
Open Innovation Maturity Framework

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Abstract: Open innovation can introduce new ways of organizing the innovation process within companies, but these new activities and processes naturally require some time to mature and work effectively. Continuous improvement of capacities and results is therefore required (Teece, Pisano and Shuen, 1997; Winter 2003). The basic aim of this research was to develop, in collaboration with 15 companies, an open innovation maturity framework to measure and benchmark excellence in open innovation. The open innovation maturity framework that was developed combines metrics in several areas of open innovation to illustrate the expertise of that organization. It can reveal organizational excellence as well as areas of improvement in order to reach the next level of maturity.

Keywords: Open Innovation, Metrics, Excellence, Maturity Framework

Measuring the Effectiveness of Open Innovation

Effective innovation is increasingly important since it not only determines a firm's competitive advantage, but often its very survival too (Söderquist and Godener, 2004). Measuring innovation management can help to monitor and optimize innovation activities (Chiesa *et al.*, 2010, 1996; Kerssens-van Drongelen *et al.*, 2000), but this is not always easy because results may not be clearly visible and the success of innovation projects may be uncertain or influenced by factors that cannot be controlled. Furthermore,

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it is sometimes only possible to assess the success of innovation activities after a long delay, or it may be credited to other organizational units (Loch and Tapper, 2002). The innovation process is increasingly being opened up to benefit from external resources. Metrics to evaluate excellence under this new 'open innovation' approach have yet to be developed (Enkel *et al.* 2009).

The use of external resources in R&D, an extension of the resource-based view (Wernerfeld, 1994), is referred to as 'open innovation', a term first coined by Henry Chesbrough (2003a). Although companies have always worked with external partners in strategic alliances and integrated their customers and suppliers into the development process (Mowery, 2009), the refocus on external sources of innovation was necessary after an era of more centralized R&D activities, in order to yield swifter results from innovation and improve efficiency (Gassmann *et al.* 2010; Gassmann, 2006). However, we still lack a clear understanding of these mechanisms, both inside and outside the organization, and how we can gain maximum advantage from this approach. Procter and Gamble recently began to measure and compare the Net Present Value (NPV) of their open innovation projects (with over 60% external contribution on average) with their closed innovation projects and discovered that open innovation projects outperform internal projects, achieving a 70% higher NPV. Henkel, meanwhile, has established new key performance indicators within their R&D process which focus on budgets allocated to R&D cooperation with external partners or which evaluate the performance of products based on customer ideas. However, only the first approaches of measurement systems and key performance indicators are known, and most of these measure input figures, making it hard to quantify the benefits of open innovation (Chiesa *et al.* 2008; Enkel and Lenz, 2010). Additional effectiveness can only be achieved by professionalizing open innovation activities.

Approaches to measurement

Measuring performance is crucial for managers who want to monitor the activities of a company. Measuring performance allows managers to plan and control their organizations more effectively (Chenhall and Langfeld-Smith, 2007; Hauser, 1998). It also affects the behaviour of employees (Kaplan and Norton, 1992; Neely, Mills, Platts, Gregory and Richards, 1996) and, accordingly, inappropriate measurement systems can lead to dysfunctional behaviour (Neely, Richards, Mills, Platts and Bourne, 1997). Primarily, performance measurement is essential "for achieving the company's objectives" (Chiesa *et al.*, 2008, p. 213) because of its role in supporting decision-making, motivating employees, stimulating learning, and improving coordination and communication (Loch and Staffan Tapper, 2002). A good system for measuring performance is necessary to address all these issues.

The development of such a system of measurement is far from straightforward, however. Kaplan and Norton (1992) discuss the identification of goals and the subsequent development of appropriate measures. Neely *et al.* (1996) introduce a process-based approach to performance measurement, which incorporates individual measures, a performance measurement system and environmental measures. Developing a system of assessing R&D activities is also considered a difficult task, since these activities are often intangible, uncertain and difficult to measure (Chiesa *et al.*, 2008; Kerssens-van Drongelen and Bilderbeek, 1999; Loch and Staffan Tapper, 2002). The most important factors when designing a measurement system are: deciding what to

measure; deciding how to measure it; collecting the appropriate data; and, eliminating conflicts within the measurement system (Neely *et al.*, 1996). Determining the appropriate metrics is thus essential in the process of designing a performance measurement system. When deciding what to measure, it is also important to bear in mind how the results will be used. Using only financial measures is inappropriate when measuring the performance of R&D activities, according to Loch and Staffan Tapper (2002). Measurement is necessary, however, in order to align and prioritize, evaluate and determine incentives, achieve operational control, and encourage learning and improvement (Loch and Staffan Tapper, 2002).

Measuring elements according to their maturity is a new approach that has the potential to help decision-makers assess the status of open innovation processes within their organizations and make direct improvements (Saraph, Benson and Schroeder, 1989). Self-assessment is also used in TQM (total quality management), where it helps organizations to improve their performance and results. It can lead to planned improvements and help achieve continuous improvement (Pun, 2002). Knowing which elements to manipulate could thus help organizations to improve the quality and effectiveness of open innovation. If the instrument is applicable to organizations in general it could perhaps even be used as a method of benchmarking with which to prioritize activities on a wider scale.

The concept of maturity in measuring effectiveness

The potential of an organization's resources and capabilities can only be realized by translating them into business processes and activities (Ray *et al.*, 2004). In Total Quality Management literature, various authors have investigated the relationship between process quality improvements and organizational performance. To date, the results have been inconclusive. Powell (1995), for instance, investigated TQM as a potential source of competitive advantage and found that it is not TQM tools and techniques themselves that drive competitive advantage but the presence of related tacit resources such as an open culture, employee empowerment and executive commitment. On the other hand, Easton and Jarrell (1998) concluded that the long-term performance of organizations that use TQM improves on the basis of financial results, while the findings of Ittner and Larcker (1997) were mixed – some process management elements, like long-term partnerships with suppliers and customers, exert a positive influence on organizational performance while others, such as the use of process improvement tools, are of no influence. Still other elements, such as an organizational commitment to teamwork, are said to function as enablers for other process management practices to succeed. The relationship between process improvements and organizational performance is thus not entirely straightforward but evidence for a positive correlation can be found in both literature on TQM and in dynamic capability literature.

One concept that has been used in software engineering to assess the effectiveness and development of a process is maturity. In this field, the maturity of a process or activity is seen as the “extent to which a specific process is explicitly defined, managed, measured, controlled, and effective” (Paulk, Curtis, Chrissis and Weber, 1993, p. 21). The concept has also been adopted for assessing R&D processes, where it refers to the presence of adequate R&D practices (Berg, Leinonen, Leivo and Pihlajamaa, 2002). Increasing maturity, according to Paulk *et al.* (1993), can be seen as the institutionalization of processes via policies, standards and organizational structures. The more components of

the process that are established, the more mature the process is and the greater the capabilities of the process. In order to assess the level of maturity and identify areas for improvement, Paulk *et al.* (1993) introduce a Capability Maturity Model (CMM). This model distinguishes five levels of maturity: initial, repeatable, defined, managed and optimizing.

The maturity levels of the CMM have been translated into a new model that measures the maturity of R&D by Berg, Pihlajamaa, Poskela and Smedlund (2006). Their Quality and Maturity Method (QMM) makes a similar distinction between levels of maturity. Maturity in R&D increases from the initial level where there are no systematic procedures, through an agreement on the approach to be taken (repeatable level), the documentation of the approach (defined level), the measurement of the approach (predictable level), to the continuous improvement of the approach (optimizing level). The concept of maturity determines the success and effectiveness of R&D in an organization. Project management activities can also be assessed with a maturity model (ProMMM, Hillson, 2003). This model includes four levels of increasing maturity (naïve, novice, normalized and natural), which address the same objectives as the levels of the CMM.

One maturity model that comes closer to open innovation is the Innovation Capability Maturity Model (Essman and Du Preez, 2009). These authors describe a three-dimensional framework with dimensions concerning innovation capability construct, organizational construct, and capability maturity. The innovation capability construct defines three areas of innovation capability: the innovation process, which relates to the practices, procedures and activities throughout all innovation stages; knowledge and competency, which relate to management requirements and technology that are needed in the innovation process; and organizational support, which relates to all the resources, structures, strategy, leadership etc. needed to support the other areas of innovation. The second dimension ensures that the model addresses all the fundamental aspects of an organization. Using these two dimensions, the third dimension of the maturity of innovation capability can be addressed. Like Paulk *et al.* (1993), the ICMM describes five levels of maturity (Essman and Du Preez, 2009, p. 48):

Level 1 – Creative individual attempts are dismissed. The organization focuses on day-to-day operations. Innovation output is inconsistent and unpredictable.

Level 2 – The need to innovate is identified; innovation is clearly defined. There is a basic understanding of the influential factors. Innovation output is inconsistent but traceable.

Level 3 – Appropriate practices, procedures and tools are in place, innovation is encouraged among employees. Outputs are consistent and ensure sustained market share and positioning.

Level 4 – Practices, procedures and tools for integrating innovation activities are used. A deep understanding has been established of the internal innovation model and how it relates to business requirements. Innovative outputs are consistent, diverse and a source of differentiation.

Level 5 – Practices, procedures and tools are institutional. Individuals are empowered to innovate. Synergy is achieved through the alignment of business and innovation strategy and synchronization of activities. Outputs provide sustained competitive advantage in existing and new markets.

This model of innovation maturity focuses only on internal research and development. It is therefore not completely suited to measuring open innovation maturity. It could

however function as a reference point for the formulation of a framework for open innovation maturity.

Adapting the concept of maturity to open innovation

In existing maturity models, elements of the central process were formulated in order to describe varying levels of maturity. It is possible to determine elements of open innovation in a similar way. In order to open innovation, companies need to manage their processes. Little research can be found that describes managerial elements of open innovation. Some managerial challenges are discussed, such as the transformation of business models and R&D organizations (Chesbrough, 2007; Gassmann and von Zedtwitz, 1999) and an internal change in culture (Huston and Sakkab, 2006) or the process distinction of open innovation (Gassmann and Enkel, 2004). However, open innovation literature does make clear the importance of partnership capacity (Cullen *et al.*, 2000; Kauser and Shaw, 2002; Mora-Valentin *et al.*, 2004; Lichtenthaler and Lichtenthaler, 2009; Cohen and Levinthal, 1990). The creation of a climate that is conducive to innovation and visionary leadership seems to be essential for innovative activities (Tidd and Bessant, 2009; Anderson and West, 1998; Thamhain, 2003). Finally, the availability of the right systems, tools and processes also appears to be an important enabler for open innovation initiatives (Thamhain, 2003; Dilk *et al.*, 2008; Kauser and Shaw, 2002; Ireland *et al.*, 2002). These elements will be described in more detail below. Our framework is based on the assumption that maturity is a measure of the effectiveness of processes.

Relational elements are central in alliance management studies. Cullen *et al.* (2002) and Kauser and Shaw (2002) describe the need for commitment and trust between cooperating partners. The institutionalization and reputation of partners, as described by Mora-Valentin *et al.* (2004) and Ireland *et al.* (2002), also affect the success of cooperation. Companies that have a good reputation as a business partner may find themselves in a favourable position when approaching new partners. Guidelines for achieving such a reputation are summarized under the concept of responsible partnering (EIRMA, 2009). However, knowledge management studies also address partnership issues. Absorptive capacity focuses more on the organization itself than on the partnership, but helps an organization to exploit partnerships (Lichtenthaler, 2008b; Kale and Singh, 2007). This involves integrating the knowledge of the partner, but is preceded by selecting a partner that has the right knowledge. As well as selecting the right partner, it is also important for organizations to select the right form of collaboration for a given initiative (Pisano and Verganti, 2008). This choice should depend on the strategy and capabilities of the organization and the goals of the specific initiative. Organizations thus require a capacity for partnership that will increase their innovative performance. We therefore formulate the following proposition for this research:

Proposition 1: The presence of partnership capacity correlates positively with the effectiveness of an organization's open innovation activities.

Another element in the studies mentioned above is the development of a climate that is conducive to innovation. Such a climate can encourage employees to strive for excellence and be entrepreneurial. It involves the communication of a vision, written and spoken support, the creation of a safe environment in which employees are involved in the

innovative process, and tasks that are evaluated consistently with the innovative vision of the organization (Anderson and West, 1998). Visionary leadership, incentives and communication are crucial in creating such a climate and ensuring that employees are committed to organization's innovative vision (Tidd and Bessant, 2009; Kauser and Shaw, 2002; Kulkarni, Ravindran and Freeze, 2007). In open innovation activities, the focus is not only on internal creativity but also on using external paths to market (Chesbrough, 2003a). Employees should be able to identify external knowledge paths for their ideas, and this demands a certain amount of entrepreneurial spirit. The creation of a climate for innovation should therefore also involve the creation of an entrepreneurial culture. Our second proposition is thus as follows:

Proposition 2: The creation of a climate for innovation is positively related to an organization's open innovation effectiveness.

As well as partnership capacity and a climate that is conducive to innovation, the open innovation process needs to be facilitated using internal processes, structures, systems and tools. Quality and process management studies provide more insight into several aspects that help improve the quality and effectiveness of the processes (Powell, 1995; Flynn, Schroeder, Sakakibara, 1994). These studies stress the importance of managing processes through process-mapping, analysis and streamlining. A measurement system should also be used to assess, control and direct processes and their improvement (Kanji, 2008). Putting the right processes in place could affect the efficiency of open innovation projects – for instance, the time-to-market of a product or idea could be shortened. Other examples are creating facilities such as research centres that can be shared between partners, and tools that help organizations to exchange knowledge and technology (Perkmann and Walsh, 2007). Intellectual property (IP) protection is a very important tool in any technology strategy for open innovation (Chesbrough, 2003a). Organizations need this in order to buy and sell IP, which is done more frequently and rapidly in the open innovation environment. The legal department of an organization that uses open innovation will need to adapt accordingly, in order to provide flexible and rapid IP management. As such, our third proposition is the following:

Proposition 3: Having the right systems and tools in place correlates positively to the effectiveness of open innovation.

Combining these three core elements of open innovation (partnership capacity, climate for innovation and internal processes) with the five maturity levels (initial/arbitrary, repeatable, defined, managed and optimizing) give us a preliminary framework for open innovation maturity. This preliminary framework was tested and optimized using interviews and workshops with R&D managers. An initial test was conducted with one company and, after a second round of optimization, the finalized framework was used to assess the maturity levels of nine case study companies. The detailed methodological description of this process is described in the following section.

Method

On the basis of a literature study, we proceeded to develop a preliminary framework for open innovation maturity. This framework incorporates the various elements of open

innovation maturity that can be derived from the relevant literature streams: partnership capacity (Cullen *et al.*, 2000; Kauser and Shaw, 2002; Mora-Valentin *et al.*, 2004; Lichtenthaler and Lichtenthaler, 2009; Cohen and Levinthal, 1990), climate for innovation and visionary leadership (Tidd and Bessant, 2009; Anderson and West, 1998; Thamhain, 2003) as well as the presence of the right systems and tools (Thamhain, 2003; Dilk *et al.*, 2008; Kauser and Shaw, 2002; Ireland *et al.*, 2002).

The next step was to identify the metrics that could be used to determine the maturity level of open innovation in organizations. Appropriate metrics also needed to be found to determine the level of maturity on the scale used. Since no research is available on open innovation maturity, this research focuses on discovering new theory. Stebbins (2001) states that exploratory research can lead to the discovery of generalizations and the understanding of social phenomena which have received little or no scientific attention. As such, exploratory research was a suitable way to develop a measurement framework for open innovation maturity.

In order to develop an instrument to assess levels of open innovation maturity, we designed qualitative, explorative research. This research involved interviews and workshops with innovation managers from five multinational and the collection of data from archives, high-tech organizations and workshops with ten companies to test and discuss the tool. Because evaluating design always includes a qualitative element, the interpretation of the participants had an influence on the quality and content of the data collected. In order to limit this subjective influence, a variety of data sources and collection methods were used. The pilot study also functioned as the second phase of analysis to ensure that the results were valid.

Five companies were selected for our case studies from the sectors of healthcare, consumer lifestyle and lighting, telecommunications, and food. Those companies represented a cross-section of sectors as well as different levels of experience in working with open innovation. In the interviews and workshops, we asked the representatives whether the categories represented their major activities in open innovation as well as which behaviour they would expect to find in a company at the various stages of maturity in these categories. We also asked them to deduce categories in order to measure those forms of behaviour (see the first findings section).

Based on an additional literature review and the discussion of the categories, we developed an excel tool that divided the three categories of climate for innovation, partnership capacity and internal process into ten closely related elements e.g. knowledge sharing and monitoring the results (see figure 1). These elements were operationalized in 31 questions with five different maturity levels for each, which together would be capable of gauging excellence. These questions and their levels were tested and refined in three workshops with ten companies from various sectors, which participated in an open innovation consortium. All of these companies were interested in a tool which could provide a way of benchmarking excellence in this area. The workshops led to several improvements to the tool, such as the automatic copying of the solutions for each question to a solutions page, a clearer indication of the results section, and the addition of an introduction page with an explanation of how to use the tool and how to interpret the results. The results of this phase of our workshop are illustrated in the findings section entitled "Evaluating the maturity of a company".

Findings

Operationalizing the open innovation maturity framework

The previous section presented a preliminary framework for examining company's levels of maturity in open innovation on the basis of the literature study. This framework was based on propositions about the elements of open innovation maturity. This section discusses whether the expectations concerning the elements were met and presents a definitive framework for open innovation maturity based on the preliminary data collected.

Expectations

Despite our expectation that there would be a clearly defined notion of best practice in open innovation, the companies we investigated in fact found it hard to identify what constituted excellence. Although they were able to answer the questions relating to open innovation maturity in all the categories, they were still unable to identify the appropriate level for them in these categories. A company could either aim to reach an average level in a category which it views as moderately important, or it could compare its results with another company that it sees as successful. We therefore concluded that the results should be used as a basis for discussion within a single firm and a means of identifying open innovation activities at various levels with no absolute judgement of whether these are adequate or inadequate. Only through a benchmarking exercise can these activities be compared and identified as adequate or inadequate relative to the other benchmarking partners.

Our propositions stated that the capacity for partnership, a climate for innovation and the right internal processes all correlate positively with more effective open innovation. Each of these elements is supported by the data collected in interviews and workshops. The interviews with research managers at large, multinational organizations revealed that a cultural change, awareness and an open mind set were among the most frequently mentioned elements of maturity in open innovation. Some managers even stated that this was the first step that any organization should take if it wants to develop its open innovation activities. The capacity for partnership was discussed mainly at the workshops, but was also mentioned in the interviews with the R&D managers. For instance, one stated that the partnership process should be improved. The tools, systems and processes needed within the organization were also discussed at each data collection moment (for instance, the tools needed to share information and innovation centres for experiments). The expectations implicit in our propositions were thus met, but on the basis of our data it became clear that the order of the three elements is also important. A climate for innovation should be the first ingredient that an organization develops, followed by partnership capacity and internal processes and tools.

Partnership capacity

The sub-elements that were found to make up partnership capacity according to the data that we collected were, in part, similar to the description in the literature study. For instance, the reputation of the organization as a trustworthy partner (mentioned by Mora-

Valentin *et al.* (2004) and Cullen *et al.* (2000)) was also often mentioned in the workshops. Here, image and PR value were mentioned in relation to this aspect. However, the concept of responsible partnering (EIRMA, 2009) was not discussed in either the workshops or interviews. Still, some elements of responsible partnering were supported by the data, such as the need for making clear agreements and defining clear targets for the partnership. This need (see also Kauser and Shaw, 2002 and Mora-Valentin *et al.*, 2004; Ireland *et al.*, 2002) was also mentioned during the workshops. Satisfying partners, on the other hand, which was not mentioned in the literature study, was said to be very important for both the reputation of the organization and the success of the partnership. This may be related to the need to resolve conflicts mentioned in the literature by Kauser and Shaw (2002) or to the need to create trust between partners (EIRMA, 2009; Colombo, Dell'Era and Frattini, 2011). Neither was the need for intense commitment in partnerships mentioned in the literature study. The importance of selecting the right partner and the right form of partnership was found in both the literature (Pisano and Verganti, 2008; Ireland *et al.*, 2002) and the data that we collected. A search strategy based on the goals of the partnering process could particularly influence innovation performance (Henttonen, Ritala and Jouhiainen, 2011). Another element found in both the literature and our data was the need to train employees to work with partners and manage alliances (Draulans *et al.*, 2003).

Climate for innovation

The sub-elements that contribute to a climate for innovation were consistent with those described in the literature study: leadership, incentives, and communication. However, on the basis of the data we collected, these sub-elements can be extended. Leadership, addressed by Anderson and West (1998) and Tidd and Bessant (2009), appears not only to involve written and spoken support, but also 'walking the walk'. An incentive system should consist of both targets and assessments or rewards. Communication, mentioned in the literature by Kauser and Shaw (2002) as a behavioural characteristic of alliance partners for example, was mentioned in two ways in the interviews and workshops. Firstly, the strategy should be communicated internally within the organization; secondly, success stories should be shared and communicated within the organization. The literature mentioned that employees should be inspired to become creative (Thamhain, 2003). The mind set of employees was also discussed in the interviews. Here it was stated that middle and lower-level employees also needed to become committed to open innovation and more outward-looking. 'Champions' have an important role in introducing a new mind set among these employees.

Internal processes

Our concept of internal processes was also extended by the data collected in the interviews and workshops. Process mapping (Powell, 1995; Flynn *et al.*, 1994) was not mentioned as such, but a need to gather information about all open innovation activities was mentioned by several participants. This information should also be disseminated throughout the organization in an appropriate way such as the intranet. Perkmann and Walsh (2007) mentioned the need for resources to facilitate open innovation activities. The data we collected made it clear that two types of resource are particularly important: innovation centres and a transaction budget. The sub-element of knowledge management,

which was placed with partnership capacity in the preliminary framework, was discussed by the participants in relation to internal organization. The workshop participants in particular mentioned the necessary of documenting knowledge and incorporating it into concrete solutions and products, which was also described by Cohen and Levinthal (1990), Lichtenthaler (2008b), and Kale and Singh (2007). The need for a system of measurement (Kanji, 2008) was supported by the data we collected in the sense participants mentioned that an organization must be able to trace open innovation projects from inputs to outputs and make use of the ideas generated. Intellectual property protection also appeared to be important for the organizations involved in open innovation activities (Chesbrough, 2003a). More specifically, according to the participants, the attitude of the legal and IP departments should be supportive of open innovation. Seeking to create win-win contracts was mentioned as the best attitude of all.

On the basis of the data gathered in interviews and workshops and the characteristics of the maturity levels described in the literature study, we can now propose a more detailed framework for open innovation maturity, which is shown in table 1. This framework is an instrument that enables the level of open innovation maturity of an organization to be determined relative to other organizations (see figure 1).

Table 1 Expected behaviour at the different maturity levels of the Open Innovation Maturity Framework.

<i>Elements</i>			
<i>Maturity level</i>	<i>Climate for innovation</i>	<i>Partnership capacity</i>	<i>Internal processes</i>
<i>1 Initial/ Arbitrary</i>	little initiative taking; accidental opportunity spotting	Affection-based collaboration; arbitrary, one-off partnering, individual initiatives	informal communication of initiatives; commitment based solely on friendships; knowledge not shared; individual absorption; no identification of results; protective legal and IP system
<i>2 Repeatable</i>	verbal management support; informal success sharing; targets at lower levels; informal assessment; individual initiatives; arbitrary screening	few, informal, repeated partnerships; informal standardization, no plan; satisfy own organization; few, dominant forms; selection based on affection and experience; skills through experience	low level monitoring; limited sharing of facilities; reputation-based commitment; knowledge and information informally shared in team; results thrown 'over the wall'; strict IP and legal conditions

3 <i>Defined</i>	written OI strategy; success sharing by management; targets based on strategy; assessment partly OI based; champions appointed; screening by champions	formal, low intense, short during partnerships; partial standardization; behavioural guidelines; diversity with few partners; previously used parties network; selection based on network experience; training through example setting	Centralized reporting; regular meetings; opening facilities; on demand budget for meeting commitments; occasional inter-department knowledge sharing; absorption of knowledge actively encouraged; manager monitors progress; trust-based IP and legal attitude
4 <i>Managed</i>	strategy encouraged by management; regulated success sharing; targets set and communicated; champions awarded based on OI targets; champions encourage initiative taking; scouts assigned	intensity, focus, endurance in partnerships; partnering tools used, clear ownership; management actively encourages satisfaction of partners; specific forms, diverse partners; diverse network expansion; strategy-based selection; training in partnering	linking initiatives; communication via intranet; start-up shared facilities; structural budget; project owners facilitate intra-organizational knowledge sharing; start process monitoring of results; long-term view of legal and IP
5 <i>Optimizing</i>	management "walks the walk"; strategic success sharing; continuous adjustment of targets; OI-based assessment; initiative taking in whole organization; wide focus on external opportunities	variation intensity; both standardization and specification; satisfaction of partners monitored; diversity along value chain; inter-network linkages; selection criteria based on proactive strategy; sharing of partnership expertise	internal and external information gathering; contacting via central position; network facilities; OI integrated in budget; knowledge accessible in database; knowledge exploited in products; monitoring process in place; win-win contracts

An overview of all the questions can be seen the appendix.

	A	B	C	D
1	1. Climate for innovation			
2				
3	1.1 Leadership			
4	Clear strategy			
	Is open innovation incorporated into a communicated strategy?		Indicate your maturity level by typing "x" in the line which represents your activities, leave the others empty.	
5				
6	<input type="radio"/> OI is not mentioned in strategy			
7	<input type="radio"/> OI is verbally supported by management			
8	<input type="radio"/> OI is incorporated into the organization's strategy			
9	<input type="radio"/> OI strategy is explained and stimulated by management			
10	<input type="radio"/> OI strategy is demonstrated by management who "walk the talk"			
11				
12	Communication of success stories			
13	Are examples of how to do open innovation communicated throughout			
	<input type="radio"/> no success stories are present			
14				
15	<input type="radio"/> successes is shared informally, mouth-to-mouth			
16	<input type="radio"/> some success stories are shared by management			
17	<input type="radio"/> success stories are shared in a regulated way			
18	<input type="radio"/> success stories are used for strategic purposes			

Level 5:
management "walks the talk"; strategic success sharing; continuous adjustment of targets; OI based assessment; initiative taking in whole organization; wide focus on external opportunities

Figure 1 Screenshot of the excel tool translating the Open Innovation Maturity Framework into a handy tool

The spider web analysis gives a number between 1 and 5 for the five levels of maturity in each subcategory that the company has the potential to attain. In the section climate for innovation in the subcategory leadership, if the company indicates that open innovation is not part of its strategy, the tool translates a 1 to the spider web, indicating an undeveloped level maturity in this category (see figure 1). If an open innovation strategy is demonstrated by management (level 5), the tool translates a 5 to the spider web analysis.

Table 2 Overview of the categories in the excel tool and the spider web analysis

<i>Climate for innovation</i>			
<i>Leadership</i>	<i>Incentives</i>	<i>Mind set</i>	
Clear strategy	Clear target	Initiative taking	
Communication of success stories	Assessment	Screening	
<i>Partnership capacity</i>			
<i>Reputation</i>	<i>Partner selection</i>	<i>Training and Education</i>	
Intensity of collaboration	Diversity in collaboration	Partnering	
Standardization	Network Building		
Partner Satisfaction	Selection Process		
<i>Internal Processes</i>			
<i>Central coordination</i>	<i>Resources</i>	<i>Knowledge management process</i>	<i>Legal and IP system</i>
Information gathering	Innovation facilities	Knowledge sharing	Attitude
Communication	Transaction currency	Knowledge absorption	
		Monitoring results	

Evaluating the maturity of companies

According to the open innovation maturity framework, four of the companies in our sample of ten can be characterized as mature (scoring on the individual items on average between 3 and 4), five as semi-mature (scoring between 2 and 3) and one as immature (lower than 2). However, this categorization into 'mature' and 'immature' does not follow a fixed scoring range; as mentioned before, there is no clearly identified standard of 'best practice' to strive for, but this can be determined flexibly for any group of companies or by comparing teams. After analysing the data, a joint workshop with all companies was held in Lund in January 2011 and in Billund in March 2011 in order to discuss the results and how to improve individual items. Overall, the companies agreed with our classification and found it to be an extremely helpful way of identifying individual areas of improvement as well as benchmarking their own open innovation efforts in relation to other major players from different sectors. In the following section, three companies are examined as examples of the three categories of maturity. To illustrate their different levels of maturity better, we used spider web diagrams, which are automatically created on a separate page using the results of the different questions.

Food Com: an immature open innovation company

This organization is an international manufacturer of food and beverage products. In this case study, we will call it Food Com. The innovation process of this organization focuses on improving and extending its products along the entire value chain. Its food and beverage specialists work closely together with research institutes and universities. However, these open innovation activities have only recently been introduced into the organization and, therefore, the organization considers itself to be immature in open innovation.

In analysing the spider diagram, it becomes obvious that Food Com started its open innovation recently by improving its cooperation management, which has resulted in a higher score in partner satisfaction as well as in the scores for the intensity of collaboration. Because the company's top management decided to put more emphasis on open innovation, screening methods to find new partners, mainly in the university and research fields, were introduced. Additionally, processes and responsibilities for collaboration activities were defined to enable Food Com's employees to take action to find and establish new partnerships. The item of transaction, scored with 3, also demonstrates that employees now possess resources that enable them to make commitments and enter into agreements with partners. Knowledge of the various collaborative projects, their results and potential partners is shared and can be accessed by different departments in Food Com. Additionally, results from collaboration efforts are monitored so that they can be developed further. Other fields of open innovation are still underdeveloped, as the poor scores between 1 and 2 reflect.



Figure 2 Scores for individual items at Food Com, an immature open innovation company.

Research Com: a semi-mature open innovation company

The case study focuses on Research Com, the international research organization with laboratories spread over Europe, North America and Asia.

Research Com has been involved in collaborative projects with third parties for many years. In addition to its ‘outside-in’ open innovation focus, Research Com has also experimented over the years with an ‘inside-out’ approach. This approach focuses on external relations with third parties and tries to integrate these parties into the company’s innovation process. Open innovation is explicitly mentioned in the overall strategy of Research Com as one of its business drivers and results (giving a score of 4 on the clear strategy item). External parties should be used to achieve results for the Research Com’s sectors. These parties may be other companies, universities and institutes. However, collaboration focused items like partner satisfaction, diversity of collaboration, network building, partnering and selection process scored lower and need to be improved. Research Com is strengthening these strategic partnerships and also sharing facilities with partners to improve the effectiveness and cost-efficiency. According to the spider diagram, the score for innovation facilities, which illustrates that Research Com opened up its facilities for partners in an open campus, is ranked as high as 4. According to the strategy of the organization, open innovation initiatives should have both an ‘outside-in’ and an ‘inside-out’ focus. The strategy mentions the need to use open innovation as a means to bring internal IP to market but also describes the need to gain access to external capabilities and bring these inside the organization. Yet, as the diagram reveals, Research Com is still working on exchanging IP and still has a rather closed IP policy.



Figure 3 Scores for individual items at Research Com, a semi-mature open innovation company.

Over the years, Research Com has developed several tools and guidelines to guide its partnership process, which have resulted in a good score for intensity of collaboration and initiative-taking as well as screening. This guideline mainly addresses issues like making clear agreements with partners, creating trust between partners and meeting expectations. The training of employees to work with partners is also addressed in this guideline. Monitoring the results of all open innovation activities is important for the main company and well established. Research Com has developed the partnership scorecard, which poses questions about the relationship with the partner and the characteristics of the partner, which greatly resembles the items of partner satisfaction and partner selection. Another tool was developed to guide the alliance process which includes partner selection, closing an agreement and managing the alliance.

TeleCom: a mature open innovation company

For many years, TeleCom has been one of the major players in the telecommunication industry striving for technology leadership through breakthrough innovations. Consequently, the company focuses heavily on open innovation through many different activities. As addition to collaboration with partners from their own and other sectors, establishing research labs at the best universities worldwide is key to TeleCom. The data analysis reveals that all the company’s partnering activities score very high (4). This is the product of TeleCom’s active training of employees in partnering, meaning that partnerships become more intense, enduring and focused; it also means that the partnering process is standardized and that partner satisfaction and the use of guidelines is encouraged by management. TeleCom constantly seeks to expand its network of partners by bringing in more diverse parties and deploying screening scouts to identify new partners, who are led by champions. The partner selection process, which is based on

the company's overall vision and strategy and its attitude towards IP, clearly focuses on creating a win-win situation for the company and its partners (scored 5).

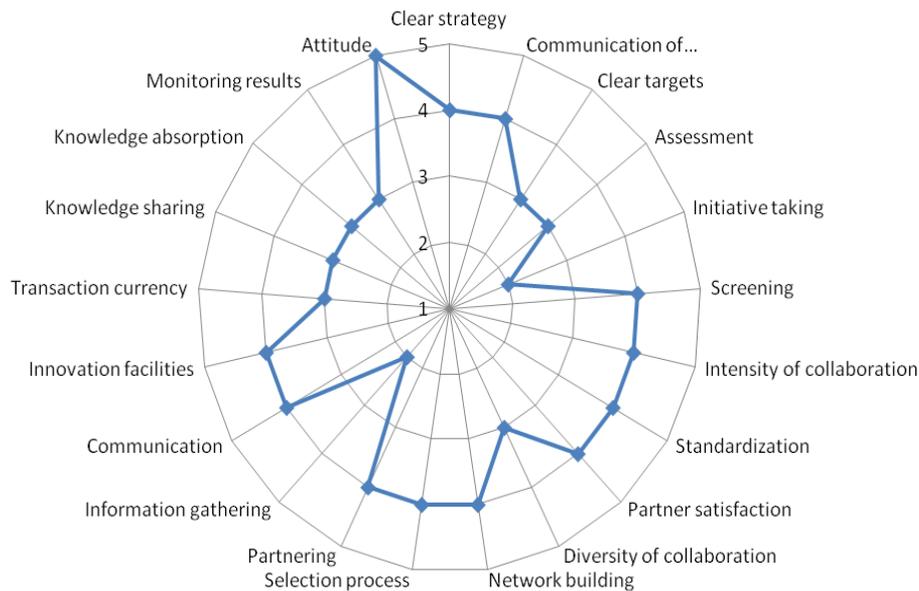


Figure 4 Scores for individual items at TeleCom, a mature open innovation company.

However, the data also revealed some weaknesses that TeleCom should address. To date, open innovation activities have only been monitored by a direct manager, not by a central function, a situation which hinders knowledge sharing. Additionally, employees only share knowledge between departments although employees are actively encouraged to absorb and share knowledge. TeleCom will work on establishing an appropriate monitoring system for open innovation while, at the same time, responsible management monitors progress instead of having a process in place that tracks all output.

Discussion of the results

Our work contributes to the general question of how to measure open innovation. Based on the literature study, a preliminary framework was developed describing three main elements of open innovation maturity. This framework was based mainly on alliance management (Kale and Singh 2001; Ireland *et al.*, 2002), innovation management literature (Tidd and Bessant, 2009; Anderson and West 1998) as well as on the work from software development (Paulk, Curtis, Chrissis and Weber, 1993; Berg, Leinonen, Leivo and Pihlajamaa, 2002; Berg, Pihlajamaa, Poskela and Smedlund, 2006). Exploratory approach interviews with R&D managers confirmed the details of the framework with metrics. However, the relevance of this research lies in joining these literature streams into an open innovation maturity framework and extends existing measurement research on open innovation (Chiesa *et al.*, 2008; Kerssens-van Drongelen *et al.*, 2000).

As the different stages of development in the maturity framework show, the approach became more detailed at each phase and was based on the behaviour and practical experiences of companies dealing with open innovation. The major managerial contribution lies in the translation of the table and concept into an easy-to-use excel tool. In order to create a practical tool, many discussions with the companies were necessary.

We agreed with the companies in the case studies on a definition of open innovation that focuses on using external partners in order to develop and introduce valuable ideas. We realize that this excluded certain parts of the open innovation approach, such as spin-offs and location decisions. This is one limitation of the tool. In order to overcome this limitation, while avoiding unnecessary complication and detracting from the tool's simplicity by adding more categories and questions, the test companies discussed the possible modularization of the tool. Under this approach, each company, based on its individual open innovation approach, would select a number of questions from each category, thereby customizing the tool. Because open innovation is not yet a clearly defined approach of strategy, respondents should examine the tool, discuss the statements and adapt these to fit their organization and understanding. It should be emphasized that the framework does not imply that each company should strive for the highest score in each category and the interpretation of results is limited without a benchmark.

Additionally, we discussed the results and the scope of the maturity framework at length with the companies involved. The framework and the excel tool are a means of achieving the objectives of the company. Measuring open innovation focuses mainly on measuring individual input or output factors (Chiesa *et al.*, 2008; Kerssens-van Drongelen *et al.*, 2000) rather than excellence in open innovation activities. The open innovation maturity framework indicates a certain maturity in the areas represented by the elements. We finally agreed with the companies that the tool could be used to evaluate a business unit or team or the whole organization when there is a consensus on the elements to be included. If the users have different approaches in each business unit or team, the excel sheet should be completed separately for each unit. In order to calculate the maturity level of the company based on individual business unit analysis, the mean of all the answers given should be calculated.

We propose that there are different archetypes for open innovation and consequently different forms in the spider diagrams, according to the open innovation approach of the organization concerned. Gianiodis, Ellis and Secchi (2010) suggest four different types of open innovation on the basis of a review of the literature: innovation seeker, innovation provider, intermediary and open innovator. These types differ according to the sources of innovation, the attributes of the firm and the mechanisms of inter-organizational exchange, and they will also produce varying outcomes. Giannopoulou, Yström and Ollila (2011) followed a similar approach concluding in four differentiating factors on approaches to open innovation. Baganza *et al.* (2011) derive two different approaches to open innovation by analysing eight case studies of Italian companies. In order to develop our archetypal approaches to open innovation while taking into account the types mentioned above, we will enlarge our sample in the next research step.

The tool calculates the profile automatically on the basis of the user's answers and produces a spider web on the third page. The interpretation of the spider web diagram should be done in the team to identify areas for improvement and which results are already satisfactory to take care of company and sector-related individual factors. However, a major limitation of our framework as well as the excel tool is that the results are not absolute figures. A company does not necessarily need or want to reach the

highest level of maturity in each category. Additionally, the interpretation of the levels differ according to the current status of open innovation, known open innovation activities in other companies as well as the progress achieved in recent years. Without a common understanding of the questions, the tool will lead to inaccurate or sub-optimal results.

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Appendix

The questions we used to assess the maturity level in the different elements.

1. Climate for innovation

1.1 Leadership

Clear strategy

Is open innovation incorporated into a communicated strategy?

- OI is not mentioned in strategy
- OI is verbally supported by management

- OI is incorporated into the organization's strategy 1
- OI strategy is explained and stimulated by management
- OI strategy is demonstrated by management who "walk the walk"

Communication of success stories

Are examples of how to do open innovation communicated throughout the organization?

- There are no success stories at present
- successes are shared informally, by word of mouth
- some success stories are shared by management
- success stories are shared in a regulated way
- success stories are used for strategic purposes

Leadership: To what extent are your open innovation initiatives supported by the management of the organization?

1.2 Incentives

Clear targets

Are there communicated targets which are in line with the open innovation strategy of the organization?

- no targets are set
- lower level initiatives are used for target setting
- targets are set in line with the OI strategy
- targets are set for and communicated to employees
- targets are continuously adjusted for each activity

Assessment

Are employees assessed and rewarded on the basis of OI targets?

- no assessment based on OI activities
- informal assessment of open innovation initiatives
- assessment is based partly on OI strategy and targets
- champions are awarded on the basis of targets
- OI based assessment for all employees, specified per location/site

Incentives: To what extent are your employees encouraged to become involved in OI? 1

2

1.3 Mind set

Initiative taking

Are employees willing to take initiative and be entrepreneurial?

- little initiative taken by employees
- individual initiatives at the lower levels of the organization
- champions are appointed to demonstrate entrepreneurship
- champions are stimulating entrepreneurship
- employees in all parts of the organization are willing to take initiative

Screening

Do employees screen the external environment for new opportunities?

- external opportunities are spotted accidentally
- arbitrary screening focused on own advantage
- champions do the screening

- scouts assigned and led by champions
- all employees are continuously looking for external opportunities

Mind set: To what extent are your employees supportive of and active in open innovation in the organization? 1 2

2. Partnership capacity

2.1 Reputation

Intensity of collaboration

How much knowledge do you exchange with your partners and how often?

- no regulated collaboration
- several informal partnerships between individuals
- large number of partnerships with limited intensity and a short duration
- partnerships become more intense, enduring and focused
- intensity is judged and adjusted for each partnership

Standardization

How standardized is your partnership process?

- no standardization
- informal way of dealing with partners, no plan upfront
- standardized tools for partnerships are present, clear ownership of project
- most common partnerships are standardized
- balance between standardization and specification of project plan

Partner satisfaction

Are you focused on satisfying your partner?

- collaboration is based on affection
- focus on satisfying itself
- behavioural guidelines are defined
- partner satisfaction and the use of guidelines are stimulated by management
- partner satisfaction is monitored constantly

Reputation: To what extent do you consider your organization to be a trustworthy partner?

2.2 Partner selection

Diversity of collaboration

Are you capable to work with diverse partners and in diverse forms of partnerships?

- arbitrary partnering
- focus on few, dominant forms of partnerships
- diversity in forms with existing partners
- specific forms, diversity increased with unknown, small and medium partners
- partnerships in all parts of the value chain

Network building

Have you built a network of diverse contacts and (potential) partners?

- one-off contacts
- repeating contacts with several parties
- previously used parties gathered in network system
- network is expanded with more diverse, new parties
- network is linked with many others and strategically expanded

Selection process

How structured is your partner selection process?

- individual, opportunistic initiatives, no deliberate selection
- selection based on affection and previous collaborations
- selection based on existing knowledge about (possible) partners
- selection based on vision and strategy
- selection criteria installed based on proactive strategy

Partner Selection: How good are you in selecting the right partner for the right moment?

2.3 Training & education

Partnering

Are your employees trained in how to start, run and finish partnerships?

- no training
- employees gain skills through experience on the job in interdisciplinary teams
- champions set examples of how to deal with partners
- employees are specifically trained in partnering
- employees continuously share new skills and knowledge about specific partners

Training & education: To what extent are your employees capable of dealing and working with external partners?

3. Internal processes

3.1 Central coordination

Information gathering

Are your open innovation activities reported to a central position?

- no reporting of initiatives
- initiatives are monitored by direct manager
- all open innovation initiatives reported to a central position
- gathering of information and linking of externally focused initiatives
- information gathered and linked for both internal & external activities

Communication

Are your open innovation activities communicated throughout the organization?

- informal communication of initiatives
- initiatives communicated in small team or groups
- communication among management via regular meetings
- initiatives communicated via widely accessible intranet
- employees brought into contact via central position

Central coordination: To what extent is there coordination of open innovation initiatives in the organization?

3.2 Resources

Innovation facilities

Are you able to facilitate open innovation activities in shared facilities?

- no supporting facilities in place
- some partners get access to each other's facilities
- facilities open for new and smaller partners
- some shared facilities in intense partnerships

- facilities owned and built by network of partners

Transaction currency

Do your employees have resources that enable them to make commitments and enter into agreements?

- commitment to agreements based solely on existing relationship
- commitment based on reputation, trust
- management makes budget available on demand
- management provides structural budget
- OI transaction currency is integral part of budget

Resources: To what extent are employees provided with practical enablers for open innovation initiatives?

3.3 Knowledge management process

Knowledge sharing

Are your employees able to share and access knowledge gained through open innovation activities?

- no sharing of knowledge
- knowledge shared in team
- irregular contact between departments
- project owners appointed to facilitate knowledge sharing
- knowledge is widely accessible through database

Knowledge absorption

Are your employees able to exploit the knowledge gained through open innovation?

- individual absorption
- informal sharing of new knowledge and ideas between employees
- employees are actively stimulated to absorb and share knowledge
- intra-organizational knowledge sharing (between departments)
- external knowledge is fully exploited in products and internal organization

Monitoring results

Are you able to monitor the progress of the results throughout the organization?

- no identification of results
- results thrown "over the wall"
- relevant manager monitors progress
- starting to establish process to follow output of project
- process in place that follows all output

Knowledge management process: How easily can employees access knowledge gained?

3.4 Legal & IP system

Attitude

Do your legal and IP department demonstrate an open attitude?

- IP wants to keep everything for themselves
- minimal IP given away under strict conditions
- trust-based legal & IP attitude
- legal & IP departments encouraged to take long-term view
- focus on win-win contracts

Legal & IP system: How well is your legal system supporting open innovation initiatives?