Living Labs as intermediary in open innovation: On the role of entrepreneurial support

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The following paper addresses the intermediary role of Living Labs in open innovation processes. This paper adds to the ongoing discussion on developing a generally accepted methodology for Living Lab implementation. It is argued that not only lead users and technology providers but also entrepreneurs play a vital role in the process of Living Lab implementation. We further compare the attributes of Living Labs to other intermediary institutions. Based on these results, we argue that Living Labs can be subdivided into Microlevel and Macrolevel Living Labs, each providing distinct approaches to fostering the commercialization process. We further argue that Macrolevel Living Labs should be concerned with establishing clustering effects on a large scale utilizing virtualization competences. Microlevel Living Labs in contrast should focus on entrepreneurial support in individual cases. An in depth case study from the health care industry illustrates this Microlevel Living Lab approach.

Keywords

Living Labs, User Driven Innovation, Open Innovation, Entrepreneurial role, Intermediary role, Technology Transfer Office, Business Incubator and Science Park.

A core challenge faced by companies today is developing new forms of management, in particular for innovation processes [Gausemeier, Fink 1999] which involve successful commercialisation of Intellectual Property (IP). In this context, it has recently been pointed out by researchers that the transition from research to innovation should be executed more efficiently – or rather more successfully. This is discussed in the context of individual companies as well as from an economic point of view [Santoro, Conte 2009]. User-centric development of technology based solutions and the early integration of potential investors and entrepreneurs seems to be highly relevant in this context [Følstad 2008].

As a concept addressing these crucial aspects, the Living Lab methodology has recently gained attention. However, a commonly accepted set of methods conceptualizing Living Lab implementation is still forming. It is expected that, with more and more cross-case analysis of documented Living Lab cases, such a commonly accepted set may be derived.

This paper contributes to this stream of research in two ways: First, the characteristics of Living Labs are compared to other science-industry intermediaries. Based on the derived contributions, Living Labs are subdivided into Microlevel and Macrolevel Living Labs. Second, an in-depth case study illustrates a Microlevel Living Lab implementation in the field of health care.

1. Living Labs as intermediaries in Open Innovation

In technology markets, intermediaries are seen as institutions providing tools, methods and services that foster knowledge transfer, thus strengthening the innovation process. This has also been discussed in the context of open innovation. Herein, intermediaries are seen as resources that reduce market imperfection due to their ability to exploit external technology in order to support the commercialization of a firm's internal ideas and to find new ways to commercialize technology [Chesbrough 2006]. Intermediaries such as Technology Transfer Offices (TTOs), Business Incubators (BIs), Science Parks (SPs), Technology Brokers and Consulting Companies have recently gained increasing attention, particularly in markets where 'openness' in the innovation process is a central issue [Reichwald, Piller 2007].

As actors and facilitators of open innovation, they conduct knowledge transfer for intra-industry and science-industry relations. Intermediaries related to the former are institutions providing services that support technology-based firms to find new stimuli of growth (e.g. finding new applications through technology utilization) [Lichtenthaler, Ernst 2007]. This external technology exploitation may determine the competitive situation of a firm [Teece 1998]. Intermediaries conducting science-industry transfer address environments where speed of innovation determines the success of a company. Intermediaries such as TTOs, BIs and SPs foster the commercialization of Intellectual Property (IP). Therefore, these science-industry intermediaries are perceived as essential for commercialization [Rothaermel et al. 2007].

Recent research has conceptualized the intermediary role of Living Labs in terms of science-industry relations into three key aspects [Baltes 2009] [Almiral, Wareham 2009]:

- **Lead User Integration**: Lead user integration is seen as a source of innovation, as they act as 'co-developers' [von Hippel 1998] [Lettl et al. 2006] [Franke et al. 2005]. Lead users are described as both, well-motivated to actively participate in innovative collaboration and qualified as they are a source of anticipative needs that can (only) be satisfied by innovative solutions. The integration of lead users in the early stages of the innovation process provides insight into tacit and latent needs and possible solutions. This requires an infrastructure, i.e. a physical environment that enables lead users to experiment with prototypes provided by technology providers to foster the creation of fast feedback loops. These feedback loops allow lead users to gain experiential knowledge and at the same time enable researchers to transform the tacit experiential knowledge into valuable solutions.
- **Technology Interaction**: In order to establish fast feedback loops within the Living Lab context, lead users need to be provided with technological prototypes. Technology providers, such as, e.g. academic institutions or technology companies, thus supply technological expertise and prototypes that should be modifiable based on lead user input. However, lead users are not necessarily engineers with sufficient technological expertise to implement technological solutions on their own. Therefore, Living Labs as an intermediary in this aspect should not only present solution prototypes but provide an environment that allows lead users to interact and modify solutions based on the specific user group's horizon.
- **Latency-free Stakeholder Access**: Based on the aspects discussed so far, Living Labs provide support in developing products tailored to serve the anticipative needs of lead users. However, lead users and technology providers do not generally have adequate resources and incentives to bring these solutions to market. This leads to the third aspect of the intermediary role of Living Labs: latency-free access to the various resources crucial for successful commercialization of technology. In order to achieve this, Living Labs have to maintain extended networks of stakeholders. Living Labs can mediate access to these resources based on a foundation of trust between Living Lab stakeholders based on past collaboration projects.

2 Science-Industry intermediary institutions in Open Innovation

A cross-comparison with other established intermediary approaches may contribute to elucidate the intermediary role of Living Labs. The intermediary institutions TTOs, BIs and SPs have been selected for such a comparison because their aim of closing the gap between research (intellectual property) and innovation (commercialization) is compatible with the concept of Living Labs.

2.1 Business Incubator: Service providers with network access

BI provide services that support the growth and survival of early stage ventures and foster the commercialization of innovation and the transfer of technology [Phillips 2002]. Their intermediary role can be classified twofold:

- **Incubation:** BIs provide internal and external services like marketing support, assistance in obtaining equity financing etc. as well as an infrastructure including office space and shared administration services, external service class among legal and patent services or accounting. The aim is to enable early stage ventures to focus on their business.
- **Networking:** Successful incubators provide access to a network of far flung tenants of incubation facilities and graduated firms. This encourages frequent business relations like e.g. buying/selling relations and exchange of know-how [Allen, Bazan 1990].

2.2 Science Park: Cluster builders enabling knowledge transfer

SPs foster the formation and growth of viable ventures focusing on technology based R&D. Science Parks are property based organisations managing know-how exchange from research institutions to and among park tenants. The intermediary role of Science Parks at its most basic level refers to the formation of clusters and knowledge transfer:

- **Cluster building:** SPs utilize and intensify clustering effects among tenants in order to enhance knowledge and technology transfer within the park as well as to foster the development and competitiveness of a region. In terms of cluster building, the basic role of SP management refers to marketing in order to attract firms fitting into a homogenous cluster and to activities facilitating joint projects among tenants [Bakouros et al. 2002].
- **Knowledge exchange:** Science Parks are generally associated with research institutions. One key aim of this symbiosis is the enhancement of science-industry knowledge transfer. More simply put, this is the transfer of know-how and people from research institutions to the park tenants [Phillimore 1999]. Thus, establishing a foundation of trust among park tenants and research institutions and providing an infrastructure enabling joint research and development projects as well as adequate information and communication technology is decisive [Lee,Win 2004] [Santoro, Gopalakrishnan 2001].

2.3 Technology Transfer Office: Exploiters of shadow options and protectors of IP

TTOs are generally linked to research institutions in order to foster technology diffusion. They facilitate the protection and commercialization of IP. The basic role of TTOs refers to:

- **Patenting and licensing:** The protection of IP with patents and to commercialize those IP-objects is one of the main focuses of TTOs [Colyvas et al. 2002]. This is generally achieved through licensing to commercializers (i.e. entrepreneurs, companies with incentives on commercialization) [Meseri, Maital 2001]. The licensing process starts by encouraging researchers and inventors to disclose their inventions - which is not a trivial mechanism and requires interventions of TTO management [Jensen et al. 2003]. Following the disclosure, the TTO is in charge of evaluating the economic potential. Upon receiving a positive evaluation, the institution is in charge of filing the patent and locating licensees.
- **Access to the business community:** In order to foster the commercialization process, it is decisive to bring IP-objects into the evoked set of potential customers. TTOs generally have access to a portfolio of IP-objects. It has been argued that TTOs with access to a sufficient number of such objects (critical mass) raise the quantity of successful transfer projects and thereby the reputation of the institution which in turn contributes to more projects [Pole 2001]. Hence, TTOs support research institutions lacking sufficient resources and reputation to commercialize their intellectual property [Debackere, Veugelers 2005].

	Business Incubator	Science Park	Technology Transfer Office	Living Labs
Aim/Target	Technology independent infrastructure enabling early stage ventures to focus on core business	Synergetic effects through cluster building to foster regional technology development	Exploiting shadow options and supporting research institutions to commercialize intellectual property	Technology-based solutions with user-centric development process, aiming for innovation-based market impact
Target Group	Early stage ventures with low budget and lacking business set-up	Viable ventures with strong focus on technology specific R&D	Researchers without incentives on intellectual property (IP) commercialization	Technology provider with incentives to exploit business models, users with latent needs
Infrastructure	1. Limited, low-budget, and standardized office space 2. Services (IT-administration...), equipment and extended infrastructure (cafeteria...) 3. Network of service providers (marketing agencies, coaching institutions...), and graduated tenants	1. Open infrastructure to encourage interaction among tenants 2. Settlement close to academic institutions 3. Shared technology-specific laboratories 4. Enabling common activities to foster community spirit 5. Network of SPs	1. Providing a repository of IP-objects 2. Presenting IP-objects such that potential commercializers (i.e. entrepreneurs, companies with necessary incentives on commercialization) are attracted 3. Social network with researchers and commercializers	1. Infrastructure enabling users interact with stimuli of technology and modification 2. Protected, technology specific test-bed for evaluation of innovative solutions 3. Network of stakeholders 4. Incubation environment supporting new business models connected to the technology itself
Core Responsibility	1. Efficiently managing administrative services 2. Maintaining a network of tenants and graduate tenants	1. Providing an attracting infrastructure 2. Motivating target ventures to settle down in the park 3. Supporting an open culture of know-how exchange within the park	1. Actively searching for valuable IP objects 2. Protecting and commercialization of IP-objects 3. Maintaining a network of commercializers 4. Creating a critical mass of IP-objects	1. Establishing a self-reinforcing tendency to collaboration projects 2. Motivating technology providers to share know-how and prototypes 3. Establishing technology provider-user exchange and interaction with community
Network elements ***Latency-free access:***	Investors, tenants and graduated firms	Tenants know-how, university know-how, human resources	Patenting and licensing offices	Technology provider, lead user, research community, specialized consultant
Facilitated access:	Specialized support services	Investors, tenants of other SPs, specialized support services	Potential commercializers, legal consultants	Academic institutions, specialized support services
Initiator	Regional public administration	Federal public administration	Academic institutions	Academic institutions, Technology-based companies
Performance Indicator	- Rate of survival (high) - Average growth rate (high) - Average incubation time (min)…	- Growth of the park (high) - Tenant retention (high)…	- Commercialization (high) - Size of repository (high) - Economic outcome (high)…	- Reputation in research community

Table 1: Attributes of science-industry intermediary institutions in Open Innovation

2.4 Living Lab attributes compared to other science-industry intermediary institutions in terms of Open Innovation

The common aim of the intermediary institutions is to enhance the commercialization of IP from a science-industry perspective. The summary presented above illustrates the different approaches and distinctions of these intermediaries. They actively support the commercialization process throughout its different phases.

TTOs foster the commercialization process in middle to later phases (disclosing, protecting and commercializing IP). Value adding is rather based on direct commercialization of IP-objects. In order to access valuable IP-objects (tradable know-how), TTOs actively search amongst cited research. We argue that Living Labs, with latency free access to the research community, should also be capable of conducting such active searches.

Living Labs foster the commercialization process in an early phase (research and development) with decreasing intensity in later phases (commercialization by entrepreneurs). The infrastructure of the Living Lab is implemented in a manner that enables user-centric solution development. In order to enhance the later stages of the commercialization process, Living Labs provide access to partners with decisive resources and specialized support services.

In contrast, BIs support the later phases of the commercialization process. They provide an infrastructure to enable early stage ventures to establish their business. It has been noted that providing at a minimum office space and services such as administration and specialized support is crucial for early stage ventures [Mian 1996].

However, Living Labs are comparable to BIs because they provide access to similar support services. Research on BI provides evidence that particularly infrastructure (e.g. low budget office space) is required to enable adequate support for early stage ventures (e.g. entrepreneurs). Therefore, we argue that a Living Lab providing low cost office space in addition to support services is able to enhance the later phases of the commercialization process to the same extent as BIs. Furthermore, the Living Lab is the only intermediary providing latency-free access (ad-hoc) to and for technology providers to (a) lead users, (b) the research community and (c) necessary stakeholders with decisive resources for commercializing IP.

Therefore we argue that Living Labs, by providing an incubation environment and latency-free stakeholder access, are able to enhance all phases of the commercialization process with adequate intensity based on individual business cases. Such an approach contributes to value creation from a micro-economic perspective because the commercialization process is supported on a small scale (individual commercializers). Therefore, we introduce the term "Microlevel Living Lab".

The value adding process in SPs is completely different. SPs aim to create synergetic effects through technology specific cluster building and thereby foster the pace and direction of technology development. Effects through synergetic innovation processes are driven by the level of shared tacit knowledge [Cavusgil et al. 2003]. This knowledge is exchanged via formal or informal communication. The communication processes in a SP are determined by physical interaction among tenants. However, this type of communication does not necessarily depend on physical interaction but can be replaced through decentralized virtual activities that cause the physical boundaries of a SP to vanish [Passiante 2002].

Living Labs are specialized on virtual collaboration projects requiring continuous exchange of knowledge. Therefore, Living Labs may create clustering effects by replacing physical through virtual interaction. The disintegration of geographical boundaries enable cluster building among virtual organisations and contribute to value creation on a large scale (collective) basis. Therefore, we call this type of Living Labs “Macrolevel Living Labs”. Because Macrolevel Living Labs are not focused on the needs of individual commercializers, they do not provide an infrastructure in terms of Microlevel Living Labs. Their focus relies rather on implementing clustering effects through virtualization among network tenants.

Because Microlevel Living Labs foster the commercialisation process on a small scale and Macrolevel Living Labs on a large scale, different approaches are required. Therefore, we conclude that, with respect to methodology implementation, Living Labs should be categorized in Macrolevel and Microlevel Living Labs. The following case-study illustrates such a Microlevel Living Lab implementation.

3 Case Study: COLIQUIO – knowledge exchange among medical experts

The case study presented here originates in a project based on recent research activities within the eArchitecture Lab (Lake Constance University) which focuses on knowledge exchange among experts. This institution is a part of CeTIM’s Knowledge Worker Living Lab (KWLL) and a member of the ENoLL.

The case-study provides insights into the intermediary role of Living Labs from a rather microlevel perspective. It illustrates a Living Lab implementation focussed on early stage entrepreneurial support. The case-study builds on recent research results focused on knowledge-exchange among experts.

Based on a joint R&D project with a technology provider, prototypes for knowledge exchange among experts were implemented in the eArchitecture Lab. These prototypes needed to be further developed and evaluated by a specific target group. Therefore, qualification criteria of expert groups were defined and tested among various industry structures. The results indicated that the expert group ‘physician’ in the healthcare industry was particularly suitable.

In a second stage, lead users from the target group ‘physician’ were integrated into the development process. Access to these lead users was established through the network of the Living Lab[1]. Lead users, modifying the prototypic solutions according to their specific needs within the eArchitecture Lab, contributed to the development and evaluation of user-adequate prototypes. Furthermore, ideas were developed to identify typical business processes within the industry in which the solutions would generate added value.

The analysis of the industry structure, stakeholders and economic structure in the German healthcare industry provided evidence that the solution addressed a market segment with sufficient economic potential. Two of the researchers involved in the project subsequently formed the early stage venture (COLIQUIO GmbH) which was accompanied with

[1] This network is organized as a community, Community of Practice for Strategic Management Architectures (CoPS)

incubation (low budget office space and administration services) within the eArchitecture Lab.

From a technical perspective, COLIQUIO provided a web-based application. Physicians utilized the closed ‘Forum’ limited to this group of experts for a relevance-based knowledge exchange. Furthermore, the platform provided a quality management application in terms of a Critical Incident Reporting Systems (CIRS) for institutions like e.g. hospitals. This integration into the business processes of the healthcare system was primarily determined by contributions from the lead-users integrated in the development process.

On a functional level, contributions on the platform were displayed according to an individual relevance filter including factors like e.g. professional profile, professional interests, timeliness etc. Thus, only contributions of high individual ‘relevance’ to the user were displayed. Hence, the request of lead users to combine a minimum time investment with a maximum level of simplicity in terms of usability was implemented.

The application had its go-live in July 2007. The most outstanding result of the lead-user integration was the user interface. Users appreciated the ease of use of the interface and its ability to filter contributions based on individual relevance, thus providing a reduction in search time. Furthermore, lead users collaborating with the technology provider, contributed to the establishment of a sustainable business model applying the developed solution (COLIQUIO) to potential business processes in the healthcare industry like e.g. hospitals (CIRS) and the pharmaceutical industry (market research). Due to high competition in the healthcare industry, low latency referring to partner (technology provider, lead user) integration was decisive. This was insured through the integration of partners out of the CoPS-network. Former project experience, collaborations and close relations with those partners contributed to the formation of a foundation of trust ensuring their latency-free integration.

In the first stage of the commercialization process, the main competitor outperformed COLIQUIO in terms of user acquisition. The better performance can be primarily attributed to the competitor’s direct marketing approach. Although, customer surveys confirmed the higher usability of COLIQUIO, this could not compensate for the established marketing effect. Moreover, it became apparent that the developmental edge based on the lead user integration was not sustainable: nine months after the go-live of COLIQUIO, the main competitor presented a virtually identical user-interface.

However, non-transparent processes like the relevance filters and the acceptance of COLQIUIO in the relevant social context could not be replicated. Integrated lead-users had an intrinsic motivation to actively advocate the solution in their community which increased the level of market penetration significantly. The integration of COLIQUIO in the health community contributed to further cooperation projects with hospitals and testimonials by prominent users. Eventually, COLIQUIO was awarded the ‘Special Prize Innovation eHealth 2008’.

In contrast, the growth rate of the competitor, in terms of user quantity and activity dropped significantly after a 12 month period. After 2 years in the market, COLQUIO can therefore be regarded as a successful innovation: with more than 21.000 active users and high user activity, COLIQUIO is a broadly established tool[2]. Furthermore, the business model proved

[2] As of 07/2009

its sustainability from an economic point of view: due to its lack of direct marketing efforts, low acquisition costs per user could be achieved. A venture capitalist (outside the CoPS network) provided COLIQUIO with a seven digit investment. Therefore, successful de-incubation can be concluded.

4 Discussion and Conclusions

Active and regular involvement of partners (physicians, technology providers) in projects within the eArchitecture Lab contributed to build a foundation of trust among these partners. Trust is the premise of latency-free access to partners crucial for the commercialization process. Due to the restrictions concerning the number of projects taking place in the eArchitecture Lab, it is necessary to limit the number of partners within the CoPS network in order to enable frequent integration. Moreover, the restricted size of the network implies that a similar technological focus of partners and projects is required. Hence, Living Labs, with its limited network size and specific technological focus in continuous projects, may function as a trust catalyst between partners.

Besides the well-known effects of early user involvement, the case-study shows that Microlevel Living Lab may also support the later phases of the commercialization process. The lead users, involved early on, and technology providers do not necessarily have incentives to take on commercialization of solutions. Therefore, commercializers, like entrepreneurs with incentives from commercialization, are decisive. The focus of the academic environment (Lake Constance University), in which the eArchitecture Lab is integrated, is on entrepreneurship. Hence, besides partners, potential entrepreneurs (students and graduates) are frequently integrated in continuous projects.

However, the potential entrepreneurs may be discouraged by high risk perception. In the case-study, risk perception could be reduced to a level where two involved researchers (students) decided to start the COLIQUIO venture. However, COLIQUIO was not a viable organisation due to its lack of capital resources. Therefore, the eArchitecture Lab provided an incubation environment in a manner that enabled the two entrepreneurs to focus on their core business. Early stage growth supported by the Microlevel Living Lab approach led ultimately to successful de-incubation.

In this paper we have investigated the intermediary role of Living Labs and have compared this approach to other intermediary institutions. Our results indicate that Living Labs may be classified into two groups:

- Macrolevel Living Labs which are more focussed on establishing clustering effects through virtual knowledge exchange in a homogenous (in terms of technology focus) group of technology based firms (cluster). Therefore, Macrolevel Living Labs need to provide web-based instruments (e.g. Skype, Exchange Platform in terms of BA-Rooms or Peer-to-Peer) and take on a moderating role to coordinate partner collaboration with the aim of establishing clustering effects (e.g. synergies) and increasing the pace of innovation.
- Microlevel Living Labs, which are rather concerned about individual business building. They provide a physical infrastructure adjusted to the specific needs of early stage ventures (e.g. low budget office space) and an environment where lead-users can modify prototypes according to their anticipated needs. Therefore,

> Microlevel Living Labs provide latency-free access to technology providers, research community and specialized consultants. Microlevel Living Labs are required to maintain a network of partners within these segments and establish a foundation of trust amongst them. The latter is realized through regularly involving partners in continuous projects. Therefore, projects should have a complementary technological focus with the partners and their number should be limited.

The concept of a Microlevel Living Lab is illustrated in the case-study. The case shows that Microlevel Living Labs are able to foster all phases of the commercialization process, from basic research and development to the ultimate commercialization of solutions. Thus, we claim that the intermediary role of Microlevel Living Labs is fundamental for transforming good solutions into a good business.

There are however some limitations of this study. First, examinations are based on a specific technology designed for knowledge interaction among experts. Therefore, our results may vary for technologies deviating from this technology specific context. Second, the case study focuses on a Microlevel Living Lab which is rather concerned about individual value creation of early stage ventures. Effects such as synergies and increased pace of innovation derived from collective value creation through virtual cluster building and knowledge exchange were not focussed on in this study.

Nonetheless, we argue that Living Labs provide the necessary infrastructure to establish clustering effects without any geographical restrictions. This approach of Living Lab seems promising. However, more empirical evidence is required for validation. Therefore, the role of Living Labs should be the subject of further research.

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