Open Innovation in Small Enterprises – a Living Lab Approach

Jesper Svensson

Halmstad University, P.O. Box 823, 301 18 Halmstad, Sweden.
E-mail: jesper.svensson@hh.se

Carina Ihlström Eriksson*

Halmstad University, P.O. Box 823, 301 18 Halmstad, Sweden.
E-mail: carina.ihlstrom_eriksson@hh.se

* Corresponding author

Abstract: In this paper we have addressed the research question: In what way does a Living Lab approach influence the innovation process from a small enterprise perspective? Within Halmstad Living Lab we have performed approximately 50 Living Lab activities involving user and enterprise representatives within the health technology sector. We have discussed our experiences according to literature on innovation and competence in relation to a Living Lab approach and have identified four challenges that need to be addressed. Examples of these challenges are; In what way can Living Lab activities contribute to expand the competencies within the small enterprises and how to create openness between enterprises and other stakeholders regarding legal documents such as IPR and patent?

Keywords: living lab; small enterprises; open innovation; challenges.

1 Introduction

Producing commercial successful IT-innovations might be a daunting task, especially for small enterprises. According to the European Commission the definition of a small enterprise is that it has fewer than 50 employees and a turnover less than € 10 millions [1]. This is especially the case if the IT products or services are launched directly to a consumer market. When users go consumers and IT is used in an everyday setting and bought by end users directly, and where usability needs to be extended to user experience, the task of developing successful IT innovations is indeed challenging.

Small enterprises often lack the resources and knowledge that larger organizations have about for example technological R&D, marketing and information about new trends in the society, and information about the users/consumers. One way to strengthen these enterprises' innovation capacity is by collaborating with other actors such as academia, the public sector and other enterprises [2]. These kinds of innovation system can thereby strengthen the innovation capacity due to cross-fertilization and collaboration between different actors.

However, innovations are created by people, not systems. To boost creativity and create new ideas that can be turned into applications and bring value through use, Eriksson *et al*. [2] suggest collaboration between people of different backgrounds, with different perspectives and that are possessing different knowledge and experiences. They further suggest that more people, including consumers, needs to be involved in the innovation process. This is in line with Thomke and von Hippel [3] that states that users are often the source of innovations. Moreover, open innovation [4] and user driven innovation [5] suggest that involvement of end users or consumers in the innovation process are important, hence they should be vital part of an innovation system.

However, there are several examples of innovation system failures. Ballon *et al*. [6] point at three such failures and argue the need for co-operation arenas where stakeholders from a variety of organizations can work together and strengthen each other. The first failure relates to the degree of interaction, either insufficient interaction between actors or too much interaction which might lead to habit formations. The second problem mentioned are missing or inadequate actors (often concerning areas such as user centricity and user knowledge) whereby the chain of innovation is broken. The final problem area concerns path dependency and lock-in. Organizations tend to stay within existing paradigms of operation which makes it harder for them to think out of the box and break new grounds.

One new approach that supports the innovation processes by involving different stakeholders is the Living Lab approach. Living Labs contributes to the challenges of mass-deployment of ICT solutions as a mean to further develop the society by involving the citizens. It brings the users/consumers/citizens into the system of innovation. In a Living Lab, ICT innovations are created and validated in collaborative multi-contextual empirical real-world environments. The individual is in focus in the role of a citizen, user, consumer, or worker and is seen as a valuable source of innovation.

A Living Lab aims at supporting the creation of usable ICT products and services and incorporates three different perspectives that are essential for launching successful IT innovations, i.e. society, market and enabling technology [2]. First, there is a need to know who the users are and to identify their needs and preferences. Second, to be able to produce commercial successful innovations, business models needs to be addressed early in the process. Finally, there is a need to incorporate knowledge about technology. Trends and technologies such as web 2.0 [7] and crowd-sourcing [8] provides new ways to leveraging on a larger mass of ideas, knowledge and experiences and substantially boosting the innovation capability.

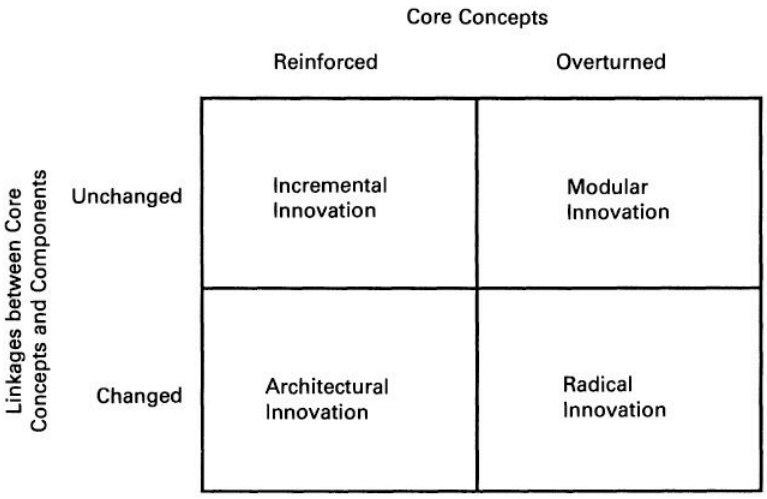
Today there are numerous Living Lab initiatives all over Europe within different application areas such as mobile technology, tourism and media [9]. During the last years the area of supporting technologies for care giving to elderly has drawn an increased societal interest, due to the fact that the population is getting older and older. For example, during the next decade the amount of elderly in their eighties or elder are expected to grow with 45 percent [10]. This area offers new opportunities for small enterprises to create IT innovations that empower the elderly to be able to stay in their own homes for a longer period of time.

The overall research question for this paper is: *In what way does a Living Lab approach influence the innovation process from a small enterprise perspective*? The aim of the paper is to discuss challenges of a Living Lab approach from a small enterprise perspective.

2 Theoretical Background

There exist several definitions of the term innovation. Tushman and Anderson [11] refer to innovation as a technical breakthrough that surpasses the incremental improvements of a previous product or process. However, a breakthrough is not enough to define innovation as a technical breakthrough that does not lead to adoption is merely an invention [12]. Henderson and Clark [13] make a distinction between products as a system and products as a set of components. This distinction underscores that there is two types of knowledge needed for successful product development. First, it requires component knowledge, knowledge about core design concepts and how these are implemented in the components. Second, it requires architectural knowledge about how the components are linked or integrated in a product. This distinction constitutes the base for a framework for defining innovation based on these two types of technological knowledge. Hence the framework is divided along two dimensions: knowledge of the components and knowledge of the linkage between them (architectural knowledge). The framework consists of four different innovations; incremental, modular, architectural and radical innovation [13, see Figure 1]. Architectural knowledge tends to be embedded in the structure and information processing procedure of established organizations and architectural innovations destroy the usefulness of the architectural knowledge of established firms. Therefore, these established firms are presented with subtle challenges compared to newcomers on a market when working with architectural innovations. If these challenges are not handled, empirical evidence shows that the role of a firm might change, from a dominant market leader to an organization that is lagging behind its competitors.

Figure 1 A framework for defining innovation [13].



According to Van de Ven [14], the value of most products and services primarily depends on development of knowledge based intangibles, e.g. product design, marketing, technological know-how, personal creativity and innovation. In this knowledge intensive society, technology is gaining a new meaning, the definition is broadened from only

including a physical artifact, to include the body of knowledge that is embodied in the design or the architecture of the artifact. Technical work is a collective effort, the people who do it can be seen as a part of a community of practitioners that creates and shares knowledge. Knowledge and complementary assets that are needed to develop knowledge-intensive technologies are therefore seldom enclosed in a single company or organisation [14]. According to Yoffie [15], the traditional vertical integration that e.g. was adopted by firms in consumer electronics and computer industries is being replaced by a horizontal model. In a vertical integration model, formerly used by companies such as IBM or Fujitsu, most components where developed in-house and these companies sold a complete package to the consumers. The model was possible due to the computers of the time where proprietary and closed products were viable. In a horizontal model, firms aim for a large and dominant market share within a horizontal layer. This is mainly because the new economics of computers: growing scale economies and the importance of network externalities [15].

In horizontal models, firms are advised to focus on building distinctive competencies, outsource the rest and become nodes in value chain networks. In these networks individual firms or innovators seldom have the power, resources or legitimacy to innovate and produce change by themselves [14]. Instead, "running in packs" more often is successful compared to "going alone" to develop and commercialize knowledge-intensive technologies. According to Van de Ven [14], many different actors and stakeholders in public and private sectors also make important contributions. These stakeholders are active participants that affect the innovation process. Therefore, a successful innovation process is not only dependent on technical and rational competence, other competences and stakeholders are needed to be involved as well.

To be able to profit from technological innovation, especially in those cases where imitation is easy, complementary assets is especially important. Otherwise the innovator risks losing the profits to the owners of certain complementary assets, such as e.g. a hardware innovation where the profit lies in the software developed. Other examples of complementary assets needed to commercialize an innovation are competitive manufacturing, distribution, service, marketing and complementary technologies [16]. For many innovations, complementary goods or services are essential for completing a product demanded by buyers. These complementary assets play an important role allocating the returns for innovations, especially for innovations not strongly protected by IPR. Firms therefore often have a relationship to a network of providers of complementary products. A firm's relationship to this network determines its value creation, value capture and the durability of its competitive advantage [17]. Therefore, to only have the core technological know-how in an innovation is not enough to be profiting from technological innovations [16].

A traditional way of innovating has been to use internal R&D resources to strengthen existing products and services and to generate ideas for new potential ideas according to Chesbrough [18]. This has been a successful approach in the vertical integration model. However, in a horizontal model this is no longer enough to survive in today's market. Outside sources of knowledge are often critical to innovation processes, most innovations are a result from borrowing rather than invention. Furthermore, the importance to innovative performance of information originating from other sources outside the formal innovating unit (i.e. an R&D unit), such as marketing and manufacturing, have also been established [19]. Instead of only relying on internal sources of innovation, Chesbrough [18] suggest an open innovation setting where the business relies on both internal and

external resources for ideas, and strives to find the best business model, regardless whether it is internal or external. This in turn also opens up opportunities to exploit new markets.

According to Cohen and Levinthal [19], the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capacity. The authors label this capability a firm's absorptive capacity and suggest that this is strongly related to an organizations level of prior related knowledge. An organizations development of absorptive capacity (which enhance innovative performance) are history- or path-dependent, a lack of investment in an area of expertise early, may negatively affect future development of technical capability in that area. Absorptive capacity is connected to R&D, a firm's capability to identify technological opportunity, appropriability (the quality of being imitable or reproducible) and competitors' interdependence via its absorptive capacity, and is connected to R&D spending. For example, if outside knowledge is less targeted to the firm's particular needs and concerns, a firm's own R&D becomes more important in permitting it to recognize the value of the knowledge, assimilate, and exploit it. Furthermore, in fields where the pace of knowledge generation is high (such as in information systems), the importance of R&D is increased to enable absorptive capacity [19].

Knowledge creation and absorptive capacity can however be generated without a specific R&D unit. In some cases cooperative R&D ventures might be fruitful (depending on the type of knowledge that is created) and trading zones can enable learning and coproduce new knowledge [20]. When different communities and stakeholders boundaries cross or overlap during a project, trading zones can emerge. These trading zones can allow formerly distinct knowledge to flow in both directions between stakeholders or communities. The stronger and richer the trading zone, the easier it is for learning to travel from one community into another and for stakeholders to coproduce new knowledge. Trading zones are therefore both physical and cognitive arenas for communities with separate knowledge, agendas and innovation trajectories to negotiate, collaborate and learn from each other [20].

The concept of Living Labs originates from Professor William Mitchell in Boston, and was initially used when users were observed as they lived for a period of time in a smart/future home. Today, there is an ongoing trend in Europe to tailor a Living Lab concept in wider use to "enhance innovation, inclusion, usefulness and usability of ICT and its applications in the society" [2, p.5], and this concept of Living Lab has been described as "a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts" [2, p.4). This trend has lead to the emergence of several definitions of Living Labs, e.g. according to the European Network of Living Labs [9] a Living Lab is "both a methodology for User Driven Innovation (UDI) and the organizations that primarily use it". The European project CoreLabs [21] defines Living Labs as "a system enabling people, users/consumers of services and products, to take active roles as contributors and co-creators in the research, development, and innovation process". Hence, the concept of Living Labs can be seen as a methodology, an organization and/or a system. Based on this, we choose to look at Living Labs as a milieu in which specific methods are used to involve different stakeholders in open innovation processes to create and validate IT-products and services in a real world setting. Nonetheless, regardless of how one looks upon the concept, to implement openness, the creative process of involving different stakeholders is crucial [2].

3 Experiences from Halmstad Living Lab

Halmstad Living Lab is a member of both the Swedish [22] as well as the European network of Living Labs [9] and works within the application area of health technology with a specific focus on small enterprise partners. Halmstad University is the host of the Living Lab, organizes the Living Lab and provides the technology and the infrastructure for the Living Lab. The partners of Halmstad Living Lab include Halmstad municipality, The Healthcare Technology Alliance [23], and several senior citizens and next of kin organizations. Furthermore Halmstad Living Lab has a network of small enterprises working within the health technology field. So far, we have been lead three research projects in this area; Secure at Home – Living Lab, Secure at Home – Smart Locks, and Silver Technology. Within these projects we have carried out approximately 50 different activities involving users and representatives from the enterprises. In the following we will discuss our experiences from a Living Lab approach from a small enterprise perspective in relation to the literature in the previous section.

In the Living Lab activities managed by Halmstad Living Lab, several different cases within every category of Henderson and Clarks [13] framework for innovation have been conducted. Even if this framework according to Henderson and Clark is not made to divide an innovation (and the process working with that innovation) neatly into a category, our cases can be assigned roughly to the different categories. From a small enterprise perspective, the Living Lab has provided the most support in architectural and radical innovation projects. For example, the activities that have concerned incremental innovation processes have been quite straight forward. Halmstad Living Lab has supported enterprises in evaluating and testing products and late versions of prototypes. The results have in several cases led to changes in the design of components, however, the linkage between core concepts and components have not changed. In Living Lab processes concerning modular innovations, changes have been made to components, but not affected the knowledge about the linkage between the components. In these cases, either researchers or user/consumer stakeholders have pointed out needed changes to components (from a user point of view) or possible enhancements of components (from a technical research point of view). Even if in some cases the small enterprise has needed to exchange components, for example the change of using WLAN instead of Bluetooth when sending information within an information system, they have been able to manage this without too much constrains. Either the enterprise has handled gathering of new knowledge and development of components within the enterprise, or with the help of researchers from the University.

From a Living Lab perspective with specific focus on the small enterprise partner, processes concerning architectural and radical innovation have gained support from the Living Lab. By involving more than one company together with researchers and user stakeholders with specific domain knowledge, radical innovations have emerged exchanging both existing knowledge about components and the linkage between existing core concept and the components. Both the creation of ideas for new architectural innovations where existing components from different companies working together with the other stakeholders in the Living Lab as well as the validation of these architectural innovations have been strengthen by the Living Lab activities. Small enterprises without specific R&D units do not have the resources to develop new knowledge compared to larger firms. The needed knowledge about specific components has been provided by the different enterprise stakeholders and the technical researchers, and the ideas and concepts

about the architectural innovation have in several cases been established by user stakeholders. Also the validation of these new architectural or radical innovations provided by Living Lab activities have supported the enterprise knowledge creation about how to design and develop the concepts into prototypes. Furthermore, these activities have generated market related input for these radical or architectural innovations. This knowledge gained from this information has been outside the enterprises traditional scope of business and therefore have provided valuable market information.

It could be further argued that these activities have supported the enterprises absorptive capacity. Cohen and Levinthal [19] suggest that the absorptive capacity is strongly related to firm's level of prior related knowledge. In our cases the enterprises have not had any own specific R&D units, instead the knowledge have been embedded in the firm and in the coworkers. The Living Lab activities seems to support the absorptive capacity, both by involving technical researchers and their knowledge in the processes and by involving other enterprises´ competences and knowledge into the processes. Furthermore, by providing outside knowledge into the Living Lab processes, enterprises have had the opportunity to adjust their strategies and development work based on user/consumer input and to identify new ways of leverage user value with the help of technology and knowledge provided by researchers and other enterprise partners. An example of this is one of the enterprises involved in a Living Lab process that totally changed its path (as seen from a path-dependant perspective) by stopping the development of the next generation of a product. Instead the enterprise started out with a new concept and a new technological platform.

From a vertical and horizontal integration model perspective [15], small enterprises do seldom have the opportunity to work with a vertical model. The changes in the computer, electronic and information system markets towards more of a horizontal model put more restrains on these enterprises to be able to handle more knowledge and complementary assets if working alone in an innovation process. By working in a Living Lab environment, small enterprises have the opportunity to collaborate with other enterprises and academic and user stakeholders, providing a trading zone [20] for the different stakeholders to exchange knowledge. These trading zones also support the enterprises in development of new innovations, if IPR issues and openness (as in open innovation processes) can be handled [18]. In our Living Lab activities we have experienced both success stories and less successful stories. In one case a new idea for a radical innovation emerged when two enterprises where connected by the Living Lab. Similar ideas for a social communication platform for seniors had emerged in user involvement activities with the two different enterprises. The enterprises had together the complementary assets as well as the specific components to be able to start working with the idea and the concept. When the enterprises where introduced to each other in the Living Lab, a collaboration started. However, this collaboration took an abrupt ending due to IPR and contract issues, leading to a concept that is free for all stakeholders in the Living Lab to continue working with. The problem is that no one of the stakeholders has the assets and knowledge needed to continue with the development of the innovation.

In several other cases these trading zones have been more successful within the Living Lab. All these cases have one thing in common, the ideas are spawned from user involvement and user driven activities. In two cases enterprises have met user groups and worked together both generating and evaluating ideas based on technology and components from the enterprise. By using technology as a trigger for generating new possible future innovations that can leverage user needs and problems, interesting

concepts have emerged. This together with technological competence from the University has led to several new innovation processes, some driven as Living Lab approaches (i.e. involvement of multiple stakeholders during the whole process), some not. Other examples of successful collaborations within these trading zones that the Living Lab has created are two user driven innovation processes where in one case two enterprises together with primary and secondary users develop a new architectural innovation based on the enterprises' existing technological components. In the other case the architectural innovation is based on one enterprise´s components, but the linkage between them are used in a new way. In this case the user group created several ideas and concepts for an innovation and they are also involved throughout the innovation process, shaping and validating the innovation.

These cases are more or less an example of a more horizontal model where small enterprises, academic researchers and user groups together are "running in packs" [14]. The Living Lab concept might prove that this environment is a successful way of supporting enterprises to focus on their distinctive competencies, and instead become a node in value chain networks consisting of other enterprises, stakeholders from the social sector (in many of our cases e.g. the municipality and care giving organizations), academia and user organizations and/or end users/consumers. Living Lab seen as a network from the small enterprise perspective might support with the resources or legitimacy to innovate and produce change [14]. Furthermore, the Living Lab does have the potential to support the enterprises to be able to profit from the technological innovations generated within this environment. In several of our cases the concepts generated by involving multiple stakeholders in idea generation and innovation creation activities have been quite easy to imitate. By identifying and involving complementary assets in the Living Lab, the involved enterprises might be able to mitigate the risks of losing the profits to other owners of certain complementary assets as described by Teece [16]. However, to be able to succeed with this, the Living Lab needs to be able to manage IPR, provide an open environment and support value chain networks that benefits all partners involved in the Living Lab.

4 Conclusion

By discussing our experiences of Living Lab activities from a small enterprise perspective in relation to literature on innovation and competence we have identified four challenges that need to be addressed.

1 – In what way can Living Lab activities contribute to expand the competencies within the small enterprises?

We think it is important to provide the enterprises with the knowledge to be able to perform user involvement activities of their own, but as most small enterprises is time pressured we also think it is important to provide assistance from our Living Lab when needed. We always have at least one enterprise representative present in our Living Lab activities, and are teaching them how to perform different activities themselves. Some of our enterprise partners have explicitly asked us to teach them more of our different methods and techniques. By involving technical researchers in the innovation process, the enterprises can benefit from their knowledge and in that way increase their competences in the technical area. However, this prerequisite that an academic partner with this

competence is available in the Living Lab environment. The enterprises that have been engaged in activities with other enterprises have also learned a lot from each other, both in the technical area and the legal area. By involving users with their domain knowledge, the enterprises continuously increase their knowledge that eventually will lead to more usable and attractive products and services.

2 - How to create openness between enterprises and other stakeholders regarding legal documents such as IPR and patent?

From our experience this is one of the most challenging tasks within the Living Lab. It is important to create an open positive arena that is based on trust, both between different enterprises and between enterprises and researchers as well as users. Competence within the legal area is needed and should be available within the Living Lab. By being a university, this expertise is available to some extent but there is a need to create standard documents that easily could be adjusted to specific situations.

3 - How can the business model aspects be incorporated early on in the innovation process to involve all stakeholders?

To have a successful innovation that is being adopted by many, it is of vital importance to secure the business model early in the innovation process. In the health technology application area there is a problem due to a strict public procurement procedure to hospitals and to municipalities. However, by involving the end users, in this case elderly and their next of kin, other business model opportunities emerged by identifying products and services that they themselves would be willing to pay for. After each activity we have discussed possible business model opportunities with the enterprises to be able to follow up on this subject in forthcoming activities.

4 - How can small enterprises be stimulated to work more consumer oriented, to involve the end users in the innovation process?

From our experience the researchers in the Living Lab is of vital importance in the initiation of user involvement activities. The small enterprises in our Living Lab mostly consist of engineers without experiences of methods and tools for user involvement, and initially some did not see the benefits of such an involvement. A good way of starting is within research projects when the researchers can plan and carry through the activities with the users. By involving representatives from the enterprise to observe and later on be more active in these activities, the enterprises can get hands on experience of both the benefits of the outcome as well as how to carry out such an activity.

This paper adds to the existing literature on Living Labs by discussing experiences from Living Lab activities from a small enterprise perspective. The practical contribution is the discussion about how to address the four identified challenges.

Future research will address the Living Lab concept from a user as well as a researcher perspective.

References

1. European Commission (2009). SME definition. Available at: ttp://ec.europa.eu/enterprise/enterprise_policy/sme_definition/index_en.htm (Retrieved on March 20th, 2009).
2. Eriksson, M., Niitamo, V.P., and Kulkki, S. (2005). *State-of-the-Art in Utilizing Living Labs Approach to User-centric ICT innovation – a European approach*. Centre of

Distance Spanning Technology at Luleå University of Technology, Sweden, Nokia Oy, Centre for Knowledge and Innovation Research at Helsinki Scholl of Economics, Finland.

3. Thomke, S., and von Hippel, E. (2002). *Customers as Innovators: A New Way to Create Value. Harvard Business Review*, Vol. 80, No. 4, pp. pp. 74-81.
4. Chesbrough, H. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston: Harvard Business School Press.
5. von Hippel, E. (1988). *The Sources of Innovation*. NY: Oxford University Press.
6. Ballon, P., Pierson, J., and Delaere, S. (2005). Test and experimentation platforms for broadband innovation: examining European practice. In Conference Proceedings of 16th European Regional Conference by the International Telecommunications Society (ITS). Porto, Portugal.
7. Dearstyne, B. W. (2007). Blogs, Mashups, & Wikis Oh, My! *Information Management Journal*, Vol.41, No. 4, pp. 24-33.
8. Hempel, J. (2007). *Tapping the Wisdom of the Crowd*. Business Week Online, p.27.
9. European Network of Living Labs (ENoLL). Available at: http://www.openlivinglabs.eu/ (Retrieved on April 15th, 2009).
10. Koch, S. (2005). *ICT-based Home Healthcare*. VINNOVA report VR 2005:11.
11. Tushman, L.M., and Anderson, P. (1986). Technological Discontinues and Organizational Environments. *Administrative Science Quarterly*, Vol. 31, No. 3, pp 439-465.
12. Denning, P. J., and Dunham, R. (2006). Innovation as language action. *Communications of the ACM*, Vol. 49, No. 5, pp. 47-52.
13. Henderson, R.M., and Clark, K.B. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. *Administrative Science Quarterly*, Vol. 35, pp 9-30.
14. Van de Ven, A.H. (2005). Running in Packs to Develop Knowledge-Intensive Technologies. *MIS Quarterly*, Vol. 29, No. 2, pp 365-378.
15. Yoffie, D.B. (1997). Introduction: CHESS and Competing in the Age of Digital Covergence. In D.B. Yoffie (ed.) *Competing in the Age of Digital Convergence*. Harvard Business School Press, Boston, MA, pp. 11-35.
16. Teece, D.J. (1986). Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy. *Research Policy*, Vol. 15, pp 285-305.
17. West, J. (2007). *Value Capture and Value Networks in Open Source Vendor Strategies*. Proceedings of HICSS-40, 2007.
18. Chesbrough, H. (2006). Open Innovation: A New Paradigm for Understanding Industrial Innovation. In H. Chesbrough, W. Vanhaverbeke, and J. West (eds.), *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press, pp. 1-12.
19. Cohen, W.M., and Levinthal, D.A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly*, Vol. 35, No.1, pp 128-152.
20. Boland, R.J., Lyytinen, K., and Yoo, Y. (2007). Wakes of Innovation in Project Networks: The Case of Digital 3-D Representations in Architecture, Engineering, and Construction. Organization Science, Vol. 18, No. 4, pp 631-647.
21. CoreLabs. Available at: http://www.ami-communities.net/wiki/CORELABS (Retrieved April 28th, 2009).
22. Open Living Labs Sweden, OLLSE. Available at: http://www.cdt.ltu.se/~ZOLLSE (Retrieved April 13th, 2009)
23. Healtcare Technology Alliance. Available at: http://www.halsoteknik.com/home (Retrieved April 13th, 2009)