

Governance of Inter-Organizational Collaborations When Engaged in Open Innovation

Abstract

Using external knowledge, through collaborative projects with external partners, leads to greater innovation performance. But, many collaborative innovation projects have failed completing their objectives. The thesis examines this problem by studying the governance mechanism of collaboration process in both execution and formation phases of projects. I seek to understand the nature of collaboration dynamics and the attributes of projects affecting governance mechanisms. To do so, three specific studies are framed: 1) How do firms manage the dynamics of collaboration process? 2) Does a formalized joint technology-development process help that a collaborative innovation project is successfully completed? 3) Which open innovation modes do managers choose for projects by different attributes?

Relevance of the Topic and Research Objectives

“Open and collaborative innovation is growing into a mainstream phenomenon of increasing business relevance in large firms, but mastering and managing it is a challenge”.

Former Head of Open Innovation at the Fraunhofer Society

The topic of open and collaborative innovation has received substantial research attention in the management literature consistently over the last 10 years. An extensive body of literature on inter-organizational collaboration (IOC) and open innovation (OI) has devoted considerable attention to show that firms can purposively transcend their organizational boundaries to improve their innovation activities through conscious use of inflows and outflows of knowledge in a cooperative relationship with external partners (e.g., Brunswicker & Vanhaverbeke, 2015; Chesbrough, 2003; Faems et al., 2008; Laursen & Salter, 2006; West & Bogers, 2014).

Open and collaborative innovation can be enacted in a variety of contexts with a range of external partners, such as customers, suppliers, universities, competitors, and start-ups (e.g., Foss et al., 2011; Laursen & Salter, 2006). To capitalize on the knowledge of these external partners, firms use a variety of mechanisms. Alliances (e.g., Faems et al., 2008), joint ventures (e.g., Ariño & De La Torre, 1998), networks (e.g., Jarvenpaa & Välikangas, 2014), licensing agreements (e.g., Li-Ying & Wang, 2015), and innovation contests, or innovation crowdsourcing (e.g., Afuah & Tucci, 2012) are examples of mechanisms that firms apply in order to access, generate, channel and organize external knowledge. Scholars have presented empirical evidence that tapping into external knowledge allows firms to improve their ability to solve their innovation problems in a more effective and efficient way, thereby leading to greater innovation performance (Foss et al., 2011; Laursen & Salter, 2006). For example, recent case study on the Lilly Open Innovation Drug Discovery (OIDD) platform depicts they are tapping into the knowledge of a large number of scientists and researchers to successfully explore new molecule types with the specific biological activity in a more open manner. This OIDD platform gained for Lilly access to a significant amount of previously inaccessible chemical diversity. It also has allowed for the identification of many scientists and researchers doing great work that were previously unknown to Lilly, thereby supporting Lilly’s internal research teams, which are focused on the development of new drugs and biopharmaceuticals (Brunswicker et al., 2016).

As much promise as openness and collaboration can bring to innovation potential, far too many collaborations have been documented as failure cases (e.g., Ariño & De La Torre, 1998; De Rond & Bouchikhi, 2004). For instance, research on international joint venture termination shows that approximately 90% of collaborations are unexpectedly terminated earlier than reaching the initially planned goals (Makino et al., 2007). An equity joint venture (JV) between two companies active in the chemical and cleaning-products industries, intending to develop a new ecological cleaning liquid for the U.S. and Asian markets, was unsuccessful and unfruitful as “the partners announced in September their decision to dissolve the JV as of December 1993” (Ariño & De La Torre, 1998: 319). De Rond and Buchikhi (2004) report how the IOC partners’ different and opposing views about compounds-developing technology, led to tensions between them, thereby stopping the collaboration before completing the partnership’s initial goals. Collaboration process can and should be better managed, resulting in fewer failures and greater levels of innovation. Consequently, managing the collaboration with external partners to successfully complete the collaboration, while vital to progress innovation, is currently quite challenging, even fraught with high risk for failure. I argue that the main question needing to be addressed to advance the cause of innovation on the literature of OI and IOC has shifted from ‘open and collaborative’ versus ‘closed’ innovation towards the appropriate governance mechanisms for guiding collaboration processes to successful innovation outcomes. ‘Governance mechanism’ is defined as a set of managerial and coordination activities adopted by partners to organize collaboration process including communication channels between the partners, decision making processes, roles and processes required for collaboration, incentive structures used to motivate involved partners, and property rights control (Grandori, 1997).

The formation phase in collaboration refers to the point when initial agreements have been established and the partners are expected to start active work towards joint objectives. A number of authors have argued that the governance of collaboration processes after the formation phase is a critical mechanism to study why some open and collaborative projects (henceforth “collaborative project”) succeed while others fail. (e.g., Das & Teng, 2000). These authors have concentrated upon the role of specific factors affecting the governance, such as partners’ expectation about efficiency of collaboration (Doz, 1996) or performance approach. But such a narrow focus can result in a constrained understanding of the governance of collaboration process itself. Moreover, other scholars argue that selection of the governance mechanism for

collaborative projects in the formation phase can play a crucial role in project successes. Most studies have targeted firm-level and industry-level characteristics as determinants of governance mechanism (van de Vrande et al., 2009). These studies provide us with limited understanding, ignoring particular attributes of the project itself (Felin & Zenger, 2014).

Thus, there is a need for a more comprehensive and holistic view to study the governance of collaboration process. The main objective of this thesis is to create such a comprehensive view, in order to advance our understanding of open and collaborative innovation governance.

Three specific research objectives are framed to address this overall objective. The first objective is understating the nature of dynamics in collaborative projects and how these dynamics affect governance mechanism to have successful outcomes. Thus, I seek to answer the following question in the first Study to address the first objective: *How do firms manage the dynamics of collaboration process with external sources to successfully complete their open and collaborative innovation projects?*

The second objective is to examine the role of introducing formality into the joint collaboration process (i.e., joint technology development process) with the aim of managing the knowledge sharing-protecting tension to have successful outcomes. This is addressed by study 2: *Does the use of a formalized joint technology development process help to increase the likelihood that an open innovation project with external sources is successfully completed?*

The final objective is to explore how the governance mechanism of open and collaborative project (is called “open innovation mode” in this thesis as well) is affected by two problem attributes namely, problem complexity and hiddenness of knowledge. The study 3 addresses this final objective: *Which open innovation modes do managers choose for projects characterized by different attributes?*

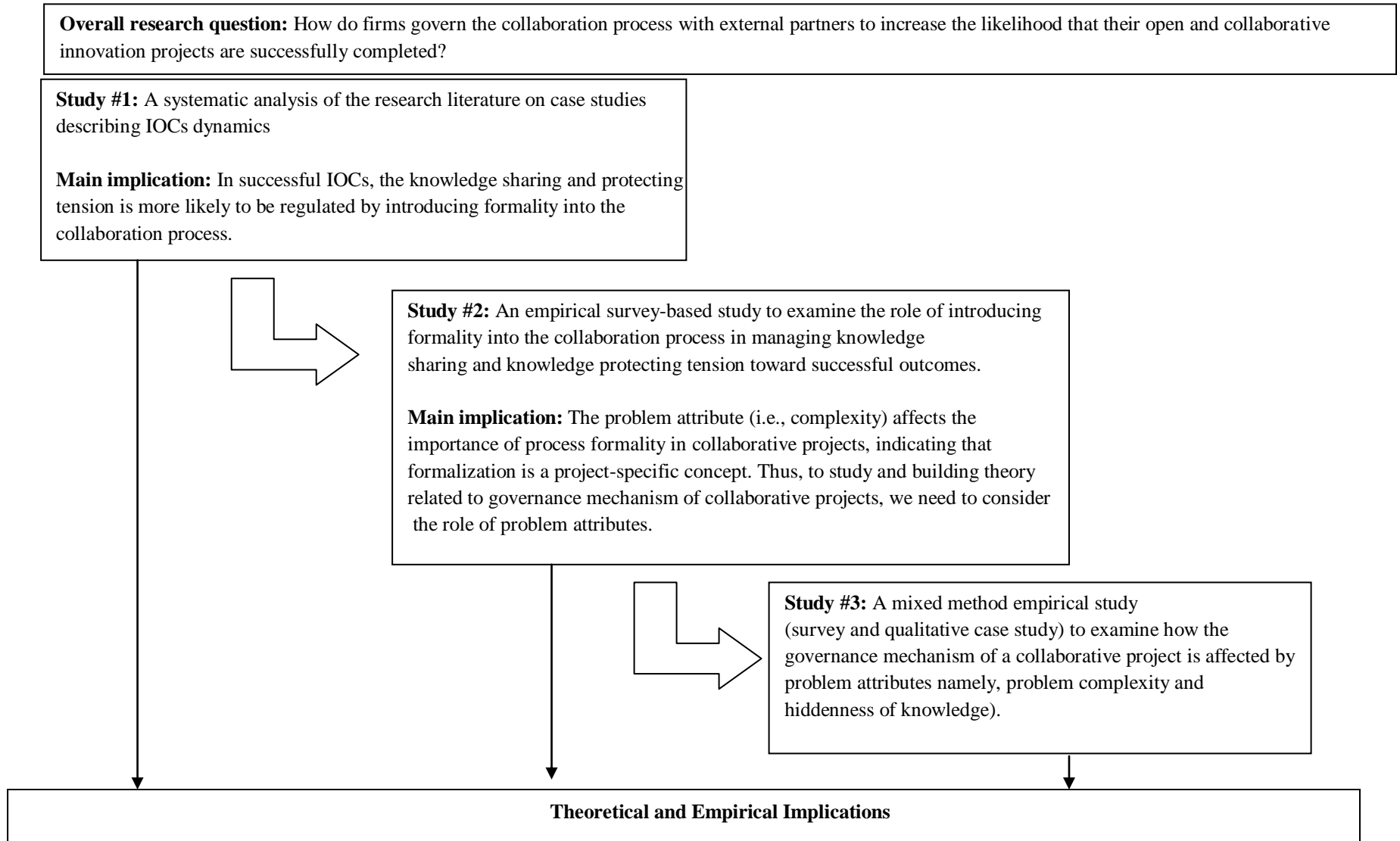
Three-Study Research on Governance of Open and Collaborative Innovation

This thesis consists of three studies. Each of the three studies¹ aims to address one of the interconnected questions (above-mentioned) derived from the overall research objective. The first study is a systematic analysis of the research literature on qualitative cases describing

¹ Each study has its own abstract, introduction, literature review, methodology, results, and discussion parts which are available in the original version of thesis.

dynamics of collaborative projects to understand the nature of dynamics and their effects on governance and project performance. The second study, an empirical survey-based study, is built based on one of the main implications of the findings from this review to understand the role of collaboration process formalization in the regulation of knowledge sharing-protecting tension. Also, the question addressed by the third study is derived by a relevant implication of the findings of the second article to explore the role of project attributes (i.e., complexity and hiddenness of required knowledge) in governance selection. A summary of the structure of thesis and relationship between three studies is presented in Figure 1. In the following sections, I will briefly explain the content and main implications of each study as well as the relationship between all three studies.

Figure 1: Structure of the Thesis



Study #1: A Review of Interorganizational Collaboration (IOC) Dynamics

In the first study, in order to better understand the governance of the collaboration process and its effect on performance, a cross-case systematic analysis of dynamics, is defined as any change in the form or state of the IOC over time (Van de Ven & Poole, 1995), is conducted across different forms of open and collaborative innovations such as alliances, joint ventures, consortia, and networks. Only longitudinal qualitative cases of collaborative projects are included in this article to capture the nature of the dynamics. There is now an accumulated wealth of longitudinal studies on collaborative projects that explore processes and dynamics of collaboration. 22 projects published in the top-tier journals, such as *Academy of Management Journal*, *Administrative Science Quarterly*, *Management Science*, etc., are included in the study.

One of the main implications of the findings from this review is the presence of simultaneous cooperative (refers to open knowledge exchange and sharing among the partners in the collaborative projects) and competitive (refers to limited and constrained exchange and sharing of knowledge) interaction style (as one of IOC characteristics) between the partners. Moreover, this review shows the presence of duality in changes in interaction style over time in collaborative projects, meaning both changes of increased competitive interaction over time, and changes in increased cooperative interaction over time. For example, over time in a research and development collaborative project, the two partners increasingly shared sensitive technological information (Faems et al., 2008). In contrast, Ness (2009) reports how changes in a goal led to highly contentious interaction style and less knowledge sharing over time in an alliance while initially the relationship was dominated by cooperative style and information sharing. This systematic review shows that the shift from competitive to cooperative (more knowledge sharing between partners over time) is primarily caused by allowing project technical teams to have control over the decision as the team-based decision making can increase flexible dialog and interaction among involved technical staff from all partners.

Comparing change in interaction style between successful and unsuccessful cases shows that successful collaborative projects are more likely to have an increased use of cooperative interaction style and knowledge sharing over time, coexisting with competitive style and hiding knowledge. Thus, the two interaction styles (i.e., simultaneous sharing and hiding of knowledge) appears to be required to ensure effective knowledge sharing to successfully complete the joint

project and at the same time protecting knowledge from potential partner opportunistic behavior. In other words, in successful projects, the partners are able to manage the simultaneous knowledge sharing and protecting (i.e., regulating knowledge sharing and protecting tension). Based on this review, knowledge sharing and protecting tension seems to be regulated by the introduction of procedural formality to collaboration process (i.e., formalization and standardization of roles and processes of collaborative project) to have successful outcomes. Thus, increased knowledge sharing between the partners over time is attributable to team-based decision making and the introduction of process formalization. At first, the presence of both procedural formality and team decision making in collaborative projects seems to be a paradox between formality and informality (team-based decision making). However, instead of a paradox, I believe that involved teams of technical staff in decision making may particularly require such formality due to the syndrome that individuals working within collaborative projects must simultaneously both trust and distrust their partners to protect themselves from opportunism. The formal procedures make the team-based decision making more feasible by reducing the possibility of opportunism. This important finding highlights the need to examine the role of procedural formality in the regulation of knowledge sharing and protecting tension that arises from the simultaneous need to trust and distrust of partners in the collaborative projects. The second study aims to deepen our understanding of this main finding based on a survey-based empirical study.

Study #2: How to Manage the Knowledge Sharing and Protecting Tension in Open and Collaborative Innovation Projects: The Role of Process Formalization

The second study is focused on studying the role of introducing formality into the collaboration process for managing knowledge sharing and knowledge protecting tension toward successful outcomes. The type of formalization receiving the most attention in the open and collaborative innovation literature is legal formalization, such as contracts around IP control (Cassiman & Veugelers, 2002; Laursen & Salter, 2014). However, these types of formalization may not address more specific activities of the partners, thus, the partners may share IP-related knowledge that they should not sharing while they are collaborating (Jarvenpaa & Majchrzak, 2016). As a result, in addition to formal legal IP control, an alternative conceptualization for formalizing of collaborative process is required. This alternative conceptualization (based on the main finding of the first study) can introduce formality into the joint collaboration process (also

called “joint technology development process”) itself by specifying activities and evaluation criteria that should be followed by the parties for completing the collaborative project. Introducing formality into the joint technology development process decreases the uncertainty about required knowledge that should be shared for furthering project goals (Avadikyan et al., 2001; Vlaar et al., 2006). This formality can create a predictable guidelines about what should be shared and what should be protected (Jarvenpaa & Majchrzak, 2016). This predictability stimulates the partners for self-monitoring and regulation of knowledge sharing and protecting tension during the joint projects to avoid the opportunistic risk. As a result, flexible interaction between the parties without losing critical knowledge is supported, thus increasing the likelihood of success of open and collaborative innovation projects.

This study is an empirical study based on a sample of 82 open innovation projects collected from large firms in the United States and Europe through survey. In this study, I argue that formalization is a project-specific variable. But, in many quantitative studies on open and collaborative innovation, formalization is almost always measured as an organizational level factor (Foss et al., 2011). Thus, with project-level data, we are able to assess the degree of process formalization used within the project in more detail compared to the more traditional level of firm-aggregated data often used in open innovation research.

I followed regression based moderated mediation analysis. The results clearly indicate that in order to manage the knowledge sharing-protecting tension, process formality seems to have a positive effect on projects outcomes. Likewise, the results of this study show that the positive relation between the level of formalization and project performance is made even stronger when the problem being solved is more complex. This indicates that as collaborative projects undertake more complex problems, the importance of process formality in creating successful innovation outcomes increases. The findings of this article clearly show that the problem attribute (i.e., complexity) affects the importance of process formality in collaborative projects, indicating that formalization is a project-specific concept. The main implication of this finding is that only focusing on firm level characteristics (firm-level aggregated data) may lead to incomplete understanding (Du et al., 2014). Thus, this implication suggests that for studying and building theory related to open and collaborative innovation particularly, adopting governance mechanism for collaborative projects, we have to consider not only industry- (van de Vrande et al., 2009) and firm-level characteristics, but also the role of problem attributes (e.g., Felin &

Zenger, 2014). The third study enhances our understanding of how the governance mechanism of open and collaborative project is affected by problem attributes in the formation phase of projects.

Study #3: What's Your 'Open Innovation Mode'? Problem Types and Open Innovation Governance Modes

The main focus of the third study is on understanding the appropriate governance mechanism of collaboration with external partners (called open mode in this study) based on problem attributes. In this study, a two-step approach is taken by combining a survey-based study (survey database of 104 open innovation projects in large firms in Europe and the United States²) with multiple case study analysis (6 open innovation projects from large firms in United States and Europe such as Clariant, Bosch, Pfizer, Eli Lilly, Evonik, and HP Labs).

I followed a three-step exploratory statistical analysis for the survey study to explore optimal fit between problem type and open innovation mode. First, I classified open innovation projects that have similar problem attributes (i.e., complexity and hiddenness of knowledge) into homogeneous clusters (hierarchical cluster analysis and K-means clustering were applied). Second, open innovation projects were clustered based on open innovation modes utilized on a specific project to develop homogenous groups of projects in terms of open innovation modes (I applied a two-step method as our variables are binary). Third, I examined how problem attributes relate to open innovation modes.

The results clearly reveal that the problem type is associated with a particular open-innovation mode. Market and contractual modes (such as licensing) are associated with simple problems for which the required solution knowledge can also be easily identified by firms. The open innovation platform (such as contests, intermediaries, tournaments) is a proper mode in which to solve simple problems with unknown required knowledge. In such cases, firms may use the crowd to identify hidden knowledge sources. Partnerships (such as alliances and joint ventures) seem to be an appropriate mode for complex problems for which the required solution is known for firms. Moreover, the results of this study show that the selection of open innovation modes is affected by the interaction of the two attributes as well. For example, for simple problems they

² In this study, I used the same dataset applied for the second study. The sample size between two studies is different due to missing values.

can adopt either open innovation markets or open innovation platforms. But, open innovation market is preferred for simple problem when the location of knowledge for solving problem is known for project teams so that they can make a contract with external partners to solve their problem. By contrast, for simple problem when project teams have no idea about the location of the required knowledge, they prefer to engage in open innovation platforms to access a wide range of potential external sources. Two different open innovation modes are adopted for the simple problem based on the level of hiddenness. Thus, the two attributes should be considered at the same time (the interaction between them) to select the appropriate open innovation mode.

Theoretical Implications of Thesis

The first theoretical contribution of this thesis is for research on the dynamics of IOCs by finding the presence of dualities in IOC characteristics (such as interaction style between partners) in different forms of collaboration such as alliance, network, etc. This finding appears to support what De Rond and Bouchikhi (2004) refer to as dialectic tensions in alliance between cooperation and competition, individual autonomy and control and other characteristics. In some collaborative projects, for instance, partner firms simultaneously cooperate (i.e., open knowledge sharing) and compete (hiding knowledge) with each other. Bengtsson and Kock (2000) show that partners in cooperative relationship tend to share and hide knowledge simultaneously. The two interaction styles seem to be needed to ensure effective knowledge sharing while maintaining alertness and visibility to potential partner opportunistic behavior. These dualities suggest dualism as an important descriptor of dynamics in collaborative projects that need to be examined so that critical issues on how partners govern collaboration are not lost (Vlaar et al., 2007).

Second, the findings have important theoretical contributions for cooperation literature (e.g., Bengtsson & Kock, 2000; Ritala & Hurmelinna-Laukkanen, 2013), arguing the advantages of simultaneous cooperation and competition among partnering firms in collaborative project successes, if managed effectively. The findings of this dissertation suggest that the balance of cooperation and competition seems to be managed by relying more on team-based decision making (i.e., involving more technical workers from the partner firms in managerial decision making) and introducing procedural formality (i.e., introducing new roles, processes, and procedures to collaboration) in projects.

Third, this thesis has theoretical contributions for research on using external knowledge by suggesting that process formalization, virtually ignored in previous studies of engaging in open and collaborative projects, supports legal formalization around IP control to manage the concern over knowledge sharing and opportunistic risk in collaborative innovation projects (Cassiman & Veugelers, 2002; Laursen & Salter, 2014) by reducing the ambiguity that individuals have in terms of what IP-related knowledge needs to be shared and what needs to be protected. Thus, future studies have to pay more attention to the procedural formality that firms need to make sure that collaborative projects using external knowledge are likely to have successful innovative outcomes without the loss of critical intellectual property.

Fourth, the findings presented in this thesis have important implications for interactive self-regulatory theory for sharing and protecting knowledge in IOCs, indicating the critical role that flexible collaboration process plays between interacting individuals who engage in daily sharing and protecting knowledge, in regulation of the sharing-protecting tension (Jarvenpaa & Majchrzak, 2016). This study suggests that flexible interaction is primarily possible not because it implies informal self-organized decision making about knowledge sharing and protecting in an ad-hoc fashion, but instead asserts that decisions that are made based on formalized joint processes. The establishment of formal process makes flexible interaction between individuals from the partners more feasible because of clarity not only about what knowledge should be shared but also about what knowledge should be protected.

Fifth, the procedural formality presented in this study has theoretical implications for the literature on relational mechanisms in IOCs, putting great emphasis on the importance of informal elements in creating trust between partner firms to ensure collaboration success (Ring & Van de Ven, 1992). At first, it seems that there is a paradox between my findings, introducing formality into the collaboration process, and the importance of informality and trust based relationship between partner firms. I believe that, instead of a paradox, process formalization can help the parties manage distrust (particularly trust and distrust coexist between individuals in the collaboration), between individuals in collaboration process, by reducing opportunistic risk of knowledge sharing.

Sixth, several authors have argued for the need for firms interested in IOC and OI to develop a dynamic capability for successful outcomes (e.g., Jarvenpaa & Majchrzak, 2016). This study can

suggest what such a dynamic capability looks like, and how it is likely to evolve. For example, I introduce process formalization as a critical dynamic capability that needs to be in place for collaborative innovation projects to succeed, explaining how successfully an individual on the team is able to manage the tension between knowledge sharing and protecting in the flexible interactive collaboration.

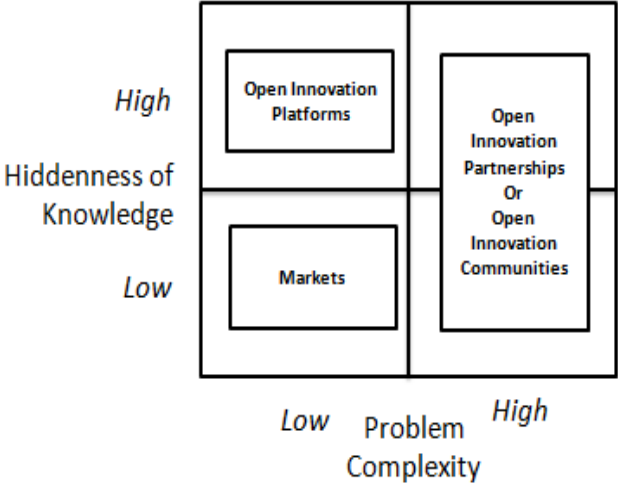
Finally, this thesis shows that there is a clear pattern of interrelationship between the attributes of the problem (i.e., complexity and hiddenness of required knowledge) to be solved and the governance mechanisms chosen for collaborative projects. This finding provides empirical insights related to recent conceptual comparative discussion of different governance mechanisms for open innovation (Felin & Zenger, 2014). Also, this finding has theoretical implications for literature on IOCs and OI in general and formalization of IOCs literature in particular with suggesting that for studying and building theory we have to consider not only industry and firm level characteristics, but also the role of projects attributes (Du et al., 2014; West et al., 2014).

Practical Implications of Thesis

The results of this thesis have several major implications for open and collaborative innovation managers. Collaborative projects are often terminated prior to reaching their initially defined objectives (e.g., Ariño & De La Torre, 1998). The results of this study provide suggestions to avoid unsuccessful collaborations. For example, this thesis shows that introducing formality into the joint technology development process reduces uncertainty about what knowledge should be shared and what knowledge should be protected. Therefore, the knowledge sharing-protecting tension is regulated, thereby reducing failures. Thus, managers need to allocate enough time, at the both the formation and execution phases of project, to specify technological activities and evaluation criteria, such as technological specifications to be followed by involved individuals from partnering firms developing the desired technology. As technical staffs involve in the daily sharing and protecting of knowledge during the course of collaboration, this study suggests that managers invite all individuals involved in the project to more efficiently specify the joint development technology process. Also, this helps individuals gain sufficient information about the technological activities, since they are already involved in the process of specification, therefore making the implementation of the formality easier.

Moreover, this dissertation provides managers with guidelines that support the decision for the selection of the right governance for open and collaborative projects at the earliest stages of the

project. First, this dissertation suggests that managers need to carefully analyze the project attributes (i.e., problem attributes) before deciding how to engage in open and collaborative innovation. Two attributes presented in this study help them to quickly position the project in the 2x2 matrix (complexity and hiddenness). Then, managers need to choose a governance mechanism fits with the problem based on the proposed mechanisms in the 2x2 matrix.



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