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The impact of R&D sources on new product development: Sources of funds and the diversity versus control of knowledge debate[☆]

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ABSTRACT

We build on the knowledge-based view to study the relative impact of alternative R&D sources on innovation performance. We contrast two arguments that have created a debate in the literature: One is that diversity of knowledge is better for innovation, because the integration of a larger variety of knowledge helps create new products that can fulfill unmet customer needs; another is that control of knowledge is better, because the incentives and contextual system of the firm facilitate employees' experimentation, which supports the creation of new products. We provide one solution to this debate by arguing that the relative importance of diversity and control of knowledge on innovation depends on the sources of finance. Hence, we find that, in general, control of knowledge has a higher impact than diversity of knowledge on the sale of new products. We also find that alternative sources of finance moderate the relationships: internal funds strengthen the impact of R&D sources with more diversity of knowledge on the sale of new products, while external funds strengthen the impact of R&D sources with more control of knowledge on the sale of new products.

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Introduction

In innovation studies, there is a stream of research that has focused on studying the effects of internal and external R&D, within the country or across countries, on innovation (for a recent discussion see [Contractor et al., 2010](#); [Hsuan and Mahnke, 2011](#); [West et al., 2014](#)). For example, some studies focus on contrasting the effects of onshore insourcing and outsourcing R&D on new product sales ([Berchicci, 2013](#); [Grimpe and Kaiser, 2010](#)), offshore insourcing and outsourcing R&D on product and process innovation ([Nieto and Rodríguez, 2011](#)), or onshore and offshore outsourcing R&D on innovation results

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(Bertrand and Mol, 2013). This discussion has accompanied the increase in the use of outsourced R&D to enhance innovativeness by firms, with companies relying on others for specialized R&D, such as pharmaceutical firms relying on biotechnology companies or automobile firms relying on component suppliers for advanced R&D. However, although important and increasingly being used, it is not clear how managers can choose among the alternatives to ensure a higher likelihood of success. Most studies have analyzed a few alternatives at a time but not all of them jointly (Berchicci, 2013; Bertrand and Mol, 2013; Cassiman and Veugelers, 2006; Grimpe and Kaiser, 2010; Nieto and Rodríguez, 2011), while managers have limited budgets and thus may want to know which of the different R&D investments may be relatively better than others.

Hence, in this paper, we extend previous studies by addressing the debate on the selection among R&D sources in terms of the diversity versus control of knowledge they provide and their ultimate impact on innovation performance. Specifically, we identify four types of R&D activities by their ownership (insourcing versus outsourcing) and by their location (onshore versus offshore): onshore insourcing, onshore outsourcing, offshore insourcing, and offshore outsourcing. Each of these options gives the company a different degree and combination of diversity and control of knowledge, and thus each is expected to have a different impact on innovation performance. Building on previous studies on R&D sources (Frenz and Ietto-Gillies, 2009; Garriga et al., 2013; Laursen and Salter, 2006; Monteiro et al., 2016), we analyze two arguments about R&D sources and their impact on innovation. One argument builds on the idea that diversity of knowledge is good for knowledge creation (Almeida and Phene, 2004; Hayek, 1945; Tsoukas, 1996). Sources of knowledge that are more diverse and different provide the firm with knowledge it lacks and can help it innovate (Chesbrough, 2003; Rodan and Galunic, 2004; van Beers and Zand, 2014). Thus, sources of R&D which can potentially provide the greatest knowledge diversity (outsourced and offshore) should help the firm the most in creating new products. The other argument builds on the idea that the control exercised within the firm enables it to better combine and create complex knowledge across operations and countries (Kogut and Zander, 1992, 1993; Szulanski, 1996). Control encourage the creation of knowledge to innovate (Cardinal, 2001; Rijdsdijk and van den Ende, 2011). Following this logic, sources of R&D that are under the greatest control within the firm (insourced and onshore) should help it the most in creating novel knowledge and new products.

Additionally, we provide one solution to this debate by arguing that the type of finance source the company uses to fund innovation activities alters the relationship between R&D sources and innovation. Previous studies have analyzed the role of finance on innovation (Greve, 2003; Hall and Lerner, 2010; Hall et al., 2016; Monteiro et al., 2016; among others), especially the effects of the availability of financial resources on innovation (Himmelberg and Petersen, 1994; Hottenrott and Peters, 2012; Mohnen et al., 2008; Monteiro et al., 2016; Savignac, 2008). Building on these studies, we differentiate between internal and external sources of finance and analyze how these sources of funds alter the previous relationship. Specifically, we propose that the use of internal funds strengthens the impact of R&D sources with more diversity of knowledge on innovation, because internal funds provide managers with more leeway and flexibility to undertake riskier and more challenging innovation projects that have more diverse external knowledge. We also propose that the use of external funds for innovation strengthens the impact of R&D sources with more control of knowledge on innovation, because external funds create pressures for undertaking innovation projects that are less risky and have lower uncertainty.

We test these ideas using a sample of 8359 manufacturing and services firms in Spain in the period 2004–2007. We find that, in general terms, control of knowledge is relatively better than diversity of knowledge for innovation, because onshore insourcing R&D has the highest impact on the sale of new products, followed by onshore outsourcing and offshore insourcing; offshore outsourcing R&D does not appear to affect the sale of new products in comparison to other sources of R&D. We also find that the source of finance modifies these relationships. Specifically, we find that internal funds weaken the relationship between onshore insourcing R&D and onshore outsourcing R&D and innovation, while external funds strengthen the relationship between onshore insourcing R&D and innovation performance.

Our study makes two contributions. First, from a theoretical viewpoint, we contribute to the literature that has studied R&D sources by analyzing the consequences on innovation performance of four types of R&D sources jointly. Much of the literature has focused on analyzing the determinants of the selection among the four alternatives (e.g., Kedia and Mukherjee, 2009; Mudambi, 2008; Poppo and Zenger, 1998; Tamayo and Huergo, 2017) rather than analyzing how the four alternatives affect innovation performance. We go beyond the analysis of one or two sources at a time, which has been done in previous studies (Berchicci, 2013; Bertrand and Mol, 2013; Cassiman and Veugelers, 2006; Grimpe and Kaiser, 2010; Nieto and Rodríguez, 2011), and provide a relative comparison of the four alternatives, ranking them according to their relative contribution to innovation driven by diversity and control.

Second, we contribute to clarifying the debate on the relative importance of control and diversity of knowledge to achieve innovation by arguing and explaining how funding sources moderate the impact of R&D sources on innovation outcomes. This deepens our understanding of the interaction between finance and innovation by going beyond the direct impact of access to funds on innovation (Hall et al., 2016; Hottenrott and Peters, 2012) and looking at finance as a potential moderator of the relationship between sources of knowledge and innovation performance (Monteiro et al., 2016). Distinguishing sources of finance by their type becomes an important moderation, as they alter the general relationship between sources of R&D and innovation performance.

These ideas are particularly important for managers. Firms have a limited budget to conduct R&D and thus managers can benefit from knowing which type of R&D source would be relatively better for innovation performance to decide the amount allocated to each source, rather than simply knowing whether to invest in a particular R&D source or not. Here we provide an

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