Exploring the Role of Value Networks for Software Innovation

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Abstract. This paper describes a research-in-progress that aims to explore the applicability and implications of open innovation practices in two firms – one that employs agile development methods and another that utilizes open source software. The open innovation paradigm has a lot in common with open source and agile development methodologies. A particular strength of agile approaches is that they move away from 'introverted' development, involving only the development personnel, and intimately involves the customer in all areas of software creation, supposedly leading to the development of a more innovative and hence more valuable information system. Open source software (OSS) development also shares two key elements of the open innovation model, namely the collaborative development of the technology and shared rights to the use of the technology. However, one shortfall with agile development in particular is the narrow focus on a single customer representative. In response to this, we argue that current thinking regarding innovation needs to be extended to include multiple stakeholders both across and outside the organization. Additionally, for firms utilizing open source, it has been found that their position in a network of potential complementors determines the amount of superior value they create for their customers. Thus, this paper aims to get a better understanding of the applicability and implications of open innovation practices in firms that employ open source and agile development methodologies. In particular, a conceptual framework is derived for further testing.

Keywords: Networks, agile development, open source software, open Innovation.

1 Introduction and Research Motivation

Traditional theoretical and empirical studies of innovation concentrated on explanatory factors internal to firms such as investments in R&D and the production and acquisition of patents (Landry and Amara, 2001). The approach in which organisations generate, develop and commercialise their own ideas belong to the closed model of innovation (Fasnacht, 2009). According to Chesbrough (2003) closed

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innovation is a view that successful innovation requires control and that firms need to be strongly self-reliant because of uncertainty with quality, availability and capability of others' ideas. Traditionally, new business development processes and the marketing of new products took place within the firm boundaries and exclusively with internal resources. Within the closed model, the innovation process is characterised by firms that invest in their own R&D, employing smart and talented people in order to outperform their competitors in new product and service development. In addition, after producing a stream of new ideas and inventions, firms must defend their intellectual property thoroughly against the competition (Dahlander and Gann, 2007).

However, more recent theories of innovation lay much emphasis on the importance of knowledge and networking. According to Nonaka et al. (2003) and Tidd et al. (2005), successful innovation is the result of combining different knowledge sets and such knowledge is frequently to be found outside the organization (Chesbrough, 2003; De Wit et al. 2007). As March and Simon (1958) suggest, most innovations come from borrowing from others rather than from inventing. In addition, changes in society and industry have led to an increased availability and mobility of knowledge workers and the development of new financial structures like venture capitalism. This has resulted in the boundaries of innovation processes to start breaking up (Chesbrough, 2003a) and the do-it-yourself mentality becoming outdated (Gassmann, 2006). It has been suggested that a paradigm shift is taking place in how companies commercialize knowledge, resulting in the boundaries of a firm eroding. This has been characterized as a move towards 'Open Innovation'. This concept has been defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (Chesbrough, 2003a: XXIV). A general theme underling open innovation is that firms cannot continue to look inward in their innovation processes, isolating themselves from possible partners, collaborators and competitors. In other words, open innovation invites firms to open up their boundaries to achieve a flexible and agile environment. Thus, it is necessary that firms develop processes to ensure a flow of ideas across its boundaries while seeking input from network players such other companies, which include competitors, as well as customers, suppliers, third parties complementors etc. Conducting open innovation in the firm has various potential benefits, such as access to a wider knowledge pool (Chesbrough 2003), higher innovative performance (Laursen and Salter 2006) and, ultimately, higher market value (Alexy 2008). The open innovation paradigm shares some commonalities with both open source and agile development methodologies, both of which are described in more detail below. The remainder of paper focuses on a conceptual framework for future research followed by a conclusion.

1.1 Agile Development

Agile methods have emerged in recent years as a popular approach to software development. Some of the most popular include eXtreme Programming (XP) (Beck, 2000) and Scrum (Schwaber and Beedle, 2002). These methods have been well received by those in the system development community and there is strong anecdotal evidence to suggest that awareness and indeed use of these methods is

highly prevalent across the community. Agile has been described as 'the business of innovation', relying on people and their creativity rather than on processes" (Highsmith and Cockburn, 2001). Highsmith (2002a) contends that "agile approaches are best employed to explore new ground and to power teams for which innovation and creativity are paramount". Indeed, agile methods stress individuals and interactions over processes and tools; working software over comprehensive documentation; customer collaboration over contract negotiation; and responding to change over following a plan (Highsmith and Cockburn, 2001). A particular strength of agile approaches is that they move away from 'introverted' development, where the team building the system are detached from the customer. Instead, agile approaches continually involve the customer in the development process, supposedly leading to the development of a more innovative and hence more valuable information system (Beck, 1999; Schwaber & Beedle 2002). Thus, agile methods, given their flexible and light-weight processes, place emphasis on close communication and collaboration in project teams (Beck, 2000; Schwaber and Beedle, 2002). Despite these claims, however, there is a lack of understanding of what constitutes innovation in software development in general and to which extent agile methods actually facilitate innovation. This is part of a much larger problem in terms of agile method research, where many benefits are claimed, but rigorous conclusive research to support these claims is lacking (Abrahamsson et al., 2009; Conboy, 2009).

Stakeholder involvement is considered imperative to the creative process, yet many with vested interest are never involved (Nonaka and Takeuchi 1995; Amabile 1996; Ekvall 1996; Mathisen and Einarsen 2004). In a truly creative environment, an organization's internal and external communication boundaries should be as porous as possible (Leonard-Barton 1995). While the customer plays an essential part in the agile process, this practice could be extended to include multiple stakeholders and even other organizations. We propose that it is useful to consider how the agile innovation process can benefit from becoming more 'open', e.g., by opening up the boundaries of a systems development entity to include other stakeholders besides the customer.

1.2 Open Source Development

Open source software has significantly transformed from its free software origins to a more mainstream, commercially viable form (Feller et al., 2008; Fitzgerald, 2006; Agerfalk et al., 2005). Indeed it demonstrates two key elements of the open innovation concept – namely the collaborative development of the technology and shared rights to the use of that technology (West and Gallagher, 2006). In other words, OSS allows more people to be involved in the process of software development besides the developers within the boundaries of a firm (Lee and Cole 2003). It has even been suggested that open source is the most prominent example of the revolutionizing of traditional innovation processes, the enabling factors of which include short design-build-test cycles, new releases with low transaction costs and a great number of ideas that are enabled by the number of programmers that are involved worldwide (Gassmann and Enkel, 2006). In its emergent form, OSS represented a

community-based software development model where geographically dispersed programmers collaborated to produce software (West and O'Mahony, 2005). However, OSS has since transitioned into the realm of mainstream business and plays an important role in the business models for firms in high technology and other industries (Rajala, 2008; Fitzgerald, 2006; Overby et al., 2006).

The benefits of adopting OSS have been well documented in the existing literature (Morgan & Finnegan, 2007a, 2007b; Ven and Verelst, 2007). Reduced licensing fees, escape from vendor lock-in, increased quality and performance were just some of the benefits cited in this literature. Additionally, Morgan and Finnegan's (2007a) study of thirteen firms that had complete or partial adoption of OSS revealed that the increased collaboration and innovation allowed by OSS ranked two of the highest benefits. Further research by the same authors (Morgan and Finnegan, 2008) revealed that firms experienced many opportunities in collaborating with other companies, research institutes and OSS communities. Working as part of a value network enabled these firms to capture value in the form of competencies and tacit knowledge that in turn created superior value for the customer. However, while there are benefits for firms using OSS, in most cases OSS is basically treated as any other third-party software and typically only one-way interaction between the firm and the environment takes place, resulting in clear distinct boundaries between the two (Alexy and Henkel, 2009). Thus, investigating the role of open value networks for value creation and capture with OSS warrants further research.

2 Theoretical Framework

For our theoretical base, we propose a framework drawn from three central open innovation archetypes proposed by Gassmann and Enkel (2006). These include: (1) the outside-in process; (2) the inside-out process; and (3) the coupled process. This framework provides a useful lens to examine the implications and applicability of open innovation in organizations that employ both agile and open source methodologies. Open innovation can be analyzed at a number of levels, which include the intra-organizational and inter-organizational networking level (Chesbrough et al., 2006). Indeed, the implications that open innovation has *within* an organization and in particular the fact that it affects different parts of an organization differently are largely neglected in the current literature (Alexy and Henkel, 2009). While there exists much research about intra-organizational level networking in general to stimulate innovation (e.g. Lagerstrom and Andersson 2003; Foss and Pedersen, 2002; Tsai and Ghoshal, 1998), this type of networking has not been analyzed explicitly within the open innovation context (Vanhaverbeke, 2006). In particular, there is no research that we know of that addresses intra-organizational networking in an agile project environment. In order to address this, we have tailored Gassmann and Enkel's framework to include innovation that occurs outside the boundaries of a business unit and across the organization as well as outside the firm. In the context of OSS, Dahlander (2004) proposes that in addition to inter-organizational relations, it is relations with users and developers that constitute the

OSS community that are also important for the firm. The importance of competitors in a firm's value network has also been highlighted as these competitors often collaborate together to further develop or stimulate adoption of a shared technology, e.g. the Eclipse Foundation (West, 2007). Thus, for the purpose of this study, multiple stakeholders outside the boundaries of the firm will include the OSS communities, customers and competitors, in additional to inter-organizational relationships with other firms and research institutes.

2.1 The Outside-In Process

Companies that decide on an outside-in process as a core open innovation approach choose to cooperate with suppliers, customers third parties etc. and integrate the external knowledge gained (Gassmann and Enkel, 2006). This can be achieved by investing in global knowledge creation, applying innovation across industries, customer and supplier integration and purchasing intellectual property. According to Gassmann and Enkel (2006), if firms possess the necessary competencies and capabilities, they can successfully integrate internal company resources with the critical resources of other members such as customers, suppliers etc, by extending new product development across organizational boundaries. Companies such as HP and Sun have used an outside-in process by donating research and development to the Mozilla open source project while exploiting the pooled R&D and knowledge of all contributors (i.e., academics, user organizations, individual hobbyists, etc.) to facilitate the sale of related products. The result was that these firms maximized the returns of their innovation by concentrating on their own needs and then incorporating the shared integrated systems (West and Gallagher 2006). As the focus of this research in on both intra-organizational and inter-organizational value networks, an outside-in open innovation approach will refer to the integration of external knowledge and resources gained from multiple stakeholders outside the business unit and the boundaries of a firm.

2.2 The Inside-Out Process

This process focuses on the externalizing of company knowledge and innovation in order to bring ideas to market faster. This approach includes licensing IP or multiplying technology by transferring ideas to other companies. In addition, outsourcing can be used to channel knowledge and ideas to the external environment. The benefits of outsourcing include gaining access to new areas of complementary knowledge, managing capacity problems which allows for more flexibility, reduced time-to-market, sharing of costs and concentration of core competencies (Gassmann and Enkel, 2006). IBM for example have used an inside-out approach as part of its open source initiative that represented spinouts in the 1990s and, more recently, donated software patents to the OSS community (West and Gallagher, 2006). In the context of this study, an inside-out process refers to leveraging and transferring knowledge to multiple stakeholders outside the boundaries of both the business unit and firm and gaining certain advantages by letting ideas flow to the outside.

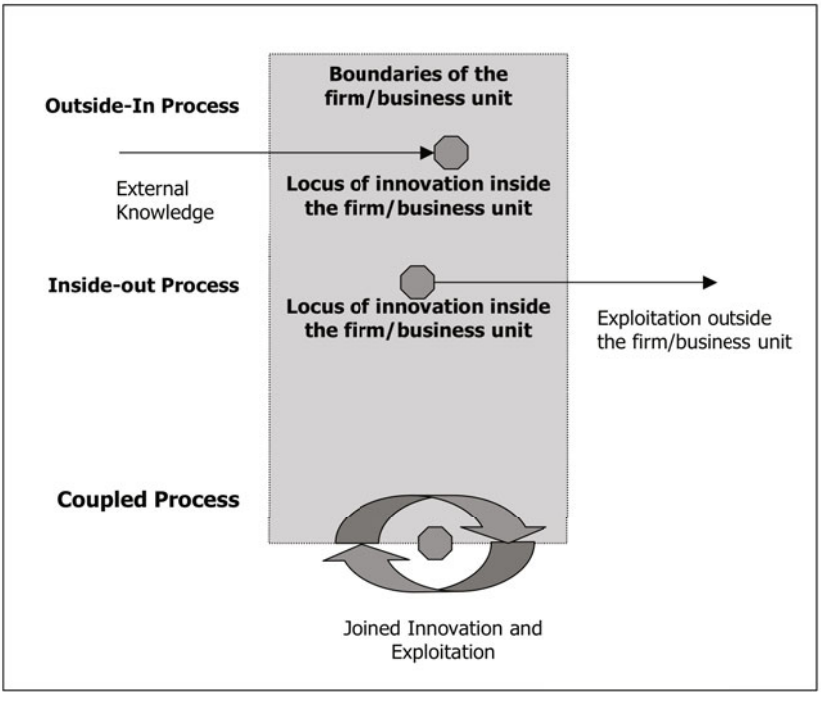

Fig. 1. Adaped Open Innovation Framework – Applying Open Innovation Principles in Firms that Employ Open Source and Agile Development Methodologies

2.3 The Coupled Process

This open innovation approach combines the outside-in (gaining external knowledge) with the inside-out process (to bring ideas to market). In order to accomplish both, these companies collaborate and cooperate with other companies (e.g. strategic alliances, joint ventures), suppliers and customers, as well as universities and research institutes. Indeed, companies like HP, Sun and IBM have also integrated elements of the coupled process by successfully cooperating with universities, research institutes etc., in both exploiting and sharing information and knowledge. To collaborate and cooperate successfully, a give and take of knowledge approach is crucial. Benefits of such an approach include an intensive exchange of knowledge and a mutual learning process. In this research, a coupled process will also refer to a combination of outside-in and inside-out as specified for this study. In particular, we will explore 1) how business units cooperate and interact with other business units in intra- organizational networks and 2) how firms cooperate and exchange knowledge with other firms, customers, communities, suppliers and competitors in value networks.

3 Proposed Research Methodology

The study will involve two case studies. Given the scarcity of empirical work in the area of open innovation and agile development and also the role of open innovation value networks for value creation and capture with OSS, a case study approach is considered most appropriate. Case studies are considered to be a suitable research approach for this study since it is exploratory in nature (Stake 2000; Yin 2003) and they explore a phenomenon in its natural setting, applying several methods of data collection to gather information from one or a few entities (Benbasat et al. 1987). We have already gained and sought agreement from key personnel in two firms – one of which employs agile development methods and another that utilizes open source software. Data collection will be carried out using semi-structured interviewing, a technique well suited to case study data collection, and particularly for exploratory research such as this because it allows expansive discussions which illuminate factors of importance (Yin 2003; Oppenheim 1992). The information gathered is likely to be more accurate than information collected by other methods since the interviewer can avoid inaccurate or incomplete answers by explaining the questions to the interviewee (Oppenheim 1992). The questions will be largely open- ended, allowing respondents freedom to convey their experiences and views of value networks and open innovation etc. (Yin 2003; Oppenheim 1992). The interviews will be conducted in a responsive (Rubin & Rubin 2005; Wengraf 2001), or reflexive (Trauth & O'Connor 1991) manner, allowing the researcher to follow up on insights uncovered mid-interview, and adjust the content and schedule of the interview accordingly. In order to aid analysis of the data after the interviews, all will be recorded with each interviewee's consent, and subsequently transcribed, proof-read and annotated by the researcher. In any cases of ambiguity, clarification will be sought from the corresponding interviewee, either via telephone or e-mail.

Data analysis will use Strauss & Corbin's (1998) open coding and axial coding techniques. Open coding is "the process of breaking down, examining, comparing, conceptualizing, and categorizing data" (Strauss & Corbin 1998). Glaser (1992) argues that codes and categories should emerge from the data, while with Strauss & Corbin's approach (1990) these are selected prior to analysis. The approach adopted in this study is more akin to the latter, where the interview questions and subsequent analysis will be based on the framework of open innovation presented earlier in this paper. This will provide a list of "intellectual bins" or "seed categories" structure the data collection and the open coding stage of data analysis. The next step will involve axial coding. Axial coding is defined by Strauss and Corbin (1998) as a set of procedures whereby data are put back together in new ways after open coding; whereas open coding fractures the data into categories, axial coding puts the data back together by making connections between the categories and sub-categories. As a list of codes begin to emerge, the analysis moves to a higher or more abstract level, looking for a relationship between the codes. Once a relationship has been determined, the focus returns to the data to question the validity of these relationships. Once the open innovation process (or lack thereof) is documented and analysed, the focus shifts to identifying the key benefits and challenges of open innovation and value networks in an open source and agile environment.

4 Future Work

This paper constitutes part of a research in progress aimed at exploring the applicability and implications of open innovation practices in firms that employ agile systems and open source development methodologies. At the moment we are in the process of collecting data from two companies that have agreed to participate in the study. Each case study has multiple embedded units of analysis corresponding to particular agile and OSS projects. Once data collection is complete, within-case analysis will be used to analyze the case-study data. Specifically, this paper argues for more open type of value networking that includes collaboration and reciprocal knowledge-sharing with other business units, customers, partners, communities and other relevant stakeholders pertinent to the business success of an organization, thus embracing open innovation principles. The conceptual framework proposed earlier raises some interesting research questions. In terms of 'outside-in' open innovation, how should firms choose which suppliers, customers, competitors and third parties to collaborate with? The 'inside-out' open innovation process also throws up some relevant questions. Deciding to change the locus of knowledge-sharing by transferring ideas to stakeholders outside the business unit or firm may prove challenging. Similar to the outside-in approach, a successful inside-out approach may be contingent on the firm's knowledge transfer capabilities and selection of appropriate stakeholders and their willingness and ability to engage and cooperate with each other. In relation to the 'coupled process' approach, how firms develop complementary internal and external value networks to create and gain external knowledge and ideas is a significant question. Additionally, there are more questions as to how the network is coordinated and maintained. Thus, it is crucial to understand how governance is shared across the network and how conflict is managed if it arises.

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