**The role of contracts and intellectual property rights in**

**open innovation**

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**Abstract:**

Our exploratory empirical study, based on interviews and a survey of firms, addresses a number of questions on the role of formal contracts and intellectual property rights in the context of firm-to-firm open innovation. We find that firms active in open innovation have a very strong preference for the governance of their open innovation relationships with other firms through formal contracts. Also, despite the open nature of open innovation, firms still see intellectual property rights as highly relevant to the protection of their innovative capabilities. We find the degree of openness of firms, their formal legal attitude, and the competitive dynamics of their product market environment to be related to the preference of open innovation firms for intellectual property rights. Furthermore, the strength of firms’ internal R&D capabilities increases the positive relationship between openness and the preference for intellectual property rights.

(142 words)

Key words: open innovation, contracts, intellectual property rights

**INTRODUCTION**

Globalization, increasing technological complexity and a variety of other environmental, strategic, and economic factors have forced firms to shift their focus from closed innovation, which relies primarily on internal R&D , to a model of ‘open innovation’(OI) (e.g. Chesbrough, 2003; 2006a; West and Bogers, 2014). While the traditional closed innovation model is based on a logic of internal focus and control, the OI model suggests that firms increasingly open up their boundaries, access external sources of knowledge and technology, and bring in-house inventions to markets via external paths (e.g. Dahlander and Gann, 2010; Foss et al., 2010; Bae and Chang, 2012). The core idea of OI refers to the exchange of knowledge of firms with a diversity of external sources (competitors, customers, start-ups, suppliers, universities and a range of other organizations and institutions) through different mechanisms (collaborative R&D, corporate venturing, crowdsourcing, licensing, etc.) (e.g. Laursen and Salter, 2006; Grimpe and Sofka, 2009; Huizingh, 2011).[[1]](#footnote-1)

This transformation from a closed to an open innovation model creates a number of new strategic, organizational and managerial challenges (e.g. Sieg, Wallin, and von Krogh, 2010; Pullen et al., 2012; Salge et al., 2013). Two of the main challenges refer to the governance and control of cooperative innovation processes and the management of the intellectual property of diverse parties (;e.g. Chesbrough, 2006a,b; Graham and Mowery, 2006; West, 2006; Laursen & Salter, 2014; Ritala and Hurmelinna Laukkanen, 2013). In particular, loss of control, increased coordination costs, diffuse property rights, risks of opportunistic behavior, as well as unintended knowledge flows complicate the governance and control of relationships in an OI context (e.g. Almirall and Casadesus-Masanell; 2010; Enkel, Gassmann, and Chesbrough, 2009; Al Aali and Teece, 2013; Henkel, Baldwin, and Shih, 2013).

The governance of inter-organizational relationships through formal contracts and intellectual property rights (IPR) are, thus, critical in the context of OI. Contracts that firms use to formalize their relationships with external sources of innovation are defined as legally binding agreements, in writing, between two or more parties (in this context firms) that are intended to create a legal obligation or a set of obligations. IPR refer to exclusive privileges granted to owners of a variety of distinct new creations in terms of [intangible assets](http://en.wikipedia.org/wiki/Intangible_asset) (discoveries, inventions, and new designs). Common types of IPR include [patents](http://en.wikipedia.org/wiki/Patent), [trademarks](http://en.wikipedia.org/wiki/Trademark), [copyrights](http://en.wikipedia.org/wiki/Copyright), [design rights](http://en.wikipedia.org/wiki/Industrial_design_right), and technical or commercial information ([trade secrets](http://en.wikipedia.org/wiki/Trade_secret)).

However, so far, little is known about the specifics of how OI firms govern their relationships with partners through contracts and how important IPR are when these OI firms collaborate with others. Not only do most contributions to the OI literature discuss governance and IPR in rather general terms (e.g. Dahlander and Gann, 2010; Huizingh, 2011; de Jong, Kalvet, and Vanhaverbeke, 2010), the debate is also largely based on some general assumptions about the behavior and strategy of OI firms with little or no systematic analysis of the actual choices that these firms make when it comes to contracts and IPR in an OI context (see Laursen and Salter, 2014; Henttonen, Hurmelinna-Laukkanen, and Ritala, 2015 for notable exceptions). Furthermore an interesting theoretical debate concerning the role of IPR in the context of OI has emerged, in which one group of scholars argues for the importance of IPR for enabling knowledge transfer (e.g. Chesbrough, 2006b; Graham and Mowery, 2006; Sandulli and Chesbrough, 2009; de Jong et al., 2010; Chesbrough and Chen, 2013), while another group of scholars suggests that IPR threaten the notion of ‘openness’ according to which knowledge should be widely accessible (e.g. Pénin, 2011; von Hippel and von Krogh, 2006).

 In order to shed light on this dichotomy in the OI literature and to build a better understanding as well as some empirical evidence regarding firms’ actual choices with regard to contracts and IPR, we address the following research questions: *Do firms govern their OI relationships via contracts and IPR (and if they do, how and why)? And what factors determine firms’ preferences for IPR in an OI context?* We address these questions on the basis of an exploratory empirical study. Given that our research questions draw from prior literature and theory in domains such as inter-firm cooperation (e.g. Gomes-Casseres, Hagedoorn, & Jaffe, 2006; Gulati, Lavie, and Singh, 2009), intellectual property (e.g. Arora, Fosfuri, and Gambardella, 2001; Arora and Merges, 2004; James, Leiblein, and Lu, 2013), and contract design (e.g. Hagedoorn and Hesen, 2007; Lerner and Malmedier, 2010), but are relatively unexplored in the domain of OI, they can be positioned in the context of ‘intermediate theory’ (Edmondson and McManus, 2007). As a result, we use a hybrid methodology and combine qualitative data, in the form of an interview study, to help elaborate the phenomena of contracts and IPR in OI and quantitative data, in the form of a survey, to provide preliminary tests of relationships between a new construct (i.e. OI) and relatively established constructs (i.e. preferences for IPR).

**RESEARCH FRAMEWORK**

*Interview Study*

Our sampling strategy is purposive and guided by our research questions (Miles and Huberman, 1994) that aim at elaborating on the role of contracts and IPR in OI. As a result, we conducted a series of interviews with representatives of five large, medium to high-tech firms that can be classified as OI firms based on a number of criteria (e.g. participation in OI conferences, the role of OI in annual reports, portrayal of OI on corporate Website; trade journal publications on OI). The qualitative interviews facilitate our survey research and provide background information, as well as richer details on the role of contracts and IPR in OI (Miles and Huberman, 1994; Punch, 2005).

*Survey*

The larger part of our data collection is based on a survey that used the key informant method to collect data for a larger group of firms active in OI. As we want to highlight the relationships between OI, contracts, and IPR, a deliberate sampling strategy is appropriate, as it maximizes the chance for these relationships to be observed (Punch, 2005). Thus, the data collection was organized via ‘Exnovate’, the European Network of Excellence on Open and Collaborative Innovation. Firms that participate in this network source external knowledge and technologies by means of OI, which makes them relevant to our research questions (Punch, 2005). Hence, by concentrating on firms that engage in OI, we are sampling to find instances that are representative of a particular dimension of interest – that is OI (Teddlie and Yu, 2007). The Exnovate network consists of about 850 firms from a range of European countries and North America. Exnovate allowed us to directly address key informants from these firms involved in external knowledge sourcing and OI. Our survey was designed and implemented according to Dillman’s (2007) tailored design method, as well as pre-tested by means of a small pilot study. Our sample of 101 corresponds to a response rate of about 12%. We tested for nonresponse bias by comparing the first and last twenty-five percent of respondents on key variables for OI and firm characteristics. The analysis indicated that the two groups are statistically similar on all variables, indicating that nonresponse bias does not pose a problem. To address common method bias, a number of procedural remedies were employed, such as improving scale items via interviews and pre-testing, protecting respondent anonymity, ensuring subjects there were no right or wrong answers, and counterbalancing question order (Podsakoff et al., 2003). In addition, Harman’s one-factor test suggests that the data do not suffer from common method variance (Podsakoff et al., 2003).

**THE ROLE OF CONTRACTS AND IPR IN OPEN INNOVATION**

**Literature Background on OI and Contracts**

Chesbrough’s seminal contributions (Chesbrough, 2003; 2006a, b) already stressed the importance of strategically managing knowledge exchange in an OI setting. His acknowledgement that OI can be too open and that there is a risk of appropriation of innovative efforts by others (Chesbrough, 2006b), suggests that protection of innovative capabilities, not only through IPR protection but also through contractual relations with partner firms, might be unavoidable (see also Luoma, Paasi, and Volkokari, 2010). Some recent contributions pay more explicit attention to the use of contracts in OI. Munsch (2009) stipulates that given the uncertainty surrounding OI efforts, contracts have to be negotiated between OI partners to govern ownership, resource commitment, IPR, exclusivity, termination conditions, and termination rights. In other words, firms active in OI would face all the contractual intricacies that play a role in standard inter-firm exchanges. Lee (2009) and Lee, Nystén-Haarala, and Huhtilaienen (2010) also stress the role that inter-firm contracts and firms’ contracting capabilities should play in OI to establish ownership and to control appropriation and contingencies. Interestingly, these authors add that, given the dynamic nature of OI, these OI contracts will to a large extent remain incomplete and subject to what we could refer to as flexible private ordering, where contract parties accept the incomplete nature of their contracts and adjust their joint efforts if circumstances so dictate (see also Almirall and Casadesus-Masanell, 2010).

 Others have expressed an alternative view of OI that does not embrace inter-firm contracting as e.g. found in Chesbrough’s original contributions. These contributions, that could be labeled as sharing an ‘open distributed innovation perspective’, stress that OI should refer to the open disclosure of knowledge and sharing of this knowledge with all possible parties interested (Pénin, 2011; von Hippel and von Krogh, 2006; Baldwin and von Hippel, 2011). For instance, Pénin (2011) states that contract-based forms of inter-organizational collaboration, such as licensing, joint ventures, and contractual alliances, are according to this alternative view not to be considered as part of a truly OI effort as these contractual collaborations usually restrict knowledge diffusion to the parties involved and certainly to third parties. Von Hippel and von Krogh (2006) mention that OI should be characterized by ‘free revealing of product and process designs’ that is available to all relevant firms and organizations. Or, as stated by Baldwin and von Hippel (2011, p. 1400): “… innovation is ‘open’ (…) when all information (…) is a public good – non-rivalrous and non-excludable.” The ultimate consequence of this particular understanding of OI is that innovation becomes open only if relevant knowledge can be shared by everyone and also becomes available to everyone, with little or no role for contracts. Interestingly, the basic thoughts behind this particular perception of OI seem to resonate elements of the ‘business world without contracts’ of Macaulay (1963) where formal contracts are of little relevance.

Besides this general dichotomy in the literature,little is known about the specific roles that contracts could play in this setting.However, contracts can be used from a legal perspective to control the progress of collaboration with partners but also to monitor the progress of collaboration from a more practical process perspective (see also Argyres and Mayer, 2007; Mellewigt, Madhok, and Weibel, 2007; Reuer and Arino, 2007). This suggests the question to what extent both perspectives are relevant in the context of these OI cooperation contracts or whether OI firms see these contracts as primarily serving one goal. In other words, to what extent are these contracts used to monitor the process of OI cooperation process or to contractually control the cooperation with OI partners?

**Empirical Insights on the Role of Contracts in OI**

Given these different perspectives on control and the use of contracts in OI, the first and obvious question is whether firms, that perceive themselves as typical representatives of OI, do indeed use contracts in their OI collaboration, or not? Interestingly, our survey results indicate that an overwhelming majority of firms in our sample, i.e. 95%, do use formal contracts when working with their OI partner firms, while very few firms rely on non-contractual partnerships for their OI activities.

Our interview study also indicates that OI firms prefer to use formal contracts with their OI partner firms. As stated during one of the interviews: “… *whenever we get into a partnership or collaboration, there is a framework agreement…”* Also, firms seem less inclined to engage in free revealing when engaging in OI with other firms, as pointed out by another manager: “… *I mean nothing is free in the world.* *It is open innovation; it is certainly not free… So who owns what in an open context? …We have agreements and contracts on how to do this…”* These formal contracts are often preceded by term sheets to stipulate preliminary terms and conditions that govern the joint activities of the OI partner firms. These term sheets help the firms to specify expectations of both parties and to speed up the contracting process. As explained by one of the managers: *“… it is very important to get the right expectations from both sides at the beginning; before you develop a contract. What normally works best, is that you first have a term sheet on the expectations from both sides before you involve the lawyers to come up with a joint development agreement, or whatever kind of agreement. Otherwise it can take ages before you come to an agreement. So you should agree on terms first and then discuss the details later...”* These term sheets serve as a first basis for negotiations, prior to the development of a more formal final contract. As illustrated by the following quote: “… w*e make a term sheet, specifying what is mine, what is yours, and what we develop together...”*

Similar to other formal inter-firm contracts, these OI contracts contain a range of contractual clauses, that refer to, amongst others, ownership, exclusivity, and financial compensation. However, in light of the dynamics of OI with frequent environmental changes as new partners and new R&D projects enter the picture, managers who we interviewed stressed that these contracts are expected to have a limited time horizon. This situation calls for what we described in the above as flexible private ordering through contracts. As mentioned by one of the managers, this implies that even if particular OI partners continue to cooperate over an extended period of time “... *contracts are not perpetual, so contracts run for a couple of years and then they have to be renewed* ….”

With regard to the specific roles of these contracts, our findings show that firms active in OI see both the legal (control) perspective and the practical (monitoring) perspective as quite relevant. On average, firms in our sample perceive contracts as an important legal mechanism to control their collaboration with OI partners, as indicated by an average score of 5.35 on a 7-point Likert scale (standard deviation 1.5). The perceived importance of formal contracts as a means to monitor the progress of collaboration is somewhat lower with an average score of 5.06 on a 7-point Likert scale (standard deviation 1.6).

**Literature Background on OI and IPR protection**

As with the literature on the role of contracts in OI, there is a relatively small body of literature that pays explicit attention to the role of IPR (patents, trademarks, copyrights, design rights, and trade secrets in terms of technical or commercial information) in OI. Interestingly, these contributions seem to follow a divide somewhat similar to the debate about contracts, with some authors advocating the advantages of IPR protection for firms active in OI, whereas others stress the tension between IPR and OI. Sandulli and Chesbrough (2009), extending Chesbrough (2006b), stress that IPR can play a role in OI to ensure that firms can capture value from their innovative activities (see also Chesbrough and Chen, 2013; Henttonen, Hurmelinna-Laukkanen, and Ritala, 2015). Even more explicit are Pisano and Teece (2007) in their understanding of the role of strong regimes of appropriability where IPR protection facilitates the exchange of knowledge between firms as they realize that, given IPR, their intangible assets are difficult to imitate or appropriate. This understanding is shared by Graham and Mowery (2006) who suggest that “… IP protection creates a platform for the transfer of knowledge assets…” (p. 185). They argue that Chesbrough’s concept of OI relies heavily on markets for intellectual capital that need to be supported by strong formal IPR (see also Dubiansky, 2006 and de Jong et al., 2010).

Pénin (2011) on the other hand stresses that IPR protection might threaten OI as broad accessibility of knowledge and technology is a crucial element of OI. In order to ensure this accessibility, IPR should not transfer control to a single owner but rather no firm should be allowed to appropriate any innovation or its future improvements and as such this would preserve the openness of OI (von Hippel and von Krogh, 2006). West (2006), West and Gallagher (2006) and Laursen and Salter (2014) appear to take a position somewhere in between a pro and a counter-IPR argument. On the one hand, they acknowledge that IPR enable firms active in OI to capture returns on their innovative efforts while also secure their exchanges with other firms. On the other hand, IPR protection may conflict with a common understanding of openness through which shared external information is without significant costs to partners.

**Empirical Insights on the Role of IPR in OI**

Given these different perspectives on OI and IPR protection, it is an interesting question whether firms, that perceive themselves as typical representatives of OI, see IPR as a relevant protection mechanism for their innovative capabilities. During our interview study, it was stressed by every manager we interviewed how important ‘*exclusivity based on patents and other intellectual property*’ and ‘*protection of knowledge*’ are for these OI firms. They indicate that, without IPR, they would be less inclined to cooperate with other firms as, based on their IPR protection, they are willing to invest in innovative activities that they can share with others.

Results from our survey show a more detailed perspective on the role of IPR. It turns out (see Table 1) that patents and technical and commercial information (trade secrets) are seen as the most important instruments to protect the innovative capabilities of firms from their OI partners, as indicated by around 90% of the firms in our sample. Trademarks and design rights are also seen as relevant by a substantial share of firms (over 70 % and nearly 65%, respectively), while a smaller share of firms (nearly 50%) see the relevance of copyrights for the protection of their innovative capabilities.

**Table 1 Share of OI firms that perceive IPR as relevant for the protection or signaling of innovative capabilities, % for protection and for signaling, relevance is indicated by a score of 5 or higher on 7-point Likert scale (n=101)**

|  |  |  |
| --- | --- | --- |
|  | Protection | Signaling |
| Patents  | 90.1%  | 77.2% |
| Trademarks | 71.3%  | 56.4% |
| Copyrights | 48.5%  | 37.6% |
| Design rights | 64.4%  | 49.5% |
| Technical / commercial information(trade secrets)  | 86.1%  | 76.2% |

These findings are in line with our interview study which indicates that firms see IPR as sensitive and crucial to their OI strategy. The interviews show that there is a general preference for establishing clear ownership of IPR in an OI context. As mentioned by one of the managers: *“… for us it is really important that if we do something, we have the right to do so. When we discuss collaboration, IPR are a very, very important point. Typically, we would like to own the IPR …”*

During the interviews, it was also frequently mentioned that IPR enable firms to share knowledge with other firms and the more protected their knowledge through IPR, the more they would be willing to collaborate. This protection of knowledge and innovative capabilities by means of IPR also enables firms to selectively exchange knowledge and share their innovative activities with certain partners. As pointed out by one of the managers: “… *we are doing open innovation, not public innovation. Our goal is not to come up with results that we share with the rest of the world. Our goal is to come up with results that we share with some partners and that we keep secret for others* …”

A manager of another firm mentioned the importance of restricted technical and commercial information sharing where in order to protect its knowledge his/her firm uses compartmented information systems for knowledge sharing with its OI partners where not all partners have access to all information. Information is shared depending on the specific nature of the relationship. Interestingly, this competitive and protective setting for the role of IPR in OI was also stressed in yet another interview. In that case, the firm would routinely evaluate the IPR portfolio of its potential partner before the start of a joint OI project and examine whether any IPR s of a potential partner would infringe on the firm’s existing IPR or on those of other firms. In other words, the firm would assess whether and to which degree a potential OI partner would indeed possess certain IPR, relevant in the context of a joint OI project. Moreover, in case a potential OI partner possesses IPR that significantly overlaps with the focal firm’s knowledge base, the OI collaboration may be reconsidered *“…because in the end it makes it unclear who owns what and that gives us more trouble than it is worth in absorbing the outside technologies…”*

The relevance of IPR not only indicates the degree to which firms expect them to play a role as a defensive appropriability mechanism, the relevance of IPR for firms can also refer to the degree to which IPR are used or perceived as signals of innovative capabilities (Cohen, Nelson, and Walsh, 2000; Hall, Jaffe, and Trajtenberg, 2005). According to Alexy, Criscuolo, and Salter (2009), IPR are even more beneficial to OI firms when they are used as a signal of innovative capabilities rather than as control rights. In that case, IPR can play a role for firms in drawing attention from (potential) partners. Managers interviewed during our field research mentioned that the degree to which firms are willing to protect their knowledge also indicates the value of that knowledge and that makes it attractive to work with these firms. As stated by one of them, when stressing the importance of IPR-backed knowledge for finding interesting partners: “… *if this knowledge is not protected, it probably does not have any value, not for us, and not for anyone else* …” Hence, cooperating with OI partner firms that do not value their IPR would make little or no sense.

**Table 2 Importance of IPR for protection or signaling for OI firms, scores on 7-point Likert scales (n=101)**

|  | Protection | Signaling  |
| --- | --- | --- |
|   | Mean | Standard deviation | Mean | Standard deviation |
| Importance of patents  | 6.23 | 1.469 | 5.67 | 1.744 |
| Importance of trademarks  | 5.47 | 1.641 | 5.02 | 1.949 |
| Importance of copyrights  | 4.80 | 1.918 | 4.36 | 2.234 |
| Importance of design rights  | 5.17 | 1.900 | 4.84 | 2.038 |
| Importance of technical or commercial information(trade secrets)  | 5.94 | 1.318 | 5.73 | 1.483 |

Our survey findings suggest that also in this context of IPR as a signal of innovative capabilities, patents and technical and commercial information (trade secrets) are seen as most important for OI activities, as indicated by over 75% of the firms in our sample (see Table 1). Trademarks and design rights are also seen as relevant signals of innovative capabilities by a substantial share of firms. Trademarks score 56%, design rights reach a score of about 50%, while a relatively small share of firms (nearly 38%) see the relevance of copyrights for signaling purposes.

When we take a closer look at the relative importance of these different IPR for both protection and signaling in the context of OI, we also see that on average patents and technical and commercial information (trade secrets) are perceived as the most important IPR (see Table 2). Yet, the other IPR (trademarks, design rights, and copyrights) still appear to be quite important as well, both for protection and signaling purposes.

**THE PREFERENCE FOR IPR BY OI FIRMS**

To address our second research question we investigate what factors determine firms’ preferences for IPR in an OI context. In line with Pisano (2006) as well as James, Leiblein and Lu (2013) we expect that firms’ strategic behaviors – such as their degree of openness in innovation – influence and shape their appropriation strategies. However, as nearly always with this line of research, there is a major concern of possible endogeneity that forces us to interpret most of our results conservatively i.e. in terms of association rather than effect.[[2]](#footnote-2) In line with our intermediate theory approach, we build on prior literature related to inter-organizational collaboration, IPR, and contracts. In addition, we draw from the emerging OI literature as well as from insights from our interview study to inform our conceptual framework regarding the preference for IPR by OI firms. This enables us to explore relationships between a relatively new construct (OI) and a more established construct (preferences for IPR).

The literature on the strategic, behavioral, and decision making aspects of OI differentiates between internal and external context characteristics (Huizingh, 2011; Almirall and Casadesus-Masanell, 2010). Following this differentiation and extending the theoretical background for our research, we develop a set of hypotheses regarding the antecedents of firms’ preferences for IPR in the context of OI.

*Degree of openness:* So far, firms’ degree of openness has mainly been conceptualized in terms of firms’ external search openness – the degree to which they search broadly and deeply across external knowledge sources (e.g. Laursen and Salter, 2006; Grimpe and Sofka, 2009; Garriga, von Krogh, and Spaeth, 2013; Love, Roper, and Vahter, 2013). Laursen and Salter (2014) suggest that there is a direct association between such search openness and its appropriability strategy: when firms open to a range of external actors, they also need to establish means to appropriate profits from their innovations. In line with this suggestion, we expect that the degree of openness of firms, the extent to which they exchange their knowledge with others, will generate awareness with these firms as to the risk of unprotected knowledge exchange with a variety of partners. As being open to other firms involves substantial hazards, including knowledge leakage and misappropriation, IPR can be a useful measure of protection. In this context, appropriation strategies such as IPR enable secure knowledge transfer and transactions (Ritala & Hurmelinna-Laukkanen, 2013; Henttonen, Hurmelinna-Laukkanen, and Ritala, 2015).

Also, the more firms engage in OI activities with a variety of other organizations such as suppliers, customers, competitors, and start-ups, the more complex their network of knowledge exchange with multiple partners. The higher this complexity, the more these firms will need to control their knowledge exchange. In such a complex setting, IPR are seen as effective means to protect knowledge exchange between firms (Arora and Merges, 2004; Merges, 2006). As such, we can expect that firms that are active in OI with a variety of partner firms will use IPR to protect their knowledge exchange (see also Hurmelinna-Laukkanen, 2011; Luoma, Paasi, and Valkokari, 2010; Henttonen, Hurmelinna-Laukkanen, and Ritala, 2015).

Besides the protection of relevant knowledge, firms can use IPR in the context of OI for a variety of other purposes. As suggested in the literature and illustrated by our interviews, when firms engage in OI, they use IPR as signaling devices to indicate their innovative capabilities (Alexy, Criscuolo, and Salter, 2009). Furthermore, IPR can help to structure and coordinate the collaboration of multiple partners (Pénin, Hussler, and Burger-Helmchen, 2011) and facilitates knowledge transfer due to the codified nature of knowledge when protected by IPR (Hurmelinna, Kyläheiko, and Jauhiainen, 2007; Alexy, Criscuolo, and Salter, 2009); Hence:

H. 1 *The more open firms are, in terms of their external knowledge exchange, the higher their preference for IPR.*

*R&D capabilities:* Following suggestions by Hall, Helmers, Rogers, and Sena (2012), we expect internal R&D capabilities of firms to impact their preference for IPR. Indeed, both scope and degree of internal R&D are expected to shape a firm’s decision making with respect to appropriation strategies (James, Leiblein and Lu, 2013). Stronger R&D capabilities indicate higher innovative potential of firms which increases the risk that the knowledge they share with their partner firms is appropriated by these partners. Since R&D capabilities function as a source of knowledge for other firms, IPR can protect the knowledge exchange of OI firms (Sandulli and Chesbrough, 2009).

We also expect that the stronger the R&D capabilities of OI firms, the more interesting they are as OI partners to others. Assuming OI firms are aware of the risks of their internal R&D capabilities, as a source of knowledge for their partners, IPR protection can limit such risks. Hence:

H.2 *The stronger the R&D capabilities of open innovation firms, the higher their preference for IPR.*

*Interaction of openness and R&D capabilities:* In addition to this direct effect of internal R&D capabilities, we expect that the strength of firms’ internal R&D capabilities plays a role in the extent to which openness leads to more IPR protection. In the context of OI, firms combine knowledge from their external and internal R&D strategies (Chesbrough, 2003; 2006; West & Bogers, 2014) and are expected to consider both strategies jointly in their selection of IPR. Combining the arguments above, implementing IPR protection with increasing openness seems particularly relevant for firms that also possess stronger R&D capabilities. Firms with stronger R&D capabilities have more ‘at stake’ when they open up their boundaries in terms of increased external knowledge exchange. When such firms become increasingly open, they increase the risk that knowledge based on their R&D capabilities leaks to external partners. In such a context, opting for IPR allows firms to avoid involuntary knowledge spillovers when they engage with their external partners (see also Cassimann and Veugelers, 2002). We expect that R&D capabilities and openness will interact with each other to the extent that:

H. 3 *The stronger the R&D capabilities of open innovation firms, the stronger the relationship between the openness of firms and their preference for IPR.*

*Formal legal attitude:* As we have seen in the foregoing, OI firms have a strong preference for formal contracts to govern their relationship with their OI partners. However, these firms still do differ to quite some extent with regard to the degree to which they actually value the importance of these contracts. The higher the importance of contracts for firms with OI partnerships, the more we can expect that this indicates the degree to which they perceive formal means of control, such as contracts, as a vital element of their business model (see also Luoma, Paasi, and Valkokari, 2010). As such, this aspect of their business model reveals a formal legal attitude towards inter-firm governance that will also affect other aspects of control, i.e., those related to the control of crucial firm knowledge. Prior literature suggests that firms are likely to select bundles of different appropriation mechanisms (James, Leiblein, and Lu, 2013; Henttonen, Hurmelinna-Laukkanen, and Ritala, 2015). For instance, Bagley (2008) proposes that firms that use and value formal contracts are also more likely to protect their valuable firm resources via IPR. As a consequence, we expect this formal legal attitude towards inter-firm governance to be associated with a higher preference for IPR. Hence:

H. 4 *The stronger the formal legal attitude of open innovation firms, the higher their preference for IPR.*

*Competitive dynamics:* As an external factor, the competitive dynamics of firms’ product markets is frequently seen as a major environmental driver of their propensity to enter into a range of partnerships with other firms (Oster, 1999; Powell, Koput, and Smith-Doerr, 1996). In markets where the competitive environment is subject to frequent changes, firms are more inclined to enter into partnerships with other firms, in search for new relevant knowledge. As indicated by Gassman and Henkel (2004) and Ozman (2008) this also applies to partnerships in the context of OI where competitive dynamics drives OI collaboration.

Interestingly, these competitive dynamics in firms’ product markets, where they face increased competition, are also found to be an important external contingency factor for their innovative performance that demands specific attention to IPR (Hausman and Leonard, 2006; Somaya, 2003; 2012). In the current context of OI, this suggests that higher levels of competitive dynamics in firms’ products markets affect their preference for IPR. The protection of OI firms’ knowledge to be exchanged with their partners is of particular relevance in dynamic product markets where the competitive landscape and its players are changing rapidly. Under these conditions, where firms collaborate to improve their innovative performance, while facing increasing competition, they are expected to value IPR to protect the innovative knowledge that they exchange with a variety of partners. Hence:

H. 5 *The higher the levels of competitive dynamics in open innovation firms’ product markets, the higher their preference for IPR.*

**Variables and Measures**

Our dependent variable measures firms’ perception of the importance of *IPR* in the context of OI. Respondents were asked to assess, on a 7 point Likert scale, how important different IPR (patents, trademarks, copyrights, design rights, technical and commercial information (trade secrets)) are for protecting their innovative capabilities from their OI partner firms (Cronbach’s alpha = .81).

 *Openness* of firms refers to the degree to which OI firms exchange their knowledge with a range of partners (i.e. suppliers, customers, competitors, universities/research institutes, innovation intermediaries, start-up firms, other firms, and new partners for competence development)(Cronbach’s alpha = .79). Following Laursen and Salter (2006), we asked respondents to indicate to what extent they access different external knowledge sources concerning their innovation activities (see also Grimpe and Sofka, 2009; Garriga, von Krogh, and Spaeth, 2013; Laursen and Salter, 2014). We included some new external knowledge sources, such as ‘innovation intermediaries’ – “… an organization or body that acts as an agent or broker in some aspects of the innovation process between two or more parties …” (Howells, 2006 p. 720) – and ‘start-up firms’, which have been shown to be relevant to the context of OI (Chesbrough, 2006a,b).

*R&D capabilities* We adapted scales from Day (1994) and Song et al. (2005) to assess to what extent firms’ internal technology development capabilities, manufacturing capabilities and new product development capabilities are inferior or superior to those of their main competitors (Cronbach’s alpha = .57). Regarding the interaction effect of R&D capabilities and openness, we mean-centered the independent variables to reduce multicollinearity.

The *formal legal attitude* of OI firms was measured with a single item, which asks respondents to assess the importance of the legal implications of formal contracts for controlling the progress of collaboration with their OI partner firms on a 7-point Likert scale.

 *Competitive dynamics* was measured through the extent to which firms indicated that their competitive environment is expected to change over the next five years. A dummy variable was created by collapsing ‘less competitive’ and ‘similar level of competitiveness’ into the category of low competitiveness, while the answer option ‘more competitive’ builds the category of high competitiveness. This reflects the likelihood of firms initiating new competitive actions, as well the likelihood of competitors responding to those actions (Gnyawali and Madhavan, 2001).

Our analysis also includes firm size (ln employees), industry sector (manufacturing, processing, and others), and country (US vs non-US) as a set of control variables that have been identified to influence strategic choices with respect to IPR (e.g. Somaya, 2012).

**Results: antecedents of firms’ preferences for IPR in OI**

We used OLS regression models to analyze our hypotheses (see table 3 for descriptive statistics and correlations). Although the correlation between R&D capabilities and openness is relatively high, Variance Inflation Factors suggest that multicollinearity does not pose a problem. Model 1 in Table 4 presents the results for the basic model with the control variables, model 2 presents the full model including core variables, while model 3 includes the interaction effect between openness and R&D capabilities. Alternatively, starting with the basic model and adding one individual core variable at a time or subsequently adding core variables does not alter the results. It turns out that two internal factors, i.e., openness (p = .002) and formal legal attitude (p = .051), are positively and significantly related to the relevance of IPR in an OI context and so is competitive dynamics (p = .006) as the external determinant. The control variables have no significant impact on the dependent variable. The interaction effect of openness and R&D capabilities, however, is marginally significant (p = .058).

Due to our relatively small sample size, we have a limited number of observations per estimated parameter, which might lead to ‘overfitting’ the sample (Hair et al., 2006). Given this limitation and to validate our results, we used bootstrapping as an alternative estimation procedure, which produces more accurate estimates for small sample sizes (Brownstone and Valletta, 2001). The bootstrap analysis generated qualitatively similar results.

**Table 3 Correlation table (n=101)**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | Standard deviation | IPR | Non-US  | Manufac-turing  | Otherindustries | Size | Openness | R&D capabilities | Formal legal attitude |
| IPR | 5.52 | 1.25 |  |  |  |  |  |  |  |  |
| Non-US  | 0.70 | 0.46 | -.003 |  |  |  |  |  |  |  |
| Manufacturing | 0.38 | 0.49 | .026 | .102 |  |  |  |  |  |  |
| Other industries | 0.21 | 0.41 | -.187\* | .120 | -.398\*\*\* |  |  |  |  |  |
| Size | 8.99 | 3.00 | .169\* | -.273\*\*\* | .132 | -.323\*\*\* |  |  |  |  |
| Openness | 4.48  | 1.01 | .365\*\*\* | .032 | -.033 | -.098 | .176\* |  |  |  |
| R&D capabilities | 4.92 | 0.87 | .121 | -.068 | .134 | -.094 | -.023 | .309\*\*\* |  |  |
| Formal legal attitude | 5.14 | 1.74 | .225\*\* | -.241\*\* | -.153 | -.112 | .143 | -.049 | -.038 |  |
| Competitive dynamics  | 0.75 | 0.43 | .306\*\*\* | .029 | .209\*\* | -.102 | .037 | .110 | .110 | .068 |

\* significant at 10%; \*\* significant at 5% level, \*\*\* significant at 1% level

In support of hypotheses1 and 4, our findings indicate that the more open these OI firms are in terms of their external knowledge exchange, which does create a risk of unintended knowledge leakage, and the more legally formal their attitude, that expresses their preference for controlling their collaboration with others through contracts, the more relevant these firms perceive IPR as means to protect their knowledge exchange. Also, in support of hypothesis 5, we find that the more OI firms operate in product markets with higher levels of competitive dynamics that express expected changes in competition, the more relevant they see IPR protection. Finally, we find no support for the expected association of the strength of R&D capabilities with the preference for IPR. However, the significant interaction effect found for hypothesis 3 indicates that the combination of stronger R&D capabilities and higher degrees of openness does increase firms’ preference for IPR protection. In other words, with increasing relative strength of internal R&D capabilities, the relationship between openness and IPR protection becomes stronger. Hence, the preference for IPR in the context of OI is associated with managerial choice (openness, formal legal attitude, and the combination of openness and stronger R&D capabilities), as well as conditioned by the external environment (competitive dynamics).

**Table 4 OLS regression results for the importance of IPR in the context of OI (n=101)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Model 1 | Model 2 | Model 3 |
| Non-US | .171 (.285) | .167 (.266) | .243(.265) |
| Manufacturing | -.177 (.283) | -.138 (.269) | -.146(.265) |
| Other industries | -.544 (.349) | -.361 (.320) | -.524(.326) |
| Size | .058 (.045) | .028(.042) | .028(.041) |
| Openness |  | .370\*\*\* | .381\*\*\* |
|  |  | (.122) | (.121) |
| R&D capabilities |  | .014 (.140)  | .044(.148)  |
| Formal legal attitude |  | .127\* (.069) | .134\*(.068) |
| Competitive dynamics Openness \* R&D capabilities  |  | .736\*\*\* (.268) | .737\*\*\*(.264).284\*(.148) |
|  |  |  |  |
| F-test | 1.42 | 4.03\*\*\* | 4.10\*\*\* |
| R² | .07 | .26 | .29 |
| R² adjusted | .02 | .20 | .22 |

\* significant at 10%; \*\* significant at 5% level; \*\*\* significant 1% . Standard errors in brackets

**DISCUSSION AND CONCLUSIONS**

Our exploratory empirical research, based on a hybrid methodological approach, indicates that in terms of the governance of their collaborative innovative activities, firms active in firm-to-firm OI appear to follow a somewhat ‘unadventurous’ strategy. This strategy is much more in line with what could be expected according to well-accepted organizational economics theory (e.g. Williamson, 1985; 1996) that is closer to Chesbrough (2006a,b) than to an alternative OI approach, as advocated by, for instance, Baldwin and von Hippel (2011), von Hippel and von Krogh (2006) and Pénin (2011). Rather than engaging in open disclosure and free revealing, firms seem to use formal contracts to organize their OI activities with specific partner firms. However, given the flexibility required by these innovative activities with a range of partners, where the objectives of collaboration might change over time, these OI contracts are not to be characterized as discrete, standard contracts but as subject to flexible private ordering (Almirall and Casadesus-Masanell, 2010; Hagedoorn and Hesen, 2007; Lee, Nystén-Haarala, and Huhtilaienen, 2010). Also, both the control and the monitoring dimensions of contracts, the degree to which firms use contracts from a legal or from a practical process perspective, appear to be relevant for OI .

Additionally, in line with those contributions that stress the relevance of IPR (e.g. Al-Aali and Teece, 2013; Dubiansky, 2006; Graham and Mowery, 2006; Pisano and Teece, 2007; Sandulli and Chesbrough, 2009; de Jong et al., 2010) and unlike contributions that emphasize the need for only limited or no appropriability of OI activities (e.g. Pénin, 2011; von Hippel and von Krogh, 2003), firms active in OI appear to prefer to systematically protect their innovative capabilities from their OI partner firms. There are differences with regard to the degree to which separate elements of IPR are used by OI firms but the overall preference for using IPR is manifest across the board. In addition, IPR are relevant indicators of the innovative capabilities of firms and as such IPR can also signal the attractiveness of firms to their (potential) OI partners.

Given firms’ preferences for using IPR in an OI context to protect their innovative capabilities, it is of interest to investigate factors that drive these OI firms’ preference for IPR. In a first attempt to explain this preference, we find internal firm characteristics and a more general external determinant to be associated with this preference. The openness of firms, their formal legal attitude, and the dynamic competitive nature of their product market environment are associated with a higher preference for IPR. While we find that stronger R&D capabilities as such, do not lead to an increased preference for IPR protection, these stronger R&D capabilities do matter in the context of increasing degrees of openness. The results show that for stronger R&D capabilities the positive influence of openness on IPR protection is augmented.

To conclude, our exploratory empirical study contributes to the OI literature by elaborating on the role of contracts and IPR and providing some preliminary tests on what drives firms’ preferences for IPR. First, our qualitative analysis expands our understanding of the governance of OI by shedding some light on the underlying mechanisms and processes of contracting and IPR. In particular, it elucidates aspects of the content (i.e. contractual clauses), purposes (i.e. control and monitoring), process (i.e. term sheets for negotiation), and dynamics (i.e. flexible private ordering) of contracting in an OI context. Furthermore, it provides a better understanding of the implementation and purpose of IPR (e.g. to evaluate potential partners or as a signaling device) when dealing with OI partners. Second, our quantitative analysis demonstrates how the preference for IPR in the context of OI is associated with internal managerial factors (i.e. openness, formal legal attitude, and the interaction of openness and R&D capabilities), as well as conditioned by the external environment (competitive dynamics). So far, most insights regarding preferences for IPR in an OI context are based on data from the Community Innovation Survey (e.g. Laursen & Salter, 2014), which is limited to more general categories that are not explicitly placed into the context of OI. Our study can add to these insights since our data allows us to place questions regarding governance and IP directly into the context of OI. As a result, it allows us to shed some light on the dichotomy in the literature regarding the role of contracts and IPR in OI, explicate some underlying mechanisms, as well as offer some first explanations regarding the preferences for IPR as shaped by specific firm-internal and external factors.

Finally, while this study does provide us with some new insights, it also has some shortcomings. Most prominently: our sample is, despite several attempts to increase its size, relatively small which not only limits the extent to which we can analyze various firm and industry characteristics associated with OI , it also limits the degree to which we can generalize our findings. As such, our research is a modest contribution, albeit one of the first contributions, to a research agenda that empirically considers the governance of OI and the role of various legal and contractual implications of OI.

 Future research should conduct a more detailed analysis of the actual contractual design of OI partnerships and the possible differences in contracts with a range of OI actors (competitors, customers, suppliers, research laboratories, universities) are important topics for future research. Also, given the various IPR options for firms that engage in OI, an interesting question for future research refers to the conditions (e.g. industry conditions, phase of the joint innovation project, nature of innovativeness of partners, nature of knowledge transfer) under which OI firms would opt for one or the other specific IPR mechanism. Given the changing nature of the innovation process and the apparent growing ‘popularity’ of OI, future research will have to be of a dynamic nature to study these topics from a perspective of changing rather than static conditions.

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1. In the context of our exploratory empirical contribution, we focus on firm-to-firm OI and leave more complex contractual and IPR issues that refer to a much wider range of inter-organizational relationships for future study. [↑](#footnote-ref-1)
2. In a recent contribution Laursen and Salter (2014) suggest that there is no unidirectional influence between openness and IP, since both openness in innovation as well as IP are strategic choice variables for the firm. Hence we investigate how managerial choices regarding openness and IPR are linked. [↑](#footnote-ref-2)