Editorial

Opening up the innovation process: towards an agenda

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Cisco is regarded as one of the world's most innovative companies. It does very little research and acquires most of its technology from external sources. After Solow (1957) had found innovation and technical progress to be the main drivers for economic growth, researchers and managers associated the establishment of a strong internal R&D capability with innovativeness. Inventions, after all, were generated by a company's own researchers, the firm's own engineering department realized the transition of ideas to commercial products, and the diffusion and exploitation of innovation was driven by the innovating firm itself. This was the paradigm according to which innovation was likened to a national treasure used to gain temporary monopolistic profits. Companies rarely resorted to sharing innovative results as a means to generate competitiveness – rarely in the early pre-competitive phase and not at all during commercialization. In the last decade, stronger global competition led to the labour sharing and cooperation between firms' innovation processes. In most industries, agility, flexibility, and concentration on core competencies are now regarded as sources of competitive advantage. The 'do-it-yourself' mentality in technology and R&D management is outdated.

Conversely, outside-in thinking deliberately builds on external sources of innovation. Opening the firm's boundaries to external inputs in a managed way enables companies to realize radically new product innovation. Recently, the strategy to access knowledge resources externally has been emphasized, as knowledge is growing faster and clusters of highly specialized knowledge are globally dispersed. External sources of knowledge and innovation have become increasingly relevant (Porter and Stern, 2001).

New information and communication technologies (ICT) have reduced the perceived distances between the actors of the innovation process while enabling integration of customers and suppliers into the design and development process. In addition, the technological success of open source software, such as Linux and Apache, has played an important role in spreading open innovation thinking.

The propensity to cooperate on R&D projects has increased since the 1980s yet reached a new peak during the 1990s. As firms replaced their internal R&D activities more and more by contract research and external development, the academic community (e.g. Rigby and Zook, 2002; Chesbrough, 2003a) began to emphasize the opening of the firm's boundaries to outside innovation. Answers have been sought regarding the managerial implications of this shift in focus. Is open innovation 'the new imperative for creating and profiting from technology' as Chesbrough (2003b) stated? This special issue aims to contribute towards structuring the topic and opening up a new debate. In the following, some drivers and patterns of the process of 'opening up' innovation are discussed.

1. Trends and streams of open innovation

Although a trend towards open innovation can be observed, open innovation is not an imperative for every company and every innovator. Instead, there is a need for a contingency approach re-

garding the management of innovation: Which of the factors that drive higher performance are preferred by open and which by closed innovation models need to be determined. The nuclear and military industries are typical examples of closed innovation industries in which non-proliferation of technology and protection remain important. The more an industry's idiosyncrasies correspond to the following developments and trends, the more appropriate the open innovation model seems to be.

(1) *Globalization* is driven by a higher mobility of capital, lower logistics costs, more efficient ICT, and increased market homogeneity across different countries. Globalization has not only lowered entry barriers for new international competitors by decreasing cost pressure, but also provides the companies that can innovate faster and are able to adapt better with an opportunity for competitive advantage. Global industries favor open innovation models because they achieve economies of scale more swiftly than the traditional closed model and promote more powerful standards and dominant designs (Anderson and Tushman, 1990).
(2) *Technology intensity*: In most industries, technology intensity has increased to such a degree that not even the largest companies can cope with or afford to develop technology on their own. The reasons are due to the lack of capabilities to cope with all upcoming technologies and due to the lack of financing to exploit them alone. Companies in high-tech sectors (e.g., semiconductors) show a higher propensity to cooperate, extensively using external sources to support product development in an environment characterized by rapid technological change (Miotti and Sachwald, 2003).
(3) *Technology fusion*: Technologies are increasing morphing into new fields such as mechatronics, optronics and bioinformatics (Kodama, 1992). Consequently, industry borders are shifting or even disappearing. For example, IBM is ranked eighth in a list of the world's largest holders of biotechnology patents. The more interdisciplinary cross-border research is required, the less a single company's existing capabilities are sufficient to provide successful innovations.
(4) *New business models*: With the rapid shift of many industry and technology borders, new business opportunities arise. For example, the multimedia industry brings together firms active in sectors as different as hardware, software, telecommunication, information and entertainment. Consequently, new alliances have been formed, leading to complementary partnerships, e.g. Vodaphone-Swisscom, Sony-Ericsson or Sony-BMG. The main motives for these alliances are the sharing of risks, the pooling of complementary competencies, and the realization of synergies. Companies also tend to acquire those innovations and technologies that fit their business model. For example, by sourcing technology and know-how externally, Procter & Gamble generated new businesses with a US$5bn turnover during the last four years.
(5) *Knowledge leveraging*: Knowledge has become the most important resource for firms. Despite discussions regarding tacit knowledge that is bound to specific persons (e.g. Nonaka, 1994), the mobility of knowledge has increased over the last decades. Open source software development can have thousands of decentralized programmers working on one platform and has become possible because of the special character of software: high separability and codability as well as its high knowledge intensity. Developing a car engine in open innovation modes is much more difficult – at least in the physical prototype stage. New ICT, especially the Internet, accelerated the knowledge diffusion process and increased the personal mobility of knowledge workers. Many specialized knowledge workers (e.g., freelancers, consultants or part-time engineers) make a living as portfolio workers, offering their service to different organizations at the same time. Instead of hiring the best engineers internally, companies are forced to act as knowledge brokers. New capabilities and organizational modes are needed to cope with this outside-in thinking.

The open innovation phenomenon is a complex issue that has received contributions from different *research streams*. Opening up the innovation process includes various perspectives: (1) globalization of innovation, (2) outsourcing of R&D, (3) early supplier integration, (4) user innovation, and (5) external commercialization and application of technology.

The various research streams and their points of view are, briefly:

(1) *Globalization of innovation*: Owing to modern ICT, virtual teamwork on a global scale has

changed from a rather exceptional working mode to a standard one. Large companies from small home countries, such as ABB and Novartis in Switzerland and Philips in the Netherlands, were pioneers of R&D internationalization. On average, European companies spend 30% of their R&D expenditures abroad, and Swiss companies spend even more than 50% (Gassmann and von Zedtwitz, 1998, 2003). Major drivers of the internationalization of R&D are access to markets and resources. Being physically close to regional centers of excellence enables a firm to increase its absorptive capacity (Cohen and Levinthal, 1990). As innovation processes require personal communication (Allen, 1977), organizations with a decentralized R&D structure are facing challenges such as a lack of trust between researchers.

(2) *Outsourcing of R&D*: Technical service providers such as engineering firms and high-tech institutions have become more important in the innovation process. Collaborative R&D appears to be a useful means by which strategic flexibility can be increased and access to new knowledge can be realized (Pisano, 1990; Quinn, 2000; Fritsch and Lukas, 2001). While R&D outsourcing has been reduced to cost savings in most companies, more and more managers are discovering the value of cooperative R&D for higher innovation rates. By cooperation with external partners, many of a company's orthodoxies – basic values and beliefs – are questioned, thus enabling breakthrough thinking. The not-invented-here syndrome, a severe barrier to innovation, can also be mitigated if external partners are involved (Katz and Allen, 1982).

(3) *Early supplier integration*: It is known that firms can significantly benefit if they are able to set up differentiated relationships with suppliers (Dyer and Singh, 1998). Suppliers' early involvement in the innovation process increases innovation performance in most industries (Hagedoorn, 1993, 2002). Suppliers can enhance the success of a firm's innovation projects by contributing their specific capabilities. Supplier involvement is also considered a promising source of competitive advantage by practitioners and management scholars alike (Teece, 1986; Kaufman et al., 2000; Sobrero and Roberts, 2002). However, the role of non-suppliers from high tech sectors as R&D partners is neglected in research despite the huge potential for spill-over effects. For example, BMW developed the i-drive system together with the small California-based high tech firm Immersion in a collaborative effort. The systematic exploitation of spill-over effects in cross-industry innovation processes is just at the beginning. Owing to the difficulties in managing such vertical innovation cooperations, strong relationships with suppliers are required (Takeishi, 2001).

(4) *User innovation*: Following von Hippel's (1986) groundbreaking work on lead users, the importance of users as a source of innovation has been widely recognized (Olson and Bakke, 2001; Lilien et al., 2002; Bonner and Walker, 2004). The degree of user integration has, however, increased from specification delivery to virtual users that develop products they desire by themselves (Dahan and Hauser, 2002; von Hippel and Katz, 2002; Gassmann et al., 2006). Integration of customers into the early phases of an innovation process has been analyzed regarding roles (Brockhoff, 2003), chances (von Hippel, 1998, 2005), and risks (Enkel et al., 2005).

(5) *External commercialization of technology*: Internally created intellectual property is being exploited more systematically outside the firm. IBM earned about US$ 1.5bn by licenses and know-how transfer in 2005. Patents have turned to strategic assets. As an indicator the number of patents worldwide has increased by more than 25% per year (1996–2004). To own intellectual property has become more important than to own factories. Companies gain leverage effects by multiplying their internally generated patents and trademarks to the outside world. In order to optimize the external commercialization of technology many multinational companies, have created own organizational units, so-called corporate incubators (Becker and Gassmann, 2006).

2. Papers in this Issue

This special issue of R&D Management brings together some of the most active authors who have explored the phenomenon of open innovation from different angles.

Most of the empirical evidence in respect of open innovation is based on cases from high-tech industries. *Chesbrough and Crowther* examine open innovation practices in rather mature and asset-intensive industries. In their sample of 12 companies, inbound activities are dominant. The

authors identify several success factors for introducing open innovation practices in these specific industries. This contribution opens up a debate for managers in low-tech industries.

Opening the innovation process to users and customers is a major constituent of open innovation. *Prügl and Schreier* provide a case study based on the computer game 'The Sims', and look at how users react when they have been asked to use a toolkit to innovate and further develop the product. They also explore the issue of how attractive an individual user's design is for other users. They subsequently discover that users in this industry have a rather long-lasting and intense relationship with the community. Leading-edge users not only use officially provided toolkits, but use user-created tools that extend design freedom even further. Users thus demand innovative solutions.

Based on four case studies in the medical equipment industry, *Lettl, Herstatt and Gemuenden* studied how users contribute to radical innovation. The authors have identified the characteristics of those users who contribute substantially to the early innovation phases as being highly motivated to provide new solutions, possessing diverse competencies, and being embedded in a supportive context. In the observed cases, the medical equipment manufacturers adopted users' prototypes as a radical innovation for the market at a rather late stage. The users therefore demonstrated real entrepreneurial behavior.

Hienerth's contribution analyzes the commercialization process of user innovations at the product and industry life cycles' very early stages. Based on 16 cases of user innovators in the Rodeo Kayak industry the author shows the transformation process from a user innovation community to a commercial and manufacturing community with the induced changes. In the study, the following were tracked: the motives for innovating, the community size, and characteristics, the type of innovation, the type of assistance and disclosure of information, and the type of communication and competition between the innovating users. The study shows how commercial activities affect the kinds of open community systems where knowledge is freely revealed.

von Hippel and von Krogh analyze the importance of 'free revealing' as a basic constituent of open innovation. They introduce the private-collective model for innovation incentives and explain its value and impact for the innovators, e.g., setting dominant designs or open standards, and for society, e.g., the extent and pace of that innovation's diffusion. The private-collective model of innovation incentives provides a framework for open source software that is neither a private nor a public good. The model therefore forms the foundation for new innovation models – those that lie between the traditional private and collective action models.

Piller and Walcher analyze Internet-based toolkits designed to create competition between users' ideas. Their study consists of two phases: first, interviews with companies in which competition between ideas were successful, and, second, developing, together with Adidas, a toolkit for an idea competition in an action research setting. The toolkit is intended to inspire creativity, enable interactions in communities, and increase efficiency, e.g., to evaluate and cluster user input. The results have been evaluated and their implications discussed.

West and Gallagher summarize the lessons learned from open source software development regarding the challenges of managing open innovation. Lack of control and governance in the innovation process are characteristics that are not usually found in traditional industries. Opening up the innovation process requires new management styles and systems, adapted to exploit the potentials of open innovation and to reduce the induced risks.

Open innovation can be a result of an explicit top down strategy. *Dodgson, Gann and Salter* examine the role of innovation technology with respect to opening innovation as described in a study of Procter & Gamble. P&G changed its R&D strategy to a 'Connect and Develop' strategy and enjoyed major success in terms of business growth through new, externally sourced products and technology. The paper shows what is required to move towards an open innovation model.

The paper of *van de Vrande, Lemmens and Vanhaverbeke* studies the effect of uncertainty on the choice of a mode of governance in cooperative product development. Based on transaction costs and real option perspectives, they argue that in early innovation phases, during which technological and market uncertainty is high, reversible modes of governance with little commitment are more appropriate. The impact of technological distance on the choice of a mode of governance is also analyzed.

Opening up the innovation process is a clear empirical trend. The selected cases in the various papers demonstrate that open innovation has

different characteristics and has to be looked upon from several angles. The analysis of open source software development shows an extreme version of open innovation but cannot be transferred one to one to an average industrial environment. A key issue here is an incentive system encouraging programmers to share their knowledge and capabilities with others. Management research and practice can profit by cherry-picking some ideas and concepts from open source development.

Externalization of innovation is not only adequate for incremental development activities as extended workbenches but also for sources for radical innovation. Users are not well known as sources for radical innovation and entrepreneurship. The papers open up a debate on determinants and contingencies for such an impact. This special issue brings together several perspectives and research streams of open innovation. The state-of-the-art of open innovation as a new emerging discipline in technology management is illustrated. However, many white spots in research on open innovation are left. Researchers are invited to fill these gaps; this journal welcomes further papers on the topic and its implications. Managers are encouraged to explore the potentials and limits of opening up the innovation process.

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