OPEN INNOVATION: A "SWINGERS' CLUB" OR "GOING STEADY"?

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Abstract

The term Open Innovation has become popular in recent years to describe an approach to innovation that decidedl y goes beyond the boundaries of a single organization by encouraging firms to pull tog ether knowledge and creativity from a wide variety of parties. As such, Open Innovation evokes an image of firms working with a multitude of partners, always searching for new linkages that could enhance their innovative potential, or for the highest bidders for knowledge that they may wish to sell – in short, this is a "swingers club" of firms engaged in innovation. Yet, drawing on resourced based view, absorptive capacity, and other concepts, we propose that firms, even when practicing Open Innovation, will not be all that open – rathe r, they will "go steady" with a more limited number of partners. To explore the microstructure of "openness" we develop a number of hypotheses for which we find general support in proprietary survey data from Spain.

Keywords

Open Innovation, Strategic Alliances, Survey data

INTRODUCTION

Open innovation – as commonly conceived – should strike one as a proposition to dance on many parties and to exchange partners frequently – in other words, a "swinger's club". Yet, is that really what we should expect? Or is the truth (both, in terms of what firms actually do and what would be optimal for them) much closer to a conventional "going steady" relationship? This is the key question for our paper. We will go about addressing this question by contrasting central ideas from the literature on open innovation with key concepts from other literatures, and by providing empirical results from data that we have recently collected in Spain.

Open innovation, according to the basic characterization one finds in the literature (Chesbrough, 2004, 2006a,b; Chesbrough, Vanhaverbeke & West, 2006) consists of a vastly different concept of innovation than that expressed in the received proprietary or "closed" innovation model. Open innovation, in fact, is supposed to generate extra value by "opening" the internal innovation process to both <u>inflows</u> of external knowledge and <u>outflows</u> of internal knowledge or technologies that have greater value outside of the firm. This value generation prescription, however, essentially implies that external knowledge should be sourced from wherever the best knowledge currently resides; likewise, internal knowledge that has little value within the firm should be sold to the highest external bidder. Both of these processes would therefore ideally entail "broad search" (in the learning literature, the analogue would be a cognitive search strategy that attempts to identify an optimum target across the whole market space, rather than just focusing on search in the "neighborhood" of one's existing position – see, e.g., the specification in Gavetti and Levinthal, 2000) – in other words, in order to find the best current knowledge or the highest bidder, the whole market should be scanned, as there is little rationale to expect that these entities are among the current set of exchange partners a firm deals with. Yet, our contention is that a variety of organizational processes, from simple inertia, pure convenience or bounded rationality, to game theoretic considerations that arise from the very attempt to pursue open innovation, suggest that in actuality such search is much less broad and could rather be described as "neighborhood search" or simply "going steady". Identifying which set-up would actually be optimal, and what is actual current practice, is obviously of high current importance for managers, policy makers, and academics alike. Some of the latter are currently working on the implications of inter-organizational collaboration on research and development, and our theory should contribute to this line of inquiry; executives, on the other hand, are trying to derive value from an open innovation approach, and it is our task as researchers to reflect on their practices and identify whether current practices are value generating or not and what could be done to improve them. Policy makers, finally, are striving to prepare the foundations for an ongoing competitiveness of their respective domain. A prominent example of the latter are the various technology programs (across several industries) that Tekes, the Finnish Funding Agency for Technology and Innovation (Tekes, 2005), has launched in recent years in order to foster co-operation between research institutes, universities and industry.

This paper is organized as follows – after a brief review of the applicable literature, we develop our model of the influences that shape the form that open innovation will take within firms. We then test our model on a proprietary data set that is based on a survey that we have recently executed in Spain.

THEORY

The basic idea of the emerging open innovation paradigm, as suggested above, is that firms open their boundaries to an inflow of externally available knowledge, as well as an outflow of internal knowledge that may have more value when applied outside of the inventing firm (Chesbrough, 2004, 2006a,b; Chesbrough, Vanhaverbeke & West, 2006). As, for instance, Chesbrough (2006a) has described, especially opportunities for sourcing or "buying" external knowledge have increased dramatically due to the broader availability of skilled personnel in the economy (e.g., because of more training through universities, or the existence of outside labor markets for such personnel that allows firms to tap into a large pool of such laborers, etc.), and particularly the rise of venture capital that gives such skilled personnel an outside option to apply their ideas and thus fosters the creation of new firms with high standards of technology in many industries (see also Arora, Fosfuri, & Gambardella, 2001). This proliferation of knowledge means that the traditional, closed innovation practices of large firms can no longer claim a knowledge monopoly in their areas of expertise (Chesbrough, 2006a). Procter & Gamble, for instance, has realized that while it employs several thousand scientists itself, its suppliers, customers, competitors and other institutions together employ more than a million persons doing research in P&G's core markets (Huston & Sakkab, 2006). Hence, it becomes increasingly unlikely that the best ideas are created in your own lab – incentive enough to actively pursue new ideas that are created by other market participants and that could be integrated into one's own product offerings.

Similarly, internal R&D oftentimes produces results that cannot be used in a focal firm's current business model. If such "surplus" inventions just sit on the shelve, the risk is that others capitalize on such inventions, without any benefit accruing to the focal firm. These others, may, for instance, even be engineers of the focal firm itself who, with venture capital backing, strike out on their own. The many path-breaking inventions that came out of Xerox's Palo Alto Research Center, but that were brought to market by other firms is a famous example (Chesbrough 2006a). Hence, the open innovation prescription is that instead of protecting intellectual property "at all cost", firms should actively seek buyers for their surplus technologies in order to realize some of the potential value that these technologies may have when combined with another firm's resource base and business model. Altogether, open innovation thus stands for openness in two directions – an inflow (buying) of external knowledge that can help the firm to innovate more effectively and efficiently, and an outflow (selling) of internal knowledge that has a higher value when combined with another firm's business. Yet, to derive the highest value out of these concepts it appears as though firms should always search for the best available knowledge wherever it is located, or for the highest bidders wherever they may be. In other words, firms should search the market broadly and not restrict themselves to choosing among a particular pre-existing set of exchange partners; rather, partner selection should be essentially random and changing. Overall, this characterization of the potential benefits and resulting incentives to pursue "open innovation" suggest that firms that want to make optimal use of the potentials of external knowledge or the sale of surplus technologies, should act like "swingers":

Hypothesis 1: Firms practicing open innovation (buy or sell) will tend to use different partners over time, rather than develop a network of specific exchange partners.

Yet, several ideas from other literatures, like the resource based view, transaction costs or game theory, suggest that additional factors also impact the economics of innovation and may

thus lead to a tradeoff between broad partner selection and the development of a more specific partner network. In other words, while a "broad search" may be valuable in terms of identifying the "best" knowledge that is currently available, or the highest bidder for surplus inventions a firm may try to sell, other factors may make it again more valuable (or more desirable) to work with a narrower set of partners, or, in other words, to "go steady". Laursen and Salter's (2006) recent finding that firms who have open search strategies tend to be more innovative, but that there is a point where additional search becomes unproductive, is an example that suggests that such tradeoffs indeed seem to exist.

Basic concepts of the resource based view (e.g., Barney, 1991; Dierickx & Cool, 1989; Peteraf, 1993), the interorganizational capabilities view (Dyer & Singh, 1998), and absorptive capacity (Cohen & Levinthal, 1990), in particular, combine to suggest an important reason for limiting partner selection to a narrower group. Specifically, to actually benefit from external knowledge requires that such knowledge is properly understood and can be integrated with existing internal capabilities to create a new productive combination. At the very least, this process assures that the firm can make use of external knowledge to produce a product that may also be offered by others; at best, a customization of external knowledge by integration with valuable and rare resources that the firm already commands may generate a unique product that, even though part of the knowledge is externally sourced, is difficult to imitate or substitute. For the sell side, i.e., the offering of internal knowledge to external partners, the situation is similar since the extent to which the external partner is capable of understanding and integrating the focal firm's knowledge into its own resource base is vital for the value that that partner will associate with the knowledge on offer, and hence for the price that the offering firm can realize.

Accordingly, the existence of prior related knowledge, or "absorptive capacity" (Cohen & Levinthal, 1990), which allows the firm to recognize valuable external knowledge and to integrate the same, is critical for the success of both sides of the open innovation paradigm, i.e., the buying of external technologies, and the selling of internal surplus knowledge (in the latter case, it is actually the absorptive capacity that the other party has built up that becomes critical). Underscoring the importance of absorptive capacity, Laursen and Salter (2005), for instance, find that firms with high levels of absorptive capacity (particularly skills and access to external networks) are likely to be more open. Yet, the more specific the absorptive capacity is to the new knowledge in question, the better recognition and integration should function. In this context, it seems intuitive that the more often a certain dyad of firms interacts, the more they understand each other and can relate to each others' R&D; thus, further transfers will function more smoothly and innovations can proceed faster and more effectively. Dyer and Singh (1998), in their work on competitive advantage creation in alliances, suggest, in fact, that repeated interactions between firms produce the potential for the creation of an alliance specific competitive advantage. This is partly due to the development of "partner specific absorptive capacity" that depends a) on the development of overlapping knowledge bases (a precondition for "understanding" each other in Cohen and Levinthal's, 1990, original conceptualization of absorptive capacity), and b) the development of "interaction routines that maximize the frequency and intensity of sociotechnical interactions" (Dyer & Singh, 1998: 663-665). With regard to the latter, Dyer and Singh (1998) specifically emphasize the importance of human asset specificity (e.g., the development of a common language, etc.), which is developed through long-standing interactions.

Yet, if a firm's absorptive capacity is stronger with respect to certain partners, then those open innovation opportunities that the firm relatively better understands should actually have a higher value to the firm, as it can reduce the costs associated with searching for knowledge or exchange partners and/or more efficiently or effectively integrate the knowledge into its own resource base. If, as the foregoing arguments suggest, absorptive capacity is higher with respect to external partners whom the focal firm has interacted with before, then this would imply that further interactions with this same group of partners have a higher value than interactions with other potential, but unknown, partners. Selecting to work with such extant partners will then tend to further enhance such specific absorptive capacity and thus make it even more likely that the same partner is selected in the future. As a result, an approach to open innovation is likely to create a microstructure of interactions that lead to the development of islands of strong ties within particular networks of firms within a sea of much looser ties. Hence, our basic proposition is essentially the opposite of hypothesis 1, i.e., that partner selection is not random, but specific and repetitive:

Hypothesis 2: In acquiring external or selling internal knowledge or technologies, firms that practice open innovation will prefer to work with a specific set of partners, rather than searching for new partners every time.

Yet, another explanation for finding the pattern suggested in hypothesis 2 is that firms may simply suffer from "inertia", and thus tend to resist frequent changes and to continue with a once chosen pattern of action (e.g., Hannan & Freeman, 1984). Accordingly, a partner, once selected, will be interacted with again and again. Since inertia results from a variety of factors like bureaucratic or mechanistic organizational structures (Burns & Stalker, 1961), complexity, encrusted internal political structures, and so on, which in general seem to increase with firm size and particularly age (Hannan & Freeman, 1984), a reasonable assumption would therefore be that if inertia is behind a "going steady" behavior, then such effects should be more pronounced for older and larger firms:

Hypothesis 3: The older and larger a firm, the more it will tend to repeat transactions with the same partners.

A further refinement to our view of the microstructure of relations that firms engaged in open innovation create comes from the consideration of the transaction costs (Williamson, 1979) of searching for and contracting with the provider or receiver of a particular piece of knowledge. The issue of search costs has essentially been dealt with above in the sense that the existence of partner-specific absorptive capacity, to utilize Dyer and Singh's term again, should lead to a reduction in these costs and thus tend to make partner selection from a pool of known exchange partners comparatively more valuable. However, the question of how exchanges between partners are governed is likely to further affect how firms will chose who to work with in a given knowledge buy or sell situation.

Dyer & Singh (1998), for example, argue that effective governance in alliances encourages transparency, discourages free-riding, and increases incentives to create value, and includes, besides formal third party or trust based governance, also hostage based safeguards to assure that knowledge is not given to others or replicated. In an open innovation setting where knowledge that is "sold" may travel beyond the confines of an alliance and into entities that are

not connected to the provider of the knowledge, such safeguards may take on particular importance, although their main task may not necessarily be to ensure that the knowledge is not replicated or shared with yet others. In fact, to the extent that the selling firm does not even use the knowledge in its own production set (a real "surplus" invention), the further proliferation of that knowledge may be less of an issue to the selling firm than the concern that the acquiring firm stands to gain substantially from applying that knowledge. As a result, the focal firm may hesitate to actually provide the knowledge lest it may loose out on the future value of it. This is similar to market failures that occur due to the problem of demonstrating and thus giving away tacit knowledge assets (e.g., Arrow, 1964, 1996), and may be ameliorated by a choice of a governance mechanism (e.g., joint venture, merger – e.g., Williamson, 1979) that aligns interests by allowing both firms to share in the benefits from the eventual application of the knowledge. Another way to overcome this problem may be to reciprocally exchange information (of perhaps about similar ex-ante value) and thus to create a situation that provides positive options for both parties. This is a more game theoretic approach of finding a mutually agreeable equilibrium of providing vs. not providing information – essentially, a way of creating commitments to enforce a beneficial situation where both firms collaborate by creating a climate of cooperation through the underlying exchange of hostages. Procter & Gamble, for instance, does seem to rely on reciprocal information sharing in many of its most successful open innovation projects (Huston & Sakkab, 2006). Similarly, reciprocal knowledge exchanges are often institutionalized in joint ventures and similar equity partnerships (Kogut, 1989). Such a quid pro quo should be the more important the more a firm is actually engaged in an open innovation approach. Hence, we propose:

> *Hypothesis 4: Firms following an open innovation approach will procure (sell) knowledge from (to) those external market participants that they have already sold (procured) knowledge to (from).*

METHODS

We test our hypotheses with data that comes from a recent survey on innovation practices in Spain, which itself is part of a larger effort to collect empirical evidence on the proliferation of open innovation concepts and the actual use of different types of innovative concepts in the economies of a number of countries, including Finland, Russia, and China. The present survey was conducted in Spain in late November and early December of 2007 by using two waves of emails and a web-based survey instrument. To ensure a high response rate, as well as to comply with Spanish privacy laws, the initial list of addressees was drawn from the alumni database of a leading Spanish business school. This database consists of email addresses of former students of Masters or Executive Education programs who have given prior permission to receive email, and contains additional data on employer firms, positions, and responsibilities. Applying a number of filters, we selected a sample of 2105 addresses of persons who are currently employed in higher management positions in Spanish firms. A cover letter in Spanish, which briefly explained the purpose of the study and offered a summary of results as "reward" was accompanied by a short letter of the Dean of the business school, encouraging the alumnis to participate. Two weeks after the first letter, a reminder letter with a similar content and another link to the survey web-page was sent out to all addressees that had not responded to the first mailing. Altogether, 131 usable responses were received, for a response rate of 6.2%. The survey responses cover the whole spectrum of the Spanish economy, with a particular emphasis on the service and the

manufacturing sector. Likewise, all sizes of firms are represented in the sample with non-negligible numbers of firms in each size-category.

The questionnaire itself was designed in a straightforward way in order to collect primarily factual information on basic firm demographics, practices with respect to acquiring external knowledge, practices with respect to the selling of internally generated knowledge into the external market, and, finally, practices and experiences regarding research collaboration with other firms and public institutions. Most questions are phrased in a direct way and offer respondents several choices to indicate how their firm acts with respect to a specific issue. Several questions also ask the respondents to rank answers in terms of their importance.

For the current paper, a number of specific questions were inserted in the sections on acquiring and selling knowledge. These, as well responses to a number of the other questions and the demographic information form the basis for the following empirical analysis. The appendix provides an English version of the particular questions that are used in this paper.

VARIABLES

The survey responses have been converted into a number of variables that will be used to construct a rigorous test of the various hypotheses. These variables are explained in the following with reference to the question numbers that appeared in the original survey (see appendix).

Specific Partner Choice is our primary dependent variable and is modeled as a dummy variable that takes on the value of one if firms have indicated that they either prefer to work with a specific set of partners, or that they always work with the same partners, and zero if they indicated that they work with random partners every time. This variable is defined separately for "buying" external knowledge (*Specific Partner Choice BUY*; based on question 23), and for "selling" knowledge to others (*Specific Partner Choice SELL*; based on question 35).

Open Innovation Reported is a dummy set to one if respondents indicated in their response to question 42 that they believe that they are applying an "open innovation" model in their company, and to zero otherwise.

Open Innovation Implied is a dummy variable that attempts to capture from the answers to questions 9 and 26 the degree of buy or sell side "openness". As for specific partner choice, the variable is separately defined for buy (*OI implied BUY*) and sell side (*OI implied Sell*) and set to one if respondents indicated in question 9 that they sometimes acquire external technologies or that the utilization of external technologies (and knowledge) is vital to their business, and if they indicated in question 26 either that surplus technologies emerge unavoidably, or that the development of such technologies is core to their business model, respectively. In addition, a third dummy variable (*OI implied Buy & Sell*) is set to one if both, the sell and the buy dummy are one, and zero otherwise.

Reciprocal Dealings Reported is a dummy variable set to one if the firm responded to question 36 that they sometimes or often provide technology to firms from whom they have sourced technology, and to zero otherwise.

Age is simply calculated as the year 2007 minus the founding year that was reported in the questionnaire.

Size is modeled as a series of six dummy variables to reflect the employee-based size classes that were offered to respondents in the questionnaire (see appendix). Size classes include *very small*, *small*, *lower medium*, *medium*, *upper medium*, and *large*, with the *very small* dummy being excluded from the regressions.

We also include self-reported R&D intensity (an ordinal scale with 5 levels) as a control variable in all models. Table 1 offers basic statistics and correlations for the variables used in the regressions.

--- Insert Table 1 about here ---

ESTIMATION APPROACH

Since our main dependent variable is dichotomous, we are primarily employing a logistic regression model to test our hypotheses. The main model is of the form:

$$PartnerChoice_i = \beta X_i + \beta_2 Openness_i + \beta_3 Age_i + \beta_3 Size_i + u_i \qquad (1)$$

Where *PartnerChoice* is either the variable ***Specific Partner Choice (BUY or SELL)*** as discussed above (assessing whether partner choice is random or not), or the variable ***Reciprocal Dealings Reported*** (assessing whether buy and sell activities are carried out with the same partners), and *Openness, Age* and *Size* are the key independent variables of interest, as explained above, *X* are other observed firm variables that may influence firm environmental performance, specifically the R&D intensity variable, and *u*, finally, accounts for any remaining unobserved firm characteristics that may also affect the dependent variable.

RESULTS AND DISCUSSION

In addressing our first two, competing hypotheses regarding the specificity or randomness of partner selection, it is illustrative to first take a look at the raw data of responses to our two specific questions regarding partner specificity (questions 23 and 35 – see appendix). Of all the persons that responded to question 23 (partner specificity in BUY situations), 21% indicated that they work with random partners every time, but three times as many (65%) stated that they prefer to work with a specific set of partners, and an additional six percent even claimed to always work with the exact same partners. Similarly, for question 35 (partner specificity in SELL situations), 20% of respondents indicated a random partner selection, 53% a preference for a specific set of partners, and 12% a reliance on the exact same partners. Thus, both for knowledge buy and sell situations, the vast majority of firms apparently relies on a rather specific network of external partners to exchange knowledge with, rather than trying to maximize the potential value of sourced or sold knowledge by scanning the entire market and engaging in essentially random partnerships. This is first evidence in support of our hypothesis 2 and clearly inconsistent with hypothesis 1.

Yet, in order to provide a more rigorous test of these two competing hypothesis, we need to identify the exact role that open innovation concepts play in these reported tendencies of partnering. Specifically, both hypotheses suggest that firms that explicitly embrace an open innovation concept and therefore actively attempt to generate value by sourcing external knowledge and/or selling their own, should be the ones that are either more open to random partnerships (hypothesis 1) or more prone to create a very specific microstructure of partnership interactions (hypothesis 2). Thus, we need to relate measures of the degree to which a firm follows an open innovation paradigm to their partnership structure in order to either find proper support or reject these hypotheses. We therefore apply the logistic model described above and relate the degree of partner specificity for either the knowledge BUY or SELL side to our different measures of openness and the various other variables discussed above as controls. Table 2 reports the resulting parameter estimates, standard deviations and significance levels.

--- Insert Table 2 about here ---

As is apparent from the results in table 2, respondents that self-report that their firms indeed apply an open innovation paradigm (captured in the variable ***Open Innovation Reported***) do not appear to be significantly more or less likely to engage in specific partner selection than others in either knowledge buy or sell situations. While both parameter estimates are negative and thus in line with the prediction of hypothesis 2 (please note that the probability modeled is that of no specific partner choice – hence, the negative signs are indicative of less random and more specific choices made by firms), there is a complete absence of statistical significance for these estimates. However, for our second set of proxies for openness, which use the responses to questions regarding actual firm behavior in buy and sell situations rather than a response to a direct, self-reflective question in order to determine whether a firm follows an open innovation approach, we find a much stronger result. Especially the variable ***OI implied BUY and SELL***, which combines the responses regarding behavior in buy and sell situations (and thus only reports that a firm is "open" if both, the response to the buy and the sell situation question indicate openness for that respective situation), shows a very strong statistical association with specific partner choice both for buy and sell situations. Since in both of these cases the rather substantial and highly significant parameter estimates of this explanatory variable are negative, (thus indicating more specific partner choices), we interpret this finding as substantial support for our hypothesis 2 and the underlying argument that the build-up of partner specific experience and particularly absorptive capacity, and the resulting economies of repeatedly selecting and working with a small network of partners, appears to outweigh the potential benefits that a broad search among unknown partners could have in an open innovation context. Accordingly, our results compel us to reject hypothesis 1, which was explicitly based on the idea that a broad search, unrestricted by current partnership ties, will reveal the most promising new technologies or located the highest bidders for internal surplus knowledge, and thus outweigh efficiencies from staying with current partners. Hence, according to our results, firms engaged in open innovation do seem to "go steady", rather than acting like "swingers" and dancing on many different parties.

The final two models in table 2 include as explanatory variables separately both the reported degree of openness in buy (***OI implied BUY***) and in sell situations (***OI implied SELL***). For these models, we note that a reported openness in knowledge sell situations (***OI implied SELL***) has very similar effects on specific partner choice in both, sell <u>and</u> buy situations, as the combined measure used above, i.e., a large negative and highly significant parameter estimate that supports hypothesis 2 and rejects hypothesis 1. Yet, the corresponding measure of openness in buy situations (***OI implied BUY***) shows no significant link to partner choice in either situation. Our interpretation of these divergent results is that a self reported openness in terms of knowledge acquisition is not a very surprising response to receive from firms, as it is reasonably intuitive, and, furthermore, a concept that has been around for quite a while that an integration of external knowledge may help the focal firm to succeed. However, being open in terms of also allowing others to access one's own knowledge may require more of a stretch of the imagination, and, in any case, a more dramatic departure from the "closed innovation" paradigm whose cornerstone was the protection and harboring of internally generated knowledge (e.g., Chesbrough, 2006a).

Accordingly, reporting openness in acquiring knowledge may not necessarily be indicative of a strong open innovation approach and thus reduce the ability of this proxy to capture the hypothesized relationship between an open innovation policy and specific partner

selection. Similarly, answering a question whether your firm is implementing an open innovation approach (captured in ***Open Innovation Reported***) may carry a strong social desirability self-reporting bias (e.g., Paulhus, 1991) – to the extent that open innovation is currently being touted as the next new wave of good management practices (see, e.g., Huston & Sakkab's 2006 Harvard Business Review article), firms may over-report being "open" and thus again reduce the ability of this proxy to find the hypothesized effect. Being open in sell situations, however, should be seen as a much stronger statement that a firm is already embracing the open innovation paradigm; similarly, finding that firms are open in both, buy and sell situations, should likewise be a rather strong indicator that the ideas of open innovation have permeated the focal firm's actions. Since it is for the latter two proxies that we find strong results in accordance with hypothesis 2, we are quite confident in our results.

Furthermore, we can also use the results reported in table 2 to address the third hypothesis regarding the question of whether inertia, rather than the capability of working with known partners, is the primary reason for the pattern of specific partner choices that we have just identified. Specifically, as we have argued above, age and size, two variables that we have collected in our survey and included in the regressions in table 2, are generally considered to be correlated with firm inertia (e.g., Sørensen & Stuart, 2000). While these are crude measures of this complex issue, we use them here because they do appear to be a good first proxy for the existence of inertia, and because we were able to collect this information from our respondents. As table 2 shows, in no specification is there any indication that either older or larger firms are particularly prone to a specific partner selection. Hence, we conclude that, based on the crude proxies age and size, there is no evidence that the specificity of partner selection is caused by inertia, refuting hypothesis 3. Instead, it appears quite likely that the specificity of partner selection is due to the capability based arguments discussed above.

Finally, we turn to the results concerning hypothesis 4, which can be found in table 3. Looking again at raw responses first, we find that 70% of respondents do <u>not</u> engage in reciprocal dealings by sourcing knowledge from partners who they have sold knowledge to, or vice versa. Yet, 27% profess to undertake reciprocal dealings sometimes, and an additional 3% report frequent interactions of this kind. Overall, a majority of respondents apparently does not see virtue in, or simply has not yet applied the idea of exchanging knowledge hostages in order to facilitate the overall exchange of knowledge as suggested in hypothesis 4.

--- Insert Table 3 about here ---

While these initial results thus seem at odds with our hypothesis, we again need to isolate the effect of actually applying open innovation concepts. As proposed, firms that explicitly attempt to wring value out of an application of the prescription of the open innovation paradigm by increasing the buying and selling of knowledge, should be in a situation where they feel a more pressing need for governance elements that enable a smooth function of these interchanges. Supporting this contention, all three models in table 3 report highly significant and relative large effects of the various proxies of an open innovation approach on employing reciprocity with respect to knowledge exchanges with the same partners (again, the probability modeled is that there is no reciprocity, and the negative signs thus indicate increasing degrees of reciprocal dealings). Like in the earlier set of regressions, the implied (as opposed to self-reported) measures of open innovation show a very strong association with reciprocal dealings, with the exception of the proxy for being open in buy situations (***OI implied BUY***), which we believe is due to the same reason as discussed above. However, in contrast to the first set of regressions, we

now also find a strong and highly significant relation between the self-reported measure of openness and reciprocal dealings in the direction predicted by hypothesis 4. It thus appears as though this self-reported variable does serve as a proxy for openness, albeit as a weak one as indicated by the prior results, where the correct directionality was found in results that failed to reach statistically significance. Yet, if this weak proxy finds a clear relation between openness and reciprocal exchange of knowledge, it appears as though the need for reciprocal dealings is indeed quite strong in firms subscribing to the open innovation paradigm.

CONCLUSION

Open Innovation has already become an important concept that is being used by firms like Intel, Procter & Gamble, Nokia or Philips (e.g., Chesbrough, 2006a, Huston & Sakkab, 2006) to boost their innovative capacity. In this paper, we have taken a look at the question of how "open" such open innovation really is or ought to be. Specifically, we have suggested that contrary to a straightforward interpretation of openness as implying that firms scan the entire market in their search for useful new knowledge or buyers for their own surplus technologies, and the resulting behavior of engaging in many different and changing partnerships with other firms over time (the "swingers' club"), there may be considerable virtue in "going steady" and focusing on interactions within a more limited specific network of partners. The logic is simply one of economic tradeoffs – broad search is more likely than limited search to uncover really novel, and/or really valuable ideas, while concentrating on repeated interactions with existing partners is likely to lead to a build-up of partner specific capabilities that, in turn, facilitate an effective and efficient transfer of knowledge and make finding new partners more easy to begin with. Drawing on recent survey data from Spain, we were indeed able to find significant support for our thesis. Moreover, our results have also allowed us to reject inertia as an alternative explanation for why open innovation firms may pursue a strategy of working with specific partners.

While our data does not allow us to link these observed practices of partner selection to firm profitability, the indication clearly is that firms perceive a more specific partner choice as superior to an unbounded search, even when pursuing an explicit open innovation strategy, suggesting further need for academics to refine our understanding of this concept and its implications. The tradeoffs described here between broad and narrow partner selection, however, may also have an important implication for the resulting nature of innovation. To the extent that a broader search is likely to uncover more novel possibilities than a reliance on repeated interactions with the same partners, the "going steady" reality that seems to prevail even (or especially) for firms subscribing to an open innovation paradigm may tend to shift innovation away from an "exploration" of completely new ideas and towards more "exploitation" of existing concepts and (March, 1991). Thus, open innovation could paradoxically actually lead to a lower degree of really path-breaking innovation, at least in the long run – a concern that would seem to be rather important for firms as well as policy makers intent on encouraging innovation. Hence, these tradeoffs and the non-intuitive implications that open innovation seems to have on the balance between exploitation and exploration clearly warrant further study.

Furthermore, we have also suggested that in addition to dealing with a specific set of partners, firms will also engaged in both, buy and sell transaction with individual exchange partners in order to create an environment of trust by having reciprocal interests in each others' knowledge. Also this hypothesis was strongly supported, indicating that among open innovation firms, reciprocity could be seen as a best practice.

Overall, our results essentially suggest that "openness" may be a relative term – a high degree on this scale may not necessarily imply that firms are constantly looking for, or are willing to exchange knowledge within an open market, but simply reflect the fact that even initially limited market interchanges of knowledge lead to additional exchanges, which will most likely consist of two-way flows of knowledge in order to support the relationships. Accordingly, we suggest that "openness" will be reflected in a series of bilateral exchange relationships rather than random interactions with firms in a population, and that openness "structures" will develop over time and reduce the amount of broad search and random partner selection in favor of established ties. This, furthermore, suggests that "communities of openness" will develop over time consisting of firms with repeated buy/sell transactions, but these will essentially be islands of strong mutual exchanges of knowledge within a sea of much lower degrees of knowledge interchanges.

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TABLE 1: BASIC STATISTICS AND CORRELATIONS

	N	Mean	Std. Dev	1	2	3	4	5	6	7	8	9	10
1. Specific Partner Choice BUY	131	.54	.5	1									
2. Specific Partner Choice SELL	131	.29	.46	0.52***	1								
3. Reciprocal Dealing Reported	104	.30	.46	0.28**	0.31**	1							
4. Open Innovation Reported	103	.24	.43	0.08	0.08	0.30**	1						
5. OI implied BUY	131	.82	.39	0.24**	0.13	-0.13	-0.10	1					
6. OI implied SELL	131	.24	.43	0.37***	0.32***	0.45***	0.22*	0.08	1				
7. OI BUY & SELL	131	.21	.41	0.32***	0.26**	0.38***	0.17^	0.24**	0.92***	1			
8. Age	116	22.03	21.62	-0.04	-0.06	0.045	0.08	0.13	-0.04	0.01	1		
9. Size	127	3.17	1.51	0.07	-0.02	0.13	0.02	0.19*	0.13	0.18*	0.52***	1	
10. R&D Intensity	122	2.16	1.53	0.15	0.15^	0.15	0.46***	-0.32**	0.30***	0.20*	-0.19*	-0.11	1

^<0.1, *<0.05, **<0.01, ***<0.001

NOTE: THE REPORTED CORRELATIONS FOR SIZE REFER TO THE ORIGINAL, ORDINAL VARIABLE WITH 6 LEVELS AS USED IN THE QUESTIONNAIRE (SEE APPENDIX).

TABLE 2: DO OPEN INNOVATION FIRMS CHOOSE SPECIFIC PARTNERS?
Models estimated with a binary logit model. Probability estimated is that of NO specific partner choice. Accordingly, negative parameter estimates indicate that the respective variable is associated with a higher degree of specific partner choice.

Dep. Variable	Specific Partner Choice BUY			Specific Partner Choice SELL		
INTERCEPT	.49 (.68)	1.32 (1.04)	.65 (.63)	1.47^ (.75)	1.88^ (1.05)	1.58* (.69)
Open Innovation Reported	-.10 (.62)	-	-	-.47 (.62)	-	-
OI implied BUY		-.88 (.79)	-		-.50 (.78)	-
OI implied SELL	-	-2.07** (.66)	-	-	-1.62** (.53)	-
OI implied BUY & SELL	-	-	-1.72** (.64)	-	-	-1.35** (.52)
Age	.02 (.01)	.01 (.01)	.01 (.01)	.03 (.02)	.01 (.01)	.01 (.01)
Small Size	-.66 (.73)	.14 (.71)	-.25 (.68)	-.65 (.79)	.24 (.77)	-.13 (.74)
Lower medium Size	-.80 (.74)	-.02 (.72)	-.24 (.69)	-.42 (.81)	.66 (.80)	.39 (.78)
Medium Size	-.87 (.83)	-.33 (.79)	-.47 (.78)	-1.15 (.90)	-.25 (.84)	-.40 (.83)
Upper medium Size	-1.89^ (.97)	-1.19 (.90)	-1.43 (.89)	-1.50 (.97)	-.02 (.91)	-.26 (.89)
Large Size	.20 (1.16)	1.26 (1.10)	.90 (1.05)	-1.13 (1.21)	.80 (1.17)	.54 (1.14)
R&D Intensity	-.20 (.17)	-.18 (.17)	-.18 (.15)	-.18 (.17)	-.20 (.16)	-.23 (.14)

N	96	111	111	96	111	111
LR (χ^2 Test)	8.24	22.86**	17.66*	7.44	16.69^	13.18

^<0.1, *<0.05, **<0.01, ***<0.001

TABLE 3: DO OPEN INNOVATION FIRMS BUY FROM AND SELL TO THE SAME PARTNERS?
Models estimated with a binary logit model. Probability estimated is that of NO reciprocal dealing. Hence, negative parameter estimates indicate that the respective variable is associated with a higher degree of reciprocal dealing.

Dep. Variable	Reciprocal Dealing Reported		
INTERCEPT	1.92* (.86)	.90 (1.33)	2.13* (.84)
Open Innovation Reported	-1.70* (.67)	-	-
OI implied BUY	-	.94 (1.01)	-
OI implied SELL	-	-2.50*** (.63)	-
OI BUY & SELL	-	-	-1.99*** (.58)
Age	.03 (.02)	-.01 (.01)	-.01 (.01)
Small Size	-1.11 (.89)	.26 (.96)	-.39 (.87)
Lower medium Size	.08 (.98)	1.33 (1.04)	.93 (1.00)
Medium Size	-1.25 (1.00)	-.24 (.98)	-.39 (.95)
Upper medium Size	-2.05^ (1.06)	-.32 (1.05)	-.47 (1.01)
Large Size	-2.34^ (1.27)	-.11 (1.30)	-.20 (1.21)
R&D Intensity	-.02 (.18)	-.01 (.20)	-.19 (.17)
N	96	97	97
LR (χ^2 Test)	15.64*	26.10**	19.20*

^<0.1, *<0.05, **<0.01, ***<0.001

APPENDIX

The following is an excerpt of the survey administered in late 2007 in Spain. The questions listed below are the primary source of data for the analysis performed in this paper. The remaining questions in the survey either collected simple demographic data like employee size, founding year etc. (questions 1 through 8), or queried other aspects of innovation practices that are not directly related to the specific hypotheses developed in the current paper.

2. Size of the company (number of employees):
o   <10 employees   Dummy: **very small**
o   10 - 50 employees   Dummy: **small**
o   50-250 employees   Dummy: **lower medium**
o   250 - 1000 employees   Dummy: **medium**
o   1000 – 5000 employees   Dummy: **upper medium**
o   >5000 employees   Dummy: **large**

9. How well does the in-house R&D of your company match with your technology requirements?
o   Completely
o   Sometimes we acquire external technologies
o   The utilization of external technologies (and knowledge) is vital to our business

23. In sourcing external technologies/IPR, do you usually:
o   Work with random new partners every time?
o   Prefer to work with a specific set of partners
o   Always deal with the same partners
o   Other _____

26. What is the extent of new technologies or intellectual property rights (IPR) that arise from your own R&D, but that you are not able utilize in your own business model?
o   None
o   "Surplus" technologies emerge unavoidably, because only a part of emerging technologies can be commercialized
o   Developing of technologies and IPR for external organizations is central to our business model

35. When you offer or sell external technologies/IPR, do you usually:
o   Work with random new partners every time
o   Prefer to work with a specific set of partners
o   Always deal with the same partners
o   Other _____

36. .Do you provide technology/IPR to firms from whom you source technology/IPR?
o   No
o   Sometimes
o   Often

42. In your opinion, are you applying the "open innovation" concept in your company?
o   Yes
o   No

NOTAS