The role of information technology for building virtual environments to integrate crowdsourcing mechanisms into the open innovation process

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ABSTRACT

Information technology enabled the development of the virtual environment, allowing collaboration with external agents and leveraging the open innovation process. Crowdsourcing is an example of this new environment, using collaboration to enhance capabilities and relationships and as a way to accelerate innovation. However, companies are still searching for the best way to apply the crowdsourcing to internal processes to create value. Based on this context, the general objective of this research is to analyze how Brazilian companies have integrated crowdsourcing mechanisms into the open innovation process. To achieve the objectives, case studies conducted in two Brazilian organizations from different sectors were applied. The results contribute to a better understanding of the adopted *crowdsourcing* mechanism and the adequate technological aspects that enable the operation of the open innovation process.

1. Introduction

Organizations today are interested in exploring social media as a way to improve the trajectory from innovation to commercialization. Intensive adoption of the internet changed the behaviour of communication and relationships, and companies are becoming more and more open to novelty and innovation. Customers can engage in product development processes, playing an active role in co-creation in many different ways (Berthon et al., 2007). Internet crowdsourcing is emerging as an electronic platform that can represent a virtual space for the development of capabilities and relationships, and as a means to accelerate innovation, new management practices and economic development. It can also be considered as an alternative way to work in mass collaboration (Howe, 2006; Steelman et al., 2014, PRPIĆ et al., 2015). Giving this context, the real challenge is how to use collaboration in order to achieve better results and improvement of internal processes, productivity and performance in business. Palacios et al. (2015) discuss emerging trends in crowdsourcing design, mechanics of organization, and form and motivation of the crowd. Mladenow et al. (2014) mention the need for more in-depth research on how company social crowd integration will occur in order to foster the open innovation paradigm on the internet.

Addressing this research gap, the following research question was formulated to conduct this study:

How do companies integrate the concepts related to crowdsourcing for open innovation and information technology?

Thus, the study aims to identify and to describe key variables related to crowdsourcing settings adopted by the companies and the integration of these variables into the open innovation process.

The study is divided into the following topics: an approach that underlies the concept of open innovation; the combination of crowdsourcing and open innovation; and the technological aspects that support virtual environments involving crowdsourcing. These three topics are covered in the theory and constitute the base for the development of framework research applied to the case study. Finally, the following topic encompasses the methodological procedure and the discussion of research results.

2. Theory

Ubiquity is an important characteristic of the internet making it a technology that is capable of aggregating millions of different ideas (Brabham, 2008; Surowiecki, 2005; Tapscott and Ticoll, 2003). Interactivity allows for increased quality in the relationship with customers, creates new paradigms for the design of products/services and enables new coordination mechanisms between organizations and their customers (Dutta and Segev, 1999). In addition, it brings new opportunities for companies to improve their internal operations and to collaborate

with their customers, business partners and suppliers through collaboration platforms and social media applications (Culnan et al., 2010).

McAfee, 2006mentions the emergence of a new wave of business communication tools, including blogs, wikis and group messaging software – which the author calls Enterprise 2.0 – that allow a more spontaneous, knowledge-based collaboration. In this context, technology gives access to experience and shared knowledge while facilitating meetings among team members to deliver the most creative ideas. Collaborative environments will orchestrate the interaction in networks of employees, partners and customers to stimulate creativity and innovation. Social networks as active participants in the production of change (blogosphere, podcasting), e-collaboration between company and customer to offer value for each, ubiquitous technologies, and Web 2.0 are some forms for improving the customer's participation in the product development process and to leverage open innovation.

2.1. Open innovation

Chesbrough (2003a, 2003b, 2006) introduced the term "open innovation", indicating that companies may and should look for new ideas and technologies within and without the company boundaries. "Open innovation" is a term given to organizations that promote open ideas, thoughts, processes, and research in order to improve the development of their products, provide better service to customers, increase efficiency and enhance the added value. Chesbrough (2003a, 2003b) considers open innovation as rare ideas that may arise internally or externally to the organization and that generate innovation for the company's products, services, and processes. Shamah and Elssawabi (2015) argue that for Supply Chains in the process of applying or considering to apply open innovation – as almost every company can implement open innovation but only to a limited extent, as the degree of openness always has to be considered.

According to Mortara et al. (2009), in open innovation processes, the organizational boundaries become non-existent, and company interaction with external means (universities, research laboratories, customers, expositors, venture capital companies, etc.) is raised. This opening of the innovation process therefore requires the creation of organizational mechanisms to encourage external collaboration. The organizational features, or the principles of this model, can be identified:

- Senior management plays a significant role for organizational changes; cohesion and strategic alignment of many of the company's functions are important to establish successful open innovation;
- Structures and specific measures are designed to promote and evaluate the opening of the innovation model;
- Independent business units of open innovation are designed with multifunctional teams or independent R&D units dedicated to research activities;
- Organizational functions are defined, for instance, by people who manage the interface between the company and its external environment;
- Incentive systems are created that must include more open goals and metrics;
- A network of partners is established in the early phases of the innovation process, encouraging the acquisition of external knowledge;
- Establishment of an inter-organizational network to probe new fields of knowledge that are different from those traditionally used;
- Definition of mechanisms to facilitate knowledge exchange and protect companies from opportunistic behaviour;
- Coordination and centralization of activities is also essential to the functioning of an open model.

Despite the positive perception of open innovation, there are still gaps in the comprehension of how to operate the concepts. There is also a lack of effective assessment systems to evaluate open innovation compared to the closed approach (Huizingh, 2011). Other barriers for the implementation of open innovation, such as the inherent complexity of organizing a variety of partners that may use different governance modes, different cultures, and the "not invented here syndrome", are also identified among the deterrent factors (Chesbrough, 2006; Lichtenthaler, 2008; van de Vrande et al., 2006).

Many are the types of openness in the literature. Dahlander and Gann (2010), for example, mention two types of opening: (i) information output – when companies reveal information or sell technology to the external environment; and (ii) information input – when companies turn to external sources (out of their own laboratories and R&D facilities). Geum et al. (2013) argue that there are many types of open innovation with distinct perspectives but common characteristics. Among them, the following are mentioned: co-creation with customers; acquisition of external knowledge; purchase of patents and R&D collaboration, which is the involvement of external networks in co-development of new products or technologies; and acquisition or purchase of joint developments.

In this context, Ahonen et al. (2007) argue that crowdsourcing may be a way to implement open innovation strategies – hence, the use of web-based communities to access the capacity of knowledge and innovation not available through traditional hierarchy and market relations. This topic is discussed in the next section.

2.2. Crowdsourcing and open innovation

Estellés-Arolas and González-Ladrón-de-Guevara (2012) argue that 'crowdsourcing' is a recent term with various definitions. These authors provide a broad definition that covers most of the existing processes of crowdsourcing: the crowd, the task at hand, the recompense, the crowdsourcer or initiator of the crowdsourcing activity, what is obtained by them after the crowdsourcing process, the type of process, and the call to participate.

Bücheler and Sieg (2011) mention that crowdsourcing and open innovation are two terms that influence various research fields. Ebner et al. (2009) argue that the main issue related to crowdsourcing and open innovation is "how to find and leverage the enormous potential of the 'collective brain' to broaden the scope of 'open R&D'".

Bediaga Escudero (2007) mentioned three types of collective intelligence in open innovation processes:

- Contest: creation of the best solutions to the real problem;
- Collection: there is no competition between users and only exchange of information without getting to collaborate to arrive at the solution of the problem;
- Collaborative practices: aim to create ideas, products or services in a joint and coordinated way.

In this way, based on the concept of collective intelligence, crowdsourcing seeks "the massive participation of volunteers and the application of principles of self-organization, by substituting selective contracts and training a specific workforce". Ye et al. (2012) discuss crowdsourcing oriented towards innovation and mention that it occurs when a company outsources specific tasks in the form of an open call. Other crowdsourcing tasks include product design, publicity, quality and technical troubleshooting.

Based on Majchrzak and Malhotra (2013) and on Malhotra and Majchrzak (2014), the concept of innovation in a crowdsourcing context consists of the public generation of ideas or solutions for the problem posed by the company that sponsors the challenge call.

Crowdsourcing describes the process by which the power of many can be used to perform tasks that were previously carried out by a few experts (Howe, 2006). The term was used for the first time by Howe (2006), in an article called "The Rise of Crowdsourcing", in which the advances in web-based collaborative platforms are cited as a tool to