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How firms collaborate with public research organizations: The evolution of proximity dimensions in successful innovation projects

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ABSTRACT

Although public research organizations (PROs) are potentially valuable collaboration partners for firms in the development of innovations, most firms find it difficult to develop and sustain fruitful collaborations with PROs. Proximity dimensions, such as geographical, cognitive, organizational, and social proximity, are important facilitators of inter-organizational collaboration. Nevertheless, our understanding of the interaction between and evolution of different proximity dimensions over time is limited. Based on a longitudinal study of 15 successful innovation projects involving firms and PROs as collaboration partners, we find that different proximity dimensions are important for the establishment of new collaborations, depending on a firm's characteristics. While engineering-based firms tend to rely on geographical and social proximity to PROs, science-based firms rely more heavily on cognitive and organizational proximity. Moreover, we observe that firms with initial social and geographical proximity to PROs can sustain and expand their collaborations by developing cognitive and organizational proximity over time.

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1. Introduction

Although most firms recognize that they must develop new or improved products, services, and processes to remain competitive, innovation is a difficult task (Katila & Ahuja, 2002). Indeed, many firms struggle to develop innovations that extend beyond their existing knowledge, technology, and competences (Stuart & Podolny, 1996). External knowledge sources are thus an important supplement to firms' internal knowledge bases and are often critical to the development of innovations. Hence, different types of alliances, partnerships and collaborations can play a crucial role in improving firms' innovation performance (De Fuentes & Dutrenit, 2012; Nieto & Santamaria, 2007). Our understanding of how companies can access, use, and manage external knowledge successfully in their innovation processes is nevertheless underdeveloped.

An important external source of knowledge in the development of innovations is universities and other public research organizations (henceforth PROs). PROs play a crucial role in R&D and innovation across a wide range of industries (Cohen, Nelson, & Walsh, 2002), and the importance of PROs as a source of external knowledge is increasingly emphasized in the literature (Fabrizio, 2009). The role of university–industry links in innovation has been extensively studied,

but the organizational dynamics underlying these relationships are not well understood (Perkmann & Walsh, 2007).

In this paper, we examine how firms can establish and sustain collaborations with PROs in the development of innovations. Although PROs and universities are a potentially valuable source of new knowledge, absorbing this knowledge is challenging for firms (Cohen & Levinthal, 1990), as evidenced by the many unsuccessful attempts at knowledge transfer between universities and firms (Santoro & Bierly, 2006). The challenge of such knowledge transfer often relates to the development of trust and the establishment of a common understanding in communications and interactions between firms and academics. An emerging body of literature indicates that different dimensions of proximity play an important role in explaining inter-organizational collaborations (Knoben & Oerlemans, 2006) and facilitating interactions between firms and academia (Boschma, 2005; D'este, Guy, & Iammarino, 2012).

In particular, the literature describes the dimensions of proximity that facilitate the formation of collaborations, whereas less attention has been given to the interplay and evolution of different dimensions of proximity over time (Balland, Boschma, & Frenken, 2014; Mattes, 2012). Hence, we pose the following research question: *How do different dimensions of proximity facilitate successful collaborations between firms and PROs, and how do these dimensions evolve over time?*

The literature on inter-organizational knowledge transfer is dominated by quantitative studies, which are often based on data from single informants representing one partner in an alliance relationship

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(Meier, 2011). Hence, we have extensive knowledge about the characteristics of successful collaborations, but the development process of such collaborations and the underlying mechanisms and processes of collaboration remain largely unexplored (Balland, 2011). Differences in firm characteristics and knowledge bases likely influence the role of different combinations of proximity dimensions (Mattes, 2012). We focus on two types of firms, science-based firms and engineering-based firms (Autio, 1997), to examine whether these two groups of firms benefit from different combinations of proximity dimensions to establish and sustain successful collaborations with PROs. This study builds on data uncovering the history of 15 successful technological innovation projects conducted by firms of varying size and age.

Our paper makes several contributions to the literature. Most prior research on the role of proximity in inter-organizational collaborations has been cross-sectional and quantitative in nature and has examined the factors that lead to the establishment of collaborations (e.g. Hansen, 2014; Huber, 2011). By contrast, our in-depth qualitative study considers the development process of successful collaborations and thus reveals how collaborations emerge and evolve over time. Moreover, by using innovation projects rather than firms as the unit of analysis, we obtain more precise information on specific collaborations. Firm-level studies overlook the fact that the same firm may have both successful and unsuccessful innovation projects involving a variety of collaboration partners, and they may therefore miss important dynamics in the collaborations. By differentiating between science-based and engineering-based firms, we show that the role of proximity in innovation depends on contextual factors.

In particular, we extend research on proximity by noting the important role of social and geographical proximity in firms' ability to establish collaborations with external partners that are cognitively and organizationally distant. Moreover, we show how firms actively build successful collaboration by becoming more proximate to PROs on the cognitive and social dimensions. Our research thus contributes to a more precise understanding of how different dimensions of proximity are related, how they develop over time, and under what conditions the proximity dimensions facilitate collaboration projects between firms and PROs to develop innovations.

The paper is organized as follows: Section 2 outlines our theoretical framework. Section 3 presents the methodological approach. Section 4 presents our findings and propositions. Finally, Section 5 contains our conclusions and the implications of our research for further research and practice.

2. Theoretical framework

2.1. Firm–PRO collaboration for innovation

Firms that seek to involve external actors in their innovation processes face the paradox that the types of actors that are likely to provide the most complementary knowledge are also the most challenging actors to work with. Collaborations between firms and PROs illustrate this paradox. On one hand, PROs are valuable collaboration partners, and firms that collaborate with PROs are more likely to develop innovations than other firms (Howells, Ramlogan, & Cheng, 2012). PROs possess technological expertise and knowledge that can be a valuable input in firms' innovation processes. In particular, PROs can facilitate organizational learning and new knowledge creation (Hardy, Phillips, & Lawrence, 2003). On the other hand, most firms find it difficult to collaborate with PROs, particularly universities. Business organizations and PROs pursue different goals; therefore, they are structurally different from each other in many ways, such as in their incentive structures and management styles. Various orientation- and transaction-related barriers thus impede firm–PRO collaboration (Bruneel, D'este, & Salter, 2010). These differences often prevent firms from using PROs as sources of external information in the innovation process, and firms generally

rate PROs very low as information sources and potential partners (Howells et al., 2012).

The ability to use external actors in the innovation process has been linked to a firm's absorptive capacity, which is defined as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen & Levinthal, 1990). A key feature of the absorptive capacity perspective is that collaboration with external actors depends on the level of prior related knowledge between the firm and the collaboration partner. A firm's absorptive capacity is thus higher when its partners are similar and when they possess similar knowledge bases (Luo & Deng, 2009). Although firms are better able to collaborate if their partners are similar, partners that are too similar may not be able to provide resources and knowledge that are sufficiently heterogeneous to facilitate the development of innovations (Nooteboom, Van Haverbeke, Duysters, Gilting, & Van Den Oord, 2007).

2.2. The proximity perspective

To better understand how firms can accumulate knowledge from collaborative PROs, we rely on the proximity perspective. The proximity literature has developed a fine-grained framework for understanding different aspects of inter-organizational collaboration, suggesting that different dimensions of proximity can facilitate successful inter-organizational collaboration (Boschma, 2005; Knobens & Oerlemans, 2006). Proximity is an important condition for collaborative innovation performance, and different proximity dimensions contribute to firm–PRO interaction and knowledge transfer in different ways (Boschma, 2005). To understand the factors behind the process of interaction and knowledge transfer, proximity is crucial because it promotes trust and understanding in complex and high-risk innovation projects (Menzel, 2008). The literature offers many different dimensions of proximity that may affect collaboration and innovation (Boschma, 2005). Our focus is in line with Broekel and Boschma (2012), who examines the role of geographical, cognitive, social, and organizational proximity in innovation performance.

Geographical proximity refers to territorial or spatial proximity (Broekel & Boschma, 2012), and it promotes knowledge transfer and innovation because it facilitates face-to-face interactions among collaborative partners (Knobens & Oerlemans, 2006). Research has well established that firms tend to collaborate with geographically close universities and PROs (Slavtchev, 2013). A study of university–industry collaborations suggests that geographically proximate links are more likely to facilitate innovation and learning effects within firms (Broström, 2010). Moreover, geographically proximate interaction is related to successful R&D projects with short times to market, whereas such interaction is generally considered less critical for long-term R&D projects (Broström, 2010).

Cognitive proximity refers to similarities in the way that actors perceive, interpret, understand, and evaluate the world (Nooteboom et al., 2007). To communicate and transfer knowledge effectively, actors require similar frames of reference (Knobens & Oerlemans, 2006). Firms must have comparable knowledge bases to be able to recognize the opportunities created by collaboration but must have fairly diverse specialized knowledge bases to utilize that knowledge effectively and creatively (Colombo, 2003). Partners' technological relatedness has an inverted U-shaped relationship with innovation value in the context of university–industry collaborations (Petruzzelli, 2011).

Organizational proximity refers to shared relations within or between organizations, and it is advantageous for innovation networks (Boschma, 2005). This dimension of proximity is supported by common rules and routines in organizations (Torre & Rallet, 2005). Arguably, significant organizational distance exists between industrial firms and PROs. Firms and PROs have different purposes and experiences, and considerable tension may exist between academic and commercial orientations. Firms with employees holding PhD employment is fond

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