Technology Innovation Management Review

December 2013

Living Labs and Crowdsourcing

Welcome to the December 2013 issue of the *Technology Innovation Management Review*. This month's editorial themes are Living Labs and Crowdsourcing. We welcome your comments on the articles in this issue as well as suggestions for future article topics and issue themes.

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Overview

The *Technology Innovation Management Review* (TIM Review) provides insights about the issues and emerging trends relevant to launching and growing technology businesses. The TIM Review focuses on the theories, strategies, and tools that help small and large technology companies succeed.

Our readers are looking for practical ideas they can apply within their own organizations. The TIM Review brings together diverse viewpoints – from academics, entrepreneurs, companies of all sizes, the public sector, the community sector, and others – to bridge the gap between theory and practice. In particular, we focus on the topics of technology and global entrepreneurship in small and large companies.

We welcome input from readers into upcoming themes. Please visit timreview.ca to suggest themes and nominate authors and guest editors.

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Editorial: Living Labs and Crowdsourcing

Chris McPhee, Editor-in-Chief

Mika Westerlund and Seppo Leminen, Guest Editors

Welcome to the December 2013 issue of the *Technology Innovation Management Review*. This month's issue includes articles on the themes of **Living Labs and Crowdsourcing**, and it is my pleasure to welcome back our guest editors, **Mika Westerlund**, Assistant Professor at Carleton University's Sprott School of Business in Ottawa, Canada, and **Seppo Leminen**, Principal Lecturer at the Laurea University of Applied Sciences and Adjunct Professor in the School of Business at Aalto University in Finland. The articles on living labs carry on the theme of our last issue (tinyurl.com/m47756y) and our September 2012 issue (tinyurl.com/lm46z67).

In the first article, **Carina Veeckman** and **Dimitri Schuurman** from the iMinds research group in Belgium, along with **Seppo Leminen** and **Mika Westerlund**, show how the main characteristics, or building blocks, of living lab environments can impact daily operations and project outcomes. Based on their multiple case-study analysis of four living Labs in Europe, they propose a "Living Lab Triangle" framework that triangulates the characteristics of the living lab environment, the living lab approach, and the innovation outcome. Their findings imply that managers and researchers contemplating innovation in living labs need to consider the intended inputs and outcomes, and must reframe their innovation activities accordingly. Their article provides practical guidelines on how living labs should be managed on the levels of community interaction, stakeholder engagement, and methodological setup.

Next, **Louna Hakkarainen** and **Sampsa Hyysalo** from Aalto University in Helsinki, Finland, share key insights from an in-depth case study of a living lab collaboration to develop and refine a "smart floor" monitoring system for elderly care. Despite its ultimate success, the near-failure of the collaboration effort provided key insights into the role of the living lab environment as a catalyst for learning between users and developers. Researchers, managers, and living lab participants will benefit from the practical insights and key messages that emerged from this case study.

In the third article, **Risto Rajala**, **Mervi Vuori**, and **Jukka-Pekka Hares** from Aalto University in Finland, and **Mika Westerlund** from Carleton University in Canada, explore how technology companies can use crowdsourcing to go beyond mere idea generation to benefit from user knowledge in product and service innovation. Through their case study of a telecommunication company's crowdsourcing initiatives, the authors argue that companies need to think about user-knowledge management in a more holistic way to complement and make benefit of users' knowledge, and they suggest four key lessons to help these companies move beyond simply crowdsourcing ideas.

In the fourth article, **Suchita Nirosh Kannangara** and **Peter Uguccioni** from the Technology Innovation Management program at Carleton University in Ottawa, Canada, examine risk management in crowdsourcing initiatives. By applying the concept of business ecosystem health to the crowdsourcing context, they examine the methods by which firms can maximize health by mitigating risk in crowdsourcing-based business ecosystems.

In addition to these four articles, this issue also includes a report on a recent TIM Lecture, "Technology Adoption by Design: Insights for Entrepreneurs", which was presented by **Stoyan Tanev**, Associate Professor in the Department of Technology and Innovation at the University of Southern Denmark.

In January, we will ring in the new year with our annual issue on the theme of Open Source Business. But, for now, we close 2013 with a look back at the most popular articles from our second year. Table 1 ranks the most popular articles published in the 12 issues between October 2012 and September 2013, based on traffic to timreview.ca over this period. This method strongly disadvantages more recently published articles, so the table also includes five trending articles that would appear in the main list if only recent traffic were considered. If you missed any of these articles when they first came out, I encourage you to add them to your reading list. Our full archive of articles back to July 2007 is available on our website at: timreview.ca/issue-archive

We hope you enjoy this issue of the TIM Review and will share your comments online. Please contact us (timreview.ca/contact) with article topics and submissions, suggestions for future themes, and any other feedback.

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Table 1. Most popular TIM Review articles published from October 2012 to September 2013*

Rank	**Article** (timreview.ca/article/)	**Author(s)**	**Issue**
1	**Neuromarketing: Understanding Customers' Subconscious Responses to Marketing** (timreview.ca/article/634)	Suomala et al.	December 2012
2	**How Can Entrepreneurs Motivate Crowdsourcing Participants?** (657)	Smith et al.	February 2013
3	**Introducing "Business Source": The Future of Corporate Open Source Licensing?** (691)	Widenius and Nyman	June 2013
4	**What Technology Startups Must Get Right to Globalize Early and Rapidly** (614)	Bailetti	October 2012
5	**Governance of Open Source Software Foundations: Who Holds the Power?** (636)	Prattico	December 2012
6	**Key Factors Affecting a Technology Entrepreneur's Choice of Incubator or Accelerator** (656)	Isabelle	February 2013
7	**An Ecosystem-Based Job-Creation Engine Fuelled by Technology Entrepreneurs** (658)	Bailetti and Bot	February 2013
8	**University-SME Collaboration and Open Innovation: Intellectual-Property Management Tools and the Roles of Intermediaries** (668)	Deschamps et al.	March 2013
9	**Global Mindset: An Entrepreneur's Perspective on the Born-Global Approach** (617)	Poole	October 2012
10	**To Internationalize Rapidly from Inception: Crowdsource** (615)	Heidari et al.	October 2012
11	**Code Forking, Governance, and Sustainability in Open Source Software** (644)	Nyman and Lindman	January 2013
12	**The Seeking Solutions Approach: Solving Challenging Business Problems with Local Open Innovation** (664)	Deutsch	March 2013
13	**Enabling Process Alignment for IT Entrepreneurship** (626)	Renaud and Bot	November 2012
14	**Platforms, Communities, and Business Ecosystems: Lessons Learned about Technology Entrepreneurship in an Interconnected World** (655)	Muegge	February 2013
15	**Green, Innovative, and Profitable: A Case Study of Managerial Capabilities at Interface Inc.** (624)	Lampikoski	November 2012
↑	**Developing an Innovation Engine to Make Canada a Global Leader in Cybersecurity** (711)	Bailetti et al.	August 2013
↑	**From Ideas to Opportunities: Exploring the Construction of Technology-Based Entrepreneurial Opportunities** (692)	Giones et al.	June 2013
↑	**Evolution of Wireless Sensor Networks for Industrial Control** (682)	Low	May 2013
↑	**Securing Canada's Information-Technology Infrastructure: Context, Principles, and Focus Areas of Cybersecurity Research** (704)	Craigen et al.	July 2013
↑	**Rethinking Open Innovation Beyond the Innovation Funnel** (673)	Vanhaverbeke	April 2013

*The rankings are based on website traffic to timreview.ca from October 1, 2012 to September 30, 2013. The list also includes 5 recently published articles (denoted by ↑) that would appear in the main list if only traffic from June 1, 2013 to November 30, 2013 were considered.

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Chris McPhee, Mika Westerlund, and Seppo Leminen

About the Editors

Chris McPhee is Editor-in-Chief of the *Technology Innovation Management Review*. Chris holds an MASc degree in Technology Innovation Management from Carleton University in Ottawa and BScH and MSc degrees in Biology from Queen's University in Kingston. He has over 15 years of management, design, and content-development experience in Canada and Scotland, primarily in the science, health, and education sectors. As an advisor and editor, he helps entrepreneurs, executives, and researchers develop and express their ideas.

Mika Westerlund, D. Sc. (Econ.) is an Assistant Professor at Carleton University's Sprott School of Business in Ottawa, Canada. He previously held positions as a Postdoctoral Scholar in the Haas School of Business at the University of California Berkeley and in the School of Economics at Aalto University. Mika earned his doctoral degree in Marketing from the Helsinki School of Economics. His current research interests include open innovation, business strategy, and management models in high-tech and service-intensive industries.

Seppo Leminen holds positions as Principal Lecturer at the Laurea University of Applied Sciences and Adjunct Professor in the School of Business at Aalto University in Finland. He holds a doctoral degree in Marketing from the Hanken School of Economics and a licentiate degree in Information Technology from the Helsinki University of Technology (now the School of Electrical Engineering at Aalto University). His doctoral research focused on perceived differences and gaps in buyer-seller relationships in the telecommunication industry. His research and consulting interests include living labs, open innovation, value co-creation and capture with users, neuromarketing, relationships, services, and business models in marketing as well as management models in high-tech and service-intensive industries.

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Keywords: living labs, crowdsourcing, open innovation

Linking Living Lab Characteristics and Their Outcomes: Towards a Conceptual Framework

Carina Veeckman, Dimitri Schuurman, Seppo Leminen, and Mika Westerlund

> *"Remember the two benefits of failure. First, if you do fail, you learn what does not work. Second, the failure gives you the opportunity to try a new approach."*
>
> Roger von Oech
> Creative Thinker

Despite almost a decade of living lab activity all over Europe, there still is a lack of empirical research into the practical implementation and the related outcomes of living labs. Therefore, this article proposes a framework to create a better understanding of the characteristics and outcomes of living labs. We investigate three living labs in Belgium and one in Finland to learn how the different building blocks of living lab environments contribute to the outputs of innovation projects launched within the lab. The findings imply that managers and researchers contemplating innovation in living labs need to consider the intended inputs and outcomes, and reframe their innovation activities accordingly. We formulate practical guidelines on how living labs should be managed on the levels of community interaction, stakeholder engagement, and methodological setup to succeed in implementing living lab projects and to create user-centred innovations. That way, living lab practitioners can work towards a more sustainable way of setting up living labs that can run innovation projects over a longer period of time.

Introduction

Co-creation links distributed sources of knowledge (Tanev et al., 2011; timreview.ca/article/496) and conceptualizes innovation as the collaborative development between two or more stakeholders. Co-creation is also described as the act of creating value to the mutual benefit of two or more actors, beyond creating actual product or service innovation in a collaborative way (Allen et al., 2009; timreview.ca/article/301). In particular, living labs are regarded as an emerging open innovation approach that involves multiple stakeholders, including users, to co-create value that eventually leads to innovation. Living labs are a new way of structuring research and help companies rapidly commercialize and upscale an innovation through validation and testing in real-life contexts (Leminen and Westerlund, 2012; tinyurl.com/orlnfh5). Living labs offer a more reliable market evaluation than test markets, and they give users power in innovation processes (Salter and White, 2013; tinyurl.com/lknek7b).

To date, there exists no consistent and commonly accepted definition of the living lab. Instead of a general definition, several authors have suggested various key characteristics and principles or have tried to harmonize the different methods and tools (cf. Mulder et al., 2008; tinyurl.com/8su2mal). However, none of these efforts link the characteristics or principles of living labs to tangible outcomes. Therefore, the objective of this study is to: i) investigate the different building blocks of a living lab environment, and ii) examine how they contribute to the outputs of innovation projects launched within the lab, based on an analysis of actual living lab projects and experiences. To reach this objective, we first discuss the definition and basic characteristics of living labs. Second, we establish our framework, based on living lab literature, to detail the triangulation between environment, approach, and outcome in living labs. Then, we describe the research design constructed for a validation of our proposed framework based on data of four living labs, and we report the results and lessons learned from our empirical

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study. We conclude by providing guidelines for innovation practitioners and explaining avenues for future research.

Multiple Definitions of the Living Lab Concept

The living lab concept appeared in academic discussion in the 1990s, but really took off only in 2006 when the European Commission kicked off projects to advance, coordinate, and promote a common European innovation system based on living labs (Dutilleul et al., 2010; tinyurl.com/lgz3svv). Several international organizations, representing industrial living lab initiatives in information and communication technologies (ICT), were founded in order to stimulate living lab research. The European Network of Living Labs (ENoLL; openlivinglabs.eu) is the most influential initiative covering living labs from all over the world. Living labs were put forward as an institution to overcome the "European Paradox" (tinyurl.com/kjm8735) or the gap between research leadership and commercial success of innovation. This increasing attention and the accompanying monetary support for living labs has unfortunately led to a wide variety of projects carried out under the "living labs" umbrella, and a proliferation of research papers that use the term "living labs" in a sense that is only loosely relate to the subject.

Despite the booming interest in living labs, they remain an under-researched area due to the lack of common understanding of the concept and its underlying mechanisms (Bergvall-Kåreborn and Ståhlbröst, 2009; tinyurl.com/kfazp4o). They have been discussed from different perspectives, and a wide diversity of thematic approaches, constellations, methodologies, and tools for living labs exist (Almirall et al., 2012; timreview.ca/article/603). The living lab has been conceptualized as an environment (Ballon et al., 2005; tinyurl.com/k2zflmz), a methodology or innovation approach (Bergvall-Kåreborn et al., 2009; tinyurl.com/kn9rzjx), an organization or an innovation intermediary (Schuurman et al., 2012; tinyurl.com/lbsjwod), a network (Leminen and Westerlund, 2012; tinyurl.com/nk2bv2r), and a system (ENoLL, 2007; tinyurl.com/nv4hhdb). This lack of common understanding makes it difficult to advance research focused on living labs.

We follow the definition by Westerlund and Leminen (2011; timreview.ca/article/489) because it stresses the multi-stakeholder aspect, the real-life context, and the various stages of the development process. They view living labs as "physical regions or virtual realities where stakeholders form public-private-people partnerships (4Ps) of firms, public agencies, universities, institutes and users, all collaborating for creation, prototyping, validating and testing of new technologies, services, products and systems in real-life contexts". In the living lab environment, different stakeholders can cooperate and share their resources, knowledge, and expertise, which is crucial to startups and small firms that have challenges acquiring venture capital (Eriksson et al., 2005; tinyurl.com/8fv3jkp). Living labs can have a demographic or geographical focus, they are either research or industry driven, and they are led by utilizers, enablers, providers, or users (Leminen et al., 2012; timreview.ca/article/602). Although the implementations vary, notions about the role of users and their engagement in the innovation process remain central. Living labs research the whole innovation process from concept to effective usage (Salter and White, 2013; tinyurl.com/lknek7b).

The Living Lab Triangle

Based on a literature review and the authors' earlier research (Veeckman et al., 2012; tinyurl.com/mm2at5q), a comprehensive framework was established to analyse the link between the building blocks of living labs and their effect on the living lab outcomes. The Living Lab Triangle framework (Figure 1) has three pillars and consists of 11 key characteristics. The foundation of our framework is based on the characterizing purposes of Følstad (2008; tinyurl.com/l7s99ph). Making a distinctive profile of each living lab was initially difficult, because Følstad's characteristics were both insufficient to identify the main building blocks of living labs that act as differentiators and incapable of assessing the impact of the living lab's R&D activities. Every living lab obtained the same score for the setup of their innovative characteristics, whereas in practice they had different outcomes. Therefore, some of the Følstad's characteristics were adjusted and combined with the key principles of good practice by Eriksson et al. (2005; tinyurl.com/8fv3jkp).

The identified characteristics are divided on a generic level (i.e., the living lab environment) and on a project level (i.e., the living lab approach). The set of characteristics on the generic level refers to material, immaterial, and contextual elements of a living lab environment, and the set on the project level defines the methodological aspects.

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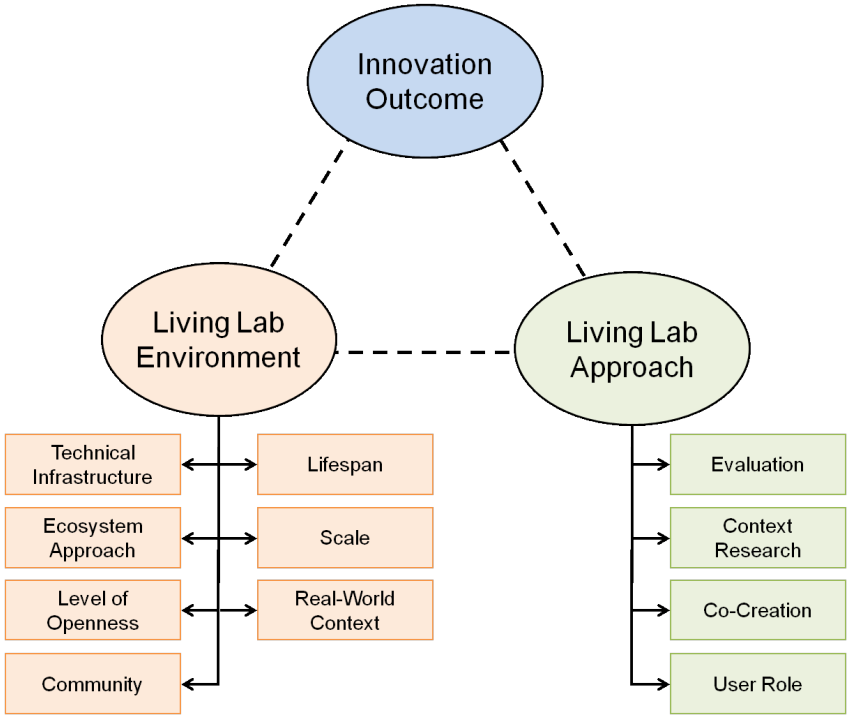

Figure 1. The Living Lab Triangle: The triangulation between environment, approach, and outcome in living labs (Veeckman et al., 2013; tinyurl.com/mcpddzd)

Pillar 1: Building blocks of the living lab environment

1. **Technical infrastructure:** When assessing or co-creating innovations, a technical component should be available for the test users within the living lab. In ideal circumstances, the testing of the innovation also includes monitoring of the technical performance during usage and non-usage of the innovation.

2. **Ecosystem approach:** Various stakeholders, from industrial partners to users and research organizations, interact to develop and evaluate a certain process, product, or service within the living lab ecosystem. Similarly, ad-hoc business ecosystems are constructed within the living lab projects (Peltoniemi and Vuori, 2004; tinyurl.com/cwtd63x). When creating an ecosystem, it is important to create value to attract and retain members, and to share the value within the ecosystem (Iansiti and Levien, 2004; tinyurl.com/bqaol6f). In practice, this means that there should be an added value for all partners involved, in order to create long-term engagement and identification with the living lab or at least on a project level (cf. Apollon project, 2012; www.apollon-pilot.eu).

3. **Level of openness:** One of the key principles in living labs is that the innovation process should be as open as possible, because a multitude of perspectives might speed up the development and bring more innovative ideas (Bergvall-Kåreborn et al., 2009; tinyurl.com/9nqmrdy). This study incorporates two levels of openness, namely how intellectual property rights are being handled (i.e., the extent of knowledge sharing) and the degree to which new partners are embraced.

4. **Community:** Users participating in the living lab are part of a community, which can range from a "community of interest" to a "community of practice", whether or not it is geographically bound. For example, in a community of practice, the panel members are informally connected by what they do together and by what they have learned through their mutual engagement in these activities (Wenger, 2000; tinyurl.com/k6ffus2). It is important to know what drives users to participate and contribute in order to keep them motivated and engaged (Ståhlbröst and Bergvall-Kåreborn, 2011; tinyurl.com/m6wub5a).

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5. **Lifespan:** This characteristic refers to the duration of the living lab, and not of a single innovation project launched within the lab. For example, a short-term living lab initiative might last less than six months, whereas a long-term initiative might have a two-year duration, and a very long-term initiative might have an indeterminate end date.

6. **Scale:** This characteristic refers to the number of users involved in living lab research activities such as the living lab panel. A small-scale living lab panel may involve fewer than 100 users, whereas a large-scale living lab may have more than 500 users. These numbers are defined on the generic level of the living lab, and not on a project level because the type of innovation or user study will define how many users can participate within the project or research activity.

7. **Real-world context:** Users should be studied within a real-life context, which implies a familiar context that reflects the users' natural environment as much as possible. For example, users are studied within their home environment rather than in a laboratory setting.

Pillar 2: Building blocks of the living lab approach

1. **Evaluation, context research, and co-creation:** Within a living lab setting, test users are involved through different phases of the innovation cycle in which they can test, evaluate, and co-create the innovation. This means that test users must be able to give a positive or negative assessment of the innovation through, for example, surveys or in-depth interviews. Test users should be given the opportunity to shape the innovation in interaction with researchers and developers. Co-creation should be iterative and make use of, for example, participatory methods. Furthermore, the usage context should be taken into account as a critical element that influences usage behaviour through, for example, ethnographic tools (cf. Veeckman and Lievens, 2013; tinyurl.com/ny457sg).

2. **User role:** Leminen, Westerlund, and Nyström (2014; tinyurl.com/ma9ja59) identified four distinct user roles in living labs on the basis of the degree of user activity and the firm's view of co-creation: i) informant, ii) tester, iii) contributor, and iv) co-creator. We propose that user roles depend on the view that companies pursue for integrating users in living labs and the degree of user activity within these living lab activities.

Pillar 3: The innovation outcome

To evaluate the success of a living lab, the innovation outcome must be considered. Knowledge of the tangible outcomes enables us to assess impact and determine which approaches worked best. Thus, the living lab setup can be improved, which leads to better implementation of future living lab projects. However, the literature is silent about which components affect the outcome in living labs, with the exception of Leminen, Westerlund, and Kortelainen (2012; tinyurl.com/kklefus) who found that it depends on: i) strategic intention; ii) passion; iii) knowledge and skills; iv) other resources; and v) partners in the living lab network (Table 1).

Table 1. Components of the innovation recipe in living labs (Leminen, Westerlund and Kortelainen, 2012; tinyurl.com/kklefus)

Component	Definition
Strategic intention	Different parties (e.g., companies, public organizations, research organizations, or user communities) having either individual or shared motives for collaboration
Passion	The passion for participation and collaboration within the user community or the partners in the ecosystem
Knowledge and skills	The knowledge and skills of participants in the living lab network (having or not having a certain expertise)
Other resources	The amount and timing of (available) resources
Partners in the living lab network	The number of different type of participants in the network

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Operationalization

We operationalized the previously discussed building blocks on a four-point scale. A low score means that a specific characteristic is not present and a high score means that it is clearly identifiable and contributes to the operation of the living lab. We modified several of the Følstad's characteristics based on the findings by Veeckman and colleagues (2012; tinyurl.com/l7mc5hx). For instance, "discovery" and "familiar context" were covered by other concepts and left out on the level of the living lab environment. The former is a principle maintained during the whole living lab process, and it forms an integral part of the way the methodologies are set up. The latter is a principle of testing in a real-world context and implies a familiar context that reflects the users' natural environment as much as possible.

We also added four new building blocks: i) the ecosystem approach, ii) level of openness, iii) community aspect, and iv) user role. We also added a new pillar: innovation outcome. These adjustments will lead to a better characterization of living labs and are essential to assess the impact of diverse setups of living lab operations. The new pillar will make a more direct link between the building blocks of a living lab setup and the outcomes of innovation projects launched within the lab. Through these additions, the interplay between the living lab environment and its projects will be considered more attentively, as we assume that the environment intentionally and unintentionally shapes the projects. Table 2 details the operationalization of our framework.

Research Design

We conducted a multiple case-study analysis of four distinct living Labs in two European countries: FLELLAP, LeYLab, and Mediatuin located in Belgium, and the Laurea Living Labs Network in Finland (Box 1). This research approach was deemed appropriate because we are dealing with new and poorly understood phenomena (cf. Eisenhardt, 1989; tinyurl.com/n666sey).

Box 1. Information about investigated living labs

FLELLAP (Belgium; vlaamsproeftuinplatform.be) **The Flemish Living Lab Platform** started in October 2010 to support the development of innovative information, communication, and entertainment products and services, within the smart media, smart grids, and smart media domain. FLELLAP was a consortium of four industrial partners and the research department iMinds-iLab.o. A large panel of over 2,000 users was built and thoroughly profiled within the three domains through quarterly domain-specific surveys. FLELLAP ended its operation in March 2013.	**LeYLab** (Belgium; leylab.be) **The Light and You Lab (LeYLab)** aims to stimulate innovation and measure the relevance of new services in three thematic domains: e-care, multimedia, and gaming. It has been operational since 2011. The LeYLab infrastructure includes a fibre Internet connection installed at 115 addresses (mostly residential, but also cultural organizations, schools, and companies), and distributed mobile devices (e.g., Android tablets and mini PCs). These connected addresses receive profiling surveys on the relevant themes, and all data running on the fibre network are monitored and logged. The LeYLab consortium consists of 11 industrial partners and the research partner iMinds-iLab.o.
Mediatuin (Belgium; mediatuin.be) **Mediatuin,** or "media garden", started in October 2010 to optimize, co-create, and validate media innovation with a cross-media focus. The Mediatuin panel exists of 2,000 profiled test users, but has no fixed infrastructure. The thematic focus of Mediatuin is media, with special attention given to radio and music. The consortium consists of three industrial partners (SonicAngel, Netlog, and Telenet) and the research partner iMinds-iLab.o.	**Laurea Living Labs Network** (Finland; laurea.fi) **The Laurea Living Lab Network** was established in 2007 and operates in several locations and living lab environments in the metropolitan area of Helsinki, Finland. Its focus is on welfare, knowledge-intensive business services, security, and social responsibility. The community consists of 8,000 students and 400 staff members at the Laurea University of Applied sciences. It integrates a flexible network of stakeholders (e.g., industrial partners, public agencies, cities and social organizations, and research institutions) for creating, developing, prototyping, validation, and testing of innovations in real-life environments.

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Table 2. Operationalization of the framework with options for each building block

Living Lab Environment			
Technical Infrastructure	**Ecosystem Approach**	**Level of Openness – Intellectual Property Rights**	**Level of Openness – Partnerships**
1. No technical infrastructure	1. No value creation and sharing for all involved stakeholders in the living lab ecosystem (e.g., stakeholders are chosen randomly)	1. Exclusive regarding results and information generated in the living lab	1. Completely exclusive partnership (e.g., exclusively controlled by a single actor)
2. Infrastructure without monitoring and technical testing	2. Value creation and sharing to some of the stakeholders in the living lab ecosystem (e.g., missing links in the value chain, no equal contribution of all stakeholders)	2. Little of the results and information generated in the living lab are shared (e.g., only brief updates or summaries)	2. Semi-exclusive partnership (e.g., only open to members of a consortium)
3. Infrastructure with basic monitoring and technical testing	3. Value creation and sharing for most of the stakeholders in the living lab ecosystem	3. Most of the results and information generated in the living lab are shared (e.g., presentations), but some results need to kept confidential	3. Inclusive partnership: everyone is welcome to use the platform but access is limited in time and space
4. Infrastructure with extensive monitoring and in-depth technical testing	4. Value creation and sharing for all involved stakeholders in the living lab ecosystem (e.g., long-term engagement and identification with the project)	4. Inclusive regarding results; everybody has access to the results and generated knowledge	4. Inclusive partnership: everyone is welcome to use the platform with no time or space limitations
Community	**Real-World Context**	**Lifespan**	**Scale**
1. No community	1. A laboratory setting	1. Short-term project (<6 months)	1. Not involving any users (N=0)
2. Mostly a passive community	2. Real-world context with severe limitations on time or space (e.g., geographical limitation, required skills or devices)	2. Medium-term project (6 months–1 year)	2. Small scale (<100 users)
3. Neither passive nor active community (equal shares)	3. Real-world context with some time or space limitations	3. Long-term project (1–2 years)	3. Medium scale (100–500 users)
4. Mostly an active community	4. Real-world context without any limitations	4. Very long-term project, with the possibility to live on permanently (>2 years)	4. Large scale (>500 users)
Living Lab Approach			
Evaluation	**Context Research**	**Co-Creation**	**User Role**
1. No evaluation by users	1. The usage context is not considered at all	1. No interaction with users	1. Informant
2. Limited evaluation by users (e.g., post survey)	2. The usage context is moderately considered (e.g., a short survey)	2. User feedback is captured, but users have no decision-making power in the innovation process	2. Tester
3. Evaluation by users through an interactive process (e.g., focus groups)	3. The usage context is substantially considered using advanced techniques (e.g., surveys, diaries)	3. User feedback is captured (iterative), which may lead to some modifications/alterations of the innovation	3. Contributor (creating with the user)
4. Multiple possibilities for feedback and evaluation by users (e.g., before, during, and after an activity)	4. The usage context is considered using more advanced techniques (e.g., ethnography tools, observations) and is viewed as a critical element that influences usage behaviour	4. User feedback is captured (iteratively); user can make changes to the innovation themselves; the user is part of the innovation process	4. Co-creator (creating by the user)

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By analyzing the main characteristics in different living labs, conclusions can be made on how these building blocks should be set up and how they affect the outcome of an innovation project. The results of this study will contribute to the current understanding and knowledge building of the living lab concept, but will also give practical guidelines on how to overcome possible challenges in the living lab setup, or how one can strive for a successful implementation of this innovation instrument.

The data was collected between 2007 and 2013, including expert interviews with the living lab staff and secondary data including various documents of the design and outcomes of the projects. Our analysis relies on the coding technique of an operationalized framework of living lab characteristics, which is grounded on a literature review and earlier testing (Veeckman et al., 2012; tinyurl.com/mm2at5q). Two of the authors in this study independently assessed the characteristics of the living labs, assigning a low score to reflect that a characteristic was not present and assigning a high score to show that the characteristic was clearly identifiable and contributed to the operation of the living lab. Disagreements in coding results were re-examined and resolved together.

Results

Table 3 shows a characterizing profile for each living lab and illustrates that the new added building blocks act as a differentiator. However, it should be noted that these results were coded on the generic level of the living lab, and not on a project level. If we applied the framework to each living lab project separately, the results could be very different because methodologies and objectives vary within those cases.

Table 3. Coding results of the framework

Living Lab Environment	**FLELLAP**	**LeYLab**	**Mediatuin**	**Laurea**
Real-world context	•••	•••	•••	•••
Technical infrastructure	•	••••	•	••
Lifespan	•••	••••	••••	••
Scale	••••	•••	••••	•
Ecosystem approach	••	••	•••	••••
Intellectual Property Rights	••	••	••	••••
Openness to partnerships	•••	•••	•••	••••
Community	•••	••••	••	••••
Living Lab Approach	**FLELLAP**	**LeYLab**	**Mediatuin**	**Laurea**
Evaluation	••	••	••	••••
Context research	••	••••	••	••••
Co-creation	••	••	••	••••
User role	•	••	•	•••

Linking Living Lab Characteristics and Their Outcomes

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The Laurea Living Labs Network obtains the highest result for most characteristics. Although it has a different approach in recruiting users and setting up the infrastructure, its main merits are the ecosystem approach and the level of openness. The strengths of LeYLab and Laurea are the fixed infrastructure and the passion of some stakeholders to move on, which make FLELLAP the weakest in class. This result is mainly due to the malfunctioning ecosystem and project-based approach, which also caused the ending of the initiative. The other two Flemish living labs, Mediatuin and LeYLab, were able to build a more sustainable model. They are still running and have the opportunity to live on in other open innovation initiatives.

There is a remarkable difference between the Flemish and the Finnish labs in terms of how the living lab approach is applied. In the Flemish labs, there is little initiative towards the evaluation or co-creation of the scope of the living lab. For example, FLELLAP only conducted a quarterly survey amongst their general panel, which related to the three thematic domains. Conversely, Laurea Living Labs has a more thematically focused research track on the generic level with co-creation, development, validation, and testing of innovations. If the Flemish living labs had a more clearly defined research track on the generic level of the living lab environment, and a mixed set of living lab tools, the possibilities of finding new opportunities or innovative ideas would be higher and projects within the lab would be better supported. Next, we present some lessons learned and discuss how a more successful implementation of living lab projects can be achieved.

Lesson 1: Create value and share it with everyone

FLELLAP and LeYLab obtained lower scores for their ecosystem approach as compared to Mediatuin and Laurea Living Labs. This result may be due to the missing links in their value chains and the unequal contribution of stakeholders. For example, FLELLAP focused on smart grids even though there was no thematic expert or electricity supplier involved. This gap brought about missed opportunities for building more innovative services in that domain. The malfunctioning ecosystem of FLELLAP resulted in the closure of the initiative in March 2013. Therefore, we recommend that, when setting up a living lab, there should be: i) a clear thematic focus for the strategy and ii) a good variety of stakeholders. A clear thematic focus will lead to complementary, shared motives for collaboration within the living lab, which in turn will benefit the community aspect (e.g., through increased engagement towards a given topic) and creation of new partnerships (e.g., less differentiated domains).

The results from our analysis also show that the type of infrastructure (i.e., an ad-hoc or fixed infrastructure) will determine the thematic focus. When opting for a fixed infrastructure (e.g., the fibre infrastructure in LeYLab), all projects running in the lab can make use of it. On one hand, it will lead to a clearer focus in the type of projects because the stakeholders should test an innovation that fits with the infrastructure. On the other hand, it will also restrain their testing possibilities because they are not able to extend beyond it. When opting for an ad-hoc infrastructure, as did FLELLAP, stakeholders feel less restricted in testing out innovations that are linked to the thematic focus of the living lab. The disadvantage is that every time a new project starts, users are equipped with new infrastructure or devices. It requires the panel manager to put in extra effort to guide each project and subpanel.

All these aspects underpin the strategic intention of the living lab and should be thoroughly discussed at the start of the initiative. It must be ensured that everyone will collaborate when diverse stakeholders are brought together, even if they have different interests, resources, and ways of operating. As illustrated by FLELLAP, which failed in building a mutual vision or a common purpose, it is of vital importance that value can be created and shared amongst every stakeholder when joining the living lab initiative. After all, living labs break down traditional and hierarchical approaches to innovation and frame them in a more experimental and collaborative manner (Hellström Reimer et al., 2012; tinyurl.com/ob925t4).

Lesson 2: When there is no value, there is no openness

A low score on the ecosystem approach may result in an even lower score for the level of openness. When there is no added value for the involved stakeholders in the ecosystem, industrial partners are less eager to share the results. Consider FLELLAP and Mediatuin, where stakeholders were reluctant to present their results to other partners or to give updates on scheduled technical improvements. Stakeholders feared competition and wanted to keep their agendas confidential. Mainly due to the lack of common purpose within these Flemish living labs, there was little to no interaction and information sharing among these stakeholders. In better circumstances, the involved stakeholders would have been able to draw on each other's knowledge, capacities, and resources.

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In FLELLAP, the pooled resources were exclusively used by the key stakeholders, which caused information blockages and inefficiencies in the innovation process. It was tremendously difficult to build up a good ecosystem and find new interested stakeholders. Furthermore, the lack of openness restrained small- and medium-sized enterprises and startups from accessing the critical assets that were afforded by the involved large businesses. For example, two smart media projects (Fietsnet and MUFOLIVE) in FLELLAP were not able to make use of the wireless Internet infrastructure of one of the large companies due to the lack of shared value creation. Therefore, we stress the importance of creating shared motives for collaboration, so that the living lab resources can be made available to each stakeholder.

Lesson 3: Community engagement is crucial
The differences in community engagement between the studied living labs are a remarkable finding. High performers on this scale included LeYLab, which is a geographical community and a community of practice through its installed fibre connection, and Laurea Living Labs, which consists of students and staff members. This engagement resulted in an active participation in panels and projects. Low performers are Mediatuin and FLELLAP with arranged panels based on a mutual interest for media and ICT. FLELLAP evidenced that a frequent communication (e.g., mailing bi-monthly newsletters, sharing results and pictures of the projects) helps to create a community from scratch. Moreover, a survey on the motivations for collaboration showed that intrinsic motivations were highest among the panel members, meaning that panel members had a personal interest in making a valuable contribution to the innovation.

Based on these results, the management of the panel and its communication could be set up more efficiently. The efforts of this approach eventually paid off in the studied labs, as evidenced by higher participation rates of FLELLAP over time relative to Mediatuin. For the panel managers of the living lab, this participation level meant a strong decrease in time and effort required in the recruitment of new people. Therefore, we recommend that, when setting up a living lab, one must have an access to a specific set of users and establish a strong communication link with them. Otherwise, there will be a need to recruit new people each time a new project starts, which means more effort and a loss of accumulated knowledge. In addition, community support will keep users motivated to participate in a living lab.

Conclusion

This article studied how the main characteristics, or building blocks, of living lab environments can impact the daily living lab operations and the outcomes of the projects. The Living Lab Triangle framework makes it possible to study the interplay between the setup of the living lab environment and the outputs of the projects within the lab. It triangulates the characteristics of the living lab environment, the living lab approach, and the innovation outcome. The study demonstrates that the living lab environment shapes the undertaken projects and that innovation practitioners should consider the intended inputs and outcomes and reframe their innovation activities accordingly.

Based on the findings from the studied living labs, we make five recommendations. For more successful implementation of projects, a living lab should establish:

1. A clear strategic intention
2. A minimum of shared value creation and sharing among all stakeholders
3. A minimum level of openness
4. A minimum set of users and establish a strong communication
5. A mixed set of living lab tools to discover new opportunities

Our framework is more comprehensive than previous conceptualizations on living labs. In addition, this study updates the current knowledge about living labs with some new real-life empirical data. However, future research should further explore the main building blocks and operationalization of the framework. Given that this study involved a small number of living labs cases, the framework should also be further validated on a larger scale. This validation should take place through a large number of living labs focusing on different domains. It would also be interesting to code the framework on the level of each living lab project, instead of the generic level, and assess to what extent the living lab environment contributes to the implementation of the projects.

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How Do We Keep the Living Laboratory Alive? Learning and Conflicts in Living Lab Collaboration

Louna Hakkarainen and Sampsa Hyysalo

> *"To understand the dynamics of interactive learning or knowledge creation, we need to study interaction between people: what was learned, how, by whom, and at what level of work and organization."*
>
> Reijo Miettinen (2002; tinyurl.com/ls3rgg5)
> Professor of Adult Education

Living lab environments are often promoted as a way to engage private companies, citizens, researchers, and public organizations in mutually beneficial learning. Based on an in-depth case study of a four-year living lab collaboration in gerontechnology, we agree that successful living lab development hinges on learning between the parties, yet its emergence cannot be presumed or taken for granted. Diverse competences and interests of participating actors often make technology development projects complicated and volatile. The study describes two specific challenges faced in a living lab project: i) power issues between the actors and ii) end-user reluctance to participate in the development of new technology. Despite the hardships, we suggest that the living lab environment worked as a catalyst for learning between users and developers. Nevertheless, realizing the benefits of this learning may be more challenging than is usually expected. Learning for interaction is needed before effective learning in interaction is possible.

Introduction

A living lab turns users from observed subjects to active co-creators of value, ideas, and innovative concepts – it is not only a testbed (McPhee et al., 2012; timreview.ca/article/601). It gives an opportunity to embed complex product ideas and prototypes within an environment that closely resembles the context of the product in real-life (Pierson and Lievens, 2005; tinyurl.com/9t9sylo). This opportunity, in turn, can stimulate interactions, create institutional support for innovation, and reduce innovation failures (Pierson and Lievens, 2005; tinyurl.com/9t9sylo).

Previous research further suggests that a living lab methodology helps in developing more context-specific insights on development and acceptance processes, and the interaction between them especially. Living lab experiments inform us about requirements of the embedding of technology in society, and they illustrate the potential societal impacts of innovation (Ballon et al., 2005; tinyurl.com/8hox58r). Almirall and Wareham (2008; tinyurl.com/8vwtjw2) posit that living labs offer governance and structure to user contributions; help the sensing of user insights; provide solutions to the filtering problem; create societal involvement; and can be used to promote user entrepreneurship. The living lab is seen to institutionalize the meeting place for all organizations involved, and integrate and synthesize the human, social, economic, and technological processes of innovation (Niitamo, Kulkki, Eriksson, and Hribernik, 2006; *Proceedings of the 12th International Conference on Concurrent Enterprising*). A human-centric innovation may emerge through the process, where technology is created and challenged in interaction with human, social, and institutional elements (Niitamo et al., 2006).

In terms of innovation research and innovation management, the research on living labs appears to be at the point where an interesting new phenomenon is charted from multiple directions, for instance, by comparing projects and experiences across living labs in dif-

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ferent countries and sectors (e.g., Leminen et al., 2012; timreview.ca/article/602), by analyzing living labs as innovation intermediaries (e.g., Katzy et al., 2012; tinyurl.com/lvroe2d), by situating living labs in the field of user-driven innovation methodologies (e.g., Ballon et al., 2005: tinyurl.com/8hox58r; Almirall et al., 2012: timreview.ca/article/603), by examining issues related to intellectual property rights (e.g., Pitkänen and Lehto, 2012; tinyurl.com/qjne78j), and by presenting specific cases of living lab development (e.g., Bendavid and Cassivi, 2012: tinyurl.com/kuup5rb; Bourgault, 2012: tinyurl.com/mz4aegx). A type of research that is hitherto missing in the living lab domain is an in-depth longitudinal case analysis examining some key facet, such as user–developer interaction. Such studies have become commonplace in innovation research over the past three decades (Van de Ven, 1999: tinyurl.com/n5h6xv2; Russell and Williams, 2001: tinyurl.com/nxeh3sv; Garud and Gehman, 2012: tinyurl.com/k97f6tu) and have thrown significant new light on how innovation processes play out.

The present article provides a rare overview of the results of such an in-depth longitudinal case study (Hakkarainen, 2013; tinyurl.com/l8dqpsr) of some of the key aspects of living labs: user involvement, learning, and interaction between participants (Katzy et al., 2012; tinyurl.com/lvroe2d). We follow these aspects during a four-year living lab collaboration that took place in a Finnish nursing home, and ask:

1. What learning occurred between participants?

2. What were the challenges in achieving this learning?

3. How were these challenges overcome?

Our research draws from one of the key traditions in the detailed studies of innovation, the social shaping of technology approach (Williams and Edge, 1996: tinyurl.com/kh2oncz; MacKenzie and Wajkman, 1984: tinyurl.com/mhbbatg), and its further development, the social learning in technological innovation approach (Williams et al., 2005: tinyurl.com/ma479bl; Stewart and Hyysalo, 2008: tinyurl.com/lox4bvp; Hyysalo, 2010: tinyurl.com/qz3ebln). Alongside other detailed longitudinal approaches to innovation, the three decades of social shaping of technology research have come to emphasize that innovations are typically long and winding journeys rather than orderly projects (Williams and Edge, 1996: tinyurl.com/kh2oncz; Van de Ven, 1999: tinyurl.com/n5h6xv2). They are characterized by high contingency and uncertainty; indeed, there may be a "fog" over the best possible courses of action (Russell and Williams, 2001: tinyurl.com/nxeh3sv; Höyssä and Hyysalo, 2009; tinyurl.com/kn59mhk). Learning, particularly related to uses and user contexts, has been found to be crucial to these processes and whatever success they may have (Williams et al., 2005: tinyurl.com/ma479bl; Hyysalo, 2009: tinyurl.com/mcwgdd8), because innovation is typically an affair between multiple stakeholder groups that have different cultures, priorities, and interests towards the project (Williams and Edge, 1996; tinyurl.com/kh2oncz). Different perceptions over the appropriate form and function of new technology tend to lead to tensions and conflicts between stakeholders (Miettinen, 1998: tinyurl.com/mre2ezj; Johnson et al., 2013: tinyurl.com/lzr5y39; Latour, 1996: tinyurl.com/mgk2ot3).

Particularly in health technology innovation, learning between developers and users has been found to be of crucial importance (Hasu, 2001: tinyurl.com/pvwp3kc; Hyppönen, 2007: tinyurl.com/od997pt; Hyysalo, 2000: tinyurl.com/kyw6pma; Hyysalo, 2010: tinyurl.com/qz3ebln). The parties typically have limited capacity to absorb information from other stakeholders due to lack of time and often required extensive background understanding. Many times, the parties find it difficult to even judge which information is relevant for them (Hyysalo, 2010; tinyurl.com/qz3ebln). It is further unclear who should invest in the learning and creation of working arrangements for interaction. In all of this, the shape of technology, uncertainties about its material realization, and the types of knowledge related to it, do matter. The net outcome is that the required learning tends to become a complex issue to master and grapple with; indeed, it is a multi-level game between stakeholders (Stewart and Hyysalo, 2008; tinyurl.com/mssxkf3).

With regard to innovation management, the longitudinal studies on innovation have come to view the orderly, controlled, and linear management models better suited for incremental new-product development projects. When initiating new product types or product categories, measures such as stage gate models act more as legitimizing devices than effective tools for management (Van de Ven, 1999: tinyurl.com/n5h6xv2; Jolivet et al., 2008: tinyurl.com/lfctg7g). In dealing with high uncertainty, periodical direction assessment and re-setting appear better suited for working towards the eventually desirable and attainable shape of technology, its business case, and social implications (Duret et al., 1999: tinyurl.com/ll4wqcx; Jolivet et al., 2008: tinyurl.com/lfctg7g).

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Our living lab research continues this line of studies of the mechanisms of learning and interaction between developers and users in real-life settings. We now proceed by first introducing the development project and the main difficulties in executing such intensive long-term collaboration. Thereafter, we present how the participants overcame these challenges and what were the most important benefits of the living lab methodology. Finally we distill a set of key messages to companies and other actors who are involved or interested in living lab collaboration, especially in the field of healthcare.

Research Approach, Methods, and Data

The data and analysis methods of our study are reported at length by Hakkarainen (2013; tinyurl.com/l8dqpsr). In short, the main bodies of data are 90 meeting memos and 16 semi-structured interviews. The project personnel, who were hired to organize the collaboration and who acted as user-side innovation intermediaries, documented nearly all the meetings held with different participant groups over the course of the four-year collaboration project. We used historiographic document analysis to track down processes of learning, tensions, and conflicts between the participants, as well as the temporality of the innovation process. The length of one memo was typically one to two A4 pages. In addition to memos, the data included project reports, plans, and marketing material. Altogether, the data included 151 different documents related to the development and use of the "smart floor" (described below). The historiographic document analysis was carried out by following the principles of source criticism and was triangulated with the analysis of the interviews in order to gain understanding of the events and to capture the multiple perspectives to the innovation process. The interviews varied from recorded and transcribed interviews of over one hour, to more informal half-hour chats during a normal workday. Open coding was used to categorize both the document and interview data on different research themes, events, methods etc. Our research covers the smart floor innovation project prior to and after living lab collaboration, as well as the intertwined phases of design and use of the system during the project.

Outline of the Collaboration Project

The origins of the smart floor system are in the Helsinki University of Technology (now Aalto University: aalto.fi), where the motion-tracking technique behind it was discovered in the early 1990s. Years later, a group of researchers and students created the first version of the floor monitoring system, and a startup company was founded around the concept in 2005. The idea for the gerontechnological device originally came from the user side: an innovation-oriented nursing home manager became aware of the discovery and encouraged the engineers to advance the technique into a floor-monitoring system for elderly care.

The system consists of: i) a sensor foil, which is installed under the flooring material; ii) the user interface on a computer situated in the office; and iii) cell phones, which the nurses carry with them during their work shifts. The movements of the residents generate alerts, which the nurses receive through the cell phones. The system can inform the nurses about, for example, a situation where a frail elderly person is getting out of bed, entering or leaving the room, entering the toilet or occupying the toilet for an unusually long time. The alarms are tailored individually to each person.

The system reached its final form during a four-year living lab undertaking, which took place in four units of a large public nursing home from 2005 to 2009. Participants in the collaboration were the startup company, researchers from the university, project personnel – who acted as user-side innovation intermediaries (Stewart and Hyysalo, 2008; tinyurl.com/lox4bvp) – management and care personnel of the nursing home, IT experts from the municipal bureau of social services and health care, and indirectly the residents of the nursing home. The funding for the project came from a municipal innovation fund and was mostly used to hire project workers at the elderly care site.

From the perspective of elderly care actors, the goal of collaboration was to develop new technology and simultaneously discover ways to utilize it. The implementation started at the end of 2007 in a pilot unit where the smart floor was installed in two rooms. Later, the system was put to use in three other units, each with around 20 residents, where the sensor foil was installed in all the rooms and public spaces. An overview of the project timeline is provided in Box 1.

The project was realized without formal co-design methods. Information exchanges took place in regular meetings, where the project workers met the end users and the developers (i.e., the nurses and the engineers), separately. User concerns were learned through weekly

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to monthly feedback meetings with the nurses discussing how the system had been utilized, what its benefits were, how it changed the care work, and how it had affected the elderly people. This feedback was complemented by observing the daily use, which the project workers valued as the most important way to collect information for the improvement of the system. Their background as care workers helped them to make sense of the daily work. But, before events got to this point, the project had to navigate a number of serious potholes, as described in the following section.

Box 1. Project timeline

1990s	Motion-tracking technique is discovered at the Helsinki School of Technology
2005	Smart floor receives an award in a business idea competition; spin-off company is founded
2006	Sensor foil is installed in the nursing home building; user collaboration begins
2007	August: User interface version 1.0
	November: Use of the system begins in the pilot room
2008	April: Implementation is extended to three full units
	May: User interface version 1.1
	June: New alarms are added to the system
	September: User interface version 2.0
2009	April: User interface version 2.2; new alarms are added to the system
	May: Startup company merges with an established electronics company
	Fall: Living lab project ends and the smart floor is launched
2013	Smart floor is installed in over 2000 rooms in residential care facilities, mainly in Finland

Birth of the Smart Floor through Conflicts and Power Plays

At the onset of the project, the engineers and the care professionals had strongly differing understandings of the maturity of the system and each other's roles. The company was in a hurry to launch their product, but from the user perspective, the smart floor was not even ready for the test implementation. The client – as represented by nursing home staff and project workers – was frustrated with the functioning of the system and severity of its bugs, and saw the engineers as arrogant and indifferent to the welfare of the residents, whereas the company saw the users' requests as unreasonable and unrealistically scheduled. The goal of the company was to create a generic product instead of a tailored system; accordingly, the engineers were skeptical about the client's demands. A struggle for power over the project ensued. The key issues revolved around how quickly and accurately the developers had to answer to the wishes and demands of the care professionals, and who finally decided what functionalities would be developed into the system. The events culminated in the nursing home management and project workers refusing to proceed with the implementation unless their suggestions and demands were met. At the end of 2007, the conflict culminated in the resignation of several members of the living lab project, bringing the whole project to the verge of collapse.

Nevertheless, when the rollout of the system began at the beginning of 2008, the developers, project workers, and management of the nursing home found common ground for carrying forward the project. The hiring of a new project coordinator seemed to be essential for the new consensus. At this point, the innovation project manager wanted to find an independent and innovative negotiator, someone who would be able to change perspectives when needed, instead of just being a passionate advocate of the user side. They were looking for a person who could convince all the stakeholder groups of each other's good intentions and react quickly to changing circumstances, in other words, a genuine innovation intermediary. Nevertheless, this person had to be practical enough to push through the demanding implementation phase.

Pushing forward with the rollout of the system required the developers, project workers, and nursing home management to ally against the care personnel, many of whom were reluctant to use the system or participate

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in its improvement. Because of heavy and demanding work, the nursing staff was unwilling to study new things alongside their normal workload or to change their work routines. The nurses saw themselves as caregivers, not machinists, and were generally reserved about complex gerontechnological devices (tinyurl.com/k5z7k2c). Broader societal dissatisfaction with the financing of elderly care services also loomed in the background. Many care workers boycotted the smart floor, for instance by not carrying the cell phone with them during their shift, and continuing to work as they used to. In these circumstances, the commitment of the nursing home management to the implementation proved to be crucial. The use of the system and attendance at the feedback meetings was made obligatory for the nursing staff, yet they were given a chance to transfer to another unit. The manager of the innovation project was a former manager of the nursing home, which seemed also to play a role in building the commitment of the department managers to the living lab project and overcoming the resistance of the nursing home staff.

During the implementation, the strict discipline was counterbalanced by the devotion of the newly hired project staff, who were also care professionals by education. They spent time in the living lab units every day and helped the nurses in the implementation of the system, occasionally also in normal care duties. The distress of the nurses was discussed in the weekly feedback meetings, where the care personnel had an opportunity to speak out, comment on the system, and express new development ideas.

Unfortunately, the disgruntled care personnel were not very keen on generating development ideas. The responsibility to develop the system further was left on the shoulders of the project workers, especially the new project coordinator. As noted, the project workers observed use, identified problems and solutions with the engineers, and thought about ways to utilize different functionalities and properties of the system with the care personnel. Another important theme of discussion with the nurses was the question of how the system should be used in order to produce optimal results: for example, how to determine the right mix of alarms for each resident, how the system affects elderly people in the long term, and what should be done when a nurse receives overlapping alarms. The project workers and the care personnel also thought about the challenges the living lab project created, for example what should be done when the system does not work the way it is supposed to.

Hence, as unfortunate the tensions and conflicts were, they did "hammer in" each stakeholder group's realities and priorities to the others, thereby leading to deeper and more appreciative collaboration. Learning sensible ways to organize and time collaboration as well as learning to listen and respond to other party's concerns had to be achieved before mutually beneficial collaboration was achieved.

Fruits of the Living Lab Collaboration

Despite the challenges, the benefits of living lab collaboration for the innovation project appear formidable. Before the user collaboration, the operating idea of the system was limited to detecting instances when elderly residents accidentally fell in the nursing home environment. During the living lab project, the system evolved from a simple "fall down alarm" to a precautionary nursing tool, which instead of simply alarming the falls actually aimed to prevent them. Fall-down detection alone had relatively low value, because falls were detected fairly quickly in a nursing home environment anyway. The living lab collaboration, thus, helped the company to change the focus as well as the value promise of the system before the market launch. The fall-down alarm evolved to a smart floor.

During the living lab project, several new alarms were added to the system. Moreover, unexpected uses emerged and were conveyed to the company. For instance, in case of a fall, the nurses used recorded data about the movements of the residents to diagnose potential risk factors in order to prevent new falls. Improving the quality of care, such as reducing the use of movement-restriction devices (e.g., bedside rails), was an important motivation for the municipal actors to start collaboration with the company and the university of technology in the first place. During the collaboration, the system evolved to reach that goal. The nurses also kept track of all the false alarms sent by the system, which enabled the company to fix a large element of the technical bugs before the large-scale marketing of the system began.

In summary, the living lab collaboration helped the company to redirect the focus of its product to a more valuable opportunity, gain new product features and value-added uses, and helped in weeding out bugs in the system. Equally important, the company gained a profound understanding of the use contexts and real-life benefits of their product, which included how the smart floor changes care work, what efficient implementation and use of the system require from the end

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users as well as from the company, and how the system affects the residents in the long run. During the collaboration, the company reached an in-depth understanding of the benefits, functioning, effects, implementation, risks, and possibilities of their product as well as the realities of the elderly care field in general. This knowledge helped the company to market their product and to support the implementation process in new client organizations.

Key Messages Emerging from the Case

Successful learning between developers and users can lead to a crucial yield with regard to the innovation process, but it is not an automatic feature of living lab collaboration per se. It requires often painstaking and conflict-ridden effort to establish such learning, even though the living lab setting and the commitment of parties to this collaborative mode of development may act as facilitating conditions. The case shows that, in high-dependability environments such as health and social care, particular attention should be paid to the following facets of living lab collaboration:

First, participants should chart different priorities and restrictions at the onset of collaboration: what issues the parties will be most concerned about, what issues are likely to be difficult to compromise, and what the conditions are in both work practice and in the technology that the parties can be flexible about.

Second, the participants should be prepared to handle conflicts, hire competent intermediary actors, and establish adequate governance structures in both organizations before the beginning of the collaboration. The needs of the project should be reviewed in the course of the collaboration, which might be difficult in the case of a rigid project plan. Regular meetings, face-to-face communication, and adequate ways to agree on scheduling are further issues that facilitate learning and help to build trust between the participants. We also recommend seeking adequate collaboration tools – in cases, just memos and lists can do the job, but at other times prototypes, mock-ups, and digital collaboration platforms may be needed.

Third, it is crucial to find adequate innovation intermediaries who can mediate between both developer and user contexts: relying solely on general process facilitation is unlikely to be sufficient. In the smart floor case, the intermediaries had to continuously adjust to unexpected situations and play several different roles. This task required creativity, negotiation skills, independence, interest in developing technology as well as elderly care practices, and the capacity to build trust between the parties. This flexibility was made possible by a loose project plan and by the project workers' sufficient understanding of the user context through their own background in care work.

Conclusion

Most researchers see collaborative learning among stakeholders in real-life environments as the core rationale for setting up living labs. The current case analysis lends support to this view. Users, indeed, became co-creators of value, ideas, and innovative concepts (McPhee et al., 2012; timreview.ca/article/601). A complex product was successfully embedded in a demanding context (Ballon et al., 2005: tinyurl.com/8hox58r; Pierson and Lievens, 2005: tinyurl.com/9t9sylo), and in doing so, interactions and institutional support were fostered and a governance structure for user and developer contributions was created (Almirall and Wareham, 2008; tinyurl.com/8vwtjw2). Insights on development and acceptance processes, the value proposition of innovation, and on deployment processes were formed (Pierson and Lievens, 2005; tinyurl.com/9t9sylo). We dare to state, that without the living lab, the current success case would likely have been another innovation failure.

The case study, however, also shows how laborious and volatile such long-term and intensive collaborative undertaking can be. Before there was effective learning *in* interaction, there had to be learning *for* that interaction (Hyysalo, 2009: tinyurl.com/mcwgdd8; 2010: tinyurl.com/qz3ebln). The early phases were characterized by the stakeholders' inability to understand and cater for each other's key concerns. The company staff underestimated the weaknesses of their prototype, did not take reliability issues seriously enough, and did not appreciate how superficial was their understanding of the elderly care context. The care personnel, in turn, were unwilling to learn to use and to work with a complex, incomplete system in addition to their demanding care duties.

The case provides further suggestions about what types of actions may turn the divergent interests and competences in to complementary ones. The active role of innovation intermediaries appears to be central, as does their deep-seated knowledge with regard to user practices. This central role helped them to seek innovation relevant information from daily use and to understand user concerns. Their frequent face-to-face communication with both parties and (by then) the genuine oppor-

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tunity to make a difference helped to build trust and overcome resistance. Further research on innovation intermediaries in living lab undertakings is needed in order to better support and enhance the learning processes in living labs. The nursing home management who forced system use and the company that continued its commitment to the collaboration also played key role in the success. The deepest knowledge transfer to the company came through hiring the key project intermediary (i.e., the project coordinator) upon completion of the project. The learning in collaboration succeeded without formal co-design methods or arrangements; it largely relied on the intermediaries' firsthand acquaintance of elderly care contexts. Knowledge of such means or having developer-side intermediaries to distill findings also could have been helpful.

To date, in-depth longitudinal analyses of living lab collaboration have been rare. The current case overview gives a glimpse of their merits in describing the microprocesses of living lab development, and how to come to better grips with them (Katzy et al., 2012; tinyurl.com/lvroe2d). Such research-based descriptions of practical living lab collaboration and change over time are needed to give managers, facilitators, and workers of living labs a better sense of the processes at stake. In terms of further research, such analyses can provide grounds for comparison between living lab development with projects conducted without living labs, and how this might vary in different sectors and in different kind of living labs.

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From Idea Crowdsourcing to Managing User Knowledge

Risto Rajala, Mika Westerlund, Mervi Vuori, and Jukka-Pekka Hares

> *"Crowdsourcing will shift its focus from individuals solving individual problems to a more collaboration-based model. Groups of people will be engaged to solve more complex problems, and the power of the crowdsourcing engine will be used to create crack virtual teams that you can build locally."*
>
> Chris McNamara
> COO, DesignCrowd
> tinyurl.com/k7gorac

This article explores how technology companies can benefit from user knowledge in product and service innovation beyond mere idea generation through crowdsourcing. We investigate a case from the telecommunications sector to discover the ways a company can overcome the challenges of motivating users to participate in innovation activity and gaining from their knowledge in the innovation process. In particular, we seek to learn how the company has created understanding about the future uses of technology and the developments of the market with the lead users. In addition, we analyze the key means of capturing value from the knowledge gathered from the users, including the essential organizational practices that support user innovation and the ways the company makes sense of the vast volume and variety of user knowledge. Our empirical inquiry increases the understanding of how technology companies can complement and use crowdsourcing to effectively utilize knowledge resident in user communities.

Introduction

There is a growing appreciation for the value of resources that lie beyond a firm's organizational boundaries and can be tapped into for innovation purposes and R&D collaboration with suppliers, universities, customers, or even competitors (Un et al., 2010; tinyurl.com/mlcbg5t). Users can be considered as one important source of innovation, and user innovation has been recognized as one central research stream within the open innovation phenomenon (Gassman, 2006; tinyurl.com/n5fq3gs). The unique knowledge held by users is perceived as a valuable resource for innovation because it improves understanding of real-life situations where the company's product or service is used (Poetz and Schreier, 2012; tinyurl.com/lgham7n). Previous research shows that innovations created by lead users have been regarded commercially attractive. Moreover, it has been shown that the needs of lead users indicate how the market is to change in the future (von Hippel, 2005; tinyurl.com/57xp5x). Also, Piller and Walcher (2006; tinyurl.com/m9nkb4r) show that innovations developed with lead users can be successfully commercialized. Hence, it is reasonable to think that, from an innovation management perspective, companies should engage users – especially lead users – in ideation processes to devise desirable solutions.

Given that the knowledge needed for innovation is becoming increasingly distributed across organizational boundaries (Swan et al., 1999; tinyurl.com/cgy3gje), the task of capturing user ideas and transforming them into commercialized innovations poses a challenge for companies. Although many companies have resorted to

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user design toolkits to capture users' ideas (Thomke and von Hippel, 2002; tinyurl.com/l6vb5gq), crowdsourcing has become an increasingly popular tool for acquiring external knowledge and ideas (Djelassi and Decoopman, 2013: tinyurl.com/lqfbrxg; Feller et al., 2012: tinyurl.com/l8oxsle). Crowdsourcing is characterized by the voluntary participation of a diverse crowd in a problem-solving initiative from a sponsoring organization that chooses from among the generated ideas and solutions (cf. Estellés-Arolas and Gonzales-Ladron-de-Guerva, 2012; tinyurl.com/ma8ohjg). A company that initiates a crowdsourcing initiative is usually exploring innovative solutions that may include new sources of revenue in the form of new products, new services, or even new business models (Dahlander and Gann, 2010: tinyurl.com/chacrs9; Djelassi and Decoopman, 2013: tinyurl.com/lqfbrxg).

But does crowdsourcing lead to increased or improved innovation? Leimeister and colleagues (2009; tinyurl.com/adzjqv6) argue that idea contests promoting the competitive nature of idea crowdsourcing may actually lead to less collaboration and information sharing among contributors. Likewise, the absence of discourse – the ability to share various perspectives and build on each other's knowledge amongst crowdsourcing participants – can inhibit co-creation in innovation (Majchrzak and Malhotra, 2013; tinyurl.com/mu6ypck). Although these challenges relate to the incentives associated with the implementation of crowdsourcing, the issue of how a company can actually transform knowledge generated by crowdsourcing into viable innovations that outperform the competition remains a major challenge for any organization. Thus, there is a need for more research on the mechanisms, concepts, and tools to manage the wisdom of crowds, as well as on filling the conceptual gap between the generation and the selection of ideas and their transformation into innovations (Ebner et al., 2009; tinyurl.com/mwm2yfm).

This study aims to increase the understanding on *how technology companies can move beyond using crowdsourcing to collect ideas to a more systematic and nuanced way of using crowdsourcing to manage user knowledge*. In particular, the study focuses on the ways an organization can utilize crowdsourcing to gather knowledge from the users and subsequently complement and use this knowledge in new product and service development. In doing so, the study examines: i) which motivations companies perceive as essential for users to share their knowledge for innovation purposes, ii) what the key organizational practices are that support effective user innovation management, and iii) what the key challenges are from a knowledge management perspective. We believe that addressing these questions through an empirical inquiry is of interest to scholars and practitioners of innovation.

The New Role of Users as Innovators

External contributors are becoming ever more important sources of knowledge and innovation for commercial product and service development. The literature on innovation management links customers to the success of product and service innovation (e.g., Von Hippel et al., 2011: tinyurl.com/cc98mlb; Coviello and Joseph, 2012: tinyurl.com/lkuu2qj) and suggests that users constitute a great potential source of innovation, because the competence and experience of users is not limited to the early idea generation: they can contribute throughout the innovation development process (Edvarsson et al., 2012; tinyurl.com/mvv2jbw). Through user innovation, companies can find new ideas more rapidly and at a lower cost than through traditional internal innovation. However, profiting from user innovation is difficult (Bogers et al., 2010; tinyurl.com/nxdeyb6) because user knowledge is considered complex and challenging to manage effectively.

Prior research has viewed users in different ways. An early work by Eason (1987; tinyurl.com/m4s5ewb) classifies users into three categories: i) primary users: those likely to be frequent users of the product or service; ii) secondary users: those who use the product or service through an intermediary; and iii) tertiary users: those affected by the introduction of the product or service or who will influence its purchase. Later works (e.g., Sharp et al., 2007; tinyurl.com/kpqdbot) have defined users as those who interact directly with the product to achieve a task. However, companies must not only understand the interactions of users with their products; it is also important to understand *non-user* behaviour, such as the reasons behind a customer's intentional decision not to take on a product or service. Also, it is important to understand the situation of people who are not yet users to possibly help them benefit from the value of use. Indeed, several scholars have stressed the importance of mobilizing a mix of users in the innovation activity. For instance, Surowiecki (2005; tinyurl.com/ld499o4) suggests that diversity among members of the crowd, independent thought on the part of the actors, and decentralization in the organization of the activity are keys to success in crowdsourcing.

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Von Hippel (1986; tinyurl.com/kxznqq3) underscores that lead users take part in successful innovation. Congruently, the study of Coviello and Joseph (2012; tinyurl.com/lkuu2qj) highlights that successful user innovation often engages lead users; they are keen to participate in the innovation activity because there is potential value created for their own needs in the innovation process. In addition to engaging lead users, Coviello and Joseph (2012; tinyurl.com/lkuu2qj) suggest that those users that are technically eager, open to learning, and willing to commit to the nascent innovation are equally relevant. They show that tech-savvy users seem to be willing to learn during the innovation process and, thus, are capable to adapt to changes and provide new ideas and relevant feedback in changing situations. Moreover, Edvarsson and colleagues (2012; tinyurl.com/mvv2jbw) demonstrate the potential for experienced users to provide context-specific expertise to the innovation process.

Crowdsourcing as a Form of User Innovation

Various community-engineering techniques leverage the potential of crowds by fostering an online user community for innovation, which provides a major opportunity for R&D (Ebner et al., 2009; tinyurl.com/mwm2yfm). Consequently, many approaches have been used to interact with users for innovation, including living labs and crowdsourcing. Companies use a variety of techniques to maximize returns from their interactions with users, and each approach has its strengths and weaknesses. In general, posting business problems in large communities – for example through "challenge driven innovation" (Bingham and Spradlin, 2011; tinyurl.com/kw7yey9) – may expose sensitive information and strategic intent to a wide audience, but crowdsourcing offers a possibility for more focused user innovation. Pisano and Verganti (2008; tinyurl.com/luw84un) suggest that, in company-led innovation approaches, innovating with a small number of contributors is appropriate when:

- one knows the knowledge domain from which the best solution to the problem is likely to emerge
- having the best experts is important and one has the capability to pick them
- one can define the problem and evaluate the proposed solutions

Conversely, Pisano and Verganti (2008; tinyurl.com/luw84un) suggest that a larger community of innovators may prove beneficial when:

- one requires ideas from many parties and the best ideas may come from unexpected sources
- participating in the network is easy
- the problem is small or, if large, can be broken into modular parts
- one can evaluate many proposed solutions cheaply

In its pure form, crowdsourcing is a manifestation of the latter approach. According to Pisano and Verganti (2008; tinyurl.com/luw84un), such an approach may be applicable in situations where a company is able to present a problem, anyone can propose solutions, and the company wishes to choose the solutions it likes best. However, large communities imply remarkable challenges for managing user knowledge. Knowledge in online user communities is characterized by mobility, appropriability, and stability that need to be orchestrated to make benefit of crowdsourcing (Feller et al., 2012; tinyurl.com/l8oxsle). Gibbert, Leibold, and Probst (2002; tinyurl.com/mbryalo) point out that the major challenges in making use of the knowledge resident in user communities include understanding and supporting users' motivations to participate in collaboration with a commercially oriented company. Community members' social orientations typically depart from the host organization's commercial focus, which can lead to unresolved tensions and to the failure of the initiative (Kelleher et al., 2011; tinyurl.com/ld8fecy).

In addition, users' knowledge and experiences are often tacit by nature and therefore difficult to share (Bonner, 2010; tinyurl.com/lddau6n). Users may find it challenging to share their knowledge in a meaningful way to support innovation. Moreover, Smith and McKeen (2005; tinyurl.com/kfxv927) show that structural challenges in the innovator's organization may hinder user participation. On the other hand, Jeppesen and Molin (2003; tinyurl.com/k2h6o4r) argue that user innovation can be structured, motivated, and organized by a company that provides the infrastructure for user participation. To this end, Boudreau and Lakhani (2009; tinyurl.com/khrzmnl) argue that executives need to consider whether users are motivated to participate by intrinsic motives such as enjoyment, status, and identity that participants can gain through their interactions with others (Deci et al., 1999; tinyurl.com/k6zambt) or by extrinsic

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motives such as financial benefits. In all, these notions on benefiting from online user communities call for more research on capturing, managing, and utilizing user knowledge for new product and service development.

Methodology

Our study follows the research design of an explorative single-case study where data collection took place using interviews. Extant literature on user innovation and crowdsourcing were used to guide the study; they provided us with an initial understanding of managing external innovation and users' roles in the innovation process. The inductive phases were conducted using an interpretive case study method (Walsham, 1995; tinyurl.com/nyca4vj), including seven semi-structured interviews with innovation and user community managers in the case organization (Table 1). In the interviews, the managers of the case organization were asked to share their views regarding the methods, knowledge gained, and the outcomes of crowdsourcing with their user communities. Given that we intend to improve the understanding of how the case company may benefit from the knowledge gained through crowdsourcing, the managers involved in the crowdsourcing initiatives within the case company were considered feasible informants. The interpretations and meanings given to the different subjects by the interviewees were taken into consideration in our analysis of the data as suggested by Denzin and Lincoln (2011; tinyurl.com/levjb4g). In addition to the interviews, we also had access to a variety of secondary data, including company reports, white papers, articles, and studies.

Table 1. List of interviews with the managers of the case organization

Interview	Title	Area of Responsibility	Years at the Organization
1	Manager	Manager of Beta Labs	7
2	Senior Manager	Innovation and benchmarking	7
3	Senior Manager	Strategy planning and dialogue	2
4	Senior Manager	Customer culture and innovation	9
5	Trend Specialist	Opportunity identification	10
6	Manager	Service creation product quality and delivery	7
7	Senior Manager	Customer insight initiative	5

The company investigated in our single case study is a globally operating manufacturer of mobile phones and related devices and software. In 2010, the company employed 60,000 people from 115 different nationalities. We selected this company because it has reportedly shown interest in benefiting from their customers' knowledge in service innovation. The case company has applied crowdsourcing to make use of the skills and creativity of the users in its product and service innovation activity. It has established a separate business unit to manage user insight in its innovation activity. This unit conducts crowdsourcing projects among other user-centered innovation activities. The case provides us with an opportunity to analyze the factors that facilitate large-scale user-knowledge management through crowdsourcing. What is more, it reveals some of the lessons to be learned from the challenges of transforming crowdsourcing initiatives away from idea generation to mastering knowledge gained from the users.

We provide illustrative excerpts from the interviews to demonstrate the key findings. After transcribing the interviews, we coded the contents and organized the data to discrete yet connected blocks that describe the key themes discovered from the data. Initially, we identified four general themes in user knowledge management: i) users' motivations for knowledge sharing, ii) diversity of the participating users, iii) facilitators of user innovation, and iv) challenges in deriving business value from user knowledge. That is, the analysis revealed those motives that companies perceive as essential to support to enhance users' knowledge sharing for innovation. Moreover, the differences between the types of users surfaced in the analysis and emphasized the importance of focusing on the lead users. Finally, the analysis separates the practices that foster user innovation through crowdsourcing and the challenges faced by companies in deriving business value from users' knowledge.

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Theme 1: Users' Motivations for Knowledge Sharing

Product giveaways

The willingness of users to participate in knowledge sharing and developing products and services is not connected with financial incentives. Instead, the users participate because they are interested in the products themselves: *"[We] have not given [direct] monetary compensations to individual lead users, but we may have rewarded them with a [rather small] promotional product gifts (such as a phone, headset, or something like that)"* (Interview 3). Monetary compensation is not among the important motivators they use to support knowledge sharing, because active participants want to be the first ones who see and get to use the new products. In addition, our interviewees underscored that users desire better and newer products and are willing to learn something new. Hence, small tangible rewards, such as the company's latest mobile devices, were seen to motivate users more than other rewards. For example, enthusiastic users submitted more than 2,500 new ideas related to mobile phones over a five-week period, just for the chance to win one of 15 new devices given away in the contest. Documents from the case show that small tangible rewards, such as the latest mobile devices, motivate people more than any other reward (tinyurl.com/k952yjs).

Meritocracy

The lead users are seen to be motivated to contribute to knowledge sharing, product development, and collaboration with a technology company in order to gain peer-to-peer recognition, for example, in the voting of user-generated ideas within the community: *"The feeling of bonding with the community and possibility to influence are significant motivators"* (Interview 1). The opportunity to participate and share their own thoughts and ideas was found to be an essential user incentive that company managers support. Moreover, the feeling of being part of the user community is considered an important motivator for users to share their knowledge in the user community. In addition, gaining credit, acknowledgement, and support from others in the user community were found to be effective motivators.

Credibility and trust

Users seem to be motivated to participate in the development of products that have a strong brand image. A good corporate reputation helps recruit voluntary users to cooperate with the company. Moreover, strong brands are seen to enhance the users' motivation to share their ideas and knowledge, because users can feel they are being given an exclusive opportunity to influence the products of a recognized brand: *"The credibility of our brand is so strong that a bank under our corporate brand could be easily established, assuming that the bank would be a culmination of a very high level of trust"* (Interview 3). One of the interviewees underscored that most of the community users she had been in contact with wanted to cooperate with the company and take part in its innovation process because they loved the brand. However, she noted that it was difficult to identify the lead users: *"Seeking the lead users is harder than head hunting -- there are even firms specialized in finding lead users from blogospheres and elsewhere on the web"* (Interview 3). Corporate credibility and brand image were considered to influence even the non-users given that some of the users of other brands have been willing to participate in the case company's innovation activity.

Theme 2: Diversity of the Participating Users

The role of lead users

Lead users are the primary target of user innovation in our case organization. The interviewed managers stressed that lead users are also most willing to participate in projects with the company: *"The target group needs to be clear and feedback should not be collected randomly from random people"* (Interview 2). The interviewees highlighted that lead users are not only enthusiastic about collaborating with the company, but they are also very interested in the latest technology and eagerly seek emerging programs because they want to try everything new. The lead users are highly capable in using the products and they have a good insight into the products: *"They seem to know more about the products than what we do"* (Interview 1). Users' ideas about the potential use of products go far beyond technological thinking about the future evolution of the products. Because lead users bring out novel ways to use the product in the future, it is important to understand the character and living context of the lead users: *"pure ideas are not important, the people behind them are"* (Interview 3).

User needs reflecting future trends

Lead users' perceptions were deemed important in the case organization because they are considered to represent the future needs of the mainstream users. However, sometimes the needs of lead users are so advanced that their behaviours never become mainstream. The preferences of lead users and the mainstream may differ significantly; some features that lead users may rate highly may be of no interest to the

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average user. Companies must take this into account when working with lead users. Crowdsourcing can significantly benefit from a mix of users given that it aims to collect a variety of ideas and knowledge. However, *"lead users are the ones who most often volunteer to participate in the projects with the company"* (Interview 3) and *"it is more difficult to reach the mainstream"* (Interview 6). Thus, it is tempting to focus on lead users that form their own homogenous community; they share ideas and thoughts with each other and want to be members in communities with like-minded others having similar interests. They are opinion leaders about technology and are considered to not only affect the innovation, but also the social behaviour of their friends and peers.

Theme 3: Facilitators of User Innovation

Mechanisms of participation

Our interviewees underscored the importance of paying attention to the ways of participating, gathering, and processing ideas. In addition to crowdsourcing, the case company has used various methods to collect customer knowledge, including workshops, interviews, ethnography, anthropology, consumer feedback, online events, forums, blogs, communities, focus groups, consumer testing, tracking, quantitative methods, open source, design reviews, and surveys. Furthermore, they use toolkits for involving consumers in the development process: *"We have invited lead users to the brainstorming events. They come there of their own accord and we pay the expenses, and of course we're trying to make it a 'wow'-experience"* (Interview 3). Users share their experiences, and the company tries to capture an impression of their everyday lives. One of the informants found that this is a way to identify important details, which the users may not even be conscious of or perceive as important. Therefore, it is important for an observer to have an analytical eye for the tacit knowledge embedded in the practices of everyday life.

Selection of relevant knowledge

Recognizing and picking relevant information is a major concern in large-scale crowdsourcing: *"How do we obtain the right knowledge, and on which level should the relevant user information be brought in so that it matches the needs of our in-house innovation? We can understand the world but we cannot control its needs so to say, because they are emerging and changing all the time. That is a big problem"* (Interview 5). It is also not always clear which part of the user input should be taken seriously. As disclosed by one of our informants (Interview 3), people may overstate their expertise in order to become chosen into the crowdsourcing program. Another consideration is that the participants may represent only a small fraction of the users and that the most enthusiastic users may be overrepresented. *"Some people like our brand so much they participate in these events eagerly"* (Interview 3). The company was seen as the leader of the process of recognizing and deciding the needs behind the users' behaviour, because the users do not usually care about the expenses or how large a customer segment their idea would serve: *"We must be the brains that decide what customers need; we cannot assume they tell themselves about the needs the customer is not even aware of yet"* (Interview 4). Yet, the interviewees emphasized the importance of being able to put oneself in the user's shoes: *"You need to have a correct mindset all the time; you need to have a user in mind. Moreover, you need to use different sources of information and then decide and pick the relevant points. It's more a matter of competence than matter of the volume of information"* (Interview 4).

Continuity of interaction

The analysis shows that, in order to gain long-haul innovation outcomes, collaboration with the users should run on a continual basis. Conversely, the knowledge should be used promptly by the company. The interviewees all felt that the crowdsourcing processes must be kept simple and straightforward: *"The process should not go like this: you first plan a study and then order it and then get it sometime in the future. No way, that would be too slow"* (Interview 2). The innovation development process should be as quick as possible and users' ideas should be utilized soon after capturing them. The process of collecting feedback should be continuous so that the company has the newest ideas available all the time. That way, the whole process becomes closer to a partnership and makes the best use of crowdsourcing. Users should be engaged in the innovation process throughout the product lifecycle.

Theme 4: Challenges in Deriving Business Value from User Knowledge

Contingencies of knowledge

The tacit nature of knowledge poses major challenges to making use of users' knowledge. Tacit knowledge is probably the most challenging to collect due to its ambiguity and implicit characteristics. Tacit knowledge gathered from users can be best utilized when obtained in person. One of the interviewees said that, in her business unit, user knowledge is exploited effectively because they are doing ethnography research where the knowledge is gained mostly by personal involvement:

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"I am not sure to what degree this kind of tacit knowledge is exploited in other firms at the moment" (Interview 5). The tacit nature of knowledge was seen as one reason why data repositories are not a feasible solution from the effective-utilization perspective. Tacit knowledge was considered to be best gained in face-to-face interaction and all of the interviewees mentioned that the only ways to collect tacit knowledge are personal interaction and working with users and observing them in action.

Sharing the acquired knowledge internally

To derive business value from the user-induced knowledge, the organization should be capable of utilizing the knowledge in its innovation process: *"There are people who want to collaborate with us to develop our devices and services and they have many ideas, but we need a system to make use of their input."* (Interview 2). The company's internal knowledge-sharing practices and cross-functional integration were perceived important in effective utilization of external knowledge.

Making sense of the data gained

The case company has conducted a large-scale project to make sense of all the knowledge obtained from the users. The sensemaking activities include data visualization where the outcome is a two-dimensional "idea map" (tinyurl.com/k952yjs). The visualization is based on advanced text-mining combined with clustering and regression analysis (Vuori, 2012; tinyurl.com/lbn3c2c). Through the idea map, a company can, for example, spot weak signals and megatrends: *"The visualizations of user-generated ideas on a map allow us to concentrate on the most relevant knowledge. For the organization's strategy people and R&D specialists, the visualized map of user knowledge is a refined view of the continuously evolving ideas and contributions from users."* (Interview 7). The idea map also contributes to deepening the understanding of the lifecycle of a certain segment. Such an understanding supports decisions regarding the technology roadmap.

Discussion

The findings discussed above provide a rationale to suggest that capturing and making use of knowledge resident in online user communities comprises four interlinked processes: management of community, management of ideas, management of innovation, and management of knowledge. Furthermore, management of information exchange between these processes is crucial, because the company assigns tasks and design challenges to the crowd and then reaps the rewards of their contributions to the processes. Whereas crowdsourcing is an effective method to promote and collect user ideas in large communities, our findings suggest that there is a need to proceed from mere collection of ideas through crowdsourcing to management of user knowledge. To capture the value of user-induced knowledge, researchers and practitioners should consider the following key takeaways of this study:

1. Users value easy sharing of their knowledge for user innovation. There are several methods available to collect knowledge from users, including workshops, interviews, crowdsourcing, netnography, living labbing, web analytics, and online market research techniques. In addition, there are a myriad of channels for gathering user input, such as idea competitions, and different ways to organize online events and focus groups, observation of user communities, consumer testing, tracking, design reviews, opinion polls, and toolkits for involving users in the development process. Those channels that have best fit with individuals' behaviour are the most effective regarding quality, credibility, and relevance of the knowledge gathered.

2. Continuous interaction with the lead users and acknowledging the users for their ideas are vital in effective user innovation. The findings highlighted that continuous interaction between the firm and its user community is crucial for innovation, and collected ideas should be assessed and implemented quickly. Furthermore, our findings show that gaining tacit knowledge from the users requires profound collaboration with the users. Therefore, we suggest that users should be engaged in the innovation process throughout the whole product lifecycle, or for a prolonged period instead of through separate encounters.

3. Good internal knowledge management practices are important. Critical processing of the acquired knowledge is vital. In practice, the experiences of the company underlined that unitary data repositories fail to make a viable solution to user knowledge management, as they cannot scale to large volumes of data. Moreover, the variety and velocity of user knowledge is often immense and cannot be standardized. According to our findings, the tacit nature of knowledge is a reason for the major challenges of user-knowledge management practices in crowdsourcing. Hence, it calls for advanced data analytics capabilities.

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4. Making sense of the data gained is a key to creating value with user knowledge. Data visualization is one of the key activities pursued by our case company in its effort to make sense of the areas of knowledge and in the practical aim of sharing the relevant knowledge with those intra-firm actors that need it most. This activity has proven to be one of the keys to create value with the ideas and knowledge gained from the users. The case company has made a great use of data mining and clustering techniques to provide both the strategy process and individual R&D projects with relevant ideas to support their specific needs out of the bunch of data collected.

Conclusion

How do the findings improve our understanding of using crowdsourcing in online user communities to source user knowledge for innovation? Although crowdsourcing is an effective way to collect ideas from large communities of heterogeneous users, our study shows that companies need to think about user-knowledge management in a more holistic way to complement and make benefit of users' knowledge. Furthermore, the study suggested four key lessons to move beyond mere idea crowdsourcing. First, technology companies need to understand and support users' motives for knowledge sharing. Although users are willing to share their ideas for free, effective incentives include the opportunity to gain access to the latest products or services, and the possibility of receiving token gifts as a reward. Second, given that user-knowledge management is often time-consuming and requires considerable effort, companies should pay attention to choosing the right users for collaboration. The case organization valued lead users, but recognized their potential bias in representing average users. Third, companies need to implement processes and practices that support user innovation and knowledge sharing. Companies can improve their innovation performance by sharing user knowledge in social action between those actors participating in the innovation process instead of collecting all data in one repository. Fourth, companies need to focus on how to visualize the data and make sense of the relevant information when using large-scale user ideation methods such as crowdsourcing in order to derive business value from users' knowledge.

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Risk Management in Crowdsourcing-Based Business Ecosystems

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> *"Risk comes from not knowing what you're doing."*
>
> Warren Buffet
> Business magnate, investor, and philanthropist

The benefits of crowdsourcing are enabled by open environments where multiple external stakeholders contribute to a firm's outcomes. However, crowdsourcing typically has been examined as a general process and not from the specific perspective of a mechanism for driving value creation and capture within a business ecosystem. In this conceptual article, we highlight this research gap by examining crowdsourcing from a business ecosystem perspective and by identifying the inherent business risks in crowdsourcing-based business ecosystems. We apply the concept of ecosystem health to the crowdsourcing context, in terms of how firms create and capture value, and we examine the methods by which these firms can maximize health by mitigating risk in crowdsourcing-based business ecosystems.

Introduction

Crowdsourcing has emerged as a new approach to innovation that leverages the potential of the "collective brain" to broaden the scope of open R&D (Traitler et al., 2011; tinyurl.com/lej7dkm). As originally defined, it is "the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call" (Howe, 2006a; tinyurl.com/yfwtk2d). In order to build a foundation to both create and capture value equitably from a crowd, companies need to understand the elements of crowdsourcing and define their business models accordingly.

For firms engaging in crowdsourcing, the benefits are enabled by open environments where multiple external stakeholders contribute to the firm's outcomes. Thus, a firm is able to capture value through ideas and innovations contributed from outside the firm. For firms that are looking at producing innovative products at low cost, crowdsourcing is "the new pool of cheap labor" (Howe, 2006b; tinyurl.com/lxbf7).

However, despite the potential benefits, firms may be hesitant to use crowdsourcing because a dependency on external knowledge can also be a significant source of risk (Feller et al., 2012; tinyurl.com/l8oxsle). In this conceptual article, we examine how this risk may be managed by taking a business ecosystem perspective. In particular, we explore the concept of ecosystem health (cf. Iansiti and Levien, 2002; tinyurl.com/o7s4ok9) as a mechanism for risk management.

The article is organized as follows. First, we briefly summarize literature that describes business ecosystems. Next, we map the business ecosystem concept against the practice of crowdsourcing to develop the concept of a crowdsourcing-based business ecosystem. We then examine the approaches that can help management teams mitigate risk and maintain the health of such ecosystems using crowdsourcing. Finally, we offer conclusions and identify avenues for future research.

Through this article, managers, innovators, and entrepreneurs will be better able to comprehend how to shape their crowdsourcing environment by reducing

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risk. Researchers will be able to identify future research areas and build effective crowdsourcing models to improve the quality of risk management.

Business Ecosystems

Ever since the term "business ecosystem" was introduced by Moore (1993; tinyurl.com/cygzy6o), the topic has gained important recognition in business model discourse (for example, see Moore, 2005: tinyurl.com/5j7jux and many articles in this publication). There are various definitions of the term, but practitioners generally agree that a business ecosystem features companies interacting both cooperatively and competitively around a common platform to meet market requirements (Muegge, 2011; timreview.ca/article/495). Muegge defines a business ecosystem as a "field of economic actors whose individual business activities, anchored around a platform, share in some large measure the outcome of the whole ecosystem".

The major difference between business ecosystems and business networks is the variety of actors (Heikkilä and Kuivaniemi, 2012; timreview.ca/article/564). Typically, business networks are groups of firms working together to address market needs, whereas business ecosystems include not only partners but also actors such as complementors, competitors, customers, etc. (Heikkilä and Kuivaniemi, 2012: timreview.ca/article/564; Bloom and Dees, 2008: tinyurl.com/mkq33km). For example, in some cases, creating a business ecosystem can be a means for a company to access specific knowledge or capabilities that it does not itself possess or wish to develop, but are possessed by a competitor (Heikkilä and Kuivaniemi, 2012; timreview.ca/article/564).

Firms create business ecosystems to coordinate innovation with different contributors and partners within different market segments (Chesbrough, 2006; tinyurl.com/d5aaxah). Not every firm has all the resources, competencies, and knowledge to output complete solutions for customer needs (Traitler et al., 2011; tinyurl.com/mkejq69). Therefore, to solve a customer's problem, a firm may require the participation of a few other firms with knowledge and expertise in their own innovation domains. The organizational and governance structures of a business ecosystem helps these companies work together and manage their "distributed creativity" (Moore, 2005; tinyurl.com/5j7jux).

Business ecosystems can enable value-creating actors to respond rapidly and effectively to market changes by capturing value (Adegbesan, 2009; tinyurl.com/kgks23r). However, different roles played by different ecosystem actors will be needed for the ecosystem to function effectively. The keystone organization orchestrates the business ecosystem and holds a leadership role in managing its activities (Iansiti and Levien, 2004a; tinyurl.com/7t4xgvn). The keystone organization also provides the platform: the technological building block for innovation and operations (Iansiti and Levien, 2004b; tinyurl.com/nmfpyms). Other participants include niche players, who are the focused actors in a business ecosystem. They provide rapid innovation in the niche areas of their expertise and contribute to the overall value proposition of the ecosystem (Iansiti and Levien, 2004a; tinyurl.com/7t4xgvn).

So how does a keystone create a productive and sustainable business ecosystem? A keystone should not only implement strategies to pursue their own goals but also strategies to maintain the overall health of the ecosystem. Iansiti and Levien (2002; tinyurl.com/o7s4ok9) introduced health as an overall performance indicator of business ecosystems; they focus on robustness, productivity, and niche creation as the determinants of overall business ecosystem health. Robustness is the ability of an ecosystem to face and survive disruptions. In order to provide durable benefits for its actors, an ecosystem should encourage endurance to survive changes in the market using a stable platform. Ecosystem robustness enhances the ability to enjoy relative predictability of the outcomes in the innovation process. Productivity is the efficiency of the ecosystem in generating new innovation (Iansiti and Levien, 2002; tinyurl.com/o7s4ok9). Ecosystem actors must benefit from their affiliation to the ecosystem and capture value. Thus, productivity is considered a determinant of ecosystem health because it reflects the importance of converting inputs from ecosystem actors into valuable outputs. Niche creation encourages diversity within ecosystems; an ecosystem must have meaningful diversity to foster new valuable innovation. Stagnant ecosystems that do not create valuable innovation will urge actors to find niches in alternative ecosystems.

Promoting Health in Crowdsourcing-Based Business Ecosystems

As in business ecosystems, a variety of actors make a crowdsourcing process successful. The aggregation of a crowd and other types of actors, such as solver brokerages (i.e., intermediary who facilitate innovation exchanges between organizations and crowds) and material suppliers, work together to execute the crowdsourcing process. The presence of a platform is also a

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key ingredient in the crowdsourcing process (Vukovic, 2009; tinyurl.com/qzc4d83). Thus, we can conceive most instances of crowdsourcing as a particular type of business ecosystem that uses a crowdsourcing process to drive collaborative innovation between different actors using a common platform.

The success of any business ecosystem depends on the collective health of the actors that influence innovation (Iansiti and Levien, 2004a; tinyurl.com/7t4xgvn). Thus, in viewing the crowdsourcing process from a business ecosystem perspective, we expect the benefits of a crowdsourcing process to contribute to the health of an ecosystem through the actions of its constituent actors. In Table 1, we map Iansiti and Levien's (2002; tinyurl.com/o7s4ok9) determinants of ecosystem health to the benefits of the crowdsourcing process in a crowdsourcing-based business ecosystem. These relationships highlight how crowdsourcing contributes to ecosystem health, but also help identify where risks might arise in the ecosystem.

Just like any other business ecosystem, crowdsourcing-based ecosystems have business risks. Table 1 helps us understand how the benefits of crowdsourcing contribute to ecosystem health. Efforts must be made to capture these benefits by reducing any ecosystem risks, thereby maintaining good health in crowdsourcing ecosystems. Some of these risks may be common to all business ecosystems, but others may be unique to crowdsourcing-based business ecosystems generally or specific instances of such ecosystems. Control measures are required to manage these risks while capturing the benefits of crowdsourcing in the ecosystem.

Managing Risk in Crowdsourcing-Based Business Ecosystems

Smith (2013; timreview.ca/article/685) analyzed the business risks that need to be considered by firms when entering or participating in a business ecosystem, and he recommended a risk management strategy to be used in such cases, depending on the type of ecosystem being considered. Here, we extend this risk management perspective by recommending an approach aimed at managing the risks of participation in a crowdsourcing-based business ecosystem.

Our recommended strategy is inspired by business management research, which quantifies risk as the product of probability and impact of risk. Thus, a risk can be mitigated by reducing the probability that it will occur or reducing its impact, or both. We adopted Iansiti and Levien's (2004a; tinyurl.com/7t4xgvn) health determinants and factors as measurements that demonstrate the impact of events that affect an ecosystem. We define probability aspects of risk management by considering how crowdsourcing affects the likelihood of each of the risk elements that apply to the ecosystem and how these risks can be managed to gain benefits of crowdsourcing to maintain ecosystem health.

From the crowdsourcing and business ecosystem literature, we identified eight risk categories:

1. Relationship complexity
(Purdy et al., 2012; tinyurl.com/bs9n5h2)

2. Control/effectiveness
(Koenig, 2012; tinyurl.com/cck69qa)

3. Coopetition
(Koenig, 2012; tinyurl.com/cck69qa)

4. Keystone/actor interdependence
(Koenig, 2012; tinyurl.com/cck69qa;
Adner, 2012: tinyurl.com/lf7yxcs)

5. Replication of business model
(Koenig, 2012; tinyurl.com/cck69qa)

6. Loss of know-how
(Elmquist et al., 2009; tinyurl.com/ndatchc)

7. Loss of certainty in results
(Felstiner, 2010: tinyurl.com/myh2t76;
Trompette et al., 2008: tinyurl.com/8q3uvs7)

8. Intellectual property risks
(Felstiner, 2010; tinyurl.com/myh2t76)

In the subsections that follow, we describe each of these categories of risk from the perspective of crowdsourcing-based business ecosystems. Then, in Table 2, we show how crowdsourcing affects the probability of each type of risk and which of Iansiti and Levien's (2004a; tinyurl.com/7t4xgvn) health metrics are most directly impacted. We also discuss and list crowdsourcing management strategies that may reduce the probability or impact of each type of risk.

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Table 1. Benefits of crowdsourcing to ecosystem health

Ecosystem Health Determinant	Factor	Benefits of Crowdsourcing to Ecosystem Health
Niche creation	Variety	Participants come from different backgrounds and occupy different niches in the crowd. The range of new ideas from these diverse sources provide the ecosystem multiple opportunities to create and capture value.
	Value creation	Ideas generated by the crowd may allow ecosystem actors to brainstorm on new innovative areas.
Productivity	Total factor productivity	Ecosystem actors need to assure that the productivity of their crowd participants creates more additional value for the ecosystem than the capital employed in the innovation process.
	Productivity improvements	Motivation and incentives for the crowd will enable them the ability to contribute ideas/solutions with much interest. The crowdsourcing process is low cost, thus it will reduce the R&D expenditure in the ecosystem.
	Delivery of innovations	Governance models and crowd incentives and motivation ensures that the crowd will deliver new ideas and viable solutions. The delivery of new ideas provides ecosystem actors to start R&D and implement them into products.
Robustness	Survival Rates	This attribute measures how long actors stay with the ecosystem. Incentives for the crowd is a good retention mechanism to keep the crowd in the ecosystem.
	Persistence of structure	The relationship among crowd members and the focal firm must be persistent. Incentives and motivations for the crowd helps to retain the crowd for future innovation processes. Retaining the crowd helps to continuously generate novel ideas and continue the innovation process. Retaining the crowd ensures the ecosystem structure is not changed by recruiting other crowds to the ecosystem.
	Predictability	The crowdsourcing platform enables the interaction between the crowd and the keystone. The platform does not change even though the crowd may change. The core of the ecosystem is not affected by a change in ecosystem actors.
	Limited obsolescence	Most of the installed base or investment in technology or components used in the crowdsourcing platform finds continued use after dramatic changes to the platform such as different crowds joining the platform.
	Continuity	The crowd will continuously generate new ideas and innovations for the firm as the platform continuously provides incentives for the crowd. These incentives promote crowd retention for future innovation activities, which provides further continuity.

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1. Relationship complexity
Purdy and colleagues (2012; tinyurl.com/bs9n5h2) described relationship complexity risk in terms of the complexity and entropy in managing relationships between actors within the ecosystem and the keystone. In a crowdsourcing context, the increased number of participants and diversity within the crowd can increase the probability of risk in managing relationships with the crowd. Incentives offered to the crowd by the keystone can contribute goodwill to the relationship and build trust. Firms can also have internal champions within the crowd to run the course of the innovation process by guiding the crowd. This role will help the crowd to have a better understanding of the requirements needed by the other actors of the ecosystem.

2. Control/effectiveness
Control risk refers to the effectiveness of the control measures, whether centrally located or distributed throughout the ecosystem (Koenig, 2012; tinyurl.com/cck69qa). Control of a crowd in any measure can seem counter-intuitive; so much of crowdsourcing research focuses on freeing participants from control and allowing broader participation that governing bodies may have historically screened out (Nambisan, 2009; tinyurl.com/pfmymbk). Effective crowd monitoring and effective solution evaluation can include control measures provided they do not act as crowd inhibitors.

3. Coopetition
Coopetition, as described by Koenig (2012; tinyurl.com/cck69qa), refers to the effects or impact of co-innovating with competitors within an ecosystem. Crowdsourcing within ecosystems focuses on innovation around "challenges" that may introduce competitive risk. Using common/shared incentives to recruit and retain membership is another method found in crowdsourcing literature to manage competitive instincts. Strong enforcement of crowd charter rules and agreements can reduce the negative impacts of competitors getting to know internal knowledge shared within an ecosystem.

4. Keystone/actor interdependence
Keystone/actor interdependence was highlighted by Adner (2006; tinyurl.com/bpj4syf) as a risk due to the uncertainties that can occur while coordinating with actors (Smith, 2013; timreview.ca/article/685). This means some actors may need to wait until other actors succeed in their contribution. The innovation's success depends not only on a firm's successful completion of its contribution but on the successful development of other actors' contributions as well. In crowdsourcing, the keystone relies on the crowd as a supplier of ideas or solutions. The crowd has less at stake relative to the keystone. They might not show interest in contributing or cheat in the process of gaining incentives from the platform (Hirth et al., 2011; tinyurl.com/l32exln). This risk can cause project delays and disrupt the innovation process of the whole ecosystem. Focused and measured "challenges", cheat-detection mechanisms, and recruiting methods that carefully manage incentives and motivations within the crowd can reduce the probability of this type of risk, and can reduce the impact of its consequences.

5. Replication of business model
Within local markets, there can be a risk of replicating business models (Koenig, 2012; tinyurl.com/cck69qa), and this risk is exacerbated by the presence of crowds within an ecosystem. With many diverse members, crowds may gain access to business model data or related insights through the crowdsourcing tasks. Careful and measured "challenges" that do not reveal business model sensitivities can reduce the probability of copycats emerging. Charter enforcement can also manage the impact by invoking enforcement rules against its own members.

6. Loss of know-how
Loss of know-how can also be a risk introduced by the presence of crowds within an ecosystem. The keystone's knowledge and internal resources are fundamental to an innovation process. When the crowd is integrated to the innovation process, they may acquire some of the a keystone's know-how. The risk of integrating the crowd is that crowd members could use a firm's know-how for their own purposes or even sell it to competitors (Elmquist et al., 2009; tinyurl.com/ndatchc). Crowd monitoring and evaluation mechanisms and strict quality assurance of solutions ensure that positive crowdsourcing outcomes are integrated back into the ecosystem.

7. Loss of certainty in results
Loss of certainty of results is always a possibility when the crowd does not feel the responsibility and accountability for solving tasks. Even the most committed crowd worker will have less at stake than a formal employee (Felstiner, 2010; tinyurl.com/myh2t76). By putting higher-qualification restrictions to govern the crowd or by using multiple crowd actors to work on a single task increases the probability of success through the innovation process.

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Table 2. Crowdsourcing strategies to reduce risks in crowdsourcing-based business ecosystems

Risk Category	How Crowdsourcing Affects Probability	Most Direct Health Determinant Impacted	Crowdsourcing Strategy to Reduce Risk
Relationship complexity	Can introduce more complexity and more uncertainty	• Productivity • Robustness • Niche creation	• Internal champions to guide the crowd • Incentives for crowd • Crowd governance
Control/ effectiveness	Control is less attractive in crowds	• Productivity • Robustness	• Crowd monitoring • Solution evaluations
Coopetition	Larger mix and diversity of participants	• Niche creation	• Common/shared incentive • Charter enforcement • Focused challenge
Keystone/actor interdependence	Crowdsourcing requires proxy, but not internal control	• Productivity • Robustness	• Focused challenge • Cheat detection • Common/shared incentive
Replication of business model	Larger number and diversity of participants	• Niche creation	• Charter enforcement • Focused challenge
Loss of know-how	Crowd actors will gain access to internal knowledge of firms in the ecosystem	• Niche creation	• Monitoring and evaluation mechanisms. • Crowd monitoring
Loss of certainty in results	The crowd actor has less at stake for not contributing to the innovation process	• Productivity • Robustness	• Higher qualification restrictions to govern the crowd • Multiple actors working on a single task
Intellectual property risks	Crowd actors have access to intellectual property when solving a task	• Niche creation	• Nondisclosure policies and crowdsourcing rules

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8. Intellectual property risks
Keystones may encounter serious intellectual property risks by assigning tasks or problem-solving challenges to an anonymous crowd. Crowd actors may have access to intellectual property within an ecosystem by completing even small tasks (Trompette et al., 2008: tinyurl.com/8q3uvs7; Felstiner, 2010: tinyurl.com/myh2t76). The platform may impose nondisclosure policies or set rules to protect proprietary material as part of an agreement when enlisting a crowd.

Conclusion

In this conceptual article we applied the perspective of business ecosystems to the process of crowdsourcing to conceptualize crowdsourcing-based business ecosystems. We described crowdsourcing and what roles actors can typically play in a crowdsourcing-based business ecosystem if they are recruited and managed by an ecosystem keystone. We reviewed the attributes a strong business ecosystem and the factors that determine its health through the participation and interaction of its actors (Iansiti and Levien, 2002; tinyurl.com/o7s4ok9). These factors were used to define the impact used by risk management strategies. This article also builds on the work of Smith (2013; timreview.ca/article/685), who offered risk management strategies for entry into business ecosystems. Our risk management approach helps mitigate the risks introduced by crowdsourcing activities within a business ecosystem.

Firms should consider crowdsourcing-based business ecosystems for the purposes of low-cost R&D, to generate and gather novel ideas, and to understand the latent needs of customers. To further help these firms identify and manage the risks of such an approach, future empirical research should explore and test the concepts and strategies identified in this article. Further research could examine how managing horizontal relationships in crowdsourcing-based ecosystem can enhance a firm's ability grow value in a business.

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TIM Lecture Series

Technology Adoption by Design: Insights for Entrepreneurs

Stoyan Tanev

> *"We need to think of technology adoption in design terms. The key is to balance product design with design for adoption. Ultimately, it is the adoption that makes innovation happen."*

Stoyan Tanev
Associate Professor
University of Southern Denmark

Overview

The sixth TIM lecture of 2013 was presented by Stoyan Tanev, Associate Professor in the Department of Technology and Innovation at the University of Southern Denmark, who examined the topics of innovation, adoption and customer creativity within the context of technology entrepreneurship. The event was held at Carleton University on November 7th, 2013.

The TIM Lecture Series is hosted by the Technology Innovation Management program (carleton.ca/tim) at Carleton University. The lectures provide a forum to promote the transfer of knowledge from university research to technology company executives and entrepreneurs as well as research and development personnel. Readers are encouraged to share related insights or provide feedback on the presentation or the TIM Lecture Series, including recommendations of future speakers.

Summary

In the first part of the lecture, Tanev discussed the problems associated with the most popular process view of innovation. Despite widespread, intensive efforts toward innovation, very few innovation initiatives are successful. At the heart of the problem is the failure to distinguish between *invention* and *innovation* (Denning and Dunham, 2012; innovators-way.com), which leads to two myths about innovation:

1. **The invention myth:** inventions cause innovations. In fact, the outcome of invention practices is an idea or prototype for consideration; the outcome of innovation practices is adoption of a new practice in a community.

2. **The process myth:** innovation is a process that can be managed; there is a "right way" to do things, standard operating procedures efficiently coordinate the activities of all, etc.

Thus, the key difference between invention and innovation is that invention is related to the creation of ideas, whereas innovation is related to adoption in the marketplace. The first myth tempts people to focus on creating ideas rather than fostering adoptions. The second myth tempts people to take "many shots on goal" rather than cultivate the skill of accurate shooting.

Tanev follows Denning and Dunham in describing these two myths as a "toxic combination" that can be overcome with an alternative definition of innovation: "the adoption of a new practice in a community" (Denning, 2012; tinyurl.com/kh9fhnf). In this definition, the innovator is an individual who does not only sense and move into new opportunities but also mobilizes all the necessary resources to enable potential customers to adopt the new practice. The definition merges together innovation and technology entrepreneurship as an investment into a project focusing on the adoption of products and assets based on scientific, engineering, and technological inventions.

Technology Adoption by Design: Insights for Entrepreneurs

Stoyan Tanev

One of the key points of the lecture was that the predominant focus on technology development and product design has to be balanced by considering their adoption in design terms. In other words, innovation could be significantly enhanced by focusing on design for adoption. It is the adoption of new products and services that makes innovation happen as well as what makes entrepreneurs successful. Adoption is a job that needs to be enabled and facilitated by the entrepreneur and should be thought in global terms. It requires specific personal skills and practices that could be taught and learned.

Grounded by this definition, key insights for entrepreneurs were provided by combining several frameworks, all of which are relevant for the adoption of new technological products and services. A key insight came in the form of a generative adoption framework suggested by Denning and Dunham (2012; innovators-way.com). The framework includes three specific practices (offering, first adoption, and sustaining) with a focus on their anatomy, typical breakdowns, and "what to practice" points.

In the second half of the lecture, Tanev focused on the problems of value transfer and customer creativity as an additional major adoption factor. In particular, the challenge with value transfer from innovators to customers relates to the innovator's focus on the total value of a new product, which is typically higher than the customer's perceived value of the product. Customers perceive value on the basis of the relative benefit of the new product compared to the existing way of doing things. The challenge with the relative benefit for customers is that: i) the potential customers do not have the full picture of the total value built in the product and ii) in the majority of the cases, the perceived value of the product is the result of their own efforts. In this sense, the value perception that will make a specific potential customer buy is to a great extent a result of this customer's own activities and efforts. On this basis, Tanev suggested that activity-based approaches such as actor-network theory and activity theory could be appropriate in studying the dynamics of product adoption.

Actor-network theory (ANT; tinyurl.com/77szlr6) could be described as a set of tools, sensibilities, and methods of analysis that treat everything in the world as a continuous effect of the webs of relations within which it is located. One of its key tenets is that nothing has reality or form outside the enactment of its relations to other things. In ANT, there is symmetry between human and non-human agents; non-human technological artifacts are considered as autonomous and active. In this way, when studying technology innovation and adoption, the type of actors at work should be increased and the objects should be made "participants in the course of action". ANT has inspired an innovation-translation approach to technology adoption, which states that innovations are never adopted in their original form and that the customer plays a key role in giving the final shape and the specific meaning of the innovation. An innovation moves in time and space by actors who modify it, deflect it, betray it, add to it, appropriate it, or let it drop. Straightforward adoption is an exception requiring explanation. In the innovation-translation approach, a technological product distributes the forces that will support or resist its adoption, and the design for adoption should set out all of the actors who seize the object or turn away from it. It should also highlight the points of articulation between the object and the interests it gives rise to.

Activity theory (AT; tinyurl.com/cz48m) provides a framework for thinking about activity as it is expressed in the use of technology. It emphasizes the importance of human intentionality and assumes an asymmetry (in contrast to ANT) in the interaction between people and things. Some of the key points of AT include: i) the analysis of activities enables the understanding of both human subjects and technological products; ii) no properties or attributes of the subject and the object exist before and beyond activities; iii) product attributes do not just manifest themselves in various circumstances, they truly exist only in activities and only when being enacted. AT considers creativity, reflexivity, and resistance as a source of change as well as critical adoption factors. Creativity refers to an imaginative activity directed towards an object in which an original product emerges. Reflexivity refers to a reflection that leads to a change in practice. Resistance refers to an opposition to a technology or to a practice associated with a technology. In this way, the adoption framework of AT could be therefore related to the customer creativity perspective suggested in the first half of the lecture.

Finally, Tanev suggested an activity checklist approach (Kaptelinin and Nardi, 2006; tinyurl.com/m4qp8s3) that could be used in combination with ANT and the generative framework for the design of technology adoption environments. The combination of the three frameworks allowed the emphasis of several final major points:

Technology Adoption by Design: Insights for Entrepreneurs

Stoyan Tanev

1. Enabling adoption is the essence of innovation and entrepreneurial practices.

2. Adoption is a double-edge job of the innovator/entrepreneur and of the customer.

3. The value of the product is in the eyes of potential customers.

4. Product adoption depends critically on the efforts and creativity of customers.

5. Customer creativity has to be enabled and supported for adoption to happen.

6. The personal skills approach to innovation is a great resource in the adoption of adoption skills.

7. Activity-based approaches are a great source of insights for innovators and entrepreneurs.

Lessons Learned

In the discussions that followed each portion of the presentation, audience members shared the lessons they learned from the presentation and injected their own knowledge and experience into the conversation.

The audience identified the following key takeaways from the presentation:

1. The idea of dropping old practices and adopting new practices is easy; making it work in reality is very challenging.

2. Humility is very important, especially when refining a product towards better adoption.

3. It is important to harness the creativity of customers. Customers are as important as the designers, but it is amazing to see how rarely customers are considered as an active part of the adoption process.

4. Innovation success requires customer value, trust, and final appreciation of the new products or services. It is the focus on practices that makes the learning possible.

5. Successful people have a natural ability for conversations; however, it is a skill that anyone can develop over time – with practice.

6. The pursuit of strategy needs to align the adoption with a difference. Successful businesses are the ones that do things differently and not just better than others.

7. It is more important to have an anchor client – not a new customer – and make the anchor client become the first adopter.

8. Use a first prototype, get feedback and use the feedback to get to the second prototype. Creativity comes from seeking and enabling feedback; feedback leads to more adoption.

9. Differentiation is very important with technology products, but differentiated value is the key.

This report was written by Stoyan Tanev and Chris McPhee; the lessons learned were captured by Derek Smith.

About the Speaker

Stoyan Tanev is an Associate Professor in the Department of Technology and Innovation and member of the Center for Integrative Innovation Management at the University of Southern Denmark in Odense, Denmark, as well as Adjunct Professor in the Department of Systems and Computer Engineering at Carleton University in Ottawa, Canada, where he was previously a faculty member in the Technology Innovation Management Program. He has a MSc and a PhD in Physics (jointly by the University Pierre and Marie Curie, Paris, France and the University of Sofia, Bulgaria, 1996), a PhD in Theology (University of Sofia, Bulgaria, 2012), an MEng in Technology Innovation Management (Carleton University, Canada, 2005) and a MA (University of Sherbrooke, Canada, 2009). He has multidisciplinary research interests with a focus on the fields of technology innovation management and value co-creation. Dr. Tanev is member of the Review Board of the *Technology Innovation Management Review*.

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