

The Evolution of Living Labs – Propositions for Improved Design and Further Research

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Abstract This paper presents an Airport Living Lab in Stockholm as a focal point for discussing how the Living Lab concept can be extended and understood. Although Living Labs have been found to have potential for driving innovation through collaboration, more research is necessary to find tangible ways of organizing this kind of collaboration. The paper is explorative and empirically induced from an ongoing development and practical implementation of a Living Lab at Stockholm-Arlanda Airport - Sweden's largest airport situated outside Stockholm. This Airport Living Lab involves a number of large industrial and academic stakeholders aiming at ensuring multi-organizational innovation delivery. In this paper we put special emphasis on investigating how a Living Lab can become a self-sustaining entity that cost-effectively could benefit its stakeholders. Of special interest is how a Living Lab may create conditions for user-oriented innovations through multi-organizational collaboration also involving competing and/or complementary organizations which would not necessarily take place otherwise. This is discussed in terms of governance structures and support processes. Congruent with the explorative aim of the paper it ends up in a discussion about ten propositions that should be on the agenda of research and implementation for Living Lab founders in the coming years.

Keywords living labs, open innovation, governance structure, support process, airports

1 Introduction

An early proponent and possible founder of the concept of a Living Lab was a group of researchers led by Professor William Mitchell at MIT School of Architecture and Planning and MIT Media Lab working on among other things technology in smart cities and homes. If so, the Living Lab concept has travelled far from its origin and is now used for innovation in a wide array of settings including tourism, advertising and marketing and ICT-services.

Still, a user-centric research methodology is a hallmark for Living Labs. Sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts¹ still provides the core and strength in the concept and fits well into the trend of open innovation.

One could argue that a Living Lab is neither a traditional research lab, nor a test-bed^{2,3,4}, but what is it then? A typical general description and aim of current Living Labs in Europe is an entity that “directly involves end users into development of new applications and services by providing bilateral access, on the one hand the consumer to the new and emerging services, and on the other, the developing enterprises to the consumer feedback. This integrates the consumer into the development process, with the potential to ensure reliable market evaluation, resulting in a significant reduction of technology and business risks.”⁵

Co-operations between industry and academia as well as with the government e.g. in the form of local municipalities implies that Living Labs typically operate in the domain of public-private partnerships often as part of regional, national and EU-sponsored innovation programs.

The concept of Living Lab also seems to have resonated most strongly in already existing so called test-beds for ICT products and services where user-involvement was already high on the agenda.³ The existing Living Labs in the ICT area are now spread all over Europe e.g. Austria, Spain, Germany, Sweden, Portugal, Finland.⁶

Looking into the progress of the recent Living Labs, much has been accomplished in line with what is encapsulated in the term Living Lab. However, well aware of that the concept of Living Lab still is tentative and in progress, it has become a strong theme also in the seventh framework program 2007-2013 of EU, an interest which is indicated by the pan-European network “The European Network of Living Labs” today consisting of 51 members.⁷

Still, in discussions with other Living Labs and based on our own work with the design of the

Airport Living Lab in Sweden, we have isolated certain question-marks regarding how this concept should be taken to the next level in terms of economical sustainability, legitimacy, attractiveness and value-creation for already involved and future relevant private as well as public partners.

More specifically our main observations of question-marks for the current state of the European Living Labs, here functioning as hypotheses, can be summarized with:

- A lack of governance structures which may cause unnecessary friction in multi-organizational collaboration further down the road.

- Much focus on end-customer validation in testing and experimentation, but not using the full potential of user collaboration in other stages of the innovation process. Most remarkably not enough attention to the “fuzzy front end” – i.e. the mechanisms that brings in new ideas into the Living Lab.

- Reliance on government financing, i.e. tax-payers, and not enough attention on cost-effectiveness in the start-up and operation of the Living Lab which may in turn hinder sustainable future financing.

Although we are not in the place to give any definite answers, we are in the Airport Living Lab project ready to suggest some research propositions that will be critical for the Living Lab movement in the coming years.

1.1 The Empirical Setting - Airport Living Lab of Stockholm

The discussions presented in this paper are the results from an ongoing research project on the design and setup of a Living Lab. In the spring of 2007 a consortium was put together with the purpose of applying for funding from the Swedish Governmental Agency for Innovation Systems (VINNOVA) to establish an airport-oriented Living Lab at Stockholm-Arlanda Airport. The consortium was granted funding and began an establishment project in August 2007 to set up the Living Lab within two years.

The consortium consisted of five parties: 1.) LfV - the Swedish Civil Aviation Authority - the governmental authority responsible for managing Arlanda airport, 2.) SAS Ground Services - the ground handling division within Scandinavian Airlines that is the main ground handling company at the airport, 3.) CSC (Computer Sciences Corporation) – a global IT-consulting, systems integration and outsourcing company which participates with its Airline Innovation Program and experience from innovating airlines and airport environments, 4.) NITA - the National IT-user Centre at Uppsala University - centre aiming at organizing research and contributing to the Swedish national debate on user-friendliness and user-oriented IT-development, and 5.) CIC - Center for Information and Communication Research at the Stockholm School of Economics - information and competence center to coordinate and pursue business research on the use of communications and information technology.

The project conducted its initiating kickoff in August 2007 and has planned to launch the Living Lab in September 2009. The project has a budget of approx. 300 000 € with half being financed by VINNOVA and the other half being financed by the commercial partners (LfV, SAS and CSC). During the summer of 2008 the project is developing and testing analytical frameworks for idea management in cross-organizational open innovation environments. Starting in the fall of 2008 a more than half year-long pilot will be conducted testing all parts of the open innovation framework developed within the project.

In the process of bringing stakeholders together and preparing for the launch of the Living Lab, there was a need to conceptualize the different functions that would have to be in place before the Living Lab was launched to the public. The observations throughout this project gave rise to a whole series of questions which has been formulated as propositions. The propositions and modeling presented in this paper are the first, largely conceptual results from the project.

In the propositions generation we have employed a mix of an exploratory and extending-coupling approaches^{8,9} where our explorative observations made during the work with the design of the Airport Living Lab have been coupled to existing research findings and then formulated as propositions. We assessed that these propositions had a combination of importance for the success of a Living Lab and that had not been given enough attention in the real world applications of existing Living Labs in Europe. In further research these propositions will be followed up throughout the project and used to generate testable hypothesis.

1.2 Theoretical Background

The researcher interested in a Living Lab environment must have an open mind in that the phenomena transcends many research disciplines - innovation management, user-centered design, entrepreneurship, cognitive science, context awareness, human-computer interaction, information science, social computing, to name a few.

Having said this, arguably the main paradigm underlying the processes in and rationale for the Living Lab concept - at least as it has developed in Europe - comes from theories of open

innovation^{10,11,12} and the shift from a closed to an open innovation paradigm. West & Gallagher¹³ define open innovation as systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels.

Innovation in itself has been a key ingredient in corporate as well as public strategy for some time, even if its importance at least on the corporate agenda seems to wane in times of high economic growth where more financial muscle can be used for securing future business opportunities. It also lies in the nature of innovation per se to transcend many academic disciplines (for an integrative review of different research traditions, see the work of Hauser, Tellis & Griffin¹⁴) and definitions in literature are numerous. In this paper we employ the broad definition of innovation as the total set of activities leading to the introduction of something new, resulting in strengthening the defendable competitive advantage of a company¹⁵ stressing that we are looking into activities that result in the invention and exploitation¹⁶ of a wide array of products, services, and processes, as well as more abstract concepts like business models, that are new to an organization.

One main underlying assumption in the Living Lab concept is in fact that (especially large) organizations only use a small portion of their stakeholders in their innovation processes. In line with this we argue that two facets of open innovation, both related to novel ways of thinking about collaboration in the innovation process, are especially relevant to the Living Lab concept: user-collaboration and inter-organizational collaboration.

User involvement is a prevailing idea in the open innovation paradigm and long prior to this theorizing; von Hippel^{17,18} advocated using customers as a source of new-product solutions and ideas. It has been argued that the users (here in the meaning of end-customers or consumers) are in fact a more productive source for innovation than the producers.¹⁹ For the Living Lab the rationale is that user involvement, as well as the potential sheer volume of input from a larger number of stakeholders, can bring about and improve innovation. Also the most prevalent common characteristics of existing European initiatives involving Living Labs include end-user involvement, openness, and cooperation between industry and academia.^{3,1}

For the sake of balance in the light of this drive for involvement of large groups of users it should be mentioned that there are certainly examples from literature of when experts dedicated to a certain issue provide better assessments than a relatively uninformed community that is acting in self-interest making them biased.²⁰ But again, it is arguably this self-interest, when mediated through larger groups, that makes the voice of the crowds so interesting in innovation and that has been described as crowdsourcing.²¹ It should be pointed out that so called experts also can be biased to their own agenda such as securing research funds or neglecting innovation coming from external sources sometimes described as a not-invented-here syndrome.²²

The case for using multi-organizational collaboration to strengthen innovative activities is strong. Multi-organizational collaboration is suggested as beneficial for the innovative performance of firms, which has been supported by large-scale empirical evidence.²³ Faems, Van Looy & Debackere²³ draw from literature to list some of the reasons including access to complementary assets, encouragement of transfers of tacit and codified knowledge resulting in mobilization of resources that would otherwise be hard to mobilize or develop, and spreading of costs for research and development among parties leading to risk-reductions.

O'Connor, Colarelli & Ayers²⁴ point out that large, established, sometimes stagnant companies have throughout the years tried to and failed to internally organize corporate venturing organizations, incubators, or "renewal engines" that aims for building the new really big, growth opportunities. These constructions have not lasted very long and arguably few have had real impact on their companies' growth. Living Labs are proposed to become a possible new focal point for multi-organizational collaboration on innovation and potentially also opening up other business opportunities with involved firms. The discussions and decision that organizations have to face in line with the Living Lab participation may increase the attention on innovation also inside the organization. In the open innovation paradigm firms leverage external knowledge. This allows them to focus any internal R&D capability on unique internal knowledge that is not available externally. The Living Lab is arguably supposed to efficiently contribute to this external knowledge by acting as a supplement to the internal innovative activities of organizations.^{25,26}

2 The Airport Living Lab Analytical Framework - Propositions for Further Design and Research

We use the proposed analytical framework of the Airport Living Lab, not only as a conceptual way of describing the forthcoming activities and potential benefits with the Living Lab, but also as a way of focusing and organizing the project resources. In this way the analytical framework is a work map of the Living Lab under construction. In the following we will walk through the parts of this analytical framework with the purpose of highlighting some propositions we posit as valuable to examine closer throughout the project. In this paper we are limiting the discussion to the stages in the innovation process leading to commercialization.

We are proposing a framework consisting of three levels illustrated in Figure 1 as a simplified way of describing the activities in an evolved Living Lab. The core of a conceptual description of the Living Lab lies in the innovation process. Previous literature has proposed possible stages of this innovation process moving from idea generation to implementation.²⁷ It should be pointed out that while this simplified linear depiction of the innovation process serves the purpose of discussion well, in reality innovation plays out in more circular iterative patterns.²⁸

The top layer of the framework (Operational level) deals with the actual open innovation process and flow of ideas from idea generation to commercialization. Problems and solutions are managed in the first module in this layer ending in a screening mechanism or trigger which decides when a problem or solution will transcend in the Business Evaluation module followed by Experimentation and Commercialization. Two parallel processes moves along these modules as the foundation of the Living Lab: in the second layer open innovation support processes (Functional level) and in the third layer Living Lab governance processes (Strategic Level).

In the following we discuss these modules and processes in further detail with the aim at putting forward our propositions for further research.

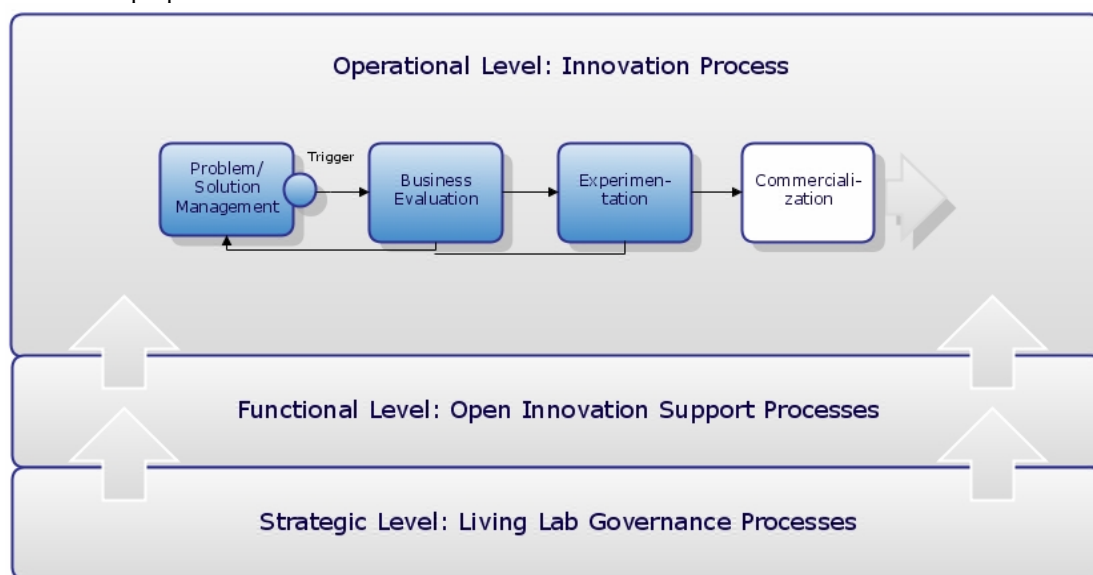


Figure 1 Analytical framework of the living lab open innovation levels

2.1 Problem/Solution Management

The purpose of this initial stage is to bring in problems and solutions into the Living Lab as well as match and start evaluating these problems and solutions with the help of users. This is where the raw material is supplied to the Living Lab innovation process and possibly the most important stage of the process. With problems/solution management we mean the whole set of e.g. routines and tools including access channels for users into the Innovation process. In practice submissions (e.g. a problem statement) are made by users (e.g. a member of the airport staff) through a certain channel (e.g. an on-line form) which is handled and stored by the Living Lab (e.g. a specific database). Choice and construction of these channels so to secure that submission is accessible to relevant user groups at the right time is a whole challenge in itself.

Still, the area of “innovation process initiation” or “initiative emergence” is under-researched

where more attention has been put on later stages than the “fuzzy front end” of the innovation process also in practice.^{29,30} In terms of traditional product portfolio management, if this fuzzy front end does not attract and manage enough different input from contributors, the innovation process of the Living Lab will have problems achieving an adequate risk-return spread.³¹ The propositions related to this stage are intended to strengthen this fuzzy front end.

It is sometimes said that great ideas come from unexpected places. One place that should not be so unexpected is from the company itself – and potentially from all employees of a company. We argue that the stakeholder called “user” in a Living Lab not should be confined to the end-customers or consumers. Previous studies have indicated that especially large organizations under-utilize the creative potential of its own staff.³²

The reasons for this has been stated e.g. as rigid and hierarchical structures, corporate culture, unclear incentives to innovate among the staff, focus on “elite” researchers and departments leaving other staff outside the innovation process. The Living Lab, existing as an external entity to the walled garden of the participating partners’ organizations, has the potential to neutralize these adverse effects on the participation of larger numbers of partner organizations’ staff.

In the Arlanda airport environment there are around 15 000 employees working and 18 million passengers passing by each year.³³ Actors present involve 80 operating airlines, 6 handling agents, as well as 128 commercial companies providing restaurants and shops. There is a clear potential in activation of these resources for innovation. In line with this, we plan to actively include and welcome these staff of the partner organizations of the Airport Living Lab into the label of “users”. If the Living Lab help answering questions from staff like “Where do I go with my ideas?”, “Will my employer take my suggestions seriously?”, “Am I the only one having this problem (that needs a solution)?” we have made a contribution. This leads down into the first proposition.

PROPOSITION 1: Activation of not only customers but also other relevant user groups like staff of Living Lab partners will increase input of ideas into the innovation process.

A crucial question for the sustainability of any Living Lab is how to attract a high quantity of submitted problems and solutions entering the innovation process i.e. how to motivate or give incentives to the real world participation. In order to reach this target a proper understanding of the users’ incentives to participate is necessary.

A basic differentiation of incentives is in intrinsic sourcing from internal influences and extrinsic sourcing from external influences, where the extrinsic in turn can be divided into material and non-material incentives.^{34,29} Research has shown that measures to boost intrinsic motivation produce a stronger effect for the generation of initiatives contrary to extrinsic motivators.³⁵

Research on the successful Open Source software community may give some insight and it is for us to assess what can be learned and transferred from innovation in the Open Source software community to a Living Lab at an airport.^{36,37,38,13} In the virtual Open Source environment large numbers of highly skilled software developers (and users) dedicate considerable amounts of time and effort to the creation, expansion, and ongoing maintenance of “free” products and services. Lakhani and Wolf³⁸ report on four distinct clusters (approximately equal in size) of response types when asking about what motives them to contribute: 1. Those that expressed enjoyment and learning as primary motivators, 2. Those that simply need the code to satisfy non-work-related user needs, 3. Those that have work-related needs and career concerns, 4. Those that feel an obligation to the community and believe that software should be free/open. In summary self-fulfillment and learning, joy of everyday innovation, career progress, and call of duty/part of a bigger whole has proved to work as strong motivators for user contribution to innovation. It seems plausible that some or all of these factors also should be activated in a Living Lab.

Whether incentives for collaboration on innovation includes personal fulfillment to solve everyday problems relating to ones own situation, financial gains, and career progress what incentives that are relevant to a specific user group will vary in between groups. In order to maximize the number of submissions as many relevant incentives as possible related to the users should be taken in consideration. While research has indicated that intrinsic incentives has been more effective in stimulating generation of new ideas, we are interested in testing a mix of several types in the Airport Living Lab setting.

PROPOSITION 2: A Living Lab should aim for providing several user incentives relevant to a specific user group in that it will increase the quantity of submitted problems and solutions from these users.

In the initial stage of the innovation process we have chosen to distinguish between problems and solutions as separate entities. Arguably there is no need to restrict the input from users to perceived problems and it is important to be able to handle both sides of a suggestion from user. If the Living Lab

also urges users to submit possible solutions, the Living Lab better utilizes the innovativeness among users. It should not be taken for granted that individual users can provide both the problem and its solution, but in fact the Living Lab in collaboration with its users can create value by acting as an active matchmaker between submitted problems and solutions. Our early findings with construction of channels and tools to accommodate submissions from users indicate that submission of problems and solutions can have different rationale and certainly could be done by different individuals. This insight should have an impact e.g. on the design of the electronic collaboration tools, incentive systems, feedback loops back to submitting users and so on.

PROPOSITION 3: A Living Lab should be designed to manage both problem and solution submissions from users.

Having both problems and solutions entering the innovation process from outside will provide an opportunity to match these problems and solutions as a crucial part of the innovation process. This matching activity can be performed by several stakeholders including the users themselves, eventual human operators working for the Living Lab and by automated processes driven by algorithms such as key word search. This theoretical foundation for this rationale has been described in the Garbage Can Model of Cohen, March & Olsen³⁹ suggesting that organizations tend to produce many "solutions" which are discarded due to a lack of appropriate problems. However problems may eventually arise for which a search of the "garbage can" might yield fitting solutions. The implication of the "garbage can model approach" in the Living Lab is also that problems and solutions that have entered the innovation process not should be discarded but stored and constantly monitored for possible future matching. This imposes suggestions for necessary storage functions when designing the electronic tools supporting the flow of problems/solutions.

PROPOSITION 4: Output of innovations from the Living Lab will increase if the number of successful matches between problems and solutions are done.

2.2 Trigger

In the next stage of the analytical framework we propose the introduction of a trigger that will cost-effectively help screen and select problems/solutions that will progress further into the innovation process.

Given a large user base active in submitting problems and solution a substantial number of information will have to be managed. To keep this management cost-effective and still allowing large quantities of problems and solutions into the system, computing power working a set of predefined criteria has the potential to be a helpful tool. These algorithms are designed to handle at least two groups of tasks: matching and screening. Both problems and solutions to these problems as well as stand-alone problems and solutions will enter the innovation process. A grouping of these submissions at an early stage has several benefits. As discussed previously a solution linked to a problem has potentially more value than a stand-alone solution in the sense that a reality check has already been made whether a solution is mirrored in a perceived problem, i.e. immediately can create user value. In line with this a matching can help assess the potential of a problem or solution.

The label trigger also includes a computer algorithm or a set of computer algorithms that signals if and when a problem/solution should progress into the next stage of the innovation process. This algorithm would potentially also be involved in matching problems and solutions that have not already been matched by users.

A basic automated matching and screening provides an alert for problems/solutions and also provides a rudimentary preparation or formatting for later evaluation by a human operator. In its simplest form e.g. an automated keyword search combined with a counter can signal that a certain keyword has reached a critical level, i.e. a problem/solution comes up frequently in user submissions. Systems for advanced keyword search also in complex circumstances with text in different formats are improving.^{40,41} A more refined system also involves a user evaluation where users are given the opportunity to promote or demote submitted problems/solutions. Examples of a such a deployment is already in place and used by e.g. Dell.⁴²

PROPOSITION 5: Using algorithms and computer software to match, screen, and select problems/solutions against predefined criteria will increase cost-effectiveness in the Living Lab innovation process.

2.3 Business Evaluation

Larger volumes of ideas as input do not by itself necessarily lead to better innovation. Ideas have to be evaluated which takes considerable effort and discipline. In this stage of the analytical framework a problem/solution has fulfilled the set criteria and the trigger mechanism passes problem/solution on to a

business evaluation.

We posit that the innovation process inside a Living Lab has lessons to learn from the company development process overall successfully utilized by venture capital (VC) firms around the world.⁴³ The venture capital industry has managed to provide value through cost-effective processes for attracting, screening and selection, business evaluation, and promotion of prospective business opportunities. The creative process of innovation tends to generate complexity in organizations as in deals and venture capitalists have worked out a set of practices to reduce this complexity. One of the more obvious services for VC firms perform, and are paid for, is the sourcing and evaluation of investment opportunities.

These professional investors, who invest relatively large sums of funds as managers, on behalf of others, has developed a disciplined process of attracting ideas, cost-effectively screening and selecting ideas with market potential and then grooming and supporting these ideas aiming at commercialization. In order to succeed in such a high-risk innovation activity a set of processes, activities and roles has been set up.

One such activity is the due diligence where one or a handful skilled individuals prepare background research and financial calculations on the future commercial potential presented in a semi-formalized format. This analysis can be performed to various levels of detail but represents a semi-formalized business evaluation analysis of anything from a loose idea to a multi-billion company. The point is that relevant decision makers have at least a vague idea and some expectations on this process and protests if a prospective idea is not put under structured scrutiny very early in the process. The due diligence in itself is boiled down into a document generally by the role of the Investment manager that later answers to an investment committee or the VC firm's partner meeting. This meeting is another example of an activity where the ideally well-documented proposition is scrutinized and decisions are taken to move on and deploy more resources.

In the Airport Living Lab we are suggesting that the trigger send an alert to a human operator to start this business evaluation. The human operator denoted Investment Manager, evaluates business potential as well as strategic fit with Living Lab partner organizations for the problem/solution. This investment professional has the mandate to gather information and with the help of experts involved inside or outside the Living Lab provide a sound business evaluation of user submissions and formulates a business proposition. In the case of the Living Lab an investment committee would consist of partners from each participating organization.

The role of the Investment Manager should act as a neutral party and perform the parts of business evaluation that users will have a hard time doing because of information asymmetries and Living Lab partners may be ill-fitted to do because of bias, e.g. assessing strategic fit for an idea or assessing the financial impact of an idea on the whole airport environment. The criteria the Investment manager will use to assess submissions are governed through the governance processes in place. These criteria are crucial and must be transparent. Criteria can focus on e.g. EBITDA, customer experience, speed to market, internal cost reduction or brand investment and this focus must be agreed on and clear to all Living Lab partners.

Let us here emphasize the chosen order of the steps in the innovation process where: 1. User evaluation is an integrated part of the problem/solution management and that 2. Business evaluation comes up early in the process as the next step. In e.g. the innovation process described by Desouza et al²⁷ a thorough evaluation is performed later, and at times, too late. Typically this business evaluation is performed as part of the Commercialization stage where the organization should look to its customers to verify that the innovation actually solves their problems and then analyze the costs and benefits of rolling out the innovation. This is in stark contrast to the processes in the venture capital industry where thorough business evaluation is performed early on.

In order for a Living Lab to create sustainability, its partners must feel that it gives them the best return on their innovation investments. With this setup in this stage the innovation process starts to draw considerably more resources. It should be noted that the stage of business evaluation comes relatively early in the innovation process. This can be motivated in terms of cost-effectiveness where managing a potential innovation increases in cost for each step it takes through the process. Making a thorough investigation of not only perceived value by users but also commercial potential as well as the strategic fit with participating organizations early in the process will save money in the long run.

PROPOSITION 6: Performing a thorough and neutral business evaluation early in the innovation process provides the most efficient usage of limited resources of the Living Lab.

One of the Living Lab concept's strength has been presented as involvement of the entire value

chain in a specific setting where all aspects of an application can be analyzed and experimented without favoring any specific technology or business model.¹ We agree with this but also like to stress that this neutrality not can be allowed to result in lax commitment to promising propositions from involved parties.

Research has acknowledged the strength in having idea stewards, champions, or ambassadors being responsible for pushing an idea forward. Innovation requires the fulfillment of specific key roles that guide a new idea through the innovation process.⁴⁴ One of these critical roles is that of the idea champion or idea sponsor^{45,46} usually described as a management-level person who recognizes the usefulness of the idea and lends authority and resources to the innovation throughout its development and implementation. It is, put simply, not enough to generate good ideas, but also to manage to keep them alive throughout the innovation process.

In practice in the Living Lab as part of the Investment Manager's assessment can also help linking business propositions to one or several specific owners that are most relevant to support and later reap the benefits of commercialization. The owner can be a participating partner or number of partners that see indications of potential in a problem/solution and takes on the responsibility to support the future progress of this problem/solution in the innovation process.

PROPOSITION 7: Linking a business proposition to relevant owner(s) early on in the innovation process will increase the number of innovations from the Living Lab that reaches commercialization.

2.4 Experimentation

The purpose of this stage is to see how the business proposition best should be developed into a product/process ready for commercialization. At this point a problem/solution grounded among users has been found to have positive commercial potential and to be in line with the businesses of the participating partners. The problem/solution has been translated into a business proposition and a decision has been taken to dedicate resources to further develop the idea into e.g. a product or service and a phase of experimentation starts. It is then crucial that the Living Lab can provide an array of flexible ways of experimentation in order to be able to handle innovations ranging from products, services, processes as well as more abstract concepts like business models. In our analytical framework of the Living Lab, the experimentation options provided by the Living Lab will tap into the actual development made by each relevant Living Lab partner.

Arguably this stage of the innovation process is where tools and processes have been developed furthest in the existing Living Labs where successful collaboration and arenas for experimentation has been designed. A number of methods that have been deployed ranging from traditional like collection and analysis of customer complains and Focus Groups to more newer usage of ICT enabled data collection and user collaboration including online interviews, log analysis, virtual product testing, and user toolkits.⁶ Experimentation is also a relatively well researched area where developers can rely on findings regarding effective testing practices including beta testing and prelaunch forecasting methods (see review e.g. in Ozer⁴⁷).

The Airport Living Lab will draw upon these experiences and provide a flexible menu of methods to help partners develop test business propositions in real life situations. In one area we posit that the scope of the Living Lab as deployed in Europe could be extended. The Living Lab concept has so far been focusing on innovation of ICT.⁶ This is natural due to its extension from the ICT test-beds or science parks.¹ If suitable to the environment and partner involvement, an evolved Living Lab concept could arguably widen its scope in this sense and also be able to handle innovation not related to ICT. Additionally it would be interesting to test whether the Airport Living Lab innovation process can be designed to also handle experimentation of more abstract innovations like novel business processes or business models possibly utilizing proven methods like scenario analysis or business process modeling.

PROPOSITION 8: A Living Lab should be able to handle innovations regarding products, services and processes both related and unrelated to ICT as well as more abstract innovations like business processes and business models.

2.5 Governance and Support Processes

The parallel processes that make up the foundation under the innovation process are denoted governance and support processes. Although not directly part of the innovation process, we suggest that these processes are critical to the long-term sustainability of a Living Lab.

The aim of the Airport Living Lab is to build a Living Lab that cost-efficiently attracts, matches, screens and selects a stream of user-generated problems and solutions that can be developed and commercialized by the Living Lab partners. To manage this stream as well as make sure that partners continuously are given transparent information as well as structured and fair chances to influence the

innovation activities, we propose the construction of a set of support and government processes that are necessary to sustain the core of the Living Lab – the innovation process. With governance processes we denote processes that create consistent management, cohesive policies, processes and decision-rights for areas of responsibility inside the Living Lab. Through a set of formalized meetings, decisions about criteria that affect support processes as well as the long-term strategy for the Living Lab is formulated here.

Much thought has been put in writing on how creativity in innovation must be balanced with discipline in order to be productive.⁴⁸ Arguably one way to move towards a disciplined creativity is through an emphasis on the support and governance processes underlying the core innovation process. Such an attention is suggested to affect the sustainability as well as cost-effectiveness of the Living Lab, both during startup and operation, in the long run.

Based on survey results on current best practices in ten prevalent European Living Labs⁶, we conclude that attention to governance processes differ greatly between Living Labs. Answers from respondents on questions on governance principles that are employed by the partners in the Living Lab including “What is the legal framework of the Living Lab (i.e. which legal agreements are signed by all the involved stakeholders)?”, “What is the governance structure of the Living Lab?” range from detailed to non-existing answers.

There are many potential ways of how participating partners could govern the Living Lab and its core – the innovation process – and at this stage we can only put forward some key concepts that we suggest as important for the Living Lab. Commitment and transparency are two such concepts. It is crucial that participating partners get involved in the governance of the Living Lab. An active commitment can arguably secure that resources can be gathered when necessary and with the right timing in order to bring a promising idea to commercialization. At the same time the innovation process should not be subject to short-term objectives from individual partners, at least not without the knowledge of all partners which urges for a great deal of transparency built into the governance.

PROPOSITION 9: Urging partners to actively govern the innovation process through regulating its support processes will provide commitment from partners well as transparency to the Living Lab which will increase long-term support for the Living Lab.

Support processes in the analytical framework are functional processes guided by the governance processes. These processes include development of the adequate electronic collaborative tools used in the innovation process phases, development of proper formats used for problem/solution submissions, templates for agreements and reports such as the business plan template used as an outcome from the business evaluation phase. Support processes including the building of structural capital will help making sure that the wheel is not reinvented which could help make the Living Lab more cost-effective.

Existing research provides insights in how electronic collaboration tools i.e. “Electronic Knowledge Networks” or “Social Media” can be used to cost-efficiently activate users in various stages of the innovation process.^{49,37,50} We can go as far as to posit that without these tools, the open innovation paradigm as suggested in a Living Lab setting would not be feasible.

These tools aim at creating electronic communities by providing access to a group of peers dealing with similar knowledge issues. We could theoretically consider the users on site in the airport as part of a community of practice⁵¹ with the electronic collaboration tools to be designed with the purpose of enabling discussion, mutual engagement, and exchange between members of this community of practice.⁴⁹ These tools for idea promotion and suggestion composing are now under construction and adaptation in the Airport Living Lab, drawing experiences from various Web 2.0 tools such as Wikis which have already proven to have an impact on customer-driven innovation.⁵²

We posit that governance processes are to be seen as strategic processes that should guide the functional support processes as well as the Living Lab relations with external actors including new potential partners. Further research on how the design of these processes combined will affect the likelihood that involved partners find value in the Living Lab also in the long-term is welcomed.

PROPOSITION 10: Building structural capital e.g. in the form of a communication infrastructure and templates for outcomes in the innovation process will increase the cost-effectiveness of the innovation process.

3 Conclusion

In this paper we have used an analytical framework of a Living Lab as deployed by the Airport Living Lab in Stockholm as a focal point to the suggested and discussed ten propositions that should be

on the agenda of research and implementation for Living Lab founders in the coming years.

The presented propositions can be grouped into three sets based on their underlying intentions for the Living Lab. The first three propositions (1-3) could be said to encapsulate an aspiration to increase the number of submitted problems/solutions. The next five propositions (4-8) aims at increasing the efficiency for translating the submissions into implemented innovations. The last two propositions (9-10) aims at securing the long-term sustainability of the Living Lab.

What are then the possible impacts of these propositions on the innovation process inside the Living Lab? Figure 2 provides for illustrative purposes a graphical representation of a relationship between the number of implemented innovations and the number of submitted ideas. In the baseline example of Figure 2 we have a situation where 1000 submitted problems/solutions have proven to result in 10 implemented innovations.

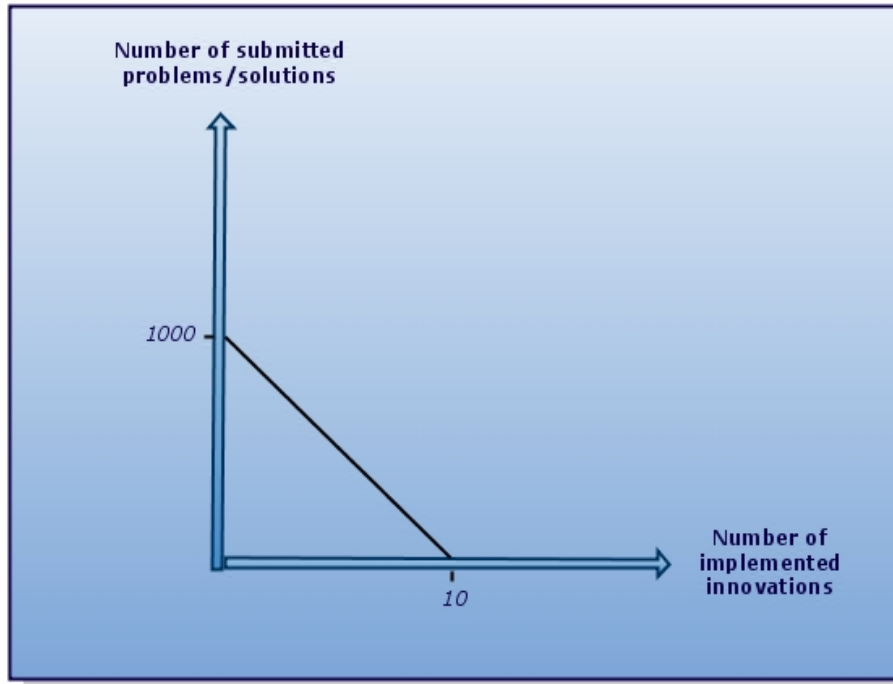


Figure 2 Example of innovation graph baseline

The overall aim of the Living Lab is to increase the number of implemented innovations. The propositions presented in this paper are hypothesized to result in this through both increasing the number of submissions from users (Propositions 1-3), in the diagram resulting in a juxtaposition of the graph upward, as well as an increase the efficiency in the subsequent progress of these submission in the innovation process (Proposition 4-8), in the diagram an increase of slope of the curve. In figure 3 the hypothesized innovation graph has moved in this way so that 1500 submissions now result in 20 implemented innovations.

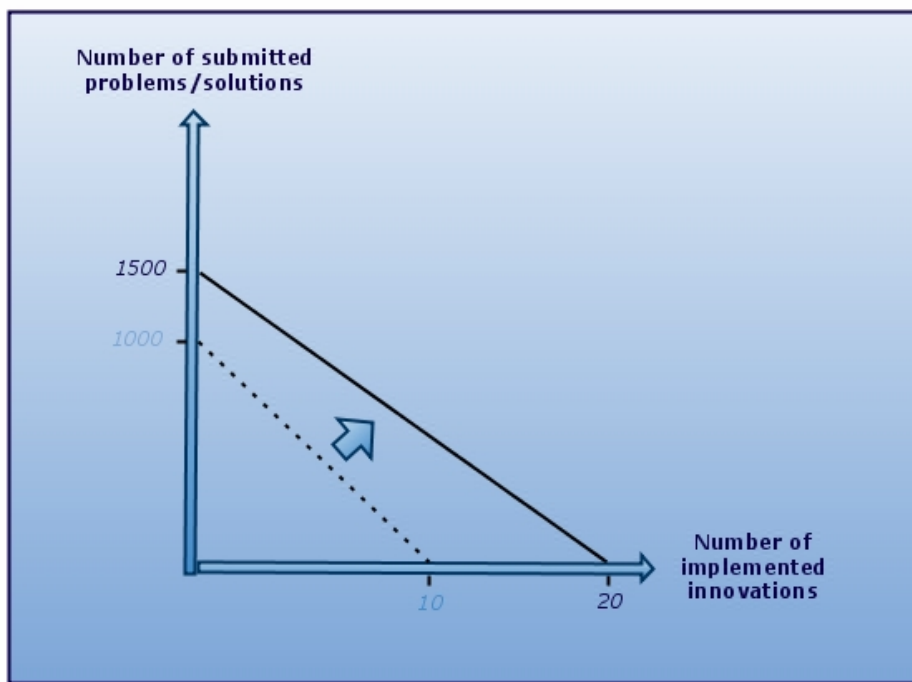


Figure 3 Hypothesized innovation graph after improvements

As for the last two propositions 9 & 10 - why this emphasis on cost-effectiveness, structure and governance? One reason is to make sure that openness in the innovation activities is the main guiding light throughout the work inside the Living Lab.

Coming back to the theoretical idea of thought behind the Living Lab movement, the question of openness vs. closeness is relevant for all the stages and layers of the Living Lab analytical framework and we see many challenges ahead in keeping the innovation as open as possible. With the assumption that open innovation provides a number of advantages over closed innovation, or at least that the Living Lab should adhere to the open innovation paradigm as closely as possible, there are challenges and traps in each stage where the process risk being closed up.

In line with the open innovation paradigm the ambition of the proposed Living Lab analytical framework is to not exclude the “non-firm actors”⁵³ such as users in any of the stages. But the openness will vary as the innovation process progress where e.g. the Business evaluation stage involves activities that are clearly closing up the process. It would be interesting to follow up on and experiment if we can open up e.g. the business evaluation stage for more user involvement than as proposed in the analytical framework. Also the experimentation stage could end up closing unnecessarily when partners of the Living Lab start activating its R&D departments to tap into the innovation activities of the Living Lab. An alternative path to this as for business propositions related to software development would be to link the business evaluation stage directly into the Open Source community.

We would like to extend this openness also to the governance where it would translate into transparency in decisions that affect the innovation activities through support processes. This will help mediation the risk of domination by certain stakeholders with potential negative impact on innovation e.g. innovation biases. Domination from specific actors collaborating on innovation and the negative impact on the very outcomes from these collaborations have been studied e.g. from a network perspective.⁵⁴ There are several possible breakdowns in the innovation process including under-consideration of minority ideas and weak reflexivity during convergence.⁵⁵ Our answer to avoid these traps is two-fold: 1. Put in place a set of governance principles that are transparent to all involved actors and that regulates the support processes of the innovation process. 2. Employ an Investment Manager that is given instructions to stay neutral and loyal to the Living Lab partnership as a whole and not to specific partners, however persuasive to a certain agenda they may be. We posit that these measures can diminish the risk of domination in the Living Lab by certain perspectives and marginalization of others.

It should be pointed out that initiatives for a “harmonization” of methods and tools for Living Labs

has been proposed in line with the activities of the European Network of Living Labs.⁵⁶ Similar discussions have been brought up on business models and value creation strategy that are suitable for a broad range of Living Labs.⁵⁷ But in the same breath it is pointed out by that such standardization will be difficult due to organizational, technical or contextual points of view. This insight is most probably valid and there is a risk in streamlining the development of Living Labs into one mold whereas the concept has the potential to add value to a number of industries and contexts where it is hard to propose a “best-practice” in terms of methods, tools, or business models. The principles of the governance and support processes must be designed utterly to suit the individual Living Lab.

The question of openness vs. closeness also comes back in looking on how the partners of a Living Lab can get the most out of their Living Lab investment. Different partners will invariably have their own level of internal openness in innovation. Clearly a question outside the scope of this article but most probably crucial to the sustainability of a Living Lab is: How can the interfaces to and awareness of the Living Lab (relatively open innovation) be designed and improved from a stakeholders’ (relatively closed innovation) perspective, so that the positive effects of the Living Lab reaches all the stakeholders? In short: How do we get the right people talking and how do we help companies to extend their strategies on how to capture the whole potential of Living Labs. How will exposure to and involvement with open innovation collaboration for a closed innovation stakeholder will affect this stakeholder and change its innovation culture? Can the Living Lab mediate different levels of openness in innovation? How to combine open innovation and open infrastructures to possibly very closed industrial projects developed in these environments? Who owns the ideas and results?

This leads into options for ownership of a Living Lab as well as where in the Innovation process the Living Lab starts and ends in relation to its individual commercial financing partners. There are a number of ownership structures possible for the Living Lab and here the founder(s) of the Living Lab should be sensitive to types of partners involved and their motives. Both the Living Lab as a non-profit organization and a firm with profit motives have been tried out among the European Living Labs. If involving a Living Lab as a vehicle not only for gathering, evaluating and experimenting with new potential innovations, but also for commercialization, the question about Intellectual Property Rights (IPR) management becomes crucial. The answer is probably to build in a high degree of flexibility where several clear alternatives regarding intellectual property rights among partners have been carved out and documented as part of the governance and founding of the Living Lab. Even if we have no firm answer to these problems at hand we posit that lessons could be learnt from how IPR is handled in the Open Source community. One interesting question is whether the Living Lab in the future could be considered a distinct organizational type aiming at focusing innovation resources and capabilities among its stakeholders?

Scholars have discussed ways of organizing innovation taking into the consideration various internal tensions including to keep innovation options open versus commitment to well-defined innovation pathways.^{58,23} We emphasize the possibility to see the Living Lab as a well-organized structure that can not only tap into the innovative energy of users but also truly support inter-organizational collaboration. Can the Living Lab as a future organizational design provide a creative breathing space where some innovation activities that have a hard time flourishing inside a Living Lab partner organization? If so, the Living Lab could for a firm become a flexible way of testing the open innovation paradigm while in orderly fashion re-organizing the firm’s internal innovation activities.

The question of sustainability for a Living Lab boils down to: How do create a win-win situation for all stakeholders over time? To answer this question we have to make clear what the stakeholders’ interest in a living lab is in the first place. What stakeholders are willing finance the infrastructure of the Living Lab and why? Whatever the answers to these questions are in a particular Living Lab, we have in this paper suggested a greater attention to the cost-effectiveness in the innovation process. One of the main challenges for the Living Lab is how to cost-effectively produce innovations with great future potential.

To keep operational cost down is truly a challenge in that the Living Lab arguably should be able to manage a high pace in its innovation process and at the same time vast amounts of information in the form of user contributions. One avenue suggested in this paper is to look closer on utilizing of electronic collaboration tools effectively also as parts of screening and evaluating mechanisms.

Designing of human–computer interaction and interfaces brings along a set of its own questions. What is the optimal mix and design of electronic collaboration tools? How should the critical interfaces between the users and knowledge repositories in the Living Lab be designed? A strength of the Living

Lab methodology is the possibility to gather user feedback with good timing, i.e. feedback in the specific context and close to the specific time that a user is exposed to a situation. This should not be underestimated and gives implications to constructions of channels. In the Airport environment we are looking into ways of cross-checking data on customer input time stamps and contextual data like flight delays. How do the electronic collaboration tools match the right timing to real-world environments? In short: How do we make user-collaboration easy to bring in great ideas into the Living Lab?

The introduction of automated or semi-automated screening systems, in the analytical framework denoted trigger, deserves some further comments. If cost-effectiveness and efficient management of information overflow speaks in favor of an automated trigger, a number of risks are also associated with such a solution. An automated system has to work by a set of clearly defined rules from which it, with today's computing power, cannot deviate much from by itself. Improvisation taking into consideration the out-of-the-ordinary would be a weakness of an automated trigger system.

The trigger will naturally be bound by the set criteria. At the same time research has found that the most innovative ideas with the largest impact enter an innovation system from other industries^{59,60} and potentially these disruptive innovations have an increased risk of being screened out in a more automated process. On the other hand the disruptive technologies have been shown to be identified only after it has disrupted the business of incumbents.⁶¹ To make investment decisions, firms must be able to identify in advance which technologies will disrupt an industry and which will not.¹⁴

Our response to these concerns is that first of all this potential problem also goes for human operators, in fact also here human operators are writing the rules that the automated trigger follows diligently. Desouza et al²⁷ observe that corporations have more success when process of screening is transparent and standardized. Efforts have to be made to make sure that Living Lab partners are involved and informed on the design of e.g. the trigger criteria. Mechanisms for this must be built in the governance and processes. Second, a counter-measure that we have discussed would be to with stick to the principle that no problems/solutions will be thrown away. This opens up some possibilities to revisit "wild cards" that do not meet the current criteria later on and possibly let these discarded submissions in the long run affect these criteria.

We acknowledge that empirical testing of several of these research proposals will not be easy. Further work lies ahead to construct testable hypotheses. Our take on this is a continuous longitudinal case study of the Airport Living Lab where especially the innovation processes inside the partner firms prior to the launch of the Airport Living Lab are of great interest in order to compare to eventual changes that these organizations will perform during the project. Continuous results from this study will be documented and presented in the coming years.

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