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# OPEN INNOVATION AND THE CONSEQUENCES FOR IT<sup>1</sup>

## 1. INTRODUCTION

Philips' High Tech Campus, the 'Corporate Venture Capital' program of DSM and the Blue Lab program of KLM are examples of a new way of innovating that is no longer limited to company innovation departments, but transcends company boundaries. A growing number of companies is interested in the phenomenon of open innovation<sup>2</sup>, academic research into open innovation is growing<sup>3</sup> and governmental agencies have looked into it as well<sup>4</sup>.

Much of the research into open innovation is of a qualitative nature, is only directed at a small element of open innovation or tries to find theoretical explanations for the phenomenon. There is less attention for quantitative research into what the actual state of affairs is in practice. Moreover, the attention for individual techniques for open innovation like corporate venture capital (CVC) or crowd sourcing (see box 1) is only a part of the story. A question is whether companies apply these techniques in isolation or whether they use them concurrently. Next, there is little attention for the implementation of open innovation. What are the real barriers companies have to face when they want to apply open innovation? Finally, despite the importance of IT in modern business, there is little attention for the connection between IT and open innovation.

This article aims to fill the gaps in the literature identified above. In order to do so, we will first define the concept of open innovation which is a hot issue in business today. Next, we will describe the process we have followed in researching ninety companies and their open innovation strategy. Finally we will discuss the results of our research and its implications for IT.

## 2. WHAT IS OPEN INNOVATION?

According to its high priest, Henry Chesbrough<sup>5</sup>, open innovation is 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and

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1 The author thanks C. Hoogduyn and K. Dekkers for their valuable contribution to this article.

2 H. Chesbrough, *Open Innovation*, Boston, Harvard Business School Press, 2003.

3 H. Chesbrough, W. Vanhaverbeke and J. West (eds.), *Open Innovation: Researching a New Paradigm*. Oxford, Oxford University Press, 2006.

4 Adviesraad voor Wetenschaps- en Technologiebeleid, *Open Stellingen*, Den Haag, 2006.

5 Chesbrough, 2003.

expand the markets for external use of innovation, respectively'. Two elements in this definition are worth highlighting. First, it is important to bring knowledge from outside into the organization to improve innovative power. This is the outside-in aspect of open innovation. Second, it is also relevant to make better use of knowledge inside the organization. This is the inside out aspect of open innovation. The latter element is often overlooked. Much valuable knowledge may remain unused by companies. This knowledge can however generate revenues for example by selling it directly, by creating a company spin off around it or by exploiting that knowledge together with an alliance partner.

Discussions about open innovation often pay attention to a limited amount of techniques that help companies to realize it: crowd sourcing, campuses, corporate venture capital, innovation intermediaries and business models (see Box 1 for definitions and examples of these techniques). These are the techniques that Chesbrough emphasizes in his work. However, they are not the entire picture. Techniques that have been around for quite a while are used in open innovation settings as well. Examples include licensing, alliances and collaboration with suppliers, clients or universities.

**Crowd sourcing:** A technique to make use of a crowd to solve problems, usually via the Internet. A company can post a question online and the public can help answer it. This may or may not include a reward for those coming up with the best answers. The Dutch airline KLM applies this technique since 2007 in its 'Blue lab'-program. This program aims at developing new services for business travelers.

**Campus:** Proximity is an important booster for innovation. Companies innovate more with organizations that are located in their region than with companies that are located further away. To exploit this aspect to the full, some companies set up campuses where they offer space for partners and innovative start ups. The High Tech Campus around Philips in Eindhoven is an example. Chemelot around chemical company DSM in the south of the Netherlands is another example.

**Corporate venture capital (CVC):** A company owned investment fund that is used to participate in start ups and thus get access to possibly interesting technologies. CVC is used for investments in external start ups, but may also be applied to fund initiatives by own staff to set up a new company (spin offs). Sometimes external venture capitalists are involved in these funds as well. DSM has a leading program in this area.

*Box 1: Definitions and examples of recent techniques for open innovation*

**Innovation intermediaries:** Companies that specialize in helping other companies to better exploit their ideas and knowledge. For example, they may help an inventor to bring his product to the market faster.

**Business models:** One of the most important misunderstandings concerning innovation is that it is mainly a technological thing. The way in which a new idea is introduced into the market is often much more important in explaining its success or failure. A business model describes the way an innovation is brought to the market. The Senseo coffeemaker is an example of a new business model. It was introduced by Sara Lee and Philips. Instead of selling coffee and coffee machines separately, like they did for decades, they now developed a joint concept for coffee making.

*Box 1: Definitions and examples of recent techniques for open innovation (continuation)*

Chesbrough explains the fact that these techniques and their role in open innovation now get so much attention by pointing to changes in the economy. First, highly qualified individuals are more widely available and mobile than previously. As a consequence, knowledge is no longer locked up inside organizations, but spreads fast instead. In addition, there are always more smart people outside a company than within. By tapping into the brainpower outside the organization, a company may gain a competitive advantage. Second, Chesbrough points at the growing venture capital industry. The availability of venture capital makes it much easier for employees to start for themselves, taking knowledge of their former employer with them. Third, the combination of these two trends is that there are many more options for companies nowadays to exploit their knowledge externally. The development of new managerial and financial techniques increases the possibility for companies to earn money by exploiting their knowledge externally. Fourth and finally, there are more capable suppliers of knowledge than before. It is no longer necessary to develop much new knowledge inside an organization. Quite some knowledge can be bought on the market.

It is striking that Chesbrough does not mention a shortage of capital or high demands for return on investment as a driver for open innovation. Some of the leading open innovation companies actually started with it because they did not have sufficient funds to fund internal R&D<sup>6</sup>. In addition, investors have demanded increasingly high returns on their investment, which forces companies to look at their return on innovation. In short: there also is a necessity for open innovation. All the trends point in its direction. But how far has open innovation advanced in practice?

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6 L. Huston and N. Sakkab, Connect and Develop, Harvard Business Review, March, 2006.

### 3. RESEARCH DESIGN

To be able to answer that question, a group of ninety companies was studied on the degree of implementation of open innovation. These companies answered questions related to five fields. The first field concerns the innovation strategy and focuses on the question whether companies have incorporated open innovation into their formal innovation strategy. Questions that were asked aimed at the ambition to innovate, the extent to which companies try to find knowledge outside the boundaries of their company and the effectiveness of the use of external knowledge. The second field is called 'outside-in' and measures whether companies use tools to acquire knowledge from external sources. The opposite of 'outside-in' is 'inside-out'. This is the subject of the third field. The 'inside-out' element studies whether companies use tools to exploit internal knowledge that is not used internally. This can be done via spin offs, alliances, licensing, etc. The fourth field focuses on the mindset of the company. The questions related to this field aim at figuring out whether companies and their employees think in terms of open innovation. When only a formal policy concerning open innovation is available, but the support for this policy is absent, open innovation will not work. Lastly, the companies were asked questions about their innovation success. This included questions about the success rate of new product introductions, the revenue generated by innovations and the time-to-market of innovations. However, it should be noted here that the focus of the research was mainly placed on the first four fields mentioned above.

For each of these fields questions were asked that could be rated on a five point scale. Each question included a short scenario. For example, one question inquired into the extent of collaboration with suppliers. A score of 1 meant that the company does not work in collaboration with its suppliers; a score of 5 meant that the company is continually collaborating with suppliers in different projects.

The questionnaire was presented to 286 relations of Atos Consulting. 91 Companies filled in the questionnaire, which means a response rate of 32%. The respondents all work in the field of R&D and innovation. The majority of the respondents filled in the questionnaire online; the rest of the companies were interviewed during a visit. With 45% of the respondents, most of the companies were big having over 16,000 employees. Industrial firms made up 25% of our dataset; 20% is active in the electronics sector and food and chemicals each represent 18% of the companies in the dataset. The majority of the companies (70%) was Dutch.

## 4. THE IMPLEMENTATION OF OPEN INNOVATION

Figure 1 shows the results of this study depicting the answers to the questions we asked in a spider web diagram. The line in the middle shows the average of the answers of all companies, the inner line shows the answers of the five lowest scoring companies and the outer line represents the answers of the five companies that scored best. A casual look at the figure already reveals some important conclusions. First, the big difference between the inner and the outer line shows that there is a big difference between the leaders and the laggards. Some organizations are quite far with the implementation of open innovation, where other companies have just started, or did not start at all.

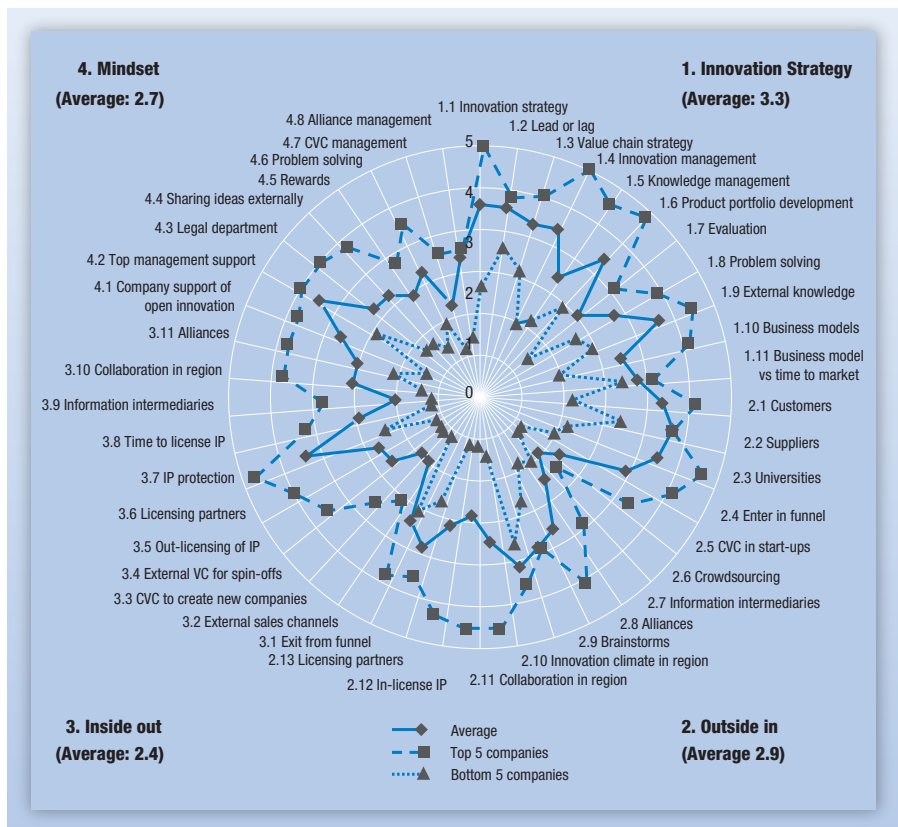


Figure 1: The implementation of open innovation

Second, the figure shows that on average the score is not very high. Most companies have implemented open innovation into their formal strategies; this is the only part that scores sufficient, with an average of 3.3 on the five point scale. Companies also pay some attention to acquiring external knowledge, this part scores a 2.9.

The major problem areas are the 'inside-out' and mindset parts. The general finding is that companies show interest for open innovation, but that they have not made much progress with the implementation of this principle. This is not strange, since companies indicated that their focus on open innovation started only one to three years ago.

When the four fields are studied in more detail, other aspects attract attention. Within the innovation strategy, many questions score relatively high. However, there are two questions that score low. Internal knowledge management is well organized, but knowledge management does not focus on knowledge outside of the company's boundary. Managing knowledge transfer with external parties hardly gets any attention<sup>7</sup>. Also, evaluation of innovation projects scores low. This research shows that companies give some attention to evaluating 'false positives' (innovation projects that get to the market, but have no success). The 'false negatives' are given no attention at all. These are projects that are stopped, but that should have been developed further, for example because it turns out that later a competitor is successful with a similar product.

A more thorough analysis of the 'outside-in' part shows the strong and weak points of the companies with respect to the acquisition of external knowledge. Most companies use traditional ways of acquiring external knowledge, like cooperation with customers, suppliers and universities. However, newer methods, like corporate venture capital, crowd sourcing and the use of innovation intermediaries are rarely used. In addition, few companies use brainstorming. Internal brainstorming takes place, but external parties are usually not involved in brainstorming. The best practice here is IBM. IBM organizes electronic brainstorming and invites external partners to participate in them.

When companies acquire much of their knowledge from external sources this might harm their internal research and development activities. However, results of this research show that companies that acquire knowledge from external sources actually invest more in internal research and development. Apparently companies that focus on open innovation understand the importance of combining internal and external knowledge.

The worst scoring element in this research is the 'inside-out' part. This part measures whether companies adequately exploit unused internal knowledge. This occurs rarely. The only element that scores high is the protection of intellectual property (IP). To be able to exploit internal knowledge, the knowledge should be protected. Companies understand this, but once IP is protected they are not effective in generating revenue from their IP. This even seems to be true for the most advanced companies.

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7 A.P. de Man (ed.), Knowledge Management and Innovation in Networks, Cheltenham, Edward Elgar, 2008.

Interestingly, the leaders do use corporate venture capital to invest in start-ups from other companies, but they hardly invest in spin offs of their own organization. Another point that shows that companies can benefit a lot more from the knowledge they possess, is that two thirds of the companies' patents remain unused. This may be logical for patents that are not valuable, patents that are only used to prevent a competitor from entering a market or for patents that are not valuable now, but may become valuable in the future. However, still a lot of valuable patents remain unused. In our interviews, we found that these patents may come from a strategy that is aimed at patenting anything that can be patented or from a strategic reorientation whereby activities in some technological areas are stopped. Such patents may be used to earn money, by selling them to third parties. The interviews we conducted show that most companies do not instruct their patent offices to search for these kinds of possibilities.

The 'mindset' for open innovation is the last element we researched. This field shows tremendous potential for improvement. Open innovation is not present in the genes of most companies. Top management usually shows a remarkable interest in open innovation and promotes the use of it. However, it does not reward it. An employee that acquires a technology from an external source is rewarded less than an employee that develops a technology internally. This shows that there is tension between the strategy in use and the espoused strategy. Also, few investments are made in supporting open innovation management. Many new tools that are available require specific management knowledge. Investing in these tools is one step too far for most companies.

Companies use different techniques to acquire knowledge from outside the organization. When focusing on these techniques, it is clear that partnering with suppliers is used the most by companies (see table 1). Furthermore, it is interesting to see that companies who obtain external knowledge are capable to integrate this in their way of working. These companies have no problems with implementing absorbed knowledge<sup>8</sup>, due to the fact they have developed and implemented the necessary processes to do so.

The research also showed that most companies have a first mover innovation strategy: they prefer to be leaders in new product development rather than fast followers. This is remarkable because other results of the study show the poor quality of innovation management within the companies. If companies really want to be first movers, they should invest more in building their innovation management skills.

Another technique often used by companies is collaboration with universities. This is also quite remarkable, because in many countries the university-industry relationships

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8 W. M. Cohen & D. A. Levinthal, Absorptive capacity: A new perspective on learning and innovation, *ASQ*, 35, pp. 128-152, 1990.



are said to be strained. Our data do not show that these partnerships are inadequate. What we do see is that the intensity of these partnerships differs. Most companies limit their relationship with universities to recruiting interns who do research for their graduate project or to hiring some PhD students to do research. The number of long-term joint innovation projects is smaller. Finally, an important technique is top management support for open innovation.

Five most used	Five least used
1. Collaboration with suppliers	1. Crowd sourcing
2. Integration mechanisms for external knowledge	2. External venture capital
3. 'First mover'-strategy	3. CVC for spin offs
4. Collaboration with universities	4. CVC for external start ups
5. Top management support	5. Innovation Intermediaries

Table 1: The most and least used open innovation techniques

Regarding the five least used open innovation techniques, it is important to notice that these are all fairly new techniques. One of these new techniques is crowd sourcing. Companies participating in the study have many questions concerning this technique. Therefore the current minimal use of this technique is understandable. Next, few companies use techniques related to 'venture capital'. Companies rarely cooperate with external venture capitalists to develop their own CVC strategy. This is understandable, because CVC itself is among the least implemented techniques. Few companies used CVC to finance spin offs and to invest in start ups outside the company. This is in sharp contrast with the open innovation literature which focuses heavily on CVC<sup>9</sup> as an important technique to be used by companies. This study shows that so far CVC is only seen as an interesting option by a few multinationals. Finally, companies have not yet discovered innovation intermediaries as a helpful tool. They hardly use them.

## 5. THE SUCCESS OF INNOVATION

Innovation must lead to success of products and services in the market place. Therefore, it is important to know whether applying open innovation techniques leads to a higher success rate of innovation. That question is difficult to answer. It is only possible to determine the success of open innovation by examining the effect

<sup>9</sup> V. van de Vrande, Not Invented Here, PhD thesis, Technische Universiteit Eindhoven, 2007.

of open innovation on the performance of the company within the timeframe of several years. Moreover, this study was primarily focused on looking for challenges in implementing open innovation. It did not aim to look at the success of open innovation. However in this study, various measures of innovation success were examined. Figure 2 shows the success rate of product introductions. This rate differs widely depending on the company. 10% of the companies indicate that more than 80% of the new product introductions can be seen as successful. Where as around 15% of the companies indicate that less than 20% of their new product introductions are successful.

The differences in success of product introductions may suggest some companies are more successful than others. This may indicate a difference in the quality of innovation management between companies. Studying the results of the companies however, shows the difference lies on a sector level. The sectors electronics, pharmaceuticals and oil & gas are more successful in market introductions of new products than other sectors. In the electronics and pharmaceutical sector, innovations are often developed together with the customer in client specific projects. This increases the success rate of the product. Also in the pharmaceuticals sector, new medicines go through various elaborate testing phases; therefore at the time of market introduction, a company can be reasonably sure about the product's reception in the market.

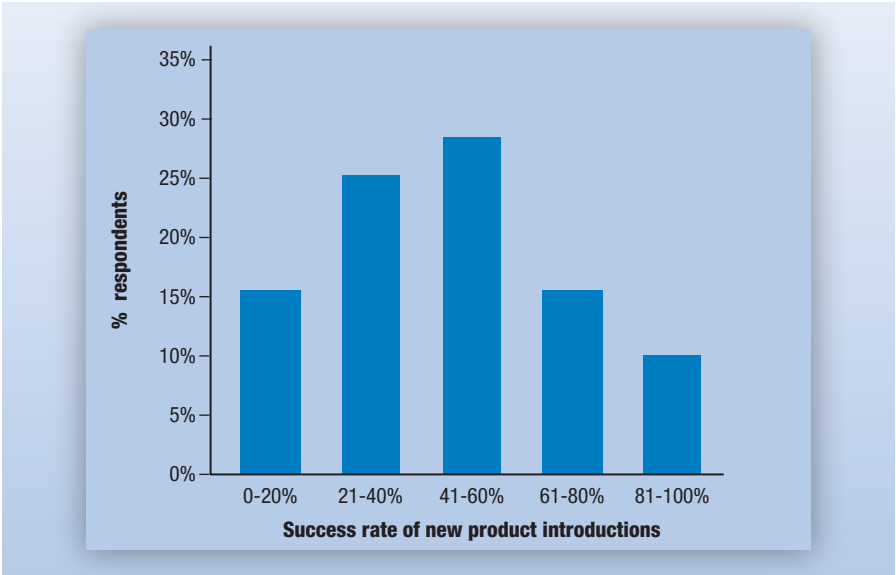


Figure 2: Success rate of product introductions

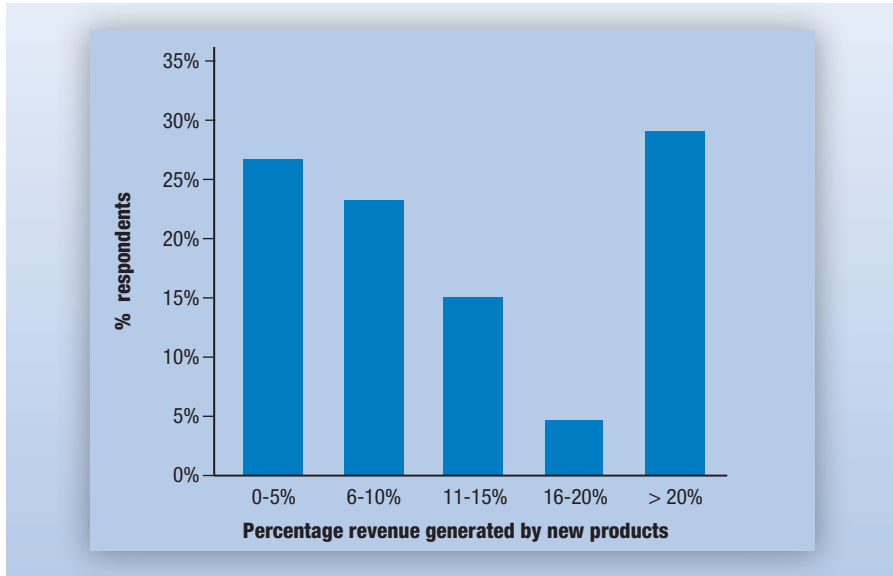


Figure 3: Revenue generated by product introductions of the last three years

Significant differences in the revenue generated from products introduced in the last three years are shown in figure 3. This is the most common measure of innovation success<sup>10</sup>. Almost a third of the companies receive more than 20% of their revenue from new products. However, more than a fourth of the companies in the study indicate that less than 5% of their revenue derives from new products. This difference is also caused by the type of industry a company is in. For instance, the high tech sector receives significantly more revenue from new products than more traditional sectors like transportation.

At this moment, it is not possible to determine whether open innovation leads to more success. This is not very surprising, due to the fact that companies have embraced open innovation only recently. Furthermore, often the development of new products or services takes several years and most companies have only been working with open innovation since the last three years. Therefore, not many innovations which were developed via open innovation processes are on the market yet.

## 6. FOUR MANAGEMENT CHALLENGES

When we look into the results of the study, there are four management challenges for implementing open innovation. The first challenge is that formal innovation

<sup>10</sup> V. Chan, C. Masso & V. Shankar,, Assessing innovation metrics, White Paper, McKinsey & Company, October, 2008.

strategies are directed at stimulating open innovation, but that open innovation has not yet won the hearts and minds of company employees. The mindset for open innovation is not yet in place. A lot of companies are in the transition phase of changing from an internally focused to an externally focused organisation. This change has not yet been completed.

The second challenge is taking internally developed knowledge outside the organization (the inside out approach). Companies do bring outside knowledge into the organization, but the reverse route is rarely taken. As a consequence, a large amount of unused knowledge is left lying on the shelves of companies. To bring this knowledge to value, more attention must be paid to the use of open innovation techniques that exist for this. In Chesbrough's definition of open innovation mentioned earlier, the inside out element plays an important role. Given the limited attention for it in practice, we can conclude that there are few companies who have implemented the entire open innovation concept.

The third challenge focuses on the techniques available for open innovation. These techniques can be divided in the more traditional techniques, for instance partnerships with universities, customers and suppliers, and new techniques like crowd sourcing and the use of information intermediaries. What we see in the results of the study is that traditional techniques are implemented. The newer techniques on the other hand are hardly known. Our research shows that companies have many questions about these new techniques. With crowd sourcing for example intellectual property is an issue. Who owns the concept? How can an organization know whether a concept, it learns about via crowd sourcing, has not already been patented by another company? Due to such ambiguities, companies are careful in applying these new innovation techniques. Specifically for crowd sourcing, we also found that organizations see it as a means to innovate in the business to consumer market, instead of the business to business market. However, this technique is also applicable in business to business settings.

The fourth challenge is a governance issue. When top management of a company supports open innovation verbally, but does not adjust the incentive system and does not invest in developing managerial skills for open innovation, then open innovation is unlikely to be a success. So top managers should walk their talk. Only saying open innovation is good, but is not enough.

## **7. OPEN INNOVATION AND IT**

What does open innovation mean for IT? In my opinion, there are three issues to look at. First, IT may be an enabler of open innovation. Second, IT may slowdown the application of open innovation and third, new IT products may be created through open innovation.

To start with the enabler role of IT. Specifically, the Internet has played an important role in one of the most publicized tools for open innovation: crowd sourcing. Most crowd sourcing depends on Internet technology. Whether it is completely open crowd sourcing or limited to a specific group, without Internet technology it would not exist. The ability of the Internet to reach large groups of people and communicate with them is an important enabler of open innovation. In addition, the role of Internet communities in open innovation is high. This runs across the innovation process. Communities can be used to generate innovative ideas, to develop them, to test them with a larger audience and to introduce them into the market. With the continuing development of new IT enabled applications, we may expect more open innovation techniques to emerge in the coming years.

IT may however also hold open innovation back. As soon as collaboration between two companies becomes more intimate, IT legacy, security policies and diverging standards may make it more difficult to share data between organizations. Seamless integration of processes with suppliers, clients and business partners is still far away. This makes it difficult to change partners. When a company enters into a relationship with a new partner, a new IT integration project has to be started. This investment is a sunk cost for a partnership. When business circumstances change and partners need to be changed as a consequence, the switching costs are high. The implication for IT is that first of all IT architectures need to be developed that can easily incorporate cross-company IT requirements. Next, open standards may lower switching cost and make it easier to set up IT systems across organizational boundaries. In the era of open innovation, the need for flexible IT systems is greater than ever.

Finally, IT may also be the subject of open innovation. This is seen most clearly in the open source movement. Open source is an example of open innovation in its most extreme form. The development of Linux, Mozilla and Apache has taken place without anyone owning them. They fall under Chesbrough's definition of innovation when companies actively contribute to their development or profit from them when they are incorporated in new business models. Companies may profit from open source developments in two ways. First, they may make a privately owned product more valuable. The numerous applications that are developed for Apple's iPhone for example, make the iPhone a more attractive product. Second, companies can benefit from open source software when they build business models around implementing that software. Hence, there is enormous potential for applying open innovation techniques in the IT industry.

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