et. al, 2011).
Innovativeness is defined as a firm’s cultural disposition, inclination, propensity and readiness to be innovative, to test new ideas and to abandon old habits (Hurley & Hult, 1998; Hult et al. 2004).

Innovativeness implies that a company is proactive, following certain routines and processes to explore and exploit new opportunities, rather than simply improving its current resources (Menguc & Auh, 2006).

For a company to be innovative, it is expected that it has the minimum set of capabilities needed to conduct its core activities. Innovation is oriented towards process rather than to isolated events, including implementation of change in products/services, processes and organizational and management systems (Veugelers, 1997; Veugelers & Cassiman, 1999; Schreyoegg & Kliesch-Eberl, 2007; Miranda & Figueiredo, 2010).

Considering the importance to the firm of external knowledge for technological innovation, its absorptive capacity is an important part of the firm’s capability to create new internal knowledge.

In contrast with learning-by-doing, which is how firms achieve improvements in activities that they already do, absorptive capacity allows companies to learn how to do something completely different (Cohen & Levinthal, 1990; Van Den Bosch, Volberda & De Boer, 1999; Szulanski, 1996; Zahra & George, 2002; Lane, Koka & Pathak, 2006; Lichtenthaler & Lichtenthaler, 2009).

Therefore, the most important theoretical contribution made by this article is its exploration of the theoretical concept of absorptive capacity, both with relation to the strategic management of technology parks as institutions, but also with relation to the innovativeness of the companies they host.

This approach enables both identification of the mechanisms of acquisition of external knowledge; the methods employed for absorption, transformation and appropriation of that knowledge within the organization; and the methods of applying the new knowledge which will transform itself into innovations - with commercial applications (Zahra & George, 2002; Malhotra, Gosain & El Sawy, 2005; Lane & Koka, 2006; Todorova & Durisin, 2007).

Empirical studies of technology parks in an international context, through the lens of absorptive capacity and innovativeness, have used analysis categories focused on organizational knowledge, formalization and mechanisms of social cooperation, and have used applied research methods to investigate them (Vega-Jurado, Gutierrez-Gracia & Fernandez-De-Lucio, 2007; Martinez, Belso-Martinez & Mas-Verdu, 2012).
For the purposes of this article, absorptive capacity is understood to be knowledge management achieved through the utilization of information technology-based methods and tools and directed to the creation of an organizational context oriented towards innovativeness. In the case of the firms hosted in technology parks, effective absorptive capacity on the part of the park itself will allow them to increase generation of ideas and creation of new products and services that meet the demands of the market, all of which is based on the perspective of inter-firm knowledge transfer.

It is assumed a priori that a technology park will use its own absorptive capacity to generate new ideas for the optimization of processes related to its own management, and that a positive result of this integrated system is the creation of an organizational environment dedicated to the innovativeness of the organizations it hosts.

Companies’ entire innovation processes are fed by the knowledge transfer that takes place within the park, ensuring sustainability for the park and all of the firms in it.

The theoretical discussion of absorptive capacity and innovativeness in this article is an attempt to answer the following research question:

**How does the absorptive capacity of a technology park contribute to the innovativeness of the firms it hosts?**

Research into absorptive capacity and innovativeness in technology parks in Brazil is of relevance to international scientific research in view of the current political and economic configuration in Brazil, with heavy investment in creation of spaces for innovation to host Brazilian companies focused on technological innovation and to foster their development.

The general objective of this paper is to present a proposal for investigation of whether technology parks’ absorptive capacity facilitates development of innovativeness by the firms they host.

2. THEORETICAL FRAMEWORK

This article is an attempt to understand absorptive capacity as a promoter of innovativeness in firms, identifying analytical indicators of a technology park’s capacity to acquire, transform, assimilate and exploit knowledge and the results of these activities in terms of creation of an environment in which firms’ innovativeness can contribute to innovation in new products and services.
The next three subsections present the theoretical concepts that provide the foundation of this paper, as follows: Absorptive Capacity, Innovativeness and Absorptive Capacity in Innovation Environments.

2.1 Absorptive Capacity

When the resource-based view (RBV) was proposed in the 1980s, it was an alternative to the dominant view of the industrial organization, since it was based on the idea that competitive advantage primarily lies in utilization of resources and competencies developed and controlled by firms, while the structures of the industries in which they do business was seen as a secondary factor. Firms are thus considered to be a perfect and complex combination of resources (Barney, 1991, 2001; Peteraf, 1993; Vasconcelos & Cyrino, 2000; Bandeira-De-Melo & Marcon, 2006).

It is known that competitive advantages are of fundamental importance to successful strategies and, along these lines, attributes related to organizational capacities encompass innovation and the reconfiguration of an organization’s resources, considering factors such as ownership of or access to rare and valuable resources; concessions, patents or privileged geographical locations; the capability to transform the factors of production into products that can be sold on the market; leverage of resources and capacities; creation of new products; regeneration of resources and capacities for the development of systems that generate innovations (Eisenhardt & Martin, 2000; Vasconcelos & Cyrino, 2000; Bandeira-De-Melo & Marcon, 2006).

In addition to stimulating the evolution to the Resource-Based Theory (RBT), the knowledge-based view (KBV) drew on the RBV, adding the new concept of dynamic capabilities and a relational (inter-organizational) view (Barney, Ketchen & Wright, 2011)

The RBT contributes a discussion of dynamic capabilities that consist of optimizing organizational routines so that they meet the needs of firms’ strategies. These are integrated processes that make use of capabilities to deal with the dynamism of the market.

Their evolution over time can vary depending on the market in the search for and integration of resources to generate new strategies for value creation (Grant, 1996; Helfet, 1997; Helfet & Raubitschek, 2000; Eisenhardt & Martin, 2000; Barney, Ketchen & Wright, 2011).

The concept of absorptive capacity is based on the idea that an organization requires prior and related knowledge in order to assimilate and utilize new knowledge. Research into
the development of memory suggests that knowledge accumulated previously increases the capacity to retain new knowledge in memory, which is known as knowledge acquisition; the capacity to remember and use acquired knowledge (Cohen & Levinthal, 1990; Van Den Bosch, Volberda & De Boer, 1999; Zahra & George, 2002; Lane, Koka & Pathak, 2006).

Absorptive capacity also refers to a firm’s capacity to identify, assimilate and exploit knowledge from external sources (Figure 1). These three dimensions do not only encompass the capability to imitate the products or processes of other firms, but also the capability to exploit knowledge that is less commercially focused, such as scientific investigations (Cohen & Levinthal, 1990; Van Den Bosch, Volberda & De Boer, 1999; Zahra & George, 2002).

Figure 1. Absorptive capacity

Organizations with higher levels of absorptive capacity tend to be more proactive, taking advantage of opportunities that occur in the environment, irrespective of current performance.

However, organizations with little absorptive capacity tend to be reactive, seeking new alternatives in response to a failure measure by some type of undefined performance criterion (Cohen & Levinthal, 1990).

Zahra and George (2002) also adopted a process-based perspective on absorptive capacity, arguing that internal knowledge sharing and integration are critical parts of absorptive capacity. They propose that absorptive capacity should be defined as a dynamic capability, being the set of organizational routines and processes through which firms acquire, assimilate, transform and exploit knowledge. They also suggest that absorptive capacity has
two basic states: potential (external knowledge that a company could acquire and utilize) or realized (external knowledge that a firm has acquired and utilized).

Absorptive capacity is dependent on processes and routines within an organization that make it possible to share, communicate and transfer knowledge (Lane, Koka & Pathak, 2006). The firm must reconfigure and realign its knowledge management capacities in order to adapt to changing environmental conditions, better and earlier than its competitors. The complementary nature of internal and external knowledge processes amplifies further still the need for coordination, which requires integrated knowledge management (Lane, Koka & Pathak, 2006; Lichtenhaler & Lichtenhaler, 2009).

The model illustrated in Figure 2 below has four components. In the center is the new definition of absorptive capacity; to the left are drivers that are partially or totally external to the firm; above and below the center are drivers that are internal to the firm; and to the right are the results of absorptive capacity. The focus of the model is on absorptive capacity, in which arrows indicate the relationships between drivers and their results. The model also redirects attention towards the role of the firm’s environment as a determinant of incentives to invest in absorptive capacity (Lane, Koka & Pathak, 2006).

![Figure 2. Model of the absorptive capacity process](source)

Finally, Chart 1 explores these capacities in terms of the interfaces between internal and external environments and knowledge originating from the processes of exploration,
retention and exploitation, identifying six capacities: inventive, absorptive, transformative, connective, innovative and desorptive.

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<td>Inventive capacity</td>
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| External (Interfirm) | Absorptive Capacity | Connective Capacity | Desorptive Capacity |

Chart 1. Knowledge interfaces  
Source: adapted from Lichtenthaler and Lichtenthaler (2009).

According to Lichtenthaler and Lichtenthaler, absorptive capacity is the capacity an organization has to intentionally create, expand or modify its resource base. Consistent with this definition is the conclusion that firms must develop their knowledge capacities dynamically if they are to profit from open innovation (Lichtenthaler & Lichtenthaler, 2009).

If a firm is to be innovative, it is expected that it will have a minimum set of capacities with which it conducts its core business activities and will attempt to mature and develop to become innovative. Innovation is focused on the process and not on isolated events, encompassing the implementation of changes to products/services, processes and organizational and management systems (Veugelers, 1997; Veugelers & Cassiman, 1999; Schreyoegg & Kliesch-Eberl, 2007; Miranda & Figueiredo, 2010).

Given the importance of external knowledge to industrial innovation, absorptive capacity is an important part of a firm’s capacity to create new knowledge. In contrast with learning-by-doing, through which firms improve what they are already doing, absorptive capacity allows firms to learn to do something completely different (Cohen & Levinthal, 1990; Van Den Bosch, Volberda & De Boer, 1999; Szulanski, 1996; Zahra & George, 2002; Lane, Koka & Pathak, 2006; Lichtenthaler & Lichtenthaler, 2009).

Therefore, the concept of absorptive capacity adopted in this article encompasses activities for acquisition, transformation, assimilation and exploration of knowledge, in which an organization is dependent on the capacity for absorption of its individual members and on the manner in which these capacities are employed in search of organizational efficiency and efficacy.

2.2 Innovativeness
Innovativeness is considered one of the principal methods of achieving a competitive advantage (Hurley & Hult, 1998; Hult & Ketchen, 2001; Martins & Terblanche, 2003; Hult, Hurley & Knight, 2004; Nieto & Quevedo, 2005; Olson, Slater, Tajeddini, Trueman & Larsen, 2006). It is an element of differentiation between one firm and another, which may influence customers when buying from a given company and can also be a determinant of organizational performance. Organizational innovativeness reflects an organization’s tendency to seek out new ideas and, consequently, to develop new products and services (Lumpkin & Dess, 1996). Organizational innovativeness is an organizational characteristic that is part of a company’s culture and reflects its propensity and drive to find new opportunities, thereby generating the capacity to innovate and to generate effective innovations for the company (Subramanian, 1996; Hurley & Hult, 1998).

Damanpour (1991), Hurley et al. (1998) and Garcia and Calantone (2002) define innovativeness as the capacity or propensity of a firm to introduce new processes, products or ideas to the organization.

The word innovativeness is normally used as a measure of the degree of novelty of an innovation (Garcia & Calantone, 2002), but organizational innovativeness can also be seen as a company’s capacity or propensity to innovate or develop new products (Damanpour, 1991; Hurley et. al, 1998; Garcia & Calantone, 2002; Andreassi & Sbragia, 2004).

There is little work in the published literature on the forms of measuring organizational innovativeness, indeed, few studies discuss innovativeness, since the majority deal with innovation itself (Garcia & Calantone, 2002).

Interesting work that has included methods for measurement of innovativeness includes a study by Deshpandé, Farley and Webster (1993), who used a five-point Likert scale and five variables to measure firm innovativeness, and studies by Calantone et al. (2002) and by Tajeddini, Trueman and Larsen (2006), who studied the relationship between innovativeness and organizational performance, with focus on the client, on the competition and on interdepartmental coordination. The last of these studies was conducted with small and medium firms in Switzerland, using a measurement scale with five variables, and was focused on the behavior of people and of the firm.

The term innovativeness has also often been confused with or used as a synonym of the word innovation (Garcia & Calantone, 2002). However, these same authors have been attempting to refine the concepts of innovation and innovativeness in an attempt to reduce problems with interpretation and understanding of these two concepts.
It is clear that there is a need to redefine the concept behind these terms in order to differentiate them. Innovation is normally defined as the final result, i.e. a new product that is launched, whereas innovativeness is recognized as a variable that represents a firm’s orientation, proactivity or inclination towards innovation (Hurley & Hult, 1998; Menguc & Auh, 2006).

According to Damanpour (1987), innovativeness can work to make production cycles leaner, reducing prices and even changing product designs. Seen from the perspective of the theory of dynamic capacities, innovativeness can be considered a value specific to the firm, a complex capability, that cannot easily be transferred or imitated by other firms (Hult & Ketchen, 2001).

One definition of innovativeness is as a company’s cultural disposition, inclination, propensity and readiness to be innovative, test new ideas and abandon old habits (Hurley & Hult, 1998; Hult et al. 2004). Innovativeness implies that a firm is proactive, following certain routines and processes to explore and exploit new opportunities, rather than simply improving its existing resources (Menguc & Auh, 2006).

Damanpour (1991) and Gopalakrishnan and Damanpour (2000) understand innovativeness to be synonymous to the number of innovations, of whatever nature, adopted by an organization in a given period. This is similar to a definition proposed by Hurley and Hult (1998) and Hult et al. (2003), who identified innovativeness as a cultural precursor, that provides social capital for the company as a facilitator of the behavior of organizations that learn, which in turn are focused on understanding creativity and adaptability. McDonald (2002) defined innovativeness as a company’s disposition and ability to adopt new technologies, processes and ideas, thereby supplying unique and new products and services before its competitors.

Menguc and Auh (2006) also claim that for a company to be innovative it must adopt a new mentality, or new attitude, which must be shared and disseminated throughout the organization to be effective. Analyzing all of these characteristics of organizational innovativeness, it becomes clear how intangible the phenomenon is, how difficult to measure and how complex within organizations.

This ambiguous causality, which is characteristic of innovativeness, also makes it more difficult for competitors to understand and imitate, meaning that firms that possess innovativeness achieve sustainable competitive advantages. Firms must constantly reorganize their resources to be able to take advantage of the competitive forces that create barriers to imitation (Reed & Defillipi, 1990).
Deschpandé and Farley (1999, 2000), claim that firms should be innovative to acquire sustainable competitive advantages and thus survive and grow in the market. They conducted research into firms in Shanghai that compete with each other, finding that firms’ success was intimately related to innovativeness and a high level of market orientation, as was an organizational culture oriented to the export market. Organizational culture captures the spirit of innovativeness of a firm (Auh & Menguc, 2005).

2.3 Absorptive Capacity in Innovation Environments

Over recent years, some authors have found solutions for conceptualization of innovation, highlighting the importance of knowledge, as an intangible asset able to guarantee organizations the capacity to adapt to changes that take place in their markets (Davenport; Prusak, 1998; Sveiby, 2000; Takeuchi; Nonaka; 2008).

An approach combining knowledge theory with theory on absorptive capacity allows for identification, dissemination and usability of new knowledge using strategic resources and improving organizational processes. Therefore, the knowledge that firms acquire about innovation, their choices of products and resources and adjustments to costs and governance, are related to their capacity to coordinate and absorb knowledge in order to transform it into actions to achieve objectives (Van Den Bosch, Volberda & De Boer, 1999; Szulanski, 1996; Zahra & George, 2002; Jansen, Van Den Bosch & Volberda, 2005; Lane, Koka & Pathak, 2006).

In this article, knowledge signifies the link that makes up the value chain that is indispensable to innovation, and starts from the existence of a process for training professionals able to perform activities for the creation and sharing of new ideas and new meanings for emerging content within organizations.

Knowledge is what is in the human mind and each organization must make its selection, defining by example what comprises knowledge in that environment in order to create a common language. Knowledge is something truly intrinsic to human beings, it encompasses beliefs and commitments related to action, and its meaning is specific to the context in which it is embedded (Nonaka & Takeuchi, 2008; Nonaka & Von Krogh, 2009).

Innovation, in turn, is the use of new elements or new combinations of elements in the production or delivery of manufactured products or of services (Schumpeter, 1997). Innovations are related to procedures and prescriptions of the process of constructing the product or service, to the creative process, to assembly, to development of the product and the
service that is being sold to the customer (Hauknes, 1998; Veugelers & Cassiman, 1999; Ahuja & Katila, 2001).

Through innovation, new knowledge is created and diffused, expanding the economic potential for development of new products and new productive methods of operating (Ahuja & Katila, 2001; Jansen, Van Den Bosch & Volberda, 2005; Stare & Bucar, 2009).

Innovation springs from a set of market strategies and activities that can be implemented by innovative firms. These strategies include products and strategies for price differentiation, alliances and networks, and the implementation of new categories of personnel, organization and management (Sundbo & Gallouj, 1998; Hauknes, 1998; Gallouj, 2002).

Innovations must be combined with an incessant search on the part of firms to generate new ideas and, to achieve this, it is necessary to construct standards, structures and processes dedicated to the creation, development, sharing and application of knowledge needed for the development of ideas (Leonard-Barton; Sensiper, 1995; Takeuchi; Nonaka, 2008).

Therefore, it can be stated that the success of a firm may lie in the number and degree of innovations implemented, or in its innovativeness, which is related to the capacity a company has to engage with new ideas, introducing them into its organization. This capacity could be one of the most important factors that have an influence on positive performance of organizations (Porter, 1990; Schumpeter, 1997; Hurley, Hult & Tomas, 1998).

The process of innovation is therefore itself related to the process of knowledge management, which is why organizations must seek out new knowledge, with an effective management process and individuals competent in the execution of their activities (Sordi & Azevedo, 2008).

Management need to organize those activities that generate knowledge, creating value and seeking creative solutions for the organization, thereby improving the organization’s production process (Nonaka & Takeuchi; Nonaka & Von Krogh, 2009, 2009).

Innovations can be classified into innovation types: product innovations are related to changes in the characteristics or composition of products or services; process innovations affect the means of production or distribution; organizational innovations are new ways of managing business, both with relation to the internal and the external environment; and marketing innovations are changes in the design, packaging and pricing of products and creation of new markets (Schumpeter, 1997; Oecd, 2005; Tidd, Bessant & Pavitt, 2008).
This study analyzes organizational innovation from the perspective of its potential for generation of new ideas from the organization’s capacity to generate knowledge. The RBV analyzes the resources and competencies of organizations - as intangible assets in the case of knowledge - and how firms should manage to differentiate themselves and remain competitive over the long term (Wernerfelt, 1984; Peteraf, 1993; Barney, 1991; 2001).

The capacities to explore and exploit external knowledge are important components of innovative capacity, and this knowledge is processed through activities that understand or recognize the value of the new information: assimilation and application of new knowledge for commercial ends (Cohen & Levinthal, 1990; Zahra & George, 2002; Jansen, Van Den Bosch & Volberda, 2005; Lane, Koka & Pathak, 2006).

3 APPLICATION OF ABSORPTIVE CAPACITY AND INNOVATIVENESS IN A TECHNOLOGY PARK

Innovation can be defined as the transformation of an idea into a product or service that can be sold on the market, a new or improved manufacturing or distribution process, or even a new method of providing a service to society (Schumpeter, 1997; Oecd, 2005; Tidd; Bessant; Pavitt, 2008).

This transformation may involve an adaptative network of organizations that answer to a variety of formal and informal rules, standards and procedures – a national innovation ecosystem, i.e., a technology park, which should be responsible for training people and business entities with the objective of creating knowledge and collaborating on promotion of new products and services for the market.

Returning to the research question posed earlier in the article: How does the absorptive capacity of a technology park contribute to the innovativeness of the firms it hosts?, the answer lies in the park’s capacity to provide an intelligent management system capable of conferring a competitive advantage on its member firms that arises from professional qualifications and the creation of new products and services that meet society’s demands.
The view that the capacity to create an innovative environment allows hosted firms to achieve better performance is supported by work by Cohen and Levinthal (1990), who showed that organizations with advanced absorptive capacity practices tend to be more proactive, to the extent that they take greater advantage of market opportunities and achieve better performance.

Zahra and George (2002) also take a similar position, suggesting that effective absorptive capacity promotes knowledge sharing in the organization, resulting in an integrative, dynamic and innovative environment.

Of the many different characteristics of a technology park that could be analyzed with the intention of understanding its absorptive capacity, the most important are external and internal knowledge that exists in the industry; organizational competencies; process flows; the environmental conditions of the industry; and business strategies.

From this perspective it is considered that the absorptive capacity of a technology park is capable of fostering innovativeness in its member firms and that the result of this action in common is the generation of new ideas for development of processes, products and services focused on the interests of society.

Based on the synthesis and comprehension of the theory expounded in this article, a theoretical framework (Figure 3) is presented that supports all of this article’s analysis and development.

This diagram is intended to synthesize the relationships that exist between absorptive capacity and the innovativeness of both the technology park and of the firms it hosts, in such a manner that application of this model to empirical settings will make a theoretical contribution and aid future studies conducted into similar subjects.
The theoretical model demonstrates how integration of internal processes with acquisition of external knowledge can lead to more innovative services and products and allow firms to create competitive advantages that can be sustained over the long term.
Environments that are favorable to technological development, in this specific case the environs of a technology park, can accelerate the search for innovation, since knowledge transfer and the innovative environment generated by the integration of firms can stimulate the search for new products and services and improvements in processes and greater investment in research and development, i.e., generation of organizational innovativeness.

The absorptive capacity of technology parks allows firms to acquire new external knowledge and use it to “do things differently”, i.e., to be more innovative.

In this context, firms can also develop their own absorptive capacity in strategic areas, improving their learning processes, achieving better results and superior organizational performance.

Investing in absorptive capacity implies developing skills in the processes of acquisition, assimilation, transformation and application of knowledge acquired externally and applied to processes of innovation focused on cooperation with organizational R&D.

Finally, the absorptive capacity of a technology park seeks to promote activities to stimulate inter-firm knowledge transfer in such a way that the entire management capacity developed within the park can generate a more innovative organizational environment populated by firms that are encouraged to be creative and, also as a result of this integration, stakeholders including civil society, public actors and private firms can benefit from products and services that are more innovative and better suited to the collective interest.

4. REFERENCES


