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Relationships among open innovation, innovative performance, government support and firm size: Comparing Brazilian firms embracing different levels of radicalism in innovation

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ABSTRACT

This work extends knowledge concerning the relationships among open innovation, innovative performance and government support for innovation within Brazilian firms. Data were obtained from two different firm samples (Sample A, on incremental innovation, and Sample B, on radical innovation). The main research results are as follows. First, in considering government support for innovation, Sample B, based on radical innovation, played a superior and stronger role than Sample A. Secondly, for both samples, the cooperation of external firms has a positive effect on firms' innovative performance, which was positively controlled by the size of the firms. Thirdly, in general, radical innovation requires synergy and a more intense focus regarding the constructs considered therein. This work also adds value in methodological terms, as this is the first research to have tested different models of samples with different levels of radicalism in innovation.

1. Introduction

This article aims to answer unresolved questions concerning open innovation (OI), as well as its impact on both incremental and radical innovation performance. What are the effects of internal and external organizational boundary collaboration on these two forms of innovation performance respectively? What moderating role does government support play in the relationship between internal and external organizational boundary collaboration and radical and incremental innovation performance?

Because of its potential to intensify internal and external knowledge flows in order to improve the process of innovation, the OI approach proposed by Chesbrough (2003b) has attracted attention from professionals and researchers concerned with the topics of innovation and technology management (e.g., Laursen and Salter, 2006; Trott and Hartmann, 2009; Randhawa et al., 2016). Several publications seek to demonstrate the main practices that companies operating in different countries and economic sectors adopt in order to operationalize OI (Van de Vrande et al., 2009; Cheng and Huizingh, 2014). Other studies show the influence of relationships between the application of OI practices and firm performance (Burcharth et al., 2014; Greco et al., 2015; Rubera et al., 2016). However, conclusions regarding the nature of the relationship remain uncertain (Cheng and Shiu, 2015). There is a lack of research analyzing and comparing the boundaries of collaboration and their influence on radical and incremental innovation. In addition, a lesser-known aspect is government support and its moderating role in the relationship between organizational boundary collaboration and innovation performance.

Drawing a comparison between companies that have developed incremental and radical innovation respectively is justified because studies in innovation management (e.g., Chang et al., 2012; Cheng and Shiu, 2015; Inauen and Schenker-Wicki, 2015) have shown that these two forms of innovation effort require different management practices, capabilities and organizational components (Bessant et al., 2010; Büschgens et al., 2013; Salter et al., 2014b). We will refer to internal and external organizational boundary collaboration as simply internal collaboration (IC) and external collaboration (EC).

In view of these gaps, to address the lack of literature with respect to this subject, the objective of the present article is to address the influence of organizational boundary collaboration on innovation

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performance in companies with both radical and incremental innovation, as well as in companies with incremental innovation alone. In addition, the study aims to verify the moderating role of government support and company size in innovation performance in an emerging market environment. To achieve this objective, a quantitative survey was conducted of a sample of 116 firms belonging to innovative sectors in Brazil (IBGE, 2013), such as electronics, industrial automation and telecommunications. Of these firms, 63 declared that they developed only incremental innovations (Sample A), while 53 firms declared that they have developed radical innovations (Sample B).

Furthermore, research on this topic is almost exclusively based on studies of North American, European and Asian firms (e.g., Chesbrough, 2003a; Van de Vrande et al., 2009; Cheng and Huizingh, 2014). Few studies have been published on this topic on firms operating in Brazil (Nagano et al., 2014) and fewer still in South America as a whole. Brazil invests a superior percentage of its gross domestic product (GDP) in activities related to R&D when compared with other Latin American economies, but it performs poorly in relation to developed countries when data related to the number of patents are taken into account (Esteves and Feldmann, 2016). In analyzing this divergence, one notices that technology acquisition is the most important innovation strategy in Brazil. Overall, locally-based firms are considered to be more innovative in terms of processes innovation than in new product innovation, which tends to require highly skilled and qualified workforce (Goedhuys and Veugelers, 2012). Another possible explanation for this situation is that the economic sectors in which Brazil specializes are in the commodity industries.

Government economic intervention intended to foster OI and growth was also an integral part of a national project involving public policies implemented by several government agencies in Brazil. Rocha (2009) and Lisboa and Latif (2013) argue that the Brazilian government's interventions aim to protect the national industry and have been viewed as a mechanism to induce economic development through import substitution strategies and quotas for local content. In addition, more recently, the Brazilian government has stimulated technological innovation and a more open ecosystem for innovation in the country through specific laws involving public incentives for innovation, such as the Innovation Law (Matias-Pereira and Kruglianskas, 2005; Fabiani and Sbragia, 2014). We therefore had an opportunity to assess whether or not government intervention truly plays a role in the different types of innovation performance.

To address these issues, this article first presents its theoretical model and research hypotheses. Second, it presents and justifies the methodological procedures used in this study. Third, the results from the companies that participated in this survey are presented. Fourth, a discussion of the implications, conclusions, limitations and future research proposals is provided.

2. Conceptual background

2.1. Incremental and radical innovation and open innovation

Baregheh et al. (2009) define innovation as a multi-stage process in which organizations turn ideas into new or improved products, service or processes in order to advance, compete and differentiate themselves in their market place. Innovations may require different efforts and can therefore be classified using a typology (Mol and Birkinshaw, 2014). Two basic types of technological innovation can be distinguished (Van de Ven et al., 2000; Garcia and Calantone, 2002; Bessant et al., 2010): incremental and radical (or continuous and non-continuous). Incremental innovation can be characterized by improvements leading to minor technological changes, causing a minor differential in the value realized by the customer. Radical innovation incorporates a substantially different technology and fulfills novel emerging customer needs (Van de Ven et al., 2000; Forés and Camisín, 2016).

Previous work (e.g., Teece, 2007; Salter et al., 2014b) suggests that incremental and radical innovations require the adoption of different management practices and capabilities. For Veryzer (1998) and Bessant et al. (2014), it is not clear whether management practices associated with incremental innovations are similarly applicable to radical innovations, or whether certain traditional practices may prove unproductive in the context of radical innovations. The results of research by Fóres and Camisón (2015) indicate that large companies are focused on incremental innovation rather than radical innovation. According to these authors, this focus occurs because large firms often seek to solidify their market positions and therefore apply incremental innovations more frequently. This finding does not mean that small companies are focused on high growth sectors, but the stronger evidence for innovation originates from small, young, high-growth, companies (Mazzucato, 2011).

OI activities have an inconclusive impact on incremental and radical innovation performance (Cheng and Shiu, 2015; Greco et al., 2015). Tödtling et al. (2009) found that firms that introduce radical innovations cooperate more often with external linkages, such as universities and research organizations, while those that have introduced less advanced innovations rely more on internal linkages. Firms with OI strategies tend to combine technology exploration and exploitation (Van de Vrande et al., 2009). Gobbo Junior and Olsson (2011) suggest that, while exploration involves radical innovation, exploitation involves incremental innovation in which strong ties are needed to support the exploitation of innovations, leading to strong internal collaborative activities.

Compared to incremental innovations, the development of radical innovation requires more intense application of organizational components, such as cross-functional development teams, organizational structures oriented towards innovation and the involvement of senior management in the innovation process, among other aspects (Mol and Birkinshaw, 2014; Büschgens et al., 2013; Salter et al., 2014b). Because of the need to transform invention into development, the integration of different functions of the organization is a relevant aspect of the development of radical innovations (Griffin et al., 2014).

Despite these differences, few studies compare radical and incremental innovation efforts with the collaborative relationships proposed by the OI approach. One of these studies, by Chang et al. (2012), found that openness capability, or the firm's ability to search for diversified sources of creative ideas from external, distant and wider orientations, increases radical innovation performance. Chiang and Hung (2010) noted that, while a limited number of external channels can facilitate incremental innovation, the broad range of external channels can enhance the innovating firm's radical innovation performance. Inauen and Schenker-Wicki (2015) recognize that inside-out OI has a significant impact on innovation performance and is more likely to create radical innovations.

Cheng and Shiu (2015) found that a company's ability to obtain and exploit the knowledge of external partners enhances its radical innovation performance. However, this situation hinders the company's incremental innovation performance. Rubera et al. (2016) found that, when complemented by market information and the strong involvement of the R&D department, OI practices positively influence the number of new-to-firm products that firms develop and introduce to markets.

2.2. Internal and external collaboration and open innovation

OI has been researched from several perspectives (Oakley, 2012; Randhawa et al., 2016), industrial contexts (Ozman, 2012) and using different levels of analysis (Bogers et al., 2017). Therefore, Bogers et al. (2017) propose a theoretical framework that compares the five levels of analysis in OI. Considering the objectives of this research, we investigated the following levels of analysis: intra-organizational (issues such as employee participation and organizational culture in OI activities), and extra-organizational (addressing the involvement of external