

Can Abundance in Knowledge necessitate a Shift from Closed to Open Innovation?

Abstract: One of the assumptions underlying the ‘Open Innovation Model’, a model not long since introduced by Henry Chesbrough, is that there is today abundant and widely distributed scientific and technological knowledge that can be put into use. According to this model, firms that practice open innovation use both internal and external sources of knowledge for their innovation purposes. Unlike this model, there is restricted flow of knowledge into and out of firms that practice closed innovation. The new or open model says there has to be knowledge transfer between firms, should this abundantly existing knowledge be put into use. Dealt with in this paper is whether and how this said knowledge abundance necessitates the shift or change of innovation practices from closed to open one. To that end, some argument points have been raised in the form of questions and these questions have also been discussed in.

Course: Economic Development and Innovation Studies
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(UNU-MERIT 2006)
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Date: 23 Sept. 2006

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Introduction: setting the scene

Scientific and technological knowledge has undeniably been of crucial importance in supporting and sustaining the technological progress and economic development of different human societies around the world. Knowledge¹ has proved itself to be economically so valuable that it has since long been used as a basis and means in realizing the whole technological transformations to the level that can be witnessed these days. Moreover, the quest for knowledge has by itself been intellectually so captivating that there are, and of course have been, many who crave for it. The gratification of one's intellect and/or the recognition of the economic value of knowledge can be seen as two motives that drive mankind towards the acquisition of it. So, it should be no wonder to see a number of R&D activities – and still more number of minds working therein – that are being undertaken within and outside business firms in an effort to ensure the acquisition, availability and applicability of knowledge. Be it for economic reasons or purely intellectual pursuit of it, there is these days a huge asset of knowledge that is accumulated throughout time.

Seen from economic point of view, the mere generation and acquisition of knowledge might make little or perhaps no sense unless it is taken beyond that and be put into some commercial use. Here is where innovation comes. Should the economic value of knowledge be realized, it has to pass through a sort of innovation process whereby it is reduced to some specific form of product and/or service which is then going to be newly introduced to the market. As a result, targeted customers are enabled to make sense of new or added values that are conveyed to them through these new, better and/or improved products and/or services. The success of innovation, and so of the relevance of that R&D-resulting knowledge that served as an input to it, ultimately lies in effectively translating the initial knowledge into a product or service that can create and fulfill those perceivable values of the customer. Apparently, knowledge and innovation are like the two sides of a coin – each needs the other. Innovation needs knowledge, should it at occur as such. Knowledge needs innovation, should it prove economically valuable. The following 'equation' may describe this somehow well:²

$$\text{Innovation} = \text{Invention} + \text{Exploitation}$$

The term 'exploitation' here reflects the economic nature/aspect of innovation as it happens in businesses. Unexploited or unused invention is just idea remains economically latent.

¹ **Note:** Unless otherwise mentioned, knowledge as it appears in this paper is meant the one that is the outcome of R&D activity. It can be either a new scientific discovery or an invention, or both.

² John E.Little, 2000: Managing Technological Innovation, P.5

Objective of the Paper and Formulation of Argument Points

What has been stated above is meant to serve as a background idea for this paper. But the starting point for the paper is the book by Henry Chesbrough (2003) wherein he introduced a ‘new’ paradigm of innovation, namely: Open Innovation Paradigm. Described and contrasted in this book are two models of innovation, namely: Open and closed ones. The open innovation paradigm assumes that:

“firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology” and the model further bases itself on the logic that *“there is today abundant knowledge, which must be used readily if it is to provide value to the company that created it”*.³

On the other hand, underlying the closed innovation model is an ‘old paradigm’ which says:

“...successful innovation requires control. Companies must generate their own ideas and then develop them, build them, market them, distribute them, finance them, and support them on their own...” (Chesbrough, xx).

As can be seen from the above quoted statements, one thing that differentiates each model from the other is depending on the source where the knowledge is originally coming from and the sink where this same knowledge is to end up in. Thus, the exercise of innovation according to the open paradigm demands the flow of knowledge into and out of a given firm. The closed innovation paradigm, on the other hand, not only confines the generation of knowledge inside the firm but also restricts the outflow as well as inflow of knowledge to the firm. The way innovation as it has been practiced by many firms is that of closed innovation model. Moreover, the abundance of both scientific and technological knowledge as well as its relatively easier accessibility is one ground for introducing the new model of open innovation.

This paper takes this latter aspect of the Open Innovation Paradigm (i.e. knowledge abundance) into consideration and looks at whether and how this abundance in knowledge is related to both models of innovation and attempts to answer the question: **Can abundance in knowledge necessitate a shift from closed to open Innovation?** In an attempt to answer this question – which is the objective of this paper – the argument points or questions as formulated below will be discussed in a way that is meant to serve to that end.

³ Refer to: Henry Chesbrough, Open Innovation: the New Imperative for Creating and Profiting from Technology, 2003, pp. xxiv, xxv.

Formulation of Questions/Argument points:

- Before we are to deal with anything in relation to knowledge abundance, we need to know where from and why this abundance in knowledge come. We need to know in particular how the accumulation of human knowledge is related to the practice of innovation activities.

→ Why is there today so 'abundant' knowledge at the first place? Is the 'old' paradigm of closed innovation 'to be held responsible' for that?

- The concepts underlying the paradigm of Open Innovation demand that knowledge has to flow from its source to where it can be put into use. This naturally necessitates the need to pose questions regarding the whereabouts and distribution of this knowledge.

→ Where is this abundant knowledge residing? What does the world knowledge landscape look like? Who is in possession of it? And, who are going after it?

- Implied under the open innovation paradigm is that, knowledge should not be necessarily used by the one who created it. Here, the creation and possession of knowledge is one thing and the exploitation of this knowledge through innovation is another. The two are separated. The nature of knowledge flow or diffusion cannot escape the influence of possible conflicting economic interests of those involved bodies (i.e. the creator of the knowledge and the user who is after it). This forces us to think of how worth or valuable are knowledge and innovation to their creator as well as user.

→ Which one matters more - Knowledge or innovation? And why?

- Here it is also important to examine whether and how the practice of innovation based on the open model lead to increased utilization of the abundant knowledge and also how the occurrence of innovation can be affected.

→ Will there be enhanced use of existing as well as newly created knowledge through the practice of innovation in the open paradigm? How will the number and rate of occurrence of innovation be influenced by such abundance in knowledge over time? Will there be a counterimpact from innovation in return?

- As can be implied from the concepts underpinning the open innovation model, this model demands knowledge be available for those who can make economic benefit out of it. This reminds us to think beyond the mere abundance of knowledge as it exists today, and ask whether there will be increased accumulation of knowledge over time with the exercise of innovation under the 'new' or open paradigm. So, this question:

→ Will the practice of open innovation model lead to still more or less accumulation of knowledge? In other words, can the practice of this model be self-sustaining in the knowledge input it may need?

Discussion of Argument Points:

★ *Why is there today so 'abundant' knowledge at the first place? Is the 'old' paradigm of closed innovation 'to be held responsible' for that?*

► Both the term 'abundant' and 'knowledge' are just relative terms and we have to be careful with respect to whom, to which time and place this 'abundance' or 'knowledge' is being referred. As understood in this paper, the term 'abundance' implies that part of the totality of something (say knowledge), usually having some already identified economic value, exists in unused form when it can potentially be put into use. 'Knowledge' as used in this paper is also to be understood from economical point of view. For the purpose of this paper 'Knowledge Abundance' is meant the totality of scientific and technological knowledge as it exists today at global level. Firms that have been running their business in a manner that uses this scientific and technological knowledge to produce products and services are the ones whom the term 'knowledge' as used here is referring to.

Having said this, we can come back to the question. Why so abundant knowledge today? Since long time humans have strived for knowledge not only because they are driven by the desire to satisfy their curiosity, to advance, deepen and expand their level of knowledge, but it is also because they have identified its potential applicability as an economic means. These internal motives coupled with outside dictating factors have basically forced and shaped all efforts and actions of man which through time led to the accumulation of vast amount of knowledge that mankind can boast and enjoy of. Human knowledge is however relative and incomplete, so all efforts and actions have always room to take place. Be it abundant or not, today's knowledge, as it lies within the sphere of human's recognition, owes its very existence to such efforts and actions. Knowledge is also cumulative by its nature. That means, knowledge that has already been discovered and/or developed can further serve as a basis for the acquisition and development of new ones. As a result, knowledge can advance both in depth and width. Considering those scientific progress and technological developments that took place over a longer span of time and specially the rapid changes that we can witness today, one can say that there are reasonable grounds to say that there is, of course, abundant knowledge. "...*Knowledge shared is knowledge multiplied...*"⁴ These days knowledge is not only accumulated, but it can also be made more easily accessible owing to internet and ICT. This may mean that knowledge can still be 'multiplied'.

Business firms are arguably among the major role players behind any scientific and technological developments; however their prime objective is achieving economic-driven purposes. Firms have also been the ones who are assuming the task of converting R&D-resulting knowledge into useful products and/or services. Competition for markets that prevails among firms can also be seen as one factor that spurs the undertaking of in-firm R&D activities. As a result, firms work hard for the acquisition and effective exploitation of this

⁴ Robert H. Buckman, 2004: Building a knowledge-Driven Organization, P. vii

knowledge so as to win a competitive advantage over their competitors. Moreover, the purposeful search for knowledge as well as its commercial development is no simple task. It costs firms time, human and material resources. So, it is no wonder if firms have been innovating in a closed manner and be in possession of huge collection of intellectual asset. So far firm-based accumulation of knowledge is concerned, then we can say the practice of closed innovation model by and within firms has led the present-day knowledge abundance.

★ *Where is this abundant knowledge residing? What does the world knowledge landscape look like? Who is in possession of it? And, who are going after it?*

► The knowledge that is said to exist abundantly is not uniformly distributed. Some have a larger share of it and others may have less of it. The global knowledge landscape is thus non-uniform. Today's big and relatively well-established firms that enjoy extensive and long-time experience in R&D-undertakings could be in possession of a large accumulation of scientific and technological knowledge so far their field of business is concerned. Universities and other public or non-industrial institutions that are meant to undertake activities like R&D can also amass and enjoy a large possession of knowledge. Knowledge in its tacit form also resides in the skills and know-how of experienced workers as well as other intellectuals. In general, those bodies that have since long been involved in the generation and development of the knowledge and have the means and resources to put to that end are the ones where the knowledge abundance can most probably be. Those who are in possession of the knowledge as well as others who may have the need for it can go after the knowledge that may fit their purposes.

It might be here worth to note that knowledge is so diversified that no single body (e.g. a business firm) can have and enjoy all range, type, and scale of scientific and/or technological knowledge. This means that two different firms can both have abundant knowledge in their respective field of business activity but yet the knowledge that each possesses can be different from the other. In such a case where the knowledge possession by a given firm is restricted in the confines of its business, the firm may be forced to look for outer sources of knowledge that lie out of its area of specialization.

★ *Which one matters more - Knowledge or innovation? and why?*

► Actually this question is not meant to compare knowledge and innovation against each other. Rather it is meant to address how the linkage and interdependence between knowledge and innovation stands in conflict with the purpose or motive behind knowledge generation and innovation within a firm, should innovation be exercised in an open manner. Consider two firms, firm A and Firm B. Both firms are used to have their own internal R&D labs. Say Firm A is the one who is innovating on and build on the knowledge that comes originally from firm B. That means firm B provides part of its internally generated and developed knowledge to Firm A. Neither firm wouldn't involve itself in such business relationship unless each sees a kind of mutual commercial success or benefit out of their acts. That way,

firm A is the one who shows growing appreciation and tendency towards the use of external ideas which it can innovate and capitalize on. As a result, firm A may show strong inclination and dependency on external source of knowledge for its innovation activity. This dependency on external knowledge sources may harm firm A's initiation to go for the internal generation of knowledge, even though it is commercially succeeding. Apparently firm A may be benefiting because it innovated on knowledge that comes from outside, but not without some negative impact on the interdependence and linkage of its innovation activities with internally created knowledge. Firm B, on the other hand, may be encouraged to generate more and more knowledge internally, but not to be used internally. Any commercial success that arises from the externalization of its internally created knowledge may not necessarily harm its innovation activities, but it is less likely to see if firm B is going to be initiated to innovate on the knowledge that is used by firm A.

So far the business relationship of firm A with firm B is concerned and if such relationship means a commercial success for both, then firm A may value the external knowledge for its internal innovation and firm B may value the same internally created knowledge because it benefited from its use by external firm. If such a relationship between the firms goes on, through time firm A is likely to be more good at innovation than it is at internal R&D undertakings and, on the contrary, it becomes more likely for firm B to be good at its R&D undertakings than innovating. Interestingly, it can be noted that the more firm A tends to be innovation-undertaker and the more firm B tends to be R&D-undertaker, the more will be their business relationship in favor of each firm. Such a tendency can, at extreme or ideal case, lead firm A to be purely an innovative firm with none of the input ideas or knowledge coming from inside and firm B to be a purely a knowledge-generating R&D 'firm'. Such ideal case may be far from reality, but the development of such tendencies within firms needs to be noted. To cut the long way short, business-running firms are generally both motivated and driven by economic benefit. This economic motive is what dictates the actions of both firms A and B. **So**, it can be said that the linkage and interdependence of knowledge generation and innovation undertakings as they happen inside a given firm can be harmed with the exercise of open innovation model between firms.

★ Will there be enhanced use of existing as well as newly created knowledge through the practice of innovation in the open paradigm? How will the number and rate of occurrence of innovation be influenced by such abundance in knowledge over time? Will there be a counterimpact from innovation in return?

► Whether an abundantly available knowledge leads to a higher number and rate of occurrence in innovation or not, depends on how the flow of this knowledge is facilitated. When knowledge that already exists but confined within the firm that created it is made accessible to others which can exploit it, then there is an increased chance to **directly innovate** around this economically useful knowledge or idea, which otherwise remain unused. Moreover, to see how increased flow or diffusion of knowledge between firms possibly leads to increased rate of innovation, it will suffice to have a look at the simple logic that underpins

the formation of ‘new’⁵ knowledge, especially technical one like invention. It is nothing new that two or more existing sets of knowledge can be combined in a new manner so as to **generate a new knowledge or invention**. Despite how creatively combined they may be, it can be said that the more abundant, distributed and accessible those internally and/or externally developed knowledge are, the more will be the chance to develop another new idea which can then be taken as an input for an innovation process. **So**, the implementation and exercise of open innovation model will **increase the likelihood of innovation occurrence** and this in turn means that **abundant knowledge will find more use than not**.

Another argument as of whether there will be enhanced use of existing knowledge through the practice of open innovation can be made as follows. As is well known, the generation and development of new knowledge through R&D can usually be time taking. That means, if a given firm can find useful knowledge from outside sources that it can directly and readily innovate on, then it will not hesitate considering this outside idea. By innovating on externally developed knowledge this firm can substantially reduce the time required to introduce new product to the market. Introducing a new, better and improved product to the market in shorter period enables this firm to win a competitive advantage. If the use of already existing knowledge allows firms to shorter time to bring their new product, then one can say that the utilization of knowledge will in effect be enhanced.

Whether and how the rate of innovation occurrence itself may counterimpact the amount and degree of generation of knowledge within firms depends on who is generating the knowledge and who is going to exploit it. As it can be agreed upon, the success of innovation is ultimately determined by the market or customers whom the outcomes of innovation are meant for. Considering a firm that exercises closed innovation system, the need to generate and develop its own knowledge is quite crucial, should this firm ensure a reliable supply of new scientific and/or technological knowledge that keeps its business go uninterrupted. Besides, such a firm has to be capable of transforming this internally generated and developed knowledge into marketable products or services, should it remain competitive in the market and so retain or expand its market share and position. Given the market conditions dictate so, for this firm **more innovation means more need for new input knowledge or ideas**. **So**, it can generally be said that there is a direct linkage between the rate at which innovation occurs and the degree of knowledge generation within firms carrying out their innovation in a closed manner.

In the case where firms follow an open innovation model, the linkage between knowledge generation and innovation occurrence can be somehow different. Here goes the argument. Such firms will innovate around knowledge that is either internally generated or obtained from external sources. Imagine a given firm that invests its resources on R&D to generate knowledge and another firm that innovates around this very knowledge and makes

⁵ **Note:** Should something be conceived and developed as new (say new knowledge or invention), implicitly it is acknowledged that there another something which is rendered to be old. The former (the new) owes its existence to the later (the old)! Newness is a relative term, and the writer of this paper denies it any absolute existence.

commercial benefit out of it. Will it be in the interest of the former firm to see its knowledge be exploited elsewhere outside? It may also pose questions like: why should we invest in a R&D if it is to serve the economic interest of outside firms? If others can innovate on our hard-won ideas, then why couldn't we ourselves? Shall we keep on undertaking our R&D activities without paying due consideration of where the outcomes are to end up? More or less other firms do behave and act similarly.

Now, consider the same firm is able to enjoy some economic benefit out of externally generated knowledge. In such a case, that firm may ask itself whether and why it should bother about its internal R&D undertakings, so far it can get the knowledge it needs from outside sources. Either way, for this firm, the role of R&D as a means of generating useful knowledge will fall under question. Business firms, owing to the economic motive that dictates their actions, may show a general inclination towards readily exploitable knowledge; however, this may not mean that firms pay less attention to the creation of ideas or knowledge generation. So, it can be seen that even if there can be a possibility of increasing the rate of innovation occurrence through increased flow of knowledge between firms, there are possible sources of concerns that may undermine the undertakings of R&D within firms which is essential to maintain the knowledge input required for innovation. The potential barrier that arises from the economic motive is one big factor that may hinder the flow of knowledge from its creator to its user.

★ *Will the practice of open innovation model lead to still more or less accumulation of knowledge? In other words, can the practice of this model be self-sustaining in the knowledge input it may need?*

► Knowledge is cumulative – be it in its totality or in specific field of science and technology. So, whether open innovation model is exercised or not doesn't alter this very nature of knowledge. But the practice of open innovation can change the knowledge landscape of the business world – a world that is shaped and formed by those firms exercising this model – depending on who is or has to create the knowledge that needs to be diffused in and out of a given firm, should this knowledge not be rendered economically latent or unused. Take for instance, firms A and B above. The practice of open innovation has been in favor of each of them, but firm B is the one where more knowledge accumulation can be expected to take place. Knowledge can still be accumulated in firm A as well, but it cannot be at the same rate as it does within firm B.

Another argument here can be made based on the assumption that there are many firms who follow and exercise open innovation model. With this, there is the possibility of having growing number of firms that may put more relevance to externally created knowledge. This in turn may lead to the direct involvement of other interested groups in the generation and development of new knowledge. Competition among firms that are running for external sources of knowledge may give others the opportunity to involve themselves in the knowledge creation process thereby striking a commercial advantage for themselves. Thus, it

can be said that there will still be more likelihood of having increased rate of knowledge creation from the side of those who either were already in the knowledge generation process (like firm B) or new comers who will purposely participate in the same activity. But the knowledge landscape cannot remain same. **So**, so far as knowledge input is concerned, the open innovation model can be self-sustaining.

Conclusion

The term 'abundance' refers to something that is existing, but not yet used economically. Quite agreeably, there is today huge collection of knowledge in the fields of science and technology, somehow in relative terms. There is also knowledge that is abundant. Innovation is that business process which uncovers the economic value of knowledge. Here comes the interest and involvement of firms in knowledge and innovation. To firms, knowledge is as worth as it can prove itself economically useful. Otherwise, it will just add more to the amount of abundant knowledge. Knowledge is not only abundant and diversified, but it is also not uniformly distributed among firms – some have strong hold of this abundant knowledge whereas others have less of it. This means there has to be a knowledge flow or transfer between firms that possess the knowledge and others who want to use it, should this knowledge be put into use. If firms practice innovation in a closed manner, knowledge finds little chance to be used outside the firm and external knowledge also finds its way hard into the firm. The practice of closed innovation model thus restricts this knowledge transfer. Open innovation practice can generally enhance the utilization of existing abundant knowledge. But the transfer of knowledge between the firms is not without problems.

It might be helpful to note here that knowledge can attract the eye of companies only as long as it proves itself economically useful. This economic motive of firms is hard to change irregardless of which innovation model is being exercised. Here lies the big challenge that has to be addressed if firms have to shift their innovation practice from closed to open one or even vice versa. Such a motive is still what has primarily forced firms to undertake the knowledge creation activities (e.g. R&D) in a closed manner. It is also believed here that it is this motive that dictates how open or closed firms can let their businesses be. Economic interest after useful knowledge! This makes it difficult to put it in concrete terms whether there has to be such a shift let alone here in this paper.

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