

# Organizing for Open Innovation: Incorporating the Externality of Control with Diversity of Contribution

Poonam Oberoi ● Christophe Haon ● Isabel M. Bodas Freitas

**Abstract.** With whom should firms join forces (diversity of contributions, DoC) and how should they share decision-making power with external actors (externality of control, EoC)? Despite the growing importance of open innovation, there is no unifying framework explaining the different ways in which firms can organize to acquire external contributions and exploit them. This conceptual article introduces a new framework according to which the relationship between DoC and a firm's innovative performance is moderated by (1) the characteristics of a project, such as the disparity between a specific problem and the firm's existing knowledge base, the problem's modularity, and the tacitness of the anticipated solution; and (2) EoC. With regards to project characteristics we argue that (a) the disparity between a specific problem and the firm's existing knowledge base moderates the DoC–performance relationship positively; (b) the problem's modularity moderates the DoC–performance relationship positively; and (c) the tacitness of the anticipated solution moderates the DoC–performance relationship negatively. We argue that EoC moderates DoC's impact on performance positively.

Groupe Sup de Co La Rochelle  
Centre de Recherche en  
Management des Entreprises

oberoi@esc-larochelle.fr

Grenoble Ecole de Management,

Christophe.haon@grenoble-em.com

Isabel-Maria.BODAS-  
FREITAS@grenoble-em.com

Open innovation involves “the use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation” (Chesbrough, Vanhaverbeke, & West, 2006: 1). Open innovation is important for the growth and sustained profitability of firms (e.g., Christensen, 1997; Drucker, 1988; Solow, 1957; Thomke, 2001). Extant literature on open innovation has mostly focused on providing evidence for whether and when open innovation is better for firm performance than closed innovation. In investigating this, scholars usually compare firms that use open innovation with those that do not, then further examine the inherent business models of those that do (Giannopolou, Ystrom, & Ollila, 2011) for a better understanding of value co-creation (West & Lakhani, 2008), leadership for diversity (Slowinski et al., 2009) and intellectual property rights management (Bughin, Chui & Johnson, 2008). Other scholars have focused on potential moderators of this relationship such as firm-level factors (Leiblein & Miller, 2003), project-level factors (Afuah & Tucci, 2012) and changing market conditions (Dittrich & Duysters, 2007). However, other relevant aspects remain relatively unexplored, including how firms engaging in open innovation organize their relationships with external actors. In response, our conceptual study seeks to address a central research question: how should firms organize for open innovation? In other words, when do certain project characteristics lead firms to seek diverse external inputs (i.e., diversity of contributions (DoC)) and when does involving external actors in the decision process (externality of control (EoC)) improve the innovative performance of firms involved in open innovation? We address these questions at the project level because each project possesses its own characteristics and could require different levels of input and involvement from external actors.

Focusing on the firm level, Laursen and Salter (2006) show that performance is associated with both the breadth and depth of the way firms organize their search for new ideas.

During the open innovation process, firms must grapple with fundamental decisions about DoC and EoC. Some firms pool their resources and create a consortium to solve a problem. For example, IBM partnered with many companies to jointly develop semiconductor technologies. Others join open-source communities, such as Linux. Still others prefer to sell general-purpose technologies, such as user toolkits, to help users develop differentiated products. Recent developments in crowdsourcing platforms have further contributed to the phenomenon of open innovation as it continues to gather even more momentum. Firms can now approach platforms such as InnoCentive, Open Connection, NineSigma, Quirky, or eYeka to manage openly different types of innovation projects. When working with such crowdsourcing platforms firms may still use DoC and EoC differently.

By addressing how firms should organize for open innovation our conceptual article makes several theoretical contributions to extant literature. First, to complement the existing literature (Laursen & Salter, 2006), we focus on DoC. From the new product development literature we borrow the distinction between competencies and the functional diversity of contributors (Haon, Gotteland, & Fornerino, 2008), arguing that, although diversity of contributors is often used as a proxy for DoC, these two terms do not mean the same thing; the underlying hypothesis is that diverse contributors do not necessarily bring in diverse contributions. External actors with the same functional status might have different competencies and experiences, whereas external actors with different functional status might well have similar competencies. Therefore, in the context of our study, DoC refers to the degree to which a firm acquires diverse external contributions; it pertains not to the number of contributors but rather to the different knowledge domains. Low DoC implies limited diversity in external contributions and high DoC implies rich external contributions.

Second, we consider organizing for open innovation as a more intricate exercise than do scholars who focus selectively on DoC from external actors (i.e., search strategies) (Laursen & Salter, 2006; Slowinski et al., 2009). As Von Hippel (1988) explains, search strategies involve investment in building and sustaining links with external actors such as users, suppliers, and a wide range of institutions. We combine DoC with a new dimension of open innovation—externality of control (EoC). EoC refers to the degree to which a firm and external actors share the decision-making power to select and exploit the final contributions from the open innovation process. Low EoC implies that the decision-making power rests largely with the firm. High EoC indicates that external actors have a significant say in the selection and exploitation of final contributions. The degree of EoC is a weak point for firms engaging in open innovation because most firms hesitate to share decision-making power and extant literature has not adequately addressed this topic. We argue that certain projects may require a high degree of EoC if they are to realize the potential benefit of diverse contributions.

Third, instead of asking when open innovation is better for firms than closed innovation (Almirall & Casadesus-Masanell, 2010), we focus on how the characteristics of a specific project influence the benefits that firms can obtain from DoC. By considering project characteristics, we achieve a better understanding of the effect of DoC on firms' innovation performance. We derive three project characteristics from the study by Afuah and Tucci (2012): (1) the disparity between a specific problem and a firm's extant knowledge base, (2) the problem's modularity, and (3) the tacitness of the anticipated solution. In this paper, the first section reviews the relevant literature on DoC, EoC, and project characteristics. The second section details the theoretical framework and

propositions of the study. The third section provides discussions, summarizes the theoretical contributions, and offers concluding remarks on the future applications of this study.

## BACKGROUND LITERATURE

### OPEN INNOVATION: DIVERSITY OF CONTRIBUTIONS AND EXTERNALITY OF CONTROL

The notion of open innovation, an innovation process opened to actors outside the traditional boundaries of a firm, was first proposed by Chesbrough (2003). The mobility of workers makes it impossible to retain the best talent and relevant knowledge within a firm indefinitely; therefore each firm must consider outside options to advance its innovation. Chesbrough (2003) argued that the rising costs of technology development and shortening product life cycles make it harder for firms to justify innovation investments. Using open innovation, firms can reduce costs, save time, and expand their innovation output by leveraging the knowledge of external actors.

Laursen and Salter (2006) posited that the breadth of external searches for open innovation - or “the number of external sources or search channels that firms rely upon in their innovative activities” (p. 134) - exhibits a curvilinear (inverted U-shaped) relationship with performance. A firm’s decision to employ very high DoC thus harms its innovative performance. Laursen and Salter (2006: 135) extrapolated findings from previous studies (Koput, 1997; Levinthal & March, 1993) to explain that strategies to search for contributions from external actors “are rooted in the past experiences and future expectations of managers, [and] such experience and expectations may lead firms to over-search the external environment with a detrimental outcome as the result”.

With its emphasis on search strategies, extant literature (Dittrich & Duyster, 2007; Fetterhoff & Voelkel, 2006; Laursen & Salter, 2006) has focused selectively on only one dimension of open innovation, namely DoC (gathering rich external contributions). Since open innovation is a new phenomenon, managers and scholars may not be accustomed to distinguishing between their actions of gathering external contributions and exploiting these contributions. We propose taking EoC into consideration to better understand the effect of DoC on a firm’s innovation performance. When firms embrace EoC they share decision-making power with regard to selecting and exploiting the final contribution with external actors and thereby mitigate the detrimental influence of high DoC on their innovation performance. If firms share decision-making power with external actors they can overcome the issues of decreased absorptive capacity and limited attention span. The following example demonstrates this argument well. BMW, a leading multinational car manufacturer, continuously seeks new and innovative ideas to personalize the interior of its vehicles. Recently, the BMW Group organized an open innovation contest entitled “BMW Group Interior Design Contest<sup>1</sup>”. Aiming to leverage the power of the crowd, BMW teamed up with an intermediate platform—Hyve ([www.hyve.de](http://www.hyve.de))—to create an online contest challenging designers and interested users from all over the world to submit their ideas on how the personalization of the interior could fit individual needs. Through the contest, BMW collected 771 designs from 1,297 contest members. A jury of high-profile experts from the BMW Group and external experts in the field of automotive transportation assessed the submitted designs. In an organized workshop the jury and community members participated in in-depth discussions regarding the best ideas to further crystalize the designs. The BMW Group did not simply ask for ideas and opinions from external actors; they went a

1. Link to the contest (accessed November 13, 2013): <http://interior-ideacontest.bmwgroup-cocreationlab.com>

step further by actively seeking the help of external actors in exploiting those ideas. Unlike BMW, a majority of firms might be reluctant to share their decision-making power with external agents since they believe that they understand their knowledge base, cultures, and resources better than external agents.

While extant literature focuses on the impact of DoC on firm performance, it neglects the impact of EoC. Hence, it is also important to take into consideration the degree of EoC, which deals with the effective exploitation of gathered contributions. Each open innovation project is different, and various project characteristics can impact the gathering and exploitation of external contributions. We now discuss the existing literature on project characteristics.

## PROJECT CHARACTERISTICS

The majority of past studies focus on the average impact of open innovation on firm performance (Dittrich & Duyster, 2007; Fetterhoff & Voelkel, 2006; Laursen & Salter, 2006). However, every open innovation project is different and its outcome depends on the specificities of the project at hand. Afuah and Tucci (2012) propose that five factors influence firms' decisions regarding whether or not to use crowdsourcing: (1) the characteristics of the problem, (2) the characteristics of the knowledge required for the solution, (3) the characteristics of the crowd, (4) the characteristics of the solutions to be evaluated and of the evaluators, and (5) the characteristics of the information technology involved. In the context of the present paper, we argue that factors (1) and (2) cited above will also influence how firms decide to organize for open innovation for specific projects, while factors (3), (4), and (5) are environment-specific and not relevant to our present paper.

Factor (2), the characteristics of knowledge required for the solution, consists of "effective distance" and "tacitness and complexity of the knowledge to be acquired." In the context of this paper, effective distance inspires a project characteristic, which we label "the disparity between a specific problem and a firm's existing knowledge base." The tacitness and complexity of the knowledge to be acquired also inspires a project characteristic, which we call "tacitness of the anticipated solution". Factor (1), the characteristics of the problem, consists of "the ease of delineation and transmission" and "modularizability." This factor is slightly more difficult to use. Although both the ease of delineation and transmission and modularizability are of the utmost importance they have serious overlaps, since a modularizable problem is logically easy to delineate and transmit (Afuah & Tucci, 2012). To avoid redundancy, we combined these two elements in the "problem modularity" characteristic.

We expect that these three project characteristics—disparity between a specific problem and a firm's existing knowledge base, problem modularity, and tacitness of the anticipated solution—influence the effect of DoC on a firm's innovative performance. These characteristics can be used to describe different types of projects, such as technical, design, marketing, or R&D-related projects. Such a conceptualization helps us create a generalizable theoretical framework. These three project characteristics can help decision makers make a cognitively sound decision regarding the desirable level of DoC in limited time and with as much information as they can actually use. Decision makers know the alternatives *ex ante* and can anticipate the consequence of choosing each alternative. They can therefore optimize and select the best alternative.

Disparity between the problem and a firm's existing knowledge base

Kogut and Zander (1992) explain that a firm's knowledge base consists of information (what people know) and know-how (how to organize a team). When employees understand how to transmit information this information can become knowledge without any loss of integrity. Von Hippel (1988) defined know-how as

the accumulated practical skills or expertise that allow employees to function efficiently. Information and know-how differ from knowledge embedded in a firm's routines (Nelson & Winter, 1982). Kogut and Zander (1992) explain that routines provide an interesting yet inadequate portrayal of a firm's knowledge base. The knowledge manifested in firm routines offers a description of information rather than actual know-how. The crucial aspect of a firm's knowledge that both Kogut and Zander (1992) and von Hippel (1988) emphasized is "accumulation", which signifies that firms acquire and amass know-how over time. We propose that a firm's gathered knowledge can be broad or narrow depending on the range of its activities. Another interesting aspect of a firm's knowledge base is its path-dependency. If the knowledge base is path-dependent then advances in this knowledge base depend on the firm's current level of knowledge and know-how (Kogut & Zander, 1992). When a firm decides to engage in open innovation, the disparity between its existing knowledge base and the knowledge required to solve a specific problem demands attention. This disparity will impact the firm's ability to identify external collaborators (if and when required), its appreciation of its own absorptive capacity and of its ability to integrate external knowledge (Conner & Prahalad, 1996; Grant & Baden-Fuller, 1995), and the means to assess whether or not it needs external help to exploit external contributions.

#### Problem modularity

It is possible to identify problems and then break them down into modules or components (Baldwin & Clark, 2006; Ethiraj, Levinthal, & Roy, 2008; Gatignon et al., 2002; Hoetker 2006; Pil & Cohen, 2006; Schilling, 2000). In so doing, firms can find different solutions for various components. The components are loosely coupled and have standardized interfaces that define functional, spatial, and other kinds of relationships with other components (Sanchez & Mahoney, 1996). The standardized interfaces between components also allow a range of variations. Modular components have interface characteristics within this range of variations. Recognizing these components gives firms flexibility in the product development process as they can leverage product variations by substituting different modular components into the product architecture without having to redesign other components.

During open innovation, communicating the problem to external actors is of utmost importance, and the modularity of the problem directly influences the ease or difficulty of its transfer. The planning and design of the problem's communication to external actors also influences the smoothness of the transfer. For a firm engrossed in the intricacies of a problem, a simple articulation of the problem might not be easy. Moreover, firms might hesitate to expose their vulnerability to external actors, who might include their competitors (Saviotti, 1998). The issue of problem transfer is common to all firms. On the basis of these insights and our preceding arguments, we deduce that the difficulty of problem transfers influences whether external actors understand the problems and can help the firm resolve them.

#### Tacitness of the anticipated solution

Tacit knowledge may not be easy to articulate or codify (Afuah & Tucci, 2012; Berman, Down, & Hill, 2002). It might reflect the know-how of a manager (rational agent) and firms acquire this know-how by "doing" (i.e. through experiences). Although it may be possible to codify some knowledge and thereby convert it into explicit knowledge (Nonaka, 1994), other forms of knowledge are difficult, if not impossible, to articulate (Kogut & Zander, 1996). For example, part of the knowledge a doctoral student gains from a supervisor is tacit, and the only way to gain it is via the supervisor's up-close observations in action and through practice. Often, such knowledge is not easy to articulate, evaluate, transfer, or exploit (Kogut & Zander, 1996; Nonaka, 1994; von Hippel, 2005). We do not

mean to suggest that all codified knowledge is easy to transfer and use. While the degree of codification affects the transferability of knowledge, firms still need a certain level of absorptive capacity to exploit even codified knowledge (Saviotti, 1998).

The way a firm organizes for open innovation may depend on whether the solution anticipated from external actors is tacit or explicit. If the anticipated solution is tacit, it will be difficult to exploit efficiently and might require frequent communication with the external actor. In this situation, a firm will have to decide whether it will include the external actor in the open innovation process only during the information contribution phase or throughout the whole exercise. If the anticipated solution is explicit, its transfer will be easy and there will be no need for frequent communication between a firm and the external actor.

In conclusion, this literature review suggests that open innovation is important for firms. It has been proven that the breadth of external searches for open innovation has an inverted U-shaped relationship with performance. However, the existing literature focuses only on gathering rich contributions from external actors (i.e., DoC). Another dimension of open innovation—EoC— deals with effective exploitation of gathered contributions and has not yet been elaborated. Furthermore, the characteristics of open innovation projects that impact gathering and exploiting rich contributions need to be explained. We now discuss our theoretical framework with the aim of articulating how DoC, EoC, and project characteristics are likely to interact.

## THEORETICAL FRAMEWORK AND PROPOSITIONS

The extant literature on open innovation explains that firms may decide to seek external contributions from different actors. To do so they might choose collaboration strategies such as forming R&D alliances, creating joint ventures, and using intermediary platforms (Chesbrough & Schwartz, 2007; Laursen & Salter, 2006). Unfortunately, despite the growing importance of open innovation, research on how firms should organize themselves to receive and exploit external contributions is limited. Both academic journals and the popular media often wrongly link open innovation with openness and flatness (Pisano & Verganti, 2008). In this context, openness relates to the degree to which participation is open to anyone who wants to join and flatness refers to whether the actors are equal partners in the process or whether there is a hierarchy involved. Although these insights are valuable, they do not provide a unifying framework in which DoC, EoC, and project characteristics explain the different ways in which firms can organize to acquire and exploit external contributions. This lack of a unifying framework leads firms to develop ad hoc tools that can be applied to a narrow range of project types. For example, InnoCentive chooses to focus on very specific scientific problems using low DoC and a medium level of EoC. On the other hand, eYeka had initially decided to address a wide range of problems (including scientific, product-concept related, or marketing related) using high DoC and low EoC; subsequently, they decided to narrow down the range of problems they focused on because certain problems, such as scientific problems, required a higher degree of EoC than eYeka was equipped to provide. A unifying theoretical framework will help firms take multiple aspects such as DoC, EoC, and project characteristics into consideration and to decide accordingly which practical approach is the most suitable.

We therefore developed propositions for how the effect of DoC on firms' innovative performance may be moderated by the characteristics of the project, as well as by the degree of EoC.

### Diversity of Contributions and Firms' Innovative Performance

In the context of our study, DoC implies that a different kind of knowledge is associated with each external agent. For example, customers might have the knowledge about the utility of a product and relevant environmental standards; a regulatory agency might have the knowledge about the product's carbon dioxide emission levels; suppliers may have the technical knowledge regarding the constituent components of a product; consultants could have the historical and analytical knowledge of industries; and technical press researchers might have the knowledge about the latest technological trends. We propose that if firms opt for external contributions, they increase their chances of gaining greater knowledge about customers' latent needs which they can use to continuously create superior customer value through their products and services (Slater & Narver, 1995). DoC could lead to an increased probability of novel linkages and thereby challenge traditional perspectives (Laursen & Salter, 2006; Sethi, Smith, & Park, 2001), leading to innovative product developments (Chandy & Tellis, 1998). Diverse knowledge might feature emerging technological trends that firms could use to develop new products. Therefore, one can predict a positive linear relationship between DoC and firm performance. However, Laursen and Salter (2006) suggest that DoC has an inverted U-shaped relationship with performance and that the more diverse contributions a firm receives, the more difficult it becomes to absorb this diverse knowledge. Based on the past literature (Katila & Ahuja, 2002; Koput, 1997), Laursen and Salter<sup>2</sup> (2006) argue that when firms are trying to be open they often have to go through a period of trial and error to learn how to gain and absorb knowledge from external sources. This process requires an extensive amount of time and resources and might be subject to uncertainty, in the sense that *ex ante* it is difficult for managers to know which external source is the most rewarding. Depending on its experience with the search for external knowledge, a firm may turn inwards or over-search. In other words, if the process is not fruitful then the firm may start focusing exclusively on its own resources and capabilities to develop new products. This has negative consequences as described by the bounded rationality literature (Simon, 1972; Spender & Grant, 1996). However, if the experience were positive a firm could start over-searching, which again has negative outcomes: first, there may be too many ideas for the manager to choose from; second, many innovative ideas may come at the wrong time and in the wrong place to be fully exploited; and third, because there are so many ideas, only a few might get the required level of attention. In accordance with current literature and our prior arguments, we propose

*Proposition 1: The diversity of contributions has an inverted U-shaped relationship with a firm's innovative performance.*

In the remaining part of this section, we focus on project characteristics and on EoC as potential moderators of this relationship.

### Moderating Effects of Project Characteristics

The three project characteristics highlighted in our literature review—disparity between the problem and a firm's existing knowledge base, problem modularity, and tacitness of the anticipated solution—are successively considered as moderators of the DoC–innovative performance relationship.

#### *Disparity between the problem and a firm's existing knowledge base*

If the disparity between a firm's knowledge base and the knowledge required to solve a specific problem is large, then the existing knowledge base and routines will not be adequate to solve this problem. Moreover, the greater the disparity between a problem and a firm's knowledge base, the more uncertain a firm is about where to look for solutions. A firm can increase its chances of finding

2. Laursen and Salter (2006) used three proxies to measure a firm's innovative performance, which are: the ability of a firm to produce radical innovation, the fraction of the firm's turnover pertaining to products new to the firm and the fraction of the firm's turnover pertaining to products significantly improved. The independent variable is constructed as a combination of 16 sources of knowledge or information enlisted here: suppliers of equipment, materials, components or software; clients or customers; competitors; consultants; commercial laboratories or R&D enterprises; universities or other higher education institutes; government research organizations; other public sector sources, (e.g., business links, government offices; private research institutes; professional conferences, meetings; trade associations; technical/trade press, computer databases; fairs, exhibitions; technical standards; health and safety standards and regulations; environment standards and regulations). Each of the 16 sources are coded as a binary variable, 0 being no use and 1 being use of the given knowledge source. Subsequently, the 16 sources are simply added up so that each firm gets 0 when no knowledge sources are used, while the firm gets the value of 16 when all knowledge sources are used. In other words, it is assumed that firms that use higher numbers of sources are more 'open', with respect to diversity of contribution, than firms that are not.

the optimal solution by opting for a high DoC. In contrast, if the disparity between a problem and a firm's knowledge base is small, a lower DoC might suffice to solve it. Firms have bounded rationality and might be able to make intelligent searches in their local neighborhoods, where routines, cognitive frames, and absorptive capacity could help them assess different alternatives and consequences (Cohen & Levinthal, 1990; Cyert & March, 1963; Nelson & Winter, 1982). Thus, if the knowledge necessary to solve the problem is similar to a firm's current knowledge base, a manager may be able to solve the problem with a low DoC. On the basis of these arguments, we propose

*Proposition 2: The disparity between a problem and a firm's knowledge base positively moderates the effect of the diversity of contributions on a firm's innovative performance.*

#### *Problem modularity*

Problems can be modular or non-modular. If a firm's problem is modular, a high DoC might be the right choice. It is possible to separate modular problems into components and then assign combinations of solutions for each component. It also is easy for a firm to assign modular problems to external actors. Different external actors with different types and levels of expertise can work on different parts of the problem and solve them concurrently (Argyres, Bercovitz, & Mayer, 2007; Argyres & Bigelow, 2010; Schilling, 2000). By opting for high DoC, firms will likely obtain high-quality solutions at a lower cost and more quickly than they otherwise might (Ethiraj, Levinthal, & Roy, 2008). In the case of a non-modular problem, an external actor who attempts to solve the problem must have the combined knowledge of all its components. Therefore, the firm might minimize its effort, costs, and time spent by assigning the problem to more homogeneous external actors, thereby relying on lower DoC. Therefore, we propose

*Proposition 3: Problem modularity positively moderates the effect of the diversity of contributions on a firm's innovative performance.*

#### *Tacitness of anticipated solution*

The nature of the anticipated solution and the ease or difficulty of transferring the solution back to a firm are project characteristics that might influence the extent of the benefits of DoC for a firm's innovative performance. The anticipated solution may be tacit or explicit. If the solution is tacit, it might be difficult for a firm to understand it and transfer it from the external actors to its own employees (Henderson & Cockburn, 1994; John, Weiss, & Dutta, 1999; Pisano, 1994). We argue that in such a scenario, a firm that opts for a low DoC performs better because the solution is grounded in its cognitive and organizational capabilities. In contrast, if the solution is tacit and the firm opts for high DoC, then it is difficult for the firm to absorb and use contributions from external actors—especially if these contributions differ significantly from the firm's own knowledge base. In such a situation, the firm will need to increase the frequency of its communication with external actors, the number of trials, and the financial input. Additionally, because firms are receiving the information they must adapt to the communication style and technical jargon of the external actors. The higher DoC, the more difficult the communication and transfer of knowledge from external actors to the firm. Conversely, if the solution is explicit, it is relatively easy for a firm to transfer the solution from external actors to its employees, even if it opts for high DoC. Therefore, we propose

*Proposition 4: The tacitness of the solution negatively moderates the effect of the diversity of contributions on a firm's innovative performance.*

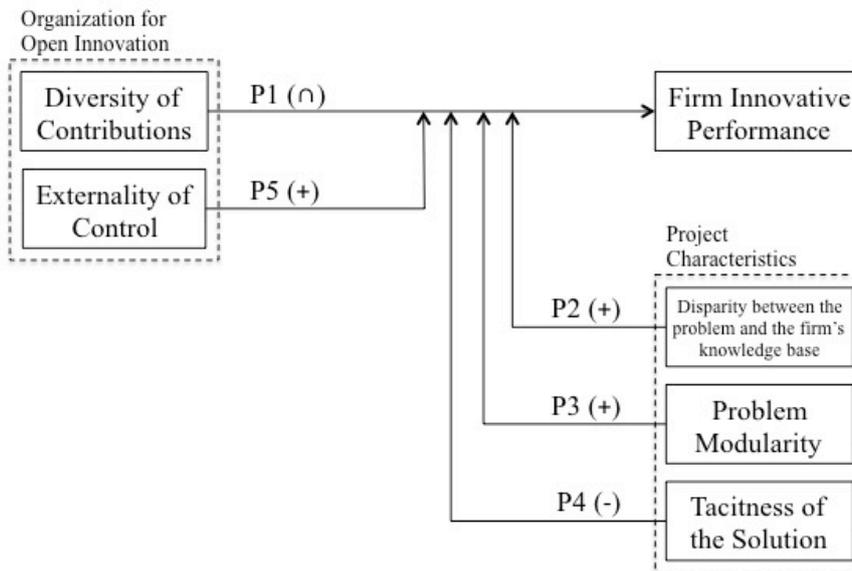
### Moderating Effects of EoC

We argue that firms with higher innovative performance are distinct from others in terms of their willingness to share decision-making power over the selection of final contributions. We label this concept EoC. Most firms focus mainly on securing a high number of contributions from external actors and may be reluctant to share decision-making power. Their reluctance derives from their belief that they know their culture and resources better than the external actors and can make the most appropriate decisions. This reluctance is a serious problem for firms engaged in open innovation. Although firms may have the best understanding of their own culture and resources, they might not be best suited to exploit contributions from external actors. Depending on the problem characteristics, sharing power during an open innovation process with external actors could help them exploit diverse contributions. Though managers have little control over the diversity of external contributions, they have considerable influence over EoC.

Firms tend to suffer from bounded rationality and possess a particular knowledge base (Simon, 1972; Spender & Grant, 1996). Since managers are rationally bounded they are satisfied with solutions they can understand, but those solutions—even if satisfactory—might not be optimal for firms. Moreover, learning new routines or building new absorptive capacity can be costly and time-consuming (Cohen & Levinthal, 1990). If a firm is more willing to share its decision-making power (through high EoC), this might allow for better exploitation of the gathered external contributions. Firms that use high EoC can create a shared system of codification (Cowan, David, & Foray, 2000) and have access to a broad collective knowledge base, which enhances their absorptive capacity (Henderson & Cockburn, 1994; Pisano, 1994; Volberda, 1996). The shared system of codification and a broad knowledge base also allow for better assimilation and exploitation of diverse contributions (Cowan, David, & Foray, 2000). Moreover, this situation could help firms take advantage of more opportunities with external actors. In some cases it is possible to transfer knowledge only through up-close observation, demonstration or hands-on experience (Hamel, 1991). Transferring tacit knowledge, for example, should be easier with high EoC because the external actors' motivation to assist the firm is greater than it would be with low EoC. Moreover, the relationship-specific heuristics and specialized language that develop between a firm and its external contributors can be conducive to conveying tacit knowledge (Uzzi, 1999). On the basis of these arguments, we propose:

*Proposition 5: Externality of control positively moderates the effect of the diversity of contributions on a firm's innovative performance.*

Figure 1 provides a summarized schematic representation of our propositions. Overall, DoC should have an inverted U-shaped relationship with firms' innovative performance. However, this relationship is moderated both by specific project characteristics and by EoC. We suggest that when the disparity between a firm's knowledge base and the knowledge required to solve a specific problem is large, high DoC exerts a positive impact on the firm's performance. We also contend that for modular problems, high DoC leads to better firm performance. We then make the case that when the solution of a problem is tacit, low DoC leads to better firm performance than high DoC. Finally, we argue that depending on the project characteristics, EoC positively moderates the DoC-firm performance relationship.

**Figure 1.** Schematic Diagram of Research Propositions

## DISCUSSION AND IMPLICATIONS

The existing research tends to focus on the performance implications of using external contributions without differentiating between DoC and EoC or considering the characteristics of specific open innovation projects. We complement prior research by offering new insights about the important decisions that firms face when they strive to develop new products using open innovation processes. First, we focus on DoC and define this as the degree to which a firm acquires diverse external contributions; the concept relates not to the number of contributors but to the richness of contributions in terms of different knowledge domain categories. We emphasize DoC, rather than diversity of contributors, as an important independent variable because diverse contributors do not necessarily bring in diverse contributions. External actors with the same functional status might have different skills and experience, whereas external actors with different statuses might have similar skills.

Second, we add to the ongoing conversation in the open innovation and search literature, which focuses selectively on DoC from external actors (i.e., search strategies) (Laursen & Salter, 2006; Slowinski et al., 2009). We suggest combining DoC with a new dimension of open innovation—EoC. EoC refers to the degree to which a firm and external actors share the decision-making power to select and exploit final contributions. Because of the assimilation and exploitation challenges that arise from diverse contributions, high DoC has been considered bad for performance. But we argue that a high DoC can in fact be good for performance, depending on the characteristics of the project. In addition, EoC enhances DoC's impact on performance. Thus, EoC is a challenging yet crucial dimension of open innovation, which merits further attention both from academics and managers.

Third, we argue that a firm's performance during open innovation is contingent on project characteristics. We focus on three characteristics, namely the disparity between a firm's existing knowledge base and the knowledge required to solve specific problems, the problem's modularity, and the tacitness of

the anticipated solution. These characteristics should dictate how a firm organizes itself, in terms of DoC, to conduct open innovation successfully. The disparity between a firm's existing knowledge base and a specific problem positively moderates the DoC–firm performance relationship. During open innovation, communicating the problem to external actors is of the utmost importance and the modularity of the problem directly influences the ease or difficulty of its transfer; hence, we propose that problem modularity positively moderates the DoC–firm performance relationship. If the proposed solution is tacit it will be difficult to exploit efficiently and might require frequent communication with the external actor. In this situation we propose that tacitness of the solution will negatively moderate the DoC–firm performance relationship. These project characteristics help decision makers assess the risks and consequences associated with each alternative.

This theoretical framework sheds light on what open innovation actually means in practice. Moreover, we offer propositions to be empirically tested in the future. This would require data from a sufficient number of open-innovation projects with variability regarding the measures of the concepts we included in our framework.

## REFERENCES

- Afuah, A., & Tucci, C. L. (2012). Crowdsourcing as a solution to distant search. *Academy of Management Review*, 37(3), 355-375.
- Almirall, E., & Casadesus-Masanell, R. (2010). Open versus closed innovation: A model of discovery and divergence. *Academy of Management Review*, 35(1), 27-47.
- Argyres, N. S., Bercovitz, J., & Mayer, K. J. (2007). Complementarity and evolution of contractual provisions: An empirical study of IT services contracts. *Organization Science*, 18(1), 3-19.
- Argyres, N., & Bigelow, L. (2010). Innovation, modularity, and vertical deintegration: Evidence from the early U.S. auto industry. *Organization Science*, 21(4), 842-853.
- Baldwin, C. Y., & Clark, K. B. (2006). The architecture of participation: Does code architecture mitigate free riding in the open source development model? *Management Science*, 52(7), 1116-1127.
- Berman, S. L., Down, J., & Hill, C. W. L. (2002). Tacit knowledge as a source of competitive advantage in the National Basketball Association. *Academy of Management Journal*, 45(1) 13-31.
- Bughin, J.R., Chui, M., & Johnson, B. (2008). The next step in open innovation. *McKinsey Quarterly*, 113-122.
- Chandy, R. K., & Tellis, G. J. (1998). Organizing for radical product innovation: The overlooked role of willingness to cannibalize. *Journal of Marketing Research*, 35(4) 474-487.
- Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston, MA: Harvard Business Press.
- Chesbrough, H., & Schwartz, K. (2007). Innovating business models with co-development partnerships. *Research Technology Management*, 50(1), 55-59.
- Chesbrough, H., Vanhaverbeke, W., & West, J. (2006). *Open innovation: Researching a new paradigm*. London: Oxford University Press.
- Christensen, C.M. (1997). *The innovator's dilemma*. Boston, MA: Harvard Business Review Press.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective of learning and innovation. *Administrative Science Quarterly*, 35(1), 128-152.
- Conner, K. R., & Prahalad, C. K. (1996). A resource-based theory of the firm: Knowledge versus opportunism. *Organization science*, 7(5), 477-501.
- Cowan, R., David, A., & Foray, D. (2000). The explicit economics of knowledge: Codification and tacitness. *Industrial and Corporate Change*, 9(2), 211-253.
- Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- Dittrich, K., & Duysters, G. (2007). Networking as a means to strategy change: The case of open innovation in mobile telephony. *Journal of Product Innovation Management*, 24(5), 510-521.
- Drucker, P. F. (1988). The coming of the new organization. *Harvard Business Review*, 66(1), 45-53.
- Ethiraj, S. K., Levinthal, D., & Roy, R. R. (2008). The dual role of modularity: Innovation and imitation. *Management Science*, 54(5), 939-955.
- Fetterhoff, T. J., & Voelkel, D. (2006). Managing open innovation in biotechnology. *Research Technology Management*, 49(3), 14-18.
- Gatignou, H., Tushman, M. L., Smith, W., & Anderson, P. (2002). A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. *Management Science*, 48(9), 1103-1122.
- Giannopolou, E., Ystrom, A., & Ollila, S. (2011). Turning open innovation into practice: Open innovation research through the lens of managers. *International Journal of Innovation Management*, 15(3), 505-524.
- Grant, R. M., & Baden-Fuller, C. (1995). A knowledge-based theory of inter-firm collaboration. *Academy of Management Proceedings*, 17-21.
- Hamel, G. (1991). Competition for competence and interpartner learning within international strategic alliances. *Strategic Management Journal*, 12(S1), 83-103.

- Haon, C., Gotteland, D., & Fornerino, M. (2009). Familiarity and competence diversity in new product development teams: Effects on new product performance. *Marketing Letters*, 20(1), 75-89.
- Henderson, R., & Cockburn, I. (1994). Measuring competence? Exploring firm effects in pharmaceutical research. *Strategic Management Journal*, 15(S1), 63-84.
- Hoetker, G. (2006). Do modular products lead to modular organizations? *Strategic Management Journal*, 27(6), 501-518.
- John, G., Weiss, A. M., & Dutta, D. (1999). Marketing in technology-intensive markets: Toward a conceptual framework. *Journal of Marketing*, 63(4), 78-91.
- Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of management journal*, 45(6), 1183-1194.
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3), 383-397.
- Kogut, B., & Zander, U. (1996). What firms do? Coordination, identity, and learning. *Organization Science*, 7(5), 502-518.
- Koput, K. W. (1997). A chaotic model of innovative search: Some answers, many questions. *Organization Science*, 8(5), 528-542.
- Laursen K., & Salter, S. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, 27(2), 131-150.
- Leiblein, M. J., & Miller, D. J. (2003). An empirical examination of transaction and firm-level influences on the vertical boundaries of the firm. *Strategic Management Journal*, 24(9), 839-859.
- Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, 14(winter), 95-112.
- Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. Cambridge, MA: Harvard University Press.
- Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14-37.
- Pil, F. K., & Cohen, S. K. (2006). Modularity: Implications for imitations, innovation, and sustained advantage. *Academy of Management Review*, 31(4), 995-1011.
- Pisano, G. P. (1994). Knowledge, integration, and the locus of learning: An empirical analysis of process development. *Strategic Management Journal*, 15 (Winter), 85-100.
- Pisano, G. P., & Verganti, R. (2008). Which kind of collaboration is right for you? *Harvard Business Review*, 86(12), 78-86.
- Sanchez, R., & Mahoney, J. T. (1996). Modularity, flexibility and knowledge management in product and organization design. *Strategic Management Journal*, 17, 63-76.
- Saviotti, P. P. (1998). On the dynamics of appropriability, of tacit and of codified knowledge. *Research Policy*, 26(7), 843-856.
- Schilling, M. A. (2000). Toward a general modular systems theory and its application to interfirm product modularity. *Academy of Management Review*, 25(2), 312-334.
- Sethi, R., Smith, D. C., & Park, C. W. (2001). The effect of cross-functional teams on creativity and the innovativeness of new products. *Journal of Marketing Research*, 37(2), 73-85.
- Simon, H. A. (1972). Theories of bounded rationality. *Decision and organization*, 1(1), 161-176.
- Slater, S. F., & Narver, J. C. (1995). Market orientation and the learning organization. *Journal of Marketing*, 59(3), 63-74.
- Slowinski, G., Hummel, E., Gupta, A., & Gilmont, E. R. (2009). Effective practices for sourcing innovation. *Research Technology Management*, 52(1), 27-34.
- Solow, R. M. (1957). Technical change and the aggregate production function. *The Review of Economics and Statistics*, 39(3), 312-320.
- Spender, J. C., & Grant, R. M. (1996). Knowledge and the firm: overview. *Strategic management journal*, 17(winter), 5-9.
- Thomke, S. (2001). Enlightened experimentation. The new imperative for innovation. *Harvard Business Review*, 79(2), 66-75.
- Uzzi, B. (1999). Embeddedness in the making of financial capital: How social relations and networks benefit firms seeking financing. *American Sociological Review*, 64(3): 481-505.
- Volberda, Henk W. (1996). Toward the flexible form: How to remain vital in hypercompetitive environments. *Organization Science*, 7(4), 359-74.
- von Hippel, E. (1988). *The sources of innovation*. New York, NY: Oxford University Press.
- von Hippel, E. (2005). *Democratizing innovation*. Boston, MA: MIT Press.
- West, J., & Lakhani, K. R. (2008). Getting clear about communities in open innovation. *Industry and Innovation*, 15(2), 223-231.

---

**Poonam Oberoi** is an Assistant Professor in Marketing at Groupe Sup de Co La Rochelle. Her research focuses on open innovation and her objective is to relate both the implementation decisions and the contextual factors of open innovation with the resulting level of performance. She successfully defended her PhD thesis at Grenoble Ecole de Management in June 2014 and was a visiting PhD Student at London Business School for the academic year 2011-2012.

**Christophe Haon** is Professor of Marketing, Grenoble Ecole de Management, and a member of the Institut du Capital Client. His research focuses on new product development, market orientation, and satisfaction. He co-authored research articles published in M@n@gement, European Management Review, Marketing Letters, Recherche et Applications en Marketing, and Systèmes d'Information et Management, among others.

**Isabel Maria Bodas Freitas** received her PhD in Science and Technology Policy at SPRU, University of Sussex, UK, in 2005. She is currently a senior Research Fellow at the Politecnico di Torino, and part-time assistant professor at Grenoble Ecole de Management. Prior to that she was a post-doc researcher at Eindhoven University of technology. Her main research interests include processes of knowledge development and transfer, adoption and diffusion of innovations, university-industry links, organizational and managerial innovations, and innovation policies.