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## Open search strategies and firm performance: The different moderating role of technological environmental dynamism

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### ABSTRACT

Mainly driven by the rapid progress of the 'open innovation' paradigm, previous research has devoted considerable efforts in investigating how the degree of openness to external knowledge influences firms' innovation performance. However, much less is known about its impact on performance at the firm level. Moreover, the question of which open search strategy is more suitable depending on environmental features is unresolved. We focus on breadth and depth as two distinct open search strategies and claim that, besides their different benefits in terms of learning and innovation, it is also necessary to consider their costs. Based on survey data of 248 high-technology manufacturing Spanish firms, this study extends recent research about the context dependency of openness effectiveness by showing that the effect of these two open search strategies on perceived firm performance is contingent with technological environmental dynamism in a reverse fashion. While search breadth is found to be positively associated with performance in less technologically dynamic environments, it seems to hurt performance in more dynamic contexts. On the contrary, while search depth is found to have a positive effect on performance in highly technologically dynamic environments, it appears to harm firm performance in more stable contexts.

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### 1. Introduction

Open innovation has become one of the hottest topics in recent literature (Linton, 2012; West and Bogers, 2014). Since the publication of Chesbrough's (2003) book, there has been a great proliferation of empirical works investigating how a higher degree of openness to a diversity of external sources affects different facets of firms' innovativeness (e.g. Chang et al., 2012; Escribano et al., 2009; Leiponen and Helfat, 2011; Nieto and Santamaría, 2007; Sidhu et al., 2007). Overall, findings reported in these

studies indicate that the wider the search for external knowledge, the higher the firm's innovation performance. This evidence has led to draw conclusions like "increasing degrees of openness will stimulate innovative activities, creation of new ideas, and ultimately higher performance" (Knudsen and Mortensen, 2011: 56), or that "the open innovation process is becoming an essential success factor for all sorts of enterprises" (Badawy, 2011: 65).

By focusing on the success side of external search, these initial studies have given rise to an optimistic view of openness (Huizingh, 2011; West and Bogers, 2014). However, external knowledge search is not costless. Yet, to date, the literature has been imbalanced in its strong focus on the benefits of openness and only some recent works have begun to stress that openness can also have considerable downsides that would explain why not all firms success with open innovation initiatives (Birkinshaw et al., 2011; Chen et al., 2011; Knudsen and Mortensen, 2011).

Without considering the cost or pains of external search, only one part of the story is told and, hence, conclusions derived from previous works analyzing the effects of openness on innovation outputs or innovation success may be biased. In this vein, there is

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no systematic evidence about the impact of open search on overall firm performance, and the scarce empirical works that have investigated this relationship offer mixed results (e.g. Belderbos et al., 2010; Faems et al., 2010; Hung and Chou, 2013; Sisodiya et al., 2013). A common feature in all these analyses is their conceptualization and measurement of openness as a unidimensional construct. However, as highlighted by some scholars (e.g. Chen et al., 2011; Laursen and Salter, 2004, 2006), different open search strategies may yield different outcomes. This reasoning provides a potential explanation for the observed inconsistency in prior empirical research focused on the openness–performance relationship. Nevertheless, to our known, no previous work has theoretically or empirically addressed how different strategies for external knowledge search relate to performance at the firm level.

Moreover, it may be that different open search strategies will be more suitable under different environmental settings. Recent contributions framed within open innovation research (Hsieh and Tidd, 2012; Huizingh, 2011; Hung and Chou, 2013) have claimed for a contingency approach and propose that external context characteristics may determine the relationship between open innovation practices and performance. However, the possible context dependency of openness effectiveness is one of least understood topics, making it imperative to investigate the moderating effects of environmental circumstances that make the investment in open innovation profitable (di Benedetto, 2010; Hung and Chou, 2013; Sisodiya et al., 2013).

The present paper tries to shed some light on these gaps in previous research by addressing the following key question: under which environmental circumstances the gains of the different open search strategies overcome their costs. This way, we aim at contributing to the literature by providing further insight about the great – but narrowly understood – complexity of external knowledge search by organizations. Specifically, this study contributes to current literature in three main aspects. First, it aims at clarifying the mixed findings reported by the scarce empirical works which have investigated the effect of openness on overall firm performance. These preceding studies have considered openness as a monolithic construct. Extending them, this study considers two separate components of firms' open search strategies, named external search breadth and depth (Laursen and Salter, 2006). Second, on a more theoretical level, this paper draws on absorptive capacity arguments (Cohen and Levinthal, 1990) for linking both open search strategies with the broader organizational learning debate on exploration and exploitation (March, 1991). Thereby, this paper contributes to the theoretical integration of three approaches that, although showing important complementarities, have evolved almost independently in prior literature (Laursen, 2012; Rosenkopf and Nerkar, 2001). Third, based on the above theoretical linking, this study proposes, and empirically finds, differing moderating roles of technological environmental dynamism on the effect of external search breadth and depth on perceived firm performance. In their recent study, Hung and Chou (2013) have pioneered the empirical analysis of a contingent model highlighting that contextual conditions may affect firm performance derived from inbound open innovation. Our findings extend their contingent model by showing that different environmental settings may require that organizations will deploy quite distinct open search strategies for improved performance.

Results are based on survey and archival data of 248 large and medium-sized high-technology manufacturing Spanish firms. Below, we review prior literature on benefits, costs, and performance implications of external knowledge search, frame the two open search strategies, and present the hypotheses that drive the analysis. After that, sampling and data collection procedures, as well as measures of variables are explained. Then, we report the

empirical findings and conclude with a discussion of main results, implications for research and practice, and future research directions.

## 2. Literature review and hypotheses

### 2.1. External knowledge search and firm performance: benefits versus costs of openness

The use of externally generated knowledge to improve internal resources and innovation processes is not new. Rather, accessing external knowledge has long been recognized as an important factor in successful innovation and many companies have implemented open innovation practices for a long time (Huizingh, 2011). The bibliographic analysis carried out by Dahlander and Gann (2010) shows that some of the most cited works by articles that had 'open innovation' in the topic field are not necessarily framed within open innovation literature. Specifically, external knowledge acquisition has been addressed in different fields within management and marketing literatures, such as market orientation (e.g. De Luca and Atuahene-Gima, 2007; Jaworski and Kohli, 1993), supply chain management (e.g. Groen and Linton, 2010; Lambert and Cooper, 2000), complementary assets (e.g. Colombo, 2006; Teece, 1986), intellectual capital (e.g. Subramaniam and Youndt, 2005; Yu, 2013), organizational learning (e.g. March, 1991; Sidhu et al., 2007), absorptive capacity (e.g. Cohen and Levinthal, 1990; Murovec and Prodan, 2009), evolutionary economics (e.g. Laursen, 2012; Nelson and Winter, 1982), or dynamic capabilities (e.g. Danneels, 2008; Voudouris et al., 2012). This observation has led some critics to assert that open innovation is old wine in new bottles (Trott and Hartmann, 2009), while other scholars have initiated a debate about whether it constitutes a real new field of study or, by contrast, a barrier that inhibits communication between different groups of academics for theory development (Groen and Linton, 2010). Proponents of open innovation also recognize that it links into broader debates in innovation and management. Nonetheless, they argue that it offers a more comprehensive perspective of external knowledge search for innovation, providing an umbrella that integrates a wide range of already existing activities, redefining the boundary between firms and the environment and, ultimately, leading academics and practitioners to rethink the design of innovation strategies in a networked world (Badawy, 2011; Huizingh, 2011; Laursen and Salter, 2006; van de Vrande and de Man, 2011).

In Chesbrough's (2003) sense, open search consists on organizations' permeability or openness to the acquisition of new ideas and knowledge from outside (von Hippel, 2010). It is argued that external search plays a key role in achieving variety through the identification and acquisition of new information and ideas that, in combination with their internal knowledge base, lead firms to generate solutions for emerging problems and new opportunities (Laursen, 2012; Voudouris et al., 2012). Consequently, by spanning organizational boundaries, firms can go beyond local search and avoid competence traps associated to an excessive focus on internal learning (Hung and Chou, 2013; Rosenkopf and Nerkar, 2001).

Rather than a binary classification of open versus closed, openness is a continuum, ranging from closed approaches on one end to open approaches on the other (Dahlander and Gann, 2010; Hsieh and Tidd, 2012; Lichtenthaler, 2011). Organizations can gather external information through a wide range of sources, such as suppliers, customers, competitors, other firms, universities, research organizations, industry associations, trade and technical publications, and so on, which may provide different kinds of complementary knowledge. Accordingly, it has been argued that

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