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Innovation networks: From technological development to business model reconfiguration

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Abstract

This case study presents an example of how a technological innovation network provides the necessary resources to change the business model, in order to achieve global competitiveness. It describes the R&D investments of a family-operated business that supplies the aluminum industry with metals and non-ferrous metal alloys. Seven years ago, when the company was facing a severe financial crisis, it ignited a "re-birth" process through research activities, which developed a product known as "aluminum tablets". The company established changes and brought product innovations by introducing tablets from steel scraps with aluminum alloys through "water atomization" technology. The impact of this innovation was not limited to the new product's technological aspect, but it also changed the company's operational and commercial activities, which ultimately resulted in a more comprehensive customer base focused in foreign trade. The present work appraises the evolution and development of this product, supported by a theoretical reference focused on innovation networks and business models.

Keywords: Innovation networks; R&D; Business model

1. Introduction

The importance of innovation on competitiveness is well recognized. However, there is less consensus about what enables an organization to innovate.

In the last 25 years, by means of research the sources of competitive innovation in inter-companies cooperation networks have been analyzed. For Dosi, international competitiveness and macroeconomic performance are functions of an innovation-based commerce and long-term innovation abilities (Dosi, 1982). And Chesnais concludes that a country's long-term competitiveness depends on virtuous and cumulative interactions among different industries in the form of cooperative agreements and inter-companies technological alliances, in order to improve technological diffusion (Chesnais, 1991).

Empirical findings support such statements. Based on studies concerning the economic performance of the region of Emilia-Romagna, in Italy, Best states that new models of global competition rely on the innovative performance of inter-firms networks (Best, 1990).

Innovation networks are a logical effect from the increasing complexity of innovative products and services. New products are complex, because they have many features and components, and also because they must satisfy multiple requirements in the complex business environment. This increased product complexity demands the integration of a broad number of different specialized skills. In this sense, innovation networks represent an organizational solution for product and service innovation, since they integrate different organizational skills favorable for a common goal (Pyka and Küppers, 2002).

1.1. Innovation

The term "innovation" is precisely defined in the academic literature. Freeman (1982) differentiates innovation from

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invention since invention is the idea or the model with which to improve a product, equipment, process or a system. On the other hand, innovation, in the economic sense, only occurs after the first commercial transaction resulting from this new product, equipment, process or system.

Different innovations may require quite different organizational efforts and may result in a multitude of competitive impacts. Thus, innovations may be categorized in an organized typology. For the purpose of this paper, two innovation types are analyzed: incremental and disruptive innovations.

Incremental innovations utilize current technology in the current market to strengthen current competencies. This type of innovation generates value by accumulative effect and by creating versatility (Abernathy and Clark, 1985).

On the other hand, disruptive innovations frequently begin in limited markets, but, after technological improvements, they substitute current technologies and simplify the product and the value proposition (Christensen et al., 2004).

1.2. Innovation networks

In the 80s, Industrial Economy theories influenced innovation research, which theorized the structural factors determinative of the innovative activities in a company (Porter, 1983). Those studies found that the ability to establish relationships in a network of organizations was a key issue, in order to develop a company's organizational innovative capacity.

Another argument for innovation networks came from the successful performance of Japanese companies. In the 80s, Nissan, Toyota and Mitsubishi built many strategic alliances with other organizations. Those alliances improved significantly the learning abilities of these Japanese companies from the interactions with their network members (Rycroft and Kash, 2004). The authors define "networks" as the linkages between organizations (other companies, universities and regulatory agencies), in order to create, capture and integrate the many different skills and knowledge needed to develop complex technologies and bring them into the market.

The Confederation of British Industry, conducted a research on the innovation best practices in British companies and found that the innovative enterprise seeks collaboration with other companies and universities, in order to maximize its knowledge and minimize its risk along the innovation process (CBI (Confederation of British Industry)/ DTI, 1993).

In Zimbabwe, the performance of innovation networks for four light engineering small and medium enterprises depended on the organizational capacity to learn and on the entrepreneur's education level and previous employment experience in big corporations. Moreover, in order to improve products and to design new products, the networks with Enterprise Support Organizations were as important as networks with customers (Chipika and Wilson, 2005).

In France, the development of environment-friendly viticulture utilized two different types of innovation networks: networks to construct common knowledge and social identity and networks to gather fast solutions for specific problems (Chiffoleau, 2005).

In Europe, small and medium size companies in the electronics hardware-based sector use almost twice as much of their R&D expenditures in partnerships than large firms do. However, these small and medium size companies are more cautious when choosing partners, because half of the partnerships fail and those companies do not have abundant resources to overcome unsuccessful projects (Narula, 2004).

In Taiwan, the high technology industry resulted from the development of an innovation network integrating a research institute, the government, universities, industrial companies and international organizations (Hsu, 2005).

In Japan, Mitsubishi and DoCoMo developed a new mobile multimedia market for a mobile videoconferencing platform. For this development, innovation networks allowed these companies to obtain both fast access to relevant knowledge and the synthesis of knowledge domains, which were created in long time periods by the departments of each company involved. For this purpose, it was necessary first to integrate each corporate capability internally and then, to reciprocally integrate the capabilities of both network partners externally (Kodama, 2005).

Other researchers have studied how innovation networks operate in reality. For this purpose two perspectives are of special interest for empirical studies: analysis of the relationship structures inside an innovation network and analysis of the dynamic and systemic behavior of a network along the innovation process.

Ahuja studied how relationship structures in cooperative networks impact innovation measured by patent number in the chemical industry. He found that direct relationships play a very different role in the innovation process than indirect relationships do (Ahuja, 2000).

A direct relationship is the access one organization has into another organization without the intermediation of a third part. On the other hand, indirect relationships occur when an organization obtains access to many other organizations through the intermediation of a third organization. Ahuja demonstrates that direct relationships are suitable for resource and knowledge interchange, while indirect relationships are suitable for quick access to specific information.

Pyka and Küppers developed a dynamic and systemic model to analyze the behavior of innovation networks throughout the innovation phases. Based on four case studies in the biotechnology, telecommunication, energy and e-commerce industries, they developed a computational model with which to simulate innovation networks. The dynamic model analyses the interdependencies of the