The future of open innovation

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Institutional openness is becoming increasingly popular in practice and academia: open innovation, open R&D and open business models. Our special issue builds on the concepts, underlying assumptions and implications discussed in two previous R&D Management special issues (2006, 2009). This overview indicates nine perspectives needed to develop an open innovation theory more fully. It also assesses some of the recent evidence that has come to light about open innovation, in theory and in practice.

1. Perspectives on open innovation

The open innovation phenomenon has developed from a small club of innovation practitioners, mostly active in high-tech industries, to a widely discussed and implemented innovation practice. Simultaneously, a small community of management researchers has recently developed into an established research field. This is reflected by several special issues on open innovation, for example, *R&D Management* 2006, 2009, and the *International Journal of Technology Management* 2010a, b. Consequently, single lectures by early proponents have been supplemented by large management seminars on open innovation, which are often fully booked. Once a field grows rapidly, there is a danger that it may become a short-term fashion and hype. This special issue reports on recent research evidence to further develop the open innovation research field.

Open innovation 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 et al., 2006). While the initial works looked primarily at research and development (R&D) processes, a number of research areas have grown out of this perspective. Open innovation is based on these different research streams. We think it useful to organize these streams into nine different perspectives:

(1) The *spatial perspective* leads to research on the globalization of innovation. Since research, technology and product development have become more global in a flat world, open innovation has become easier. On the one hand, being physically close to regional centers of excellence enables a firm to increase its absorptive capacity, therefore promoting access to the knowledge and competences of the best talents worldwide without having to employ them (Cohen and Levinthal, 1990). Access to resources is one of the main drivers of R&D's internationalization. Prominent examples of such R&D are Norvatis's research in New Jersey, BMW's design center in Palo Alto and Hitachi's research lab in Dublin (von Zedtwitz and Gassmann, 2002). New information and communication technologies

enable virtual R&D teams and decentralized innovation processes (Boutellier et al., 1998).

(2) The *structural perspective* shows that work division has increased in innovation. There is a strong trend toward more R&D outsourcing and alliances (Hagedoorn and Duysters, 2002). Industries' value chains are becoming more disaggregated. Drivers of this trend are cost reduction and greater specialization due to more complex technologies and product systems. Open innovation approaches compensate for central R&D units by not just focusing on short-term, customer-oriented business unit research activities.

(3) The *user perspective*. Users are integrated into the innovation process to utilize the freedom available in its early phases in order to understand potential customers' latent requirements and to integrate users' hidden application knowledge (von Hippel, 1986). This research field on innovation's downstream-side started with lead users' involvement in the innovation process (von Hippel, 1988), the availability of toolkits (von Hippel and Katz, 2002) and the idea of mass customization (Franke and Piller, 2003), while involving the quasi-political concept of democratizing the innovation process (von Hippel, 2005). User innovation is one of open innovation's best-researched part fields.

(4) The *supplier perspective*. The downstream side of innovation has been less intensively researched but has a strong impact on innovation. Suppliers' early integration into the innovation process can significantly increase innovation performance in most industries (Hagedoorn, 1993, 2002).

(5) The *leveraging perspective*. Most research and practice are oriented toward the existing market and business. Existing research competencies and intellectual property's multiplication into new market fields have often been neglected, despite their potential to create new revenue streams. The involvement of business model thinking seems to be crucial (Kim and Mauborgne, 2004; Chesbrough, 2006, 2007). Created technology and intellectual property's external commercialization is a future field with high potential.

(6) The *process perspective*. There are three core processes in opening up the innovation process: outside-in, inside-out and coupled (Gassmann and Enkel, 2004). Sometimes, these processes complement one another, although the dominance of the outside-in process is usually observed.

(7) The *tool perspective*. Opening up the innovation process requires a set of instruments. Those tools, for example, enable customers to create or configure their own product with tools kits or enable companies to integrate external problem solvers or idea creators via websites. Examples are 'The Sims' with which an online community of gamers develops add-on packages, or Swarosvski, whose customers can create their own figures.

(8) The *institutional perspective*. Open innovation can be considered a private-collective innovation model. Instead of the private investment model of innovation with Schumpeter's temporary monopolistic profits, the free revealing of inventions, findings, discoveries and knowledge is a defining characteristic of the open innovation model (von Hippel and von Krogh, 2003, 2006). Spillovers of proprietary knowledge occur regularly by means of compensation (e.g., licensing) or without compensation (e.g., most open source initiatives).

(9) The *cultural perspective*. Opening up the innovation process starts with a mindset. The seminal work on the not-invented-here syndrome by Katz and Allen (1982) was a starting point within the field. Creating a culture that values outside competence and know-how is crucial for open innovation practice. This culture is influenced by many factors: besides being influenced by the values of the company, it is also influenced by concrete artefacts such as incentive systems, management information systems, communication platforms, project decision criteria, supplier evaluation lists and its handling and so on. In order to better understand the influence of all those aspects on the open innovation culture, research should draw more from the psychological field.

While we think it is useful to identify these different research streams, we do not yet know whether others will arise or whether two or more of these will converge. Consequently, this should be treated as a highly preliminary list.

2. Future of open innovation

The era of open innovation has just begun. A major shift has started toward a new paradigm in the sense of Kuhn (1962). Earlier conceptions of innovation gave rise to anomalies in the Kuhnian sense, such as the inability of Xerox to appropriate the value generated by its Palo Alto Re-

search Center (PARC) in the 1980s, or the inability of Lucent to leverage its considerably greater research capabilities at Bell Labs against Cisco (which had no research capability at the time) in the 1990s. In developing an alternative approach to innovation, open innovation provided a novel explanation for these anomalies. Further research has largely validated this approach, and has extended it significantly. Today, open innovation has changed its status from the research interest of a few to a mainstream research area. Initiated by scholars in the field technology and innovation management, it is currently often also cited in strategy, general management and organization behavior journals. The question is: How far will open innovation go and how long will it last? A real paradigm shift is irreversible and differs from fashion and science hypes in terms of its long-term impact.

Some trends can be identified by analysing the recent past and drawing on previous research on open innovation:

(1) *Industry penetration: from pioneers to mainstream*. The opening up of the innovation process has become increasingly popular in leading industries. The principle of open innovation has, for example, penetrated pioneering industries such as software, electronics, telecom, pharma and biotech, while the software and electronics industries are progressively building on the open innovation trend (Chesbrough, 2003). In software, the open source trend has been so strong that even previous, rather monolithic, organizations such as SAP and Microsoft have started to build decentralized research labs on university campuses to increase their absorptive capacity for outside-in innovation processes. Even Apple, with its strong position and high acceptance among its brand community, had to open up its proprietary technology to its addicted high-tech users. Prominent examples in the electronic industry are Philips' open innovation park, Xerox's Palo Alto Research Center, Siemens' open innovation program and IBM's open source initiatives. Today, many electronic suppliers drive open innovation on a strategic level. British Telecom's incubation activities have long been adopted by Deutsche Telecom and Swisscom. The pharma and biotechnology sectors too have a broad spectrum of open innovation models. Open innovation starts with simple outsourcing deals with contract service organizations to reduce overcapacities, cut costs, grow through complementary assets or reduce risks. More strategic modes of open innovation have already become a standard in the pharma industry, for example, Bayer with its Creative Center, Eli Lilly and its Innocentive Initiative, and Pfizer with the in-licensed drug Lipitor. Its overwhelming success has further disseminated the open innovation model to other industry players. Lipitor became the first pharmaceutical product to top US$10 billion in annual sales (Gassmann et al., 2008). Overall, the trend toward open innovation is still growing. There are many reasons for driving open innovation (see, e.g., Chesbrough, 2003; Gassmann, 2006), but there is also a bandwagon effect: in our executive education programmes, we have observed that CTOs with closed innovation models and strong internal R&D are under increasing pressure to justify their refusal to cooperate with the outside world and exploit the open innovation wave.

(2) *R&D intensity: from high to low tech*. From the above, it is clear that open innovation mainly started in the high-tech sector, but there is a new trend for the low-tech sector to exploit the potentials of opening up their innovation process. Open innovation's management innovation has spread to different sectors, such as machinery, turbines, medical tools, fast moving consumer goods, food, architecture and logistics. User-driven innovation has the longest tradition; here, well-known examples are the construction and elevator industries (Herstatt and von Hippel, 1992; Boutellier et al., 2008) as well as the sports industry (Hienerth, 2006). Besides users' systematic involvement in the early phase of innovation, these industries have started to open up in all other directions as well. Not only has supplier integration's potential been discovered but also the more systematic use of universities and knowledge brokers.

(3) *Size: from large firms to SMEs*. While most of the firms described in early works on open innovation were large multinational firms, it has become apparent that smaller and medium-sized firms (SME) are also opening up their innovation process. Empirical evidence regarding so-called 'born globals' – rapidly growing SMEs already active on a global scale early in their existence – indicates that the source of their competitive advantage is the protection and leveraging of their intellectual

property. Some SMEs can overcome their 'liability of smallness' by opening up their innovation process (Keupp and Gassmann, 2007; van de Vrande et al., 2010). External technology commercialization can also be a core competence of such rapidly growing SMEs. Owing to business schools' intensive teaching of the open innovation idea in executive education and in general management, SMEs seem to be catching up with implementing the open innovation concept. However, despite their smallness and lack of resources, which are acknowledged liabilities, they still implement open innovation far less than multinationals do.

(4) *Processes: from stage gate to probe-and-learn*. Open innovation is also promoted by a parallel trend in innovation processes. While the dominant design of the 1980s and 1990s was the highly structured stage-gate process (Cooper, 1994), there is a new trend towards more iterative and interactive probe-and-learn processes (Lynn et al., 1996). In software development, this trend is reflected by linear, top-down V models' replacement with highly iterative processes, such as extreme programming (Beck, 2000; Gassmann et al., 2006). These processes support early interaction with customers, suppliers and R&D partners. However, even in linear software development processes, a decision of when to use open source or to develop proprietary software has become standard.

(5) *Structure: from standalone to alliances*. Modern technology is becoming so complex that even large firms cannot afford to develop a new product alone. Consequently, there is a strong trend toward R&D partnerships and alliances (Hagedoorn and Duyster, 2002). Vertical alliances are complemented by horizontal alliances and cross-industry partnerships. However, earlier research on R&D partnerships and alliances focused primarily on cost-saving and transaction cost economizing (Williamson, 1975). Recent research, however, focuses on how these inter-organizational relationships can enhance value creation (Enkel, 2010). A recent example is the development of the Apple iPod: the external entrepreneur Tony Fadell developed the idea and concept, Apple hired a 35-person team and partners from Philips, Ideo, General Magic, Apple, Connectix and WebTV to develop the iPod system. The technical design was managed by Portal Player – a Wolfson, Toshiba and Texas Instruments alliance that earns US$15 per sold iPod. A huge alliance worked behind the curtain to produce *the* Apple product. There are also other prominent examples from the telecommunication and automotive sectors.

(6) *Universities: from ivory towers to knowledge brokers*. Currently, universities are still largely financed by public money, but in many regions of the world, this financing will decrease despite soothing public statements. Large companies like ABB, Daimler, Siemens and GE have already reduced their corporate research activities or have increased third-party financing. This will force all players in the innovation game to cooperate even further. The new alliance between IBM and the ETH Zurich in Switzerland on research into nanotechnology seems to be unique: both the partners have the rights to publish and commercialize the jointly created intellectual property. This will accelerate the race toward the commercialization of research results, placing unique pressure on IBM. Such open research also accelerates research and energizes the involved research teams, as exemplified by the human genome project, which made impossible results possible.

(7) *Processes: from amateurs to professionals*. Similar to the first structured innovation processes, industry is starting to professionalize the internal processes to manage open innovation more effectively and efficiently. Nevertheless, it is currently still more trial and error than a professionally managed process. The variance between a best practice in open innovation and the average is huge. This difference will, however, decrease because open innovation knowledge will spread through the various industries. Two important sources of diffusion are the mobility of executives experienced in open innovation from initial adopters to newly adopting organizations, and the availability of third-party intermediaries like Innocentive, NineSigma and others to help companies experiment with these processes (West and Lakhani, 2008). Additionally, the measurement of open innovation activities' value is increasingly important. While the possibilities of opening the innovation process are growing, metrics systems are not yet adapted to monitor and measure the value of activities. Nonetheless, we know that only adapted measurement systems allow for the successful

implementation of open innovation and support the right capabilities (Enkel and Lenz, 2009).

(8) *Content: from products to services*. While today's research mainly aims at product and, partly, process innovation, the huge potential of innovating the largest sector in developed countries has been neglected: the service sector is still underdeveloped in terms of the innovation processes. Apart from a few exceptions, like the work by Thomke (2003), there has not been much service innovation. Opening up the service sector to the innovation process provides new opportunities, for example, Amazon's Elastic Cloud computing service.

(9) *Intellectual property: from protection to a tradable good*. According to Schumpeter, patents are there to create incentives for inventors and entrepreneurs to invest in innovations. This works by protecting innovators from imitators and, thus, enables them to gain temporary monopolistic profits. Although this is valid, it will be complemented by an attractive secondary market in which new players enter. A 2006 case made a difference: Research in Motion had to pay US$612.5 million to the small firm NTP for violating a patent – an email push function used for the Blackberry. High turnovers attract new players, which trade and realize profits from arbitrage. This situation is similar to the hedge funds in the 1990s when arbitrage margins attracted players to the financial industry. Large auctions of IP have already taken place, although it has just started. In Europe, the largest auctioneer Ocean Tomo started off in 2007. Its turnover from auctions is around €70 million – once firms realize the potential of and culturally accept the auction mechanism, IP auctions' turnover will increase by many factors. Europe currently also has patent funds, for example, two run by Deutsche Bank and one by Credit Suisse. They buy intellectual property – mostly from universities and high-tech ventures – and leverage its value through professional management. The trade in IP has just begun, but in the near future, a whole industry will arise around intellectual property's secondary markets. New business models, of IP aggregators, IP insurers and even intellectual commons where IP is pooled and shared, are all springing up as part of this evolution.

Taking stock of these different trends, it seems clear to us that open innovation has quite a long life left ahead of it, as there is a long and growing list of phenomena that it can help us understand and interpret. However, we should note that it is unlikely that 'the last word' will ever be spoken on a topic as dynamic as innovation. Open innovation should instead perhaps be viewed as 'the next word.'

3. Papers in this issue

This second special issue of R&D Management completes the overview of some of the most active authors in the field, who have developed a further understanding of open R&D and open innovation in recent years.

The work of *Chiaroni*, *Chiesa and Frattini* focuses on the organizational change process through which a firm evolves from being a closed innovator to becoming an open one. Adopting a longitudinal, firm-level perspective, they investigate the changes entailed in this shift in a firm's organizational structures and management systems. The paper uses established concepts in organizational change research to examine the rich empirical basis that documents the adoption of open innovation by four Italian firms operating in mature, asset-intensive industries. The results show that the journey from closed to open innovation involves four main dimensions of the firm's organization, i.e. inter-organizational networks, organizational structures, evaluation processes and knowledge management systems, along which change can be managed and stimulated.

Automotive original equipment manufacturers (OEM) have historically invested in their own research and development to boost their innovativeness. Owing to increasing innovation and cost pressures, the automotive industry needs to look outside its own boundaries to escape this productivity dilemma. While there is a tendency to look outside for external sources to increase innovativeness, there are as yet hardly any external paths to markets outside the current business. *Ili*, *Albers and Miller* show that open innovation is far better at achieving better R&D productivity for companies in the automotive industry than a closed innovation model by investigating 42 automotive companies, including five OEMs.

Enkel and Gassmann explore the phenomenon of cross-industry innovation. While most studies on open innovation focus on traditional external

sources within the same value chain, like customers, suppliers, competitors or cooperation partners, these authors study innovation created by using sources outside the own industry. However, there is limited insight into how the cognitive distance between the source of knowledge and its application is responsible for the innovation effort's explorative or exploitative outcome. By analysing 25 cases, the authors study the influence of a higher or a lower cognitive distance on the outcome of analogical thinking in cross-industry innovation.

While most open innovation literature neglects the human side of open innovation teams, *du Chatenier*, *Verstegen*, *Biemans*, *Mulder and Omta* examine the competencies that open innovation professionals need to work in such teams and to cope with the challenges they face. A qualitative study was undertaken that consisted of explorative interviews and focus group discussions. This resulted in a competence profile for open innovation professionals. The profile adds a new perspective to the field of open innovation management by focusing on how individuals involved in open innovation teams can enhance open innovation success. It reveals, among other things, how professionals can generate new knowledge, build trust and deal with low reciprocal commitment in open innovation teams. The ability to broker solutions and be socially competent seems to be especially important for open innovation professionals.

Sieg, *Wallin and von Krogh* study an innovation intermediary to solve R&D problems. Using an exploratory case study design, they investigate the managerial challenges in seven chemical companies working with the same innovation intermediary, InnoCentive. Three recurring challenges were identified in all the companies: (1) enlisting internal scientists to work with the innovation intermediary; (2) selecting the right problems; and (3) formulating problems to enable novel solutions. By reviewing the knowledge management literature, they explain how these challenges arise from scientists' differing work practices in internal vs external R&D problem solving. They furthermore identify and discuss a number of solutions for these challenges.

Chiang and Hung argue that accessing knowledge intensively from a limited number of external channels (open search depth) can facilitate the innovating company's incremental innovation performance. They also argue that accessing knowledge from a broad range of external channels (open search breadth) can enhance the innovating firm's radical innovation performance. Using hierarchical regressions to analyse survey data collected from 184 Taiwanese electronic product manufacturers, they find that open search depth is positively related to the innovating firm's incremental innovation performance and that open search breadth is positively related to radical innovation performance.

Haeussler empirically investigates the determinants of knowledge regulation. The author argues that when the level of external knowledge inflow is considerable, firms regulate knowledge outflows less strongly. Firms that profit from external knowledge are less restrictive regarding outgoing knowledge in the hope of future benefits. Having tested this proposition in a large-scale survey of the German biotechnology industry, the author finds that the type of competitive relationship, as well as the knowledge source and the type of channel through which knowledge is accessed, governs the knowledge regulation decision.

Sofka and Grimpe also investigate the relationship between search strategies and innovation performance. They argue that firms need to specialize with regard to their search strategy and that its effectiveness is moderated by R&D investments and potential knowledge spillovers from firms' environments. Based on a sample of more than 5,000 firms from five European countries, the results show that, generally, being open to innovation pays off. However, both moderating factors have a crucial role to play: on the one hand, in-house R&D investments are most effective when combined with a market-oriented search strategy. On the other, a technologically advanced environment requires firms to reach out to sources of scientific knowledge in order to access highly novel knowledge and to enhance innovation performance.

Hughes and Wareham examine the strategy of a global pharmaceutical company that uses open innovation widely. Three main research questions are addressed: (1) What open innovation concepts are salient regarding the company's innovation portfolio? (2) WHAT open innovation concepts are used in the strategy formulation? and (3) What other concepts are present that augment open innovation? Interviews with 120 top managers as well as archival documents were analysed by means of thematic analysis. The authors found that two concepts – value capture models and technology evaluation criteria – which are prominent in the literature, were not present in the portfolio of this case. Conversely, they found a focus on open innovation capability building,

external information sharing and uncertain knowledge arbitrage in networks. Finally, they discuss these capabilities in relation to absorptive capacity, proposing a simple, but important, bi-directional perspective to embrace open innovation.

4. Contribution and further knowledge gaps

This special issue contributes further to the knowledge body of open innovation as a young research field. Contributions are too often still fragmented and restricted to one dimension, for example, user innovation or supplier integration. These high specialization parts of the open innovation phenomenon have a long tradition and also promoted these disciplines. But at the same time, there is a need for a consistent open innovation theory. A new perspective might be needed to integrate these disparate strands of evidence into a larger theory.

It might be helpful to address some of the research questions – knowledge gaps in an interesting field – to develop such a theory: firstly, we know that intellectual property will play a core role in open innovation, but the determinants of successful tradable patents still need to be identified. Patent valuation remains quite problematic, as most patent transactions are not reported publicly, and patents are highly idiosyncratic by their very construction. Secondary markets require better information on valuation if they are to advance materially in the medium term. A longitudinal analysis of an auctioning firm's patents or of a patent fund might be very helpful. Secondly, the next logical open innovation step is trading intellectual property and, especially, patents, which holds huge potentials for both patent owners as well as traders. But the crucial question for policy makers remains whether this is good for the economy. It seems clear that some minimal protection is essential to stimulate risk-taking, and it seems equally clear that extremely strong patents strangle any follow-on inventions that build on them. Balancing risk-taking and promoting cumulative innovation are challenging social questions. Thirdly, SMEs are the largest number of companies in an economy, but they are under-researched in the open innovation literature. There are large sample studies that show that open innovation policies benefit (Laursen and Salter, 2006), but these same studies also show that larger size benefits. A crucial question for SMEs is how they can manage open innovation despite the liability due to their smallness. This is especially relevant when a firm is dependent on a few strong customers, such as the automotive sector. Fourthly, the existing work does not focus sufficiently on open innovation's spatial aspect. Opening up the innovation process creates a challenging situation of managing dispersed virtual R&D teams. These teams are more difficult to energize, coordinate and enable in their knowledge creation. The operational functioning of open innovation depends on firms' ability to manage decentralized innovation processes and often includes participants who are not even on the company's payroll. At the same time, large firms internationalize their own R&D with two dominant motives: to be closer to their markets and lead users and to access the best talents worldwide by increasing their absorptive capacity. A great deal of management research has to be carried out to merge these two young research fields. Last, but not the least, there is as yet no holistic model of open innovation that includes the innovation process's determinants and industry specifics, as well as the limits to opening it up.

The field of open innovation is still at an early stage; it offers a wide field in which academics, practitioners and policy makers can be active. We invite them to address these knowledge gaps and further develop the research field.

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