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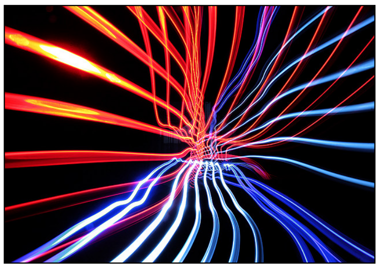

Insights

Welcome to the September 2015 issue of the *Technology Innovation Management Review*. We welcome your comments on the articles in this issue as well as suggestions for future article topics and issue themes.

Carleton University

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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.

Contribute

Contribute to the TIM Review in the following ways:

- Read and comment on articles.
- Review the upcoming themes and tell us what topics you would like to see covered.
- Write an article for a future issue; see the author guidelines and editorial process for details.
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Please contact the Editor if you have any questions or comments: timreview.ca/contact

About TIM

The TIM Review has international contributors and readers, and it is published in association with the Technology Innovation Management program (TIM; timprogram.ca), an international graduate program at Carleton University in Ottawa, Canada.

Editorial: Insights

Chris McPhee, Editor-in-Chief

Welcome to the September 2015 issue of the *Technology Innovation Management Review*. The authors in this issue share insights on entrepreneurial marketing, open innovation, living labs, and opportunity identification.

In the first article, **Hamidreza Kavandi**, a power systems professional and recent graduate of the Technology Innovation Management (TIM) program at Carleton University in Ottawa, Canada, and **Mika Westerlund**, Associate Professor at Carleton University, investigate how entrepreneurial marketing can encourage resellers to adopt smart micro-grid technology. Based on a literature review on user adoption and entrepreneurial marketing, they gathered data from 99 power resellers to validate a model of the relationships between reseller's antecedents and intention to adopt smart micro-grid technology, and the role of vendor's entrepreneurial marketing in the adoption. In discussing their findings, they highlight the implications for both technology vendors and researchers interested in user adoption theory.

Next, **Odd Jarl Borch**, Professor of Strategy and Business Development at the University of Nordland in Bodø, Norway, and **Marina Solesvik**, Professor of Innovation and Management at the Stord/Haugesund University College in Norway, discuss the role of open innovation in collaborative design processes. Their article presents the results of a longitudinal case study of a collaborative project to design and develop a specialized vessel to support offshore oil and gas operations in the High Arctic. Through the perspective of open innovation and by adopting a competence-based view, their results demonstrate how a firm can "reach out" beyond its walls to gain novel competences related to innovation.

Then, **Bernhard Katzy**, Professor of Technology and Innovation Management at University BW Munich in Germany and Leiden University in the Netherlands, and Co-Founder of the Center for Technology and Innovation Management (CeTIM), and **Claudia Bücker**, Co-Founder of CeTIM, examine the coordination of novel innovation activities in living labs. By examining three cases of living labs in central Europe, they highlight the importance of user-centric product development activities in living labs and propose an organizational model to yield practical and theoretical insights.

Seppo Leminen, Principal Lecturer at the Laurea University of Applied Sciences and Adjunct Professor in the School of Business at Aalto University in Finland, then answers the question "What are living labs?" In this primer on living labs, he provides a general definition and highlights the different ways the term has been used by different researchers and practitioners. He also identifies the key characteristics and benefits of living labs, and how they are categorized.

Finally, this issue includes a summary of a recent TIM Lecture presented by **Brian Hurley**, President and CEO of Purple Forge (purpleforge.com). Hurley shared his company's experiences identifying new business opportunities in self-service solutions to improve the customer experience, particularly through mobile devices. Integrating the IBM Watson cognitive computing system into Purple Forge's existing platform solution enables users to ask questions about an organization using natural language and then to receive appropriate answers drawn from an ever-improving knowledge base.

In October, we welcome **Taina Tukiainen**, **Seppo Leminen**, and **Mika Westerlund** as guest editors for the theme of Regional Innovation Ecosystems.

And, in November, we celebrate our 100th issue with a look ahead to new frontiers and some of the key questions we seek to answer in our next 100 issues.

We welcome your submissions of articles on technology entrepreneurship, innovation management, and other topics relevant to launching and growing technology companies and solving practical problems in emerging domains. Please contact us (timreview.ca/contact) with potential article topics and submissions.

We hope you enjoy this issue of the TIM Review and will share your comments online.

Chris McPhee
Editor-in-Chief

Editorial: Insights

Chris McPhee

About the Editor

Chris McPhee is Editor-in-Chief of the *Technology Innovation Management Review*. He holds an MASc degree in Technology Innovation Management from Carleton University in Ottawa, Canada, and BScH and MSc degrees in Biology from Queen's University in Kingston, Canada. Chris 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.

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Keywords: entrepreneurship, entrepreneurial marketing, user adoption, open innovation, competence-based view, competence, collaborative design, living labs, coordination, innovation activities, opportunity identification, cognitive computing, IBM Watson

Using Entrepreneurial Marketing to Foster Reseller Adoption of Smart Micro-Grid Technology

Hamidreza Kavandi and Mika Westerlund

> *Benjamin Franklin may have discovered electricity, but it was the man who invented the meter who made the money.*
>
> Earl Warren (1891–1974)
> Politician and Chief Justice of the United States

This article investigates how entrepreneurial marketing can encourage resellers to adopt smart micro-grid technology. An online survey based on the literature on user adoption and entrepreneurial marketing was used to gather data from 99 power systems resellers. The data were analyzed using the partial least squares method to validate a model of the relationships between reseller's antecedents and intention to adopt smart micro-grid technology, and the role of vendor's entrepreneurial marketing in the adoption. The results suggest that user adoption models can only partially be applied to the reseller context, and future research should develop models that can further explain reseller's decision making with regards to becoming involved in an emerging technology. As to the implications for practice, vendors need to demonstrate proactive entrepreneurial marketing, particularly entrepreneurial orientation, to increase the performance expectancy perceived by their resellers by increasing awareness and understanding of smart micro-grid technology to cultivate its diffusion.

Introduction

The growing demand for electricity and the environmental impact of energy generation impose major challenges for the energy industry. At the same time, smart grid technology represents an emerging field of power systems that allows for better management of interconnected loads and alternative and renewable energy resources than the traditional power systems technologies. A smart micro-grid is a small-scale, intelligent power system based on the smart grid technology, and it has advanced energy generation, transmission, distribution, consumption, and metering elements, and machine-to-machine communication ability. Smart micro-grid solutions utilize two-way flow of electricity and communications to enhance reliability, efficiency, security, quality, and sustainability of local energy supply (Fang et al., 2012). However, in spite of the benefits that smart micro-grid technology provides, it has not been widely adopted in the market (Luthra et al., 2014), and existing research into smart micro-grid technology is limited to a technical perspective (Cardenas et al., 2014; Saxena, 2014). There is a need to understand the market adoption of smart micro-grid technology, especially as it relates to resellers who act as intermediaries between technology vendors and end users.

Although there is ample research on technology marketing strategies, the role of vendors' marketing to resellers is largely neglected (Westerlund & Rajala, 2014). Vendors of smart micro-grids include both small firms that make or add smart technology into power system utilities and large technology providers such as Siemens, Schneider, or Alstom Power. Resellers include energy retailers such as Direct Energy and renewable energy equipment retailers such as Solpowered Energy Corporation. Resellers target end users who are businesses, residential communities, and individuals that want to ensure energy supply in times of power outages. Giordano and Fulli (2012) discuss the actions that can improve the consumer value proposition in power systems technology and enhance consumer engagement in energy efficiency. However, prior studies have not focused on reseller intentions or decision making with regards to becoming involved in a technology, nor how the vendor might advance these intentions. Thus, there is a research gap on the topic of why resellers adopt specific technology for modification and reselling purposes, and how vendors can encourage this adoption through entrepreneurial marketing. Entrepreneurial marketing is considered more proactive, more innovative, more opportunity and growth oriented, and more willing to take risks than conventional marketing (Hills & Hultman, 2011).

This research introduces a conceptual model based on the literature for user acceptance and entrepreneurial marketing to understand the relationships between smart micro-grid technology drivers and technology adoption by resellers, as well as the role of entrepreneurial marketing by vendors in those relationships. Previous research typically applies technology and user acceptance models to the end-user context (e.g., Venkatesh et al., 2012); there are few models available that would explain technology choices of resellers (Westerlund, & Rajala, 2014). Entrepreneurial marketing by vendors is understood as a combination of strategic orientations (cf. Jones & Rowley, 2011), which act as potential moderators in the relationships between smart micro-grid technology and the reseller's intention to adopt such technology. The model is tested using survey data from power systems technology resellers through the partial least squares analysis, a form of structural equation modelling, which is effective for predictive behavioural models (cf. Lowry & Gaskin, 2014).

The article is structured as follows. After this introduction, we review the literature on user acceptance and entrepreneurial marketing. Then, we present a conceptual model with hypotheses on the relationships between the drivers of smart micro-grid technology adoption and a reseller's intention to adopt such technology, as well as the role of entrepreneurial marketing by vendors in those relationships. Thereafter, we summarize the methodology and results from the analysis. Finally, we conclude by describing the implications of the results for theory and practice.

Literature Review

User adoption to reseller adoption

The technology acceptance model is the most widely used model for understanding the adoption of technology (Benbasat & Barki, 2007), because it is contextually versatile and provides proven measures to predict user adoption of any given product, service, or system (Venkatesh et al., 2003). The technology acceptance model was developed to understand an individual's adoption of information technology, therefore it has two fundamental elements: i) perceived usefulness, or the degree to which an individual believes using the system would enhance their job performance, and ii) perceived ease of use, or the degree to which an individual believes using the system would be free of physical or mental effort (Davis, 1989). These two elements are individual reactions to using information technology, and they have been shown to influence an individual's intention to use the technology, and ultimately, the actual use (Venkatesh et al., 2003)

Despite the vast popularity of the technology acceptance model in research on information systems, there has been criticism against the model. For instance, Benbasat and Barki (2007) argue that the intense focus on the model has led to: i) the diversion of researchers' attention away from important phenomena such as the antecedents of user's beliefs or the consequences of adoption; ii) the creation of an illusion of progress in knowledge accumulation; iii) the inability to expand and adapt the core model to rapidly evolving technology adoption contexts; and iv) a state of theoretical confusion and chaos arising from efforts to modify and apply the model to evolving IT contexts, where the adaptations have not been based on solid and commonly accepted foundations. Furthermore, Ozaki (2009) notes that people decide to adopt an innovation not only because they see functionality, usability, or reasonable costs, but also because they are interested in the way the innovation reflects their identity, image, memberships, values, beliefs, and norms.

The scholarly community has invested significant resources and research effort in revising the technology acceptance model to meet the changing technological landscape, but these developments have brought us back full circle to the models origins (Benbasat & Barki, 2007). Venkatesh, Morris, and Davis (2003) introduced one of the most notable revised models – the unified theory of acceptance and use of technology (UTAUT) – using four explicit antecedents that affect a user's behavioural intention to adopt technology: performance expectancy, effort expectancy, social influence, and facilitating conditions. The model also includes implicit elements of an attitude toward using technology, self-efficacy, and anxiety. Later, Venkatesh, Thong, and Xu (2012) presented an improved model (UTAUT2) by adding three explicit antecedents: hedonic motivation, price value, and habit. Besides putting forward revised antecedents of adoption, both UTAUT models emphasize the role of factors that moderate adoption, such as demographics and experience.

Whereas technology adoption has been extensively studied in the end-user context (cf. Benbasat & Barki, 2007), there are few studies focused on the adoption of technology in the channel context, particularly with respect to resellers (Osmonbekov, 2010; Westerlund & Rajala, 2014). We find this lack of research surprising given that resellers are key intermediaries between vendors and end-customers (Chung et al., 2012) and that one of the most effective ways to diffuse innovations to markets is to leverage the power of downstream channels (Sreenivas & Srinivas, 2008). However, user acceptance models may not be applicable when studying reseller adoption, given that they have been designed for the individual context and resellers may emphasize dissimilar aspects when choosing technologies to adopt for modifying and reselling purposes. Then again, channel intermediaries may also be end users of emerging technology, and user acceptance models are known to have high predictive power (Benbasat & Barki, 2007). In this study, the reseller's technology adoption model builds on four elements derived from UTAUT and UTAUT2 (Venkatesh et al., 2003; Venkatesh et al., 2012): performance expectancy, effort expectancy, facilitating conditions, and price value.

Entrepreneurial marketing
Marketing is a critical activity that plays an important role in a company's success (Franco et al., 2014). Entrepreneurial marketing is a field of marketing associated with entrepreneurial behaviour and small firm resources and practices that are based on effectuation rather than causation (Mort et al., 2012). The entrepreneurial marketing construct has evolved as a response to contemporary market conditions where creative, non-standard solutions are required to address the complex, chaotic, and fragmented nature of the business environment (Fillis, 2010). Entrepreneurial marketing describes the marketing processes of firms pursuing opportunities in uncertain market circumstances (Becherer et al., 2008), and it is used as the proactive exploitation of opportunities for acquiring and retaining profitable customers through innovative approaches to risk management, resource leveraging, and value creation (Morris et al., 2002). Exploitation of opportunities requires rapid market learning and perseverance in the face of obstacles and the ability to take advantage of unexpected events (Mort et al., 2012) to overcome initial market barriers (Franco et al., 2014).

Both marketing and entrepreneurship are change focused, opportunistic in nature, and innovative in their approach (Collinson & Shaw, 2001). They both acknowledge the importance of opportunity recognition (Miles et al., 2015). However, entrepreneurial marketing is distinct from conventional marketing: rather than relying on the traditional 4Ps of marketing (product, price, place, and promotion), entrepreneurial marketing emphasizes the entrepreneurial 4Ps (purpose, practice, process, and people) (Martin, 2009). Entrepreneurial marketing outcomes comprise innovation and customer value (Jones et al., 2013) through firms' proactive, innovative, risky, and opportunity- and growth oriented actions (Hills & Hultman, 2011). For example, fast growth technology companies use new approaches, interactive processes and networks to promoting and selling innovations (Jones et al., 2013), and tend to have long-term orientation to opportunity creation and exploitation (Hills et al., 2008). Hence, the previous literature (e.g., Morris et al., 2002; Jones & Rowley, 2011; Ahmadi & O'Cass, 2015) views entrepreneurial marketing as a combination of strategic orientations. Taken together, the key orientations are customer orientation, entrepreneurial orientation, and innovation orientation.

Customer orientation refers to the importance of employees being customer-focused and close to customers, meaning they are well positioned to address customer needs and wants. Customer orientation has three dimensions: i) responsiveness toward customers, ii) communication with customers, and iii) understanding and delivering customer value (Jones & Rowley, 2011). The first dimension, responsiveness towards customers, means employee/corporate responsiveness to customer feedback and how fast the reaction can shift to customer preferences (Jones & Rowley, 2011). The second dimension, communication with customers, refers to a policy of frequent customer feedback and mechanisms to build long-term customer relationships; entrepreneurial marketing calls for increasing the reach through personal contact networks and improving interpersonal communication skills (Martin, 2009). The third dimension, understanding and delivering customer value, draws on the fact that, without entrepreneurial expertise, managers and entrepreneurs are inclined to rely on generic information, which limits their ability to be innovative and create superior customer value in uncertain environments (Miles et al., 2015).

Entrepreneurial orientation refers to a firm's innovation culture and risk taking attitude. Entrepreneurial orientation has three dimensions: i) propensity for risk taking,

ii) pro-activeness toward opportunities, and ii) innovativeness (Jones & Rowley, 2011). Risk taking explains the acceptance of risks to make new opportunities and revolutionary activity (Jones et al., 2013). It shows whether a firm has a tendency for high-risk products and whether risk taking is considered a positive attitude (Ahmadi & O'Cass, 2015). Subsequently, pro-activeness means the commitment to find new opportunities and cheaper, simpler, or more effective ways of completing tasks (Jones et al., 2013). Whereas innovativeness refers to receptiveness to innovation (Jones & Rowley, 2011), some definitions emphasize the dualistic nature of innovation in terms of invention and commercialization of that invention (cf. Ahmadi & O'Cass, 2015). That way, a firm's R&D aims at inventing new technology and being competitive through rapid commercialization of that technology.

Innovation orientation is associated with creativity in identifying new opportunities and using innovative techniques to solve customer problems (Jones & Rowley, 2011). Innovation is a marketing-oriented construct that creates an outward-looking focus for all that the company does, and it is central to entrepreneurship as the means by which entrepreneurs can exploit change and provide an opportunity to create businesses (Miles et al., 2015). Innovation orientation also refers to being driven by ideas and intuition as opposed to customer orientation, which is associated with being driven by an assessment of market needs (Morrish, 2011). Innovation orientation has two dimensions: i) knowledge infrastructure and ii) propensity to innovate (Jones et al., 2013). The former means making an infrastructure's knowledge meet formal and informal procedures, practices must be intensive, and data must be gathered and information must be disseminated from inside and using external resources (Jones & Rowley, 2011). The latter refers to processes for shaping the organization's culture to use and sustain creativity and innovation into all types of processes and services (Jones et al., 2013).

Conceptual Model

Through this study, we develop a conceptual model with constructs and variables derived from the literature on user adoption and entrepreneurial marketing. This conceptual model (Figure 1) helps to illustrate a number of hypotheses on the relationships between the antecedents of smart micro-grid technology adoption and the reseller's intention to adopt such technology, as well as on the role of vendor's entrepreneurial marketing for reseller's behavioural intention.

Antecedents of smart micro-grid technology adoption (cf. UTAUT/UTAUT2) comprise four independent constructs: effort expectancy and performance expectancy as input/output constructs, and facilitating conditions and price value as contextual constructs. The reseller's behavioural intention to adopt smart micro-grid technology is the dependent construct. Unlike in many previous studies focused on technology adoption, the present model lacks actual behaviour – the actual adoption of the SMG technology – as a dependent construct. It was not included because the literature on technology adoption is unified on the correlation between behavioural intention and actual behaviour, and because the current market adoption rate of the smart micro-grid technology is too low (cf. Luthra et al., 2014) to reliably observe actual adoption. Vendor's entrepreneurial marketing, as a moderating factor, consists of three separate yet interrelated constructs: customer orientation, innovation orientation, and entrepreneurial orientation.

The model includes four groups of hypotheses: H1 through H4 address the direct effects of the antecedents of smart micro-grid adoption to reseller's behavioural intention. Consequently, H5 through H8 suggest the moderating effects of customer orientation, H9 through H12 of innovation orientation, and H13 through H16 of entrepreneurial orientation on the mentioned direct effects. Appendix 1 details the hypotheses.

The model assumes that there are aspects that advance or hinder the adoption of smart micro-grid technology. Smart micro-grid technology offers several benefits: it can provide value in terms of improved efficiency and reliability through advanced real-time control of energy generation and consumption, as well as sustainability through reduced greenhouse gas emissions enabled by the use of cleaner energy sources and better balancing of peaks in electricity consumption (Hashmi, 2011). Conversely, Valocchi, Juliano, and Schurr (2012) list several barriers for the adoption of smart-micro grid technology, including higher price, technology immaturity, lack of suitable infrastructure, integration issues with existing technology, cybersecurity, lack of public awareness, lack of standards, and lack of technical skills. In the absence of a user adoption model for smart micro-grid technology, we took these barriers and benefits into consideration when planning the variables that form the constructs. In addition, variables drawn from end-user adoption models were altered to address the reseller context.

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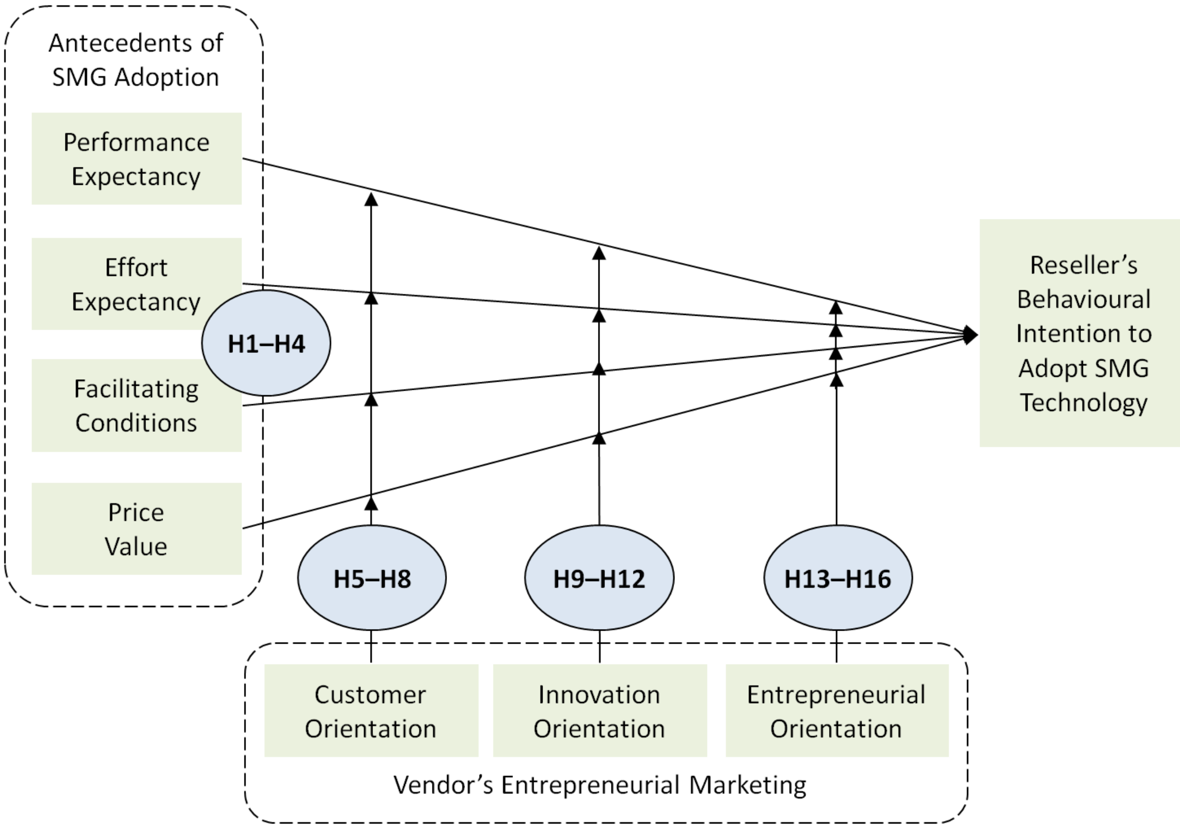

Figure 1. Conceptual model of the use of entrepreneurial marketing to foster reseller adoption of smart micro-grid (SMG) technology, including hypotheses (H1 to H16)

Method

The design of the empirical research followed three steps: i) semi-structured interviews were conducted with three industry experts in Canada (a sales engineer from a compact substation business, a design engineer from a smart metering technology manufacturer, and a CEO of a solar system company) to explore ideas that could be useful in designing a survey; ii) an online questionnaire was administered to power technology resellers about their adoption of smart micro-grid technology and attitudes on vendor's marketing; and iii) the survey data was analyzed to test the hypotheses and validate the proposed research model. The lead author of this study has worked in the power systems industry for over 13 years, focusing mainly on project management and electrical engineering. A total of 300 contacts in North America, representing industry professionals who work at resellers and have a technical background in power systems, were derived from his LinkedIn account. Responses were received from 107 individuals (36%) representing executives, entrepreneurs, sales and customer service staff, and various engineers and maintenance staff. After filtering the responses for completeness, the usable data set consisted of 99 completed questionnaires.

The data were analyzed using the basic partial least squares algorithm from SmartPLS 3.0 software (Ringle et al., 2015) to test the conceptual research model and validate the established hypotheses. The partial least squares technique does not require normalized data and places minimum requirements on measurement levels, unlike many other multivariate modelling approaches (Tenenhaus et al., 2005). Moreover, the partial least squares technique is robust even if there is missing data, and it allows for modelling of multiple relationships simultaneously, easy testing of moderating effects, and effective handling of multicollinearity among constructs (Chin et al., 2003; Haenlein & Kaplan, 2004). Given that the partial least squares technique is considered appropriate for predictive models such as various adoption models (Teo et al., 2003), it is appropriate for analyzing technology adoption. Finally, because our research model includes moderating effects, we verified that our effective sample size of 99 responses was sufficient by following the example of Youssef (2011).

Table 1 shows the internal validity of constructs (see Appendix 2 for details) in terms of average variance extracted (AVE), composite reliability (CR), and Cronbach's Alpha (CA). In order to provide a feasible solution, AVE should be more than .50 (Chou & Chang, 2008), and CA and CR should each be more than .70 (Hair et al., 2014). All construct values exceed the thresholds, and, thus, they are appropriate for this research. Moreover, Table 1 shows construct correlations; a correlation of more than .60 is a sign of possible bias. Although some of the correlations exceed the value, there are not alarmingly high overlaps, and these conceptually interrelated constructs still measure different qualities. Finally, satisfactory discriminant validity among constructs is obtained when the square root of the average variance (shown as numbers in parentheses) is greater than the corresponding construct correlations.

Results

When examining the data for the current adoption rate of smart micro-grid technology among resellers, the analysis showed that approximately 50 percent of the respondents attribute less than 5% of their annual sales to the technology, and such solutions are a significant source of revenue (i.e.. constituting more than half of sales) for only approximately 10 percent of the surveyed resellers. These results confirm that the adoption of smart micro-grid technology is still in its infancy, and that we were justified in excluding actual adoption from the conceptual model and hypotheses. We proceeded with the partial least squares analysis and performed both graph runs for correlation coefficients (ß-values) and bootstrapping procedures (using 500 replications) for statistical significance (T-values) for both the main effects model and the moderated models. Furthermore, we considered both differences in correlation coefficients (Δß) and the coefficients of determination (ΔR^2) when calculating the effect size (f^2) of each moderating effect, as suggested by Henseler and Fassott (2010).

Figure 2 demonstrates that H1, H2, H5, H6, H9, and H13 are supported by the analysis. After testing all 16 hypotheses, it can be concluded that only 6 hypotheses were supported, and 10 were not. Performance expectancy and effort expectancy have direct and significant effects (T-value>1.96) on behavioral intention. Whereas performance expectancy increases the probability of SMG adoption, effort expectancy decreases the likelihood. Unexpectedly, facilitating conditions and price value were not associated with reseller's intention to adopt SMG technology. As to moderating effects, custom-

Table 1. Internal validity and construct correlations

Construct	AVE	C R	C A	1(BI)	2(CO)	3(EE)	4(EO)	5(FC)	6(IO)	7(PE)	8(PV)
1. Behavioural Intention	.743	.945	.930	(.861)							
2. Customer Orientation	.762	.941	.922	.418	(.873)						
3. Effort Expectancy	.717	.927	.901	.378	.695	(.847)					
4. Entrepreneurial Orientation	.672	.891	.838	.499	.715	.620	(.820)				
5. Facilitating Conditions	.628	.871	.803	.408	.716	.700	.651	(.792)			
6. Innovation Orientation	.741	.920	.884	.485	.722	.622	.795	.604	(.861)		
7. Performance Expectancy	.724	.948	.936	.586	.662	.757	.566	.572	.663	(.851)	
8. Price Value	.641	.899	.860	.413	.609	.511	.568	.680	.620	.563	(.801)

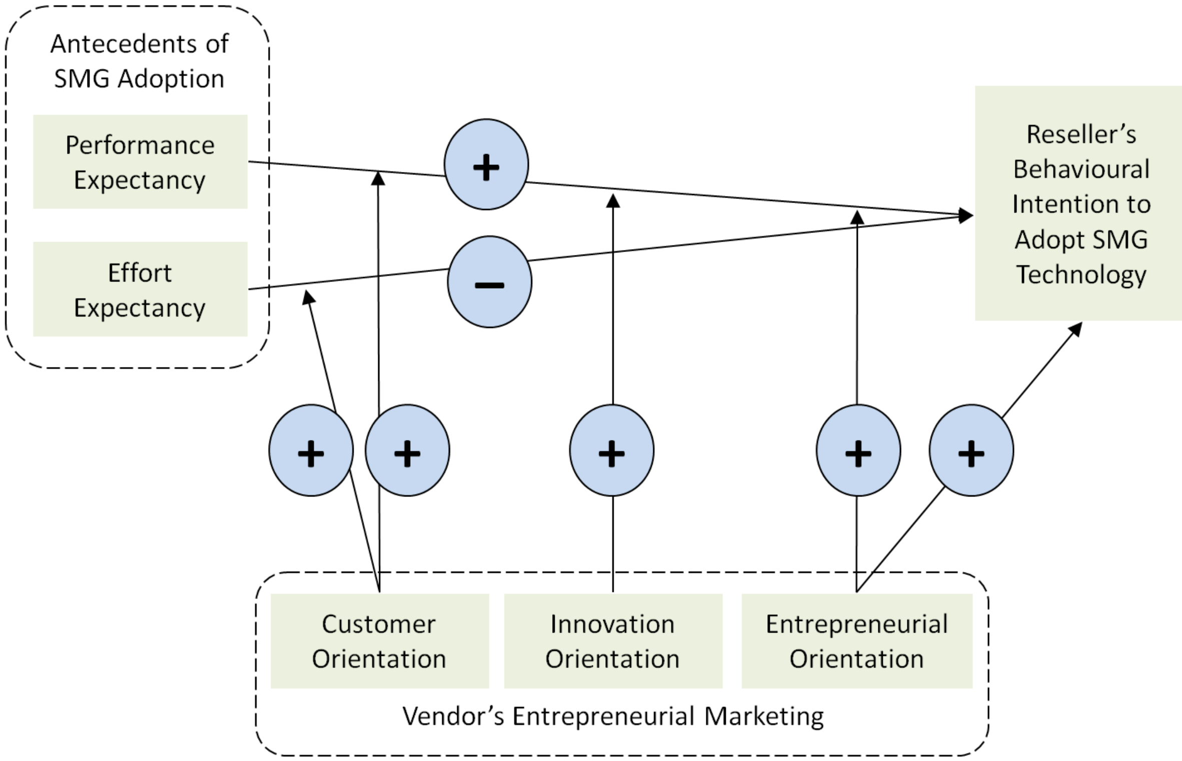

Figure 2. The final model with validated hypotheses

er orientation strengthens both the effects of performance expectancy and effort expectancy on behavioral intension. Moreover, both innovation orientation and entrepreneurial orientation increase the effect of performance expectancy on behavioral intention. Finally, a secondary finding from the analysis was that entrepreneurial orientation has a direct effect on reseller's behavioral intention. In all, the model explains approximately 40% of the variance (Adj. R2) in the independent construct.

Conclusion

This study focused on understanding the role of vendor's entrepreneurial marketing in the adoption of smart micro-grid technology by resellers. The endeavour is of importance because smart micro-grid technology has not yet been widely adopted in the market despite of the value it can provide, and because resellers play important roles as distribution channel members in the market diffusion of new technology. Despite the limitations of our research – the focus on power systems resellers in North America only and the lack of previously validated reseller adoption models – the results from our empirical analysis point out what factors influence the adoption of smart micro-grid technology by resellers and what barriers must be removed. Thus, the results can be used as a guideline for developing strategies to encourage reseller adoption of novel smart micro-grid solutions.

The results show that performance expectancy increases reseller's behavioural intention to adopt smart micro-grid technology whereas effort expectancy decreases the intention. Moreover, the vendor's entrepreneurial marketing in terms of customer orientation moderates both of these relationships. In other words, customer orientation advances the intention of resellers to adopt novel technology. In addition, both innovation orientation and entrepreneurial orientation moderate the relationship between performance expectancy and behavioural intention, thereby helping resellers to adopt the technology. Surprisingly, the study also found that the vendor's entrepreneurial orientation has a direct positive effect on the reseller's intention to adopt smart micro-grid technology. Previous literature on user adoption shows that behavioural intention predicts actual behaviour (i.e., the likelihood of a reseller buying, modifying, and reselling a vendor's smart micro-grid technology).

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These results contribute to the existing theory of user adoption. The main implications include: i) the limited applicability of the user adoption models in the reseller context and ii) the importance of vendor's entrepreneurial marketing for the adoption of novel technology by resellers. First, it is obvious that existing technology adoption and user adoption models are only partially applicable in the reseller context. Although they have been widely used over the past decades to understand the spread of new technology on the market (cf. Venkatesh et al., 2012), the strict focus on the end user has neglected resellers as agents in the diffusion. Although resellers may also be end users of the novel technology, the motivation of a reseller to engage in technology is likely different. Hence, future research should focus on developing reseller adoption models that focus on the input/output of functional value (e.g., how to make more money and differentiate from the competitors by selling a specific technology) rather than the use value (e.g., how to benefit from implementing and using a specific technology). Second, a vendor's proactive channel marketing seems to have major effect on why resellers adopt and stock novel technology. The results reinforce similar findings from other contexts (cf. Westerlund & Rajala, 2014) and suggest that research should pay more attention to channel marketing instead of looking only at the end-user part.

The findings are also interesting from the practice point of view, as improving the input/output ratio expected by the reseller may significantly promote their adoption of smart micro-grid technology. In more detail, performance expectancy is the main driver of reseller adoption, and a vendor's entrepreneurial marketing amplifies the importance of that specific driver. Moreover, the fact that facilitating conditions or price value were not significant factors reflects the lack of awareness and understanding of smart micro-grid technology among power systems resellers. Thus, vendors need to address the vendor–reseller relationship, the benefits of new technological solutions, and entrepreneurial marketing strategies when planning their marketing activity and subsequent marketing messages aimed at power systems resellers. Vendors can foster the adoption of smart micro-grid technology among their resellers by offering more information, extended support, better incentives, and by creating trust in the vendor–reseller relationship.

About the Authors

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Mika Westerlund, DSc (Econ), is an Associate Professor at Carleton University 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 in Helsinki, Finland. Mika earned his doctoral degree in Marketing from the Helsinki School of Economics in Finland. His current research interests include open and user innovation, the Internet of Things, business strategy, and management models in high-tech and service-intensive industries.

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Appendix 1. Hypotheses

Hypothesis	Dependent Variable	Independent Variable	Moderator	Explanation
H1	Behavioural intention	Performance expectancy	N/A	Performance expectancy has a positive effect on behavioural intention.
H2	Behavioural intention	Effort expectancy	N/A	Effort expectancy has a positive effect on behavioural intention.
H3	Behavioural intention	Facilitating conditions	N/A	Facilitating conditions has a positive effect on behavioural intention.
H4	Behavioural intention	Price value	N/A	Price value has a positive effect on behavioural intention.
H5	Behavioural intention	Performance expectancy	Customer orientation	The influence of performance expectancy on behavioural intention is positively moderated by customer orientation.
H6	Behavioural intention	Effort expectancy	Customer orientation	The influence of effort expectancy on behavioural intention is positively moderated by customer orientation.
H7	Behavioural intention	Facilitating conditions	Customer orientation	The influence of facilitating conditions on behavioural intention is positively moderated by customer orientation.
H8	Behavioural intention	Price value	Customer orientation	The influence of price value on behavioural intention is positively moderated by customer orientation.
H9	Behavioural intention	Performance expectancy	Innovation orientation	The influence of performance expectancy on behavioural intention is positively moderated by innovation orientation.
H10	Behavioural intention	Effort expectancy	Innovation orientation	The influence effort expectancy on behavioural intention is positively moderated by innovation orientation.
H11	Behavioural intention	Facilitating conditions	Innovation orientation	The influence of facilitating conditions on behavioural intention is positively moderated by innovation orientation.
H12	Behavioural intention	Price value	Innovation orientation	The influence of price value on behavioural intention is positively moderated by innovation orientation.
H13	Behavioural intention	Performance expectancy	Entrepreneurial orientation	The influence of performance expectancy on behavioural intention is positively moderated by entrepreneurial orientation.
H14	Behavioural intention	Effort expectancy	Entrepreneurial orientation	The influence of effort expectancy on behavioural intention is positively moderated by entrepreneurial orientation.
H15	Behavioural intention	Facilitating conditions	Entrepreneurial orientation	The influence of facilitating conditions on behavioural intention is positively moderated by entrepreneurial orientation.
H16	Behavioural intention	Price value	Entrepreneurial orientation	The influence of price value on behavioural intention is positively moderated by entrepreneurial orientation.

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Appendix 2. Details of internal validity of constructs

	Item	Loading	Weight	Item description
Behavioural Intention	**BI1**	.886	.190	Reselling SMG solutions is a really good opportunity for my business.
	BI2	.926	.201	Reselling SMG solutions is a really wise idea for my business.
	BI3	.813	.189	Reselling SMG solutions provides the best opportunity to enhance my business.
	BI4	.835	.211	Reselling SMG solutions is promoting my business.
	BI6	.868	.187	Reselling SMG solutions corresponds well with my business content.
	BI7	.837	.183	Reselling SMG solutions is pleasant for my business.
Customer Orientation	**CO2**	.877	.254	Communication with customers is strongly valued in my business.
	CO3	.923	.258	Understanding and delivering customer value have a highly positive impact on my business.
	CO4	.834	.180	The ability to react to customer needs quickly has a very strong impact on reselling SMG solutions.
	CO6	.869	.206	The adoption of customer satisfaction perspective has a strong impact on SMG solution retail business.
	CO7	.861	.244	Understanding customer needs and adapting the seller's response to satisfy those needs are crucial for the success.
Effort Expectancy	**EE2**	.876	.196	Prefer reselling SMG solutions that are easy to learn to operate.
	EE3	.877	.239	Prefer reselling SMG solutions that are easy to use.
	EE4	.825	.250	Prefer reselling SMG solutions that promote clear and understandable interaction with the supplier.
	EE5	.823	.268	Prefer reselling more flexible and interactive SMG solutions
	EE7	.831	.231	Prefer reselling SMG solutions that require little time in doing operational tasks.
Entrepreneurial Orientation	**EO2**	.782	.247	Would put more effort in reselling SMG solutions if the supplier responded to my inquiry quickly.
	EO4	.822	.303	Would put more effort in reselling SMG solutions if I had pro-active support from the supplier.
	EO6	.874	.321	Would put more effort in reselling SMG solutions if the supplier emphasized the development of new and innovative products.
	EO7	.797	.347	Would put more effort in reselling SMG solutions if my business was asked to introduce new products/services or administrative or operational techniques.
Facilitating Condition	**FC4**	.762	.311	Prefer reselling SMG solutions that are compatible with other systems that my business sells.
	FC5	.786	.296	Prefer reselling SMG solutions that have guidance available for my business.
	FC6	.813	.295	Prefer reselling SMG solutions that have specialized instructions available for my business.
	FC7	.806	.360	Prefer reselling SMG solutions that have specific person or technical group available for assistance with system difficulties.
Innovation Orientation	**IO4**	.859	.312	Would put more effort in reselling SMG solution if the supplier supported sustaining innovation
	IO5	.852	.252	Would put more effort in reselling SMG technology if the supplier identified new opportunities for my business.
	IO6	.854	.260	Would put more effort in reselling SMG solutions if the supplier supported my innovation and application of SMG solutions.
	IO7	.880	.336	Would put more effort in reselling SMG solutions if they converted opportunities into concrete, workable, and marketable ideas.
Performance Expectancy	**PE1**	.890	.209	Prefer reselling SMG solutions that will improve my business performance.
	PE2	.901	.194	Prefer reselling SMG solutions that will increase my business productivity.
	PE3	.914	.188	Prefer reselling SMG solutions that will enhance the effectiveness in my business.
	PE4	.833	.173	Prefer reselling SMG solutions that enable me to reach my business goals more quickly.
	PE5	.859	.161	Prefer reselling SMG solutions that provide me with valuable information from the perspective of business.
	PE6	.758	.138	Prefer reselling SMG solutions that will increase my business output for the same amount of effort.
	PE7	.787	.102	Prefer reselling SMG solutions that will increase my chances of obtaining business benefits.
Price Value	**PV1**	.796	.242	Prefer reselling SMG solutions whose high price/value ratio makes an important benefit for my business against competitors.
	PV2	.828	.204	Prefer reselling SMG solutions that are superior in bearing the monetary cost of use compared to regular systems.
	PV3	.858	.278	High price/value ratio of a SMG solution has a positive effect on my business as a reseller.
	PV4	.756	.258	Prefer reselling SMG technology with a high price/value ratio, because I think it can act as a predictor of customer's behaviour.
	PV7	.762	.269	Prefer reselling SMG technology that has a balanced tradeoff between the perceived benefits and the monetary cost of using it.

Innovation on the Open Sea: Examining Competence Transfer and Open Innovation in the Design of Offshore Vessels

Odd Jarl Borch and Marina Z. Solesvik

> *The sea! the sea! the open sea!*
> *The blue, the fresh, the ever free!*
>
> Bryan W. Procter
> (Barry Cornwall) (1787–1874)
> Poet and solicitor

In this article, we discuss the role of open innovation in collaborative design processes in mature industries such as the shipping industry. We examine the design of high-tech offshore service vessels in environments characterized by high volatility and complexity. We elaborate on the role that accumulating and sharing core competences plays in speeding up the innovation process and increasing product value. We present a longitudinal case study of a shipping company implementing an open innovation approach that integrates its own core competences in offshore operations with the competences of ship designers and ship builders to develop a new design for challenging environments. In this article, we draw on an open innovation approach and a competence-based view to demonstrate how the firm can "reach out" to gain novel competences related to innovation, which may transform the competitive environment to the firm's advantage. The article would be useful to innovation scholars and practitioners who work with innovative product development.

Introduction

New product development and design are expensive, risky, and resource-intensive processes (Parker, 2000). The role of innovation in new product development and design is significant (Veryzer, 1998), and success is often a result of a collaborative effort (Kotabe & Swan, 1995; Solesvik, 2011). Modern firms, especially small and medium-sized enterprises, often cannot afford to have all necessary R&D competences in-house. Thus, they actively involve product users and other stakeholders in new product and new design development through open innovation processes (Piller & Walcher, 2006).

Open innovation was conceptualized relatively recently (Chesbrough, 2002), but it has rapidly become a popular approach to new product development. Open innovation is defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively" (Chesbrough, 2006). There are many approaches and dimensions to open innovation, but for the purposes of this study, we focus on the importance of tight cooperation between the end user and suppliers of core production units.

Opening up an organization to allow partner access to inner competences is a challenging strategic issue. The idea of core competence (Prahalad & Hamel, 1990) was theorized by Hamel and Heene (1994), Sanchez, Heene, and Thomas (1996), Sanchez (2004), and Freiling (2004), who collectively developed the competence-based view into a new strategic management perspective. Several definitions of firm competence have been proposed, but for the purpose of this study, we use the definition proposed by Sanchez, Heene, and Thomas (1996), who view a core competence as "a resource that increases the ability to sustain the coordinated deployment of assets in a way that helps a firm achieve its goals."

Competence Transfer and Open Innovation in the Design of Offshore Vessels

Odd Jarl Borch and Marina Z. Solesvik

Prior research into the competence-based view suggests that a firm as an open system might link firm-addressable resources, capabilities and competences in collaborative networks in order to respond to quickly changing market opportunities (Sanchez, 2004). Moreover, Sanchez and colleagues (1996) noted that:

> *"To have access to resources that are under the control of other firms but that are useful in pursuing its own goals, a firm may bid for use of other firms' competences or resources in market transactions, or may enter into competence alliances to connect its competences and resources with those of other firms."*

The competence-based view distinguishes between competence leveraging and competence building. The former activity applies a firm's existing competences in existing or new markets without qualitative changes in the existing kinds of asset stocks and flows (Sanchez et al., 1996). The competence-based approach recognizes that a firm can leverage firm-specific and firm-addressable resources and competences to achieve goals and competitive advantage (Easton & Araujo, 1996). Firm-addressable competences can be obtained through market transactions or through collaboration with other firms. Child, Faulkner, and Tallman (2005) argue that, in a network, members have immediate access to necessary competences without the need to invest in developing these competences internally. However, this openness comes with a risk of sharing core competence with others without receiving the expected benefits in return, and there may be costs due to adaptations in resource configuration within the firm during the alliance. The latter activity, competence building, implies qualitative changes in the existing asset stocks and flows as well as abilities to coordinate and deploy new and existing assets in order to achieve the firm's goals (Metzenthin, 2005). Competence building influences the industry dynamics: firms identify and seek to change desirable qualitative changes in stocks and flows of assets through learning (Post, 1997).

The competence-based view postulates that firms strive to leverage competences to fulfil their ambitions. Durand (1997) has suggested that there is both a static and a dynamic mode to accumulating competence. The static modes relate to reinforcement and synergistic fit related to present competences. The dynamic modes include access to new knowledge through new network access and adapting the organization to others through alliances (Sanchez et al., 1996). However, diffusion of resources and competences due to interfirm collaboration might be difficult because firms often fail to develop a common alliance strategy (Freiling, 2004). This mode can be costly, and some firms are reluctant to share desirable competences with other firms. Thus, the firm has to be careful when selecting partners; it must have a clear picture of its ambitions and the core competences involved in the cooperative process. And, it must take care to safeguard its own resources throughout the process.

In this article, we apply the competence-based view to the field of ship design and shipbuilding, which has joined the global trend towards open innovation approaches (Solesvik & Gulbrandsen, 2013). In the next section, we present and briefly analyze an illustrative case from a Norwegian offshore shipping company that has recently built an innovative offshore vessel for the High Arctic using a collaborative approach including competence transfer and open innovation. We examine the case in light of the open innovation perspective and the competence-based view, with an emphasis on their importance to companies developing products for highly volatile and complex environments.

Illustrative Case: Offshore Shipping in the High Arctic

The Arctic contains as much as 25% of the remaining oil and gas resources in the world. The High Arctic encompasses the regions north of the Arctic Circle where cold weather may cause severe ice and icing conditions. It includes Alaska, northeastern Canada, the Greenland coast, the Barents Sea, northern and eastern Russia, and the North East Passage (i.e., the Northern Sea Route) through northern Russia. The centre of gravity for Norwegian petroleum activities is moving gradually north into the Norwegian Sea, the Barents Sea, and the rest of what is termed Arctic waters. Operations in this region require vessels that are tailor-made for a harsh climate and an area with limited infrastructure. These conditions call for vessels with ice-strengthening and a high degree of functionality, and they must be well equipped for multi-purpose action.

Simon Møkster Shipping AS (mokster.no) is an offshore shipping company located in Stavanger, the oil capital of Norway. Captain Simon Møkster established the company in 1968, and the company is still owned and managed by the Møkster family. The company owns 25 offshore vessels. There are 665 employees in the company, 32 work in the main office, and the rest of employees work at sea. However, although many Norwegian offshore shipping companies operate both in the Norwegian offshore sector and worldwide, Simon

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Møkster Shipping AS decided only to develop their operations alongside the Norwegian coast, one of the most challenging sea areas in the world. They focused on adding competence on operating in the conditions found in the High Arctic.

Recently, the company wanted to win contracts to support offshore oil and gas operations in the Goliath field in the Barents Sea with stand-by vessel and emergency response and rescue vessels. The conditions for offshore operations in the Barents Sea are different from the familiar conditions of the North Sea. The conversion of standard offshore vessels to ice-class vessels and equipping them with the winterization package is not the optimal solution (Berg et al., 2012). Thus, the company's management decided to invest into the fleet of tailor-made vessels for the Arctic. Given that the Arctic market is quite new and such ships have not been developed before by Norwegian designers, the design needed to be very innovative in terms of functionality, capacity, and environmentally friendly operation. There were two innovation options in the purchase phase: i) order a complete new project from a ship design company and not be involved into the innovation development process or ii) engage in open innovation and be an active participant in the R&D process. The shipping company opted for the latter opportunity even though it had a small administration staff with limited capacity.

The shipping company decided to cooperate with a ship design and shipbuilding company to develop a tailor-made vessel, and they evaluated several candidate design companies. Due to technology newness and the lack of R&D in this area, the company searched for partners that could understand every aspect of the value chain including designing, building, equipping, and running this type of vessel. Finally, the VARD company (vard.com) was selected to develop and build the vessel that would support operations of the oil company ENI (eninorge.com/en/). VARD unites a ship design firm and a shipyard in the same corporation, in addition to offering equipment and industry services.

The shipping company contributed their top-level competence including the CEO, CTO, and operation management, while closely following the process and scrutinizing the suggestions from the design company. They involved their most experienced operative personnel, bringing them to shore from their vessels to work on the details. The operating personnel, together with middle management, cooperated tightly with the designers to bring the different units together. Information was constantly exchanged between partners, and the designers had to reveal their knowledge as to best practice in the field and the limitations of different constructions. Not only the technical aspects had to be considered during the process: the cost of building and running the vessels was a critical issue. The financial and operating staff had to be included and the designers, the yard, and the equipment producers were confronted with functionality and cost issues.

One challenge was to learn what details the oil company would demand. The oil company participated marginally in the new vessel development due to market rules as to open competition. However, there was a systematic evaluation of data from other contracts with oil companies and the tacit knowledge acquired by senior staff and vessel management. After the first stage of development, an offer was given to the oil company on time with the necessary specifications. The Simon Møkster Shipping company competed with several other concepts, but won due to functionality details and environmental friendliness in combination with a competitive price. The new advanced vessel with unique characteristics was delivered to its new owners in 2015.

Analysis

The case discussion illustrates how a shipping company became involved in the open innovation process by first choosing a design partner with broad value chain insight and then taking part in the entire process of design and development with their own staff. In this case, an important factor for involving a company in open innovation was the lack of knowledge about market characteristics and customer needs. The context of the High Arctic is specific and little expertise had been accumulated in the area of offshore operations in the High Arctic with harsh weather conditions and long distances to the shore. Simon Møkster Shipping brought in their most experienced personnel to interact with the designer and refine the tacit operational knowledge into formalized knowledge related to the functionality of the vessel and to have the necessary tailor-made functionality guaranteed. These activities included a time-consuming representation at the shipyard following the building process, with two or three staff members at the site in constant dialogue with the different sub-contractors and installations. Second, there were customer demands to consider. In this industry, the oil companies continuously look for vessels with increased productivity, safety, and efficiency. The competition in this mature market with several large suppliers is fierce. One of the ways to win a competitive game is to be one step ahead of rivals. Innovativeness, achieved here by reaching out of the firm's boundaries to obtain market context competence from crew and shore staff, is an important factor that can help firms gain competitive advantage.

Many companies prefer to concentrate on their own core competences (Borch & Solesvik, 2013, 2014). Simon Møkster Shipping decided to share their core competence with the cooperating design, equipment, and construction companies. This activity is in line with the findings of recent research that stresses the popularity of a multi-firm network organizational form in contemporary business (Fjeldstad et al., 2012). According to the multi-firm network concept, firms concentrate on their core competences and collaborate with other firms to obtain the other firms' core competences and thereby achieve the project's goals.

In the case of Simon Møkster Shipping AS, the company brought both their strategic apex and highly competent middle management staff into the process to a much larger degree than most of their competitors. The company contributed with the expertise of its employees in Arctic waters operations, and was creative in their price and contract strategy towards ENI as their customer. Simon Møkster Shipping then succeeded in not only emphasizing the technological innovation, but also innovation related to management and marketing. The management group of the firm supported intra-firm collaboration by collecting feedback from the sea personnel related to operations in the Arctic seas and about which construction features should be taken into account in the design phase. The company shared the salaries and scarce time of key personnel with the ship designers and yard personnel. In return, the shipping company employees involved in this open innovation project acquired new insight on complex construction under uncertainty, and gained the designer's knowledge about their competitors' best practice. Some other firms and organizations shared their competences as well, including the classification society, equipment suppliers, and others. This connection may take a formal contract approach with loose couplings or it may become a long-term partnership with strong ties based on trust and reciprocal exchange as in cluster thinking. In this case, strong cluster mechanisms were present in the region, which served as a platform for specific cooperative arrangements. As suggested by the competence-based view, firms can "reach out" and develop their competences if necessary. In this case, collaboration using an open innovation approach helped the shipping company to overcome its liability of smallness to develop a competitive edge in R&D and innovation.

Conclusions and Implications

In this article, we have emphasized the importance of collaborative efforts in new product development. Consistent with Jennings and colleagues (2015), modern design is a critical element of competitive advantage. An open innovation approach, where research and development efforts are undertaken in close reciprocal relationships with external providers, allows for the unification of core competences from different actors and increases the speed and quality of new product development. One important finding is that the firm has to gather significant core competence in their own organization and bring this into the process of development when collaborating with cooperating institutions. This may represent large (sunk) costs and a high risk of losing strategic knowledge if the company does not succeed in winning customers and contracts.

We added to the knowledge base by combining the open innovation perspective and the competence-based view. Both perspectives seek to explain the process of resource accumulation and inventions to increase the competitive advantage of a firm. We show in this article how the competence-based approach may help the firm to "reach out" to gain novel competences, which may transform the competitive environment to a firm's advantage. Furthermore, participation in joint R&D lifts the competences of firms to a higher level faster (Reiling, 2004).

The article raises new questions about how competences influence the aspects of open innovation activities, notably the rationale to enter into an open innovation agreement, partner evaluation and selection, and termination of the open innovation collaboration. Practitioners from the maritime industry and from other industries can use the information presented in this article when they elaborate the collaboration processes related to new product design and development. In particular, the presented case illustrates how firms can unite their competences with other firms and participate more actively in collaborative design, thereby avoiding buying off-the-shelf goods where competition is harsh. New trends in the industry, increasing complexity of operations (Borch & Batalden, 2014), and very special requirements regarding tailor-made production units for the different purposes enforce broader participation of the companies' specialists in the development of innovative products.

Competence Transfer and Open Innovation in the Design of Offshore Vessels

Odd Jarl Borch and Marina Z. Solesvik

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The Organization of Living Labs: Coordinating Activities for Regional Innovation

Bernhard R. Katzy and Claudia Bücker

> *"There is nothing so terrible as activity without insight."*
>
> Johann von Goethe (1749–1832)
> Writer and statesman

This article contributes to the ongoing knowledge from the first decade of operating living labs with a study on the coordination of novel innovation activities in living labs. The article provides an organizational model for living labs to order the activities that eventually will allow the conceptualization of living labs as innovation systems, thus giving user involvement a more central role in innovation process theories. This article shows how innovation networks systematically align their activities to reliably achieve their objectives. Next to this interpretivist theoretical contribution, the article contributes relevant practical insights to technology innovation management practitioners based on in-depth living lab cases that exhibit interesting, relevant, and new activities.

Introduction

Living labs are one form of regional innovation system that the Finish prime minister, in his term as European Union president, introduced to stimulate European innovation activities. This 2006 decision to implement living labs, so named to promote the relevance of a real-life environment for user involvement in the early product development process to increase the success of innovation, lead to initiatives in over 500 European regions. Such coordinated European activity is a kind of quasi-experiment in developing and introducing new regional innovation activities.

Economists frequently refer to "innovation capital" as a factor with strong influence on the relationship between available knowledge in a region and the economic performance created from it (Audretsch & Keilbach, 2004). However, they restrict their research to quantifying the input and output of a living lab but do not "open the black box" of what innovation capital really is. While this factor combination is sufficient to interpret statistical census data on a national level, economists recommend a more detailed examination of the activities that take place in a living lab (e.g., Audretsch & Keilbach, 2004, 2005). The aim of this article is to follow this recommendation by presenting a study on the basis of engaged scholarship following the method of innovation research originally established and refined by Andy van de Ven (2007) and his team in the Minnesota Innovation Research Program. As such, the study presented here is clearly rooted in the technology innovation management (TIM) discipline by virtue of the studied innovation processes in living labs and the dedicated methodology. The study is further rooted in the TIM domain by its object of analysis. We base our study on identifying the activities and actors that make user-centric innovation happen.

For scientists and engineers, who are used to collaborating in large networks for the creation of knowledge, the terms "innovation network" or "innovation system" are more appropriate compared to the term "living lab" (Katzy et al., 2003). Such innovation systems exist on national and regional levels, and for dedicated technologies, products, or user groups (e.g., knowledge workers). In this article, we use these two terms interchangeably to cover living labs as well as other collaborative networks that are more targeted to developing new technology, knowledge, products, or any combination of them. A broader term allows us to discuss alternative configurations of innovation systems and their activities at a later stage.

Collaboration across firm boundaries in regional innovation systems or clusters is a strong driver towards living labs (Katzy & Dissel, 2004; Katzy et al., 2007; Röttmer & Katzy, 2005). This is especially true for small and medium-sized enterprises (SMEs) (McPhee et al., 2012; Niitamo et al., 2012). Incentives are provided to universities to transfer their knowledge to industry (Tsai-Lin et al., 2014).

Through grants and subsidies, firms are motivated to tolerate "spill-over effects" and to open up some parts of their knowledge to others (Röttmer & Katzy, 2006). A final driver that we refer to here is the availability of information and communication technologies that allow connections between users and product developers over distances (Katzy et al., 2004; Sari et al., 2009).

Innovation networks have already been modelled as virtual organizations with formal and semi-formal modelling methods (Sari et al., 2009), but so far, the research focus has been more on information technology infrastructures and less on innovation activities. Research on living labs has resulted in insights on the structure of the underlying regional networks and their technical infrastructures. Living labs now add a novel set of innovation activities that makes use of these infrastructures.

Research Methodology

The current study is based on Van de Ven´s method of engaged scholarship (Van de Ven, 2007) through which the first author joined ongoing projects in a support role. To this end, we selected living labs and similar innovation systems that are sufficiently stable in operation over a sufficiently long time period of more than five years. Engaging in projects in these living labs allowed us to identify newly developed innovation activities, especially user-centric product development, which goes beyond the structural analysis of living labs and allows for deeper understanding on how user-centric innovation is undertaken.

We examined three cases of living labs:

1. Colliquio online platform (Lake Constance region, central Europe)

2. Wireless Leiden (Netherlands)

3. Mobiliance (City of Nuremberg region, Germany)

Data were obtained by joining those living labs in operation when undertaking projects and when planning or reflecting on innovation activities of these networks.

Colliquio
The Colliquio platform provides a solution for medical doctors to exchange medical information over the Internet. The story began when a young innovator approached the Constance living lab wishing to address the fact that both his father and uncle (two medical doctors) were not exchanging medical data using Internet. The director of the Constance living lab gave him the task of looking for a team. After one week of consideration, he, together with two friends, decided to develop the Colliquio platform. They came back to the Lake Constance living lab and their project was accepted. The development was undertaken in 2012 with participation of the prospective end users (medical doctors), who needed to change their professional behaviour and work routines in order to make use of the new platform. Medical work routines are often certified and require careful change management to maintain all professional standards. Privacy of patient data on the Internet is one issue that needed to be considered in the Colliquio case.

Wireless Leiden
The specific contribution of the Wireless Leiden project is that the users build their own wireless network on the rooftops of the City of Leiden in the Netherlands. The users are highly skilled professionals who are like the proverbial example of the mountain bikers and surfers who are capable of building their own product. In the course of the project, the volunteers established a dense social network out of which the technical rooftop network was created. Initially, companies, especially the telecom providers, were against the network. But later, entrepreneurial activities emerged between existing and newly created firms.

Mobiliance
The Mobiliance platform provides a solution for connected public transport, travel planning, and booking on mobile devices. The technical development took place in a publicly funded project together with partners from different backgrounds, such as universities, large firms, the government and startups. The knowledge worker living lab engaged in intensive intermediation to bring these different partners together. The Mobiliance case is a novel example of entrepreneurial financing: a startup company with considerable financial backing was created while the basic research project was still going on, thus the project bridged the gap between scientific research and societal benefits by simultaneously conducting basic research and innovation activities in what Donald Stokes refers to as "Pasteur´s quadrant" (Stokes, 1997).

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Results and Discussion

It has long been recognized that "actors" (people, institutions, governments, etc.) are important components of a living lab (Audretsch & Keilbach, 2004). However, the activities that take place in a living lab have so far received less attention. In this study, we show that unravelling the activities in a living lab, and not only focusing on the actors, considerably contributes to understand how things are done.

In the case of the Colliquio project, thanks to the concurrent approach in the development and innovation process, input and feedback from prospective users could be taken into account until very late in the development process when first working prototypes became available. Prospective users on the other side became well acquainted with the new product from their involvement, outlining features and functionality of the "Colliquio product" under development. Over the course of the process, user perception and developer perception increasingly aligned. An interesting observation in this case is that the product received a prestigious Swiss Innovation award. The other interesting aspect in the Colliquio case is the entrepreneurial coordination of the product development process, which is intertwined with the user involvement that was carefully moderated by the living lab professionals over a period of six months. However, despite all the support, the project almost failed when public funding expired. A mix of harsh cost cutting in the project, the money from the innovation award, and the engagement of the prospective users as investors saved the project.

In the case of Wireless Leiden, the first prototypes made out of orange juice tins and rabbit wire were quickly in use while the volunteers continued to develop more reliable technical solutions and an organizational structure to maintain the network.

In the Mobiliance case, research and product development took place simultaneously. Research was carried out in a publicly funded project, whereas product development took place in the startup. Even before the publicly funded research project ended, the developed prototype was demonstrated to end users in the city of Nuremberg, and the users were involved in the further user-centric development of the platform. A startup company was created early in the research process to speed up market introduction, which is another new innovation activity in that early stage. This activity required intensive coordination and moderation between the research activities on one side and the entrepreneurial exploitation of the startup company on the other side. Another important moderation was between the large, resource-rich governmental and public research institutions, and the "lean" startup company. Furthermore, the ways of working between large research centres, in this case the European Space Agency, with high safety requirements, and an Internet startup with agile development approaches had to be moderated.

From the cross-case analysis of the living labs studied here, a main operations pattern emerges, as shown in Figure 1. At the core is the "Co-Creation Phase" where users, developers, and further actors collaborate to achieve user-centric product development. Our study suggests that this intensive collaboration is coordinated by experts, as is symbolized with the blue circle in Figure 1, rather than by the "invisible hand of the market", which is postulated by open innovation scholars.

The Co-Creation Phase is embedded into a preparation phase of bringing together the right partners for a project. This phase may be a longer ideation, search, and matching process (Holzmann et al., 2014) as in the Colliquio project, where the project initiators were asked several times, by living lab experts, to go back and find users, developers, and partners before the project was launched. The users were involved in defining their requirements. The matchmaking milestone is a good kick-off point for the Co-Creation Phase and, by that time, a project plan should be available to show how to reach graduation within an acceptable timeframe. Product development as an activity in the Constance innovation system is an expectable observation. Given that the expectable network refers to living labs with high user centricity, it is not surprising that user involvement activities are readily observable in the case. Even more interesting is the explicit and intensive coordination activity between user involvement and the other activities. Through this coordination, the living lab experts make sure that the result is achieved in due time and that the multiple interconnected requirements for the product are met. Coordinating multiple simultaneous activities creates the interdependencies that are typical of living labs.

Living labs are not closed systems and, in our study, the labs were connected in many ways to regional and international partners. Such connections are illustrated in Figure 2 as bridging, an activity that, in other contexts, happens by itself or through regional proximity in a cluster.

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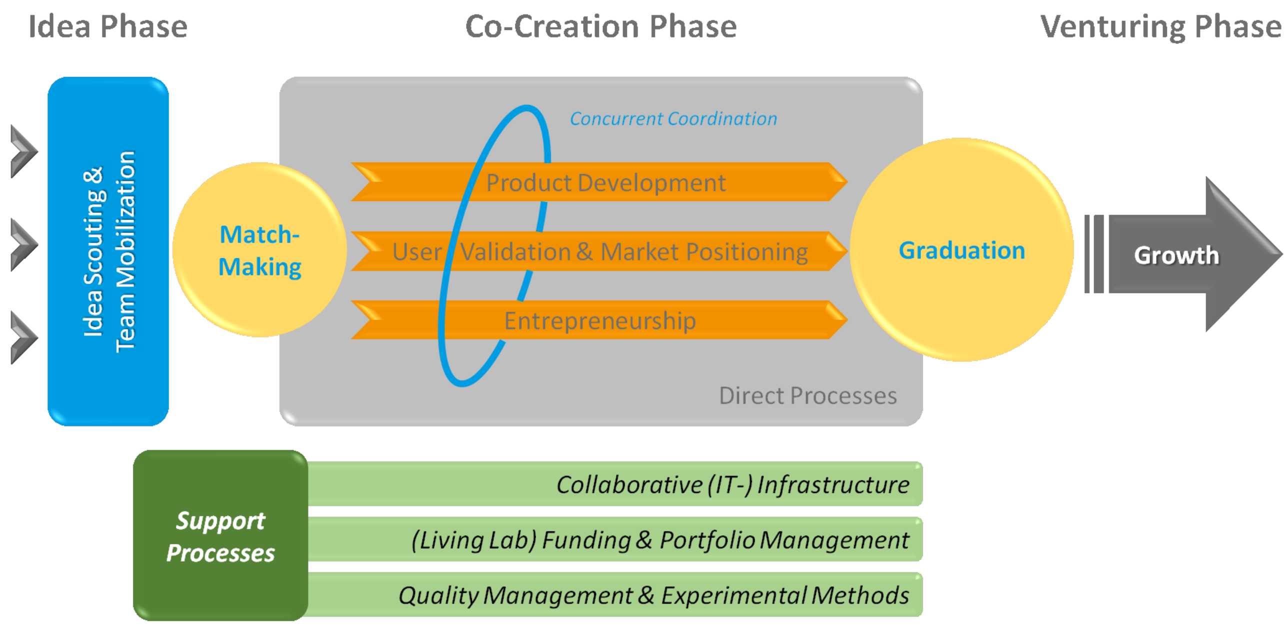

Figure 1. The three phases of the living lab operations pattern (Katzy, 2012)

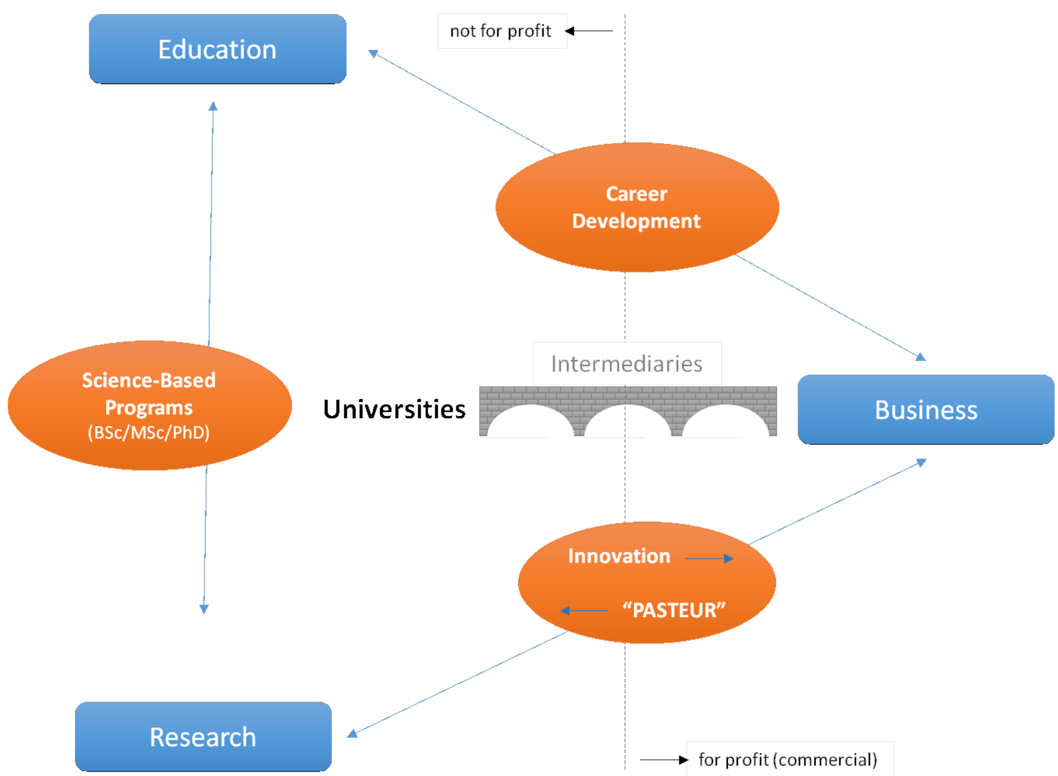

Figure 2. External connections of a living lab innovation system

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It may seem that Figure 2 focuses on actors again. Therefore, it should be emphasized that it involves the "interactions" as repeated activities that are carried out in the living lab.

Conclusion

This article builds on the first decade of living labs by identifying the often novel innovation activities, especially user-centric product development activities, that are developed and undertaken in living labs and enable them to perform. The study is based on an in-depth engaged-scholarship study of three living lab operations.

Our study focuses on the visible hands of users, engineers, and innovators with their complete activities to provide a complementary view on innovation systems for an analysis of how the performed activities contribute to make innovation happen (Katzy et al., 2012). Using a cross-case analysis, an organizational model for living labs is proposed. From the organizational model, further practical insights can be drawn, such as a business model for living labs.

Conforming to the best case scenario in Pasteur´s quadrant (Stokes, 1997), practically useful results can thus emerge in parallel to theoretical advancements. Reflective practitioners in this study state that the concepts of innovation systems, as described here, contribute much more readily available support in guiding their daily action.

Future research can be based on the activities and processes identified in this study in order to develop an alternative conceptualization of living labs. Such research would allow a new and different measurement of living labs based on the performed activities, not based on what constitutes a living lab. Furthermore, it is difficult to generalize the findings of the current study of only three cases, however deep the insights into the activities and processes of living labs might be. Therefore, future research should focus on generalizing the findings reported here.

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Keywords: living labs, innovation systems, co-creation, ideation, venturing, activities, processes

Q&A

Seppo Leminen

Q. What are living labs?

A. The term "living lab" is at risk of becoming a buzzword in the innovation domain because it lacks a consistent or commonly accepted definition. Indeed, a wide variety of activities are carried out under the umbrella of living labs, and they feature many different methodologies and research perspectives. However, even if a common definition is beyond our reach, insights can be gained by understanding the common characteristics and types of living labs. Here we examine typical usages of the term "living lab" and how such labs may be categorized and studied; we also outline the practical benefits of this form of innovation.

In the literature, Westerlund and Leminen (2014) have found that a living lab has been variously perceived as:

- *A regional system* (cf. Oliveira et al., 2006)
- *An innovation system* (cf. Ballon et al., 2005; Eriksson et al., 2005)
- *An ecosystem* (cf. Lievens et al., 2011; Schaffers & Turkama, 2012; Tang et al., 2012)
- *A network* (cf. Leminen, 2013, 2015; Leminen & Westerlund, 2012; Leminen et al., 2014a, forthcoming; Nyström et al., 2014)
- *A combined approach* (cf. Dutilleul et al., 2010)
- *An environment with embedded technologies and users* (cf. Bajgier et al., 1991; Intille et al., 2005; Intille et al., 2006)
- *A context or a methodology* (cf. Almirall et al., 2012; Bergvall-Kåreborn et al., 2009; Dell'Era & Landoni 2014; Mulder & Stapper, 2009;)
- *An enhancement or implementation of public and user involvement,* such as for rural innovations (cf. Schaffers & Kulkki, 2007), regional innovations (cf. Juujärvi & Pesso, 2013), smart cities (Ballon et al., 2011), enabler-driven or user driven innovations (cf. Leminen, 2013; Leminen et al., 2012a; Leminen et al., 2014a; Leminen & Westerlund, 2012), public–private partnerships (PPPs) (cf. Lepik et al., 2010; Niitamo et al., 2006), and a public–private–people partnership (4Ps or quadruple helix) (cf. Arnkil et al., 2010; Ferrari et al., 2011; Molinari, 2011)
- *A development project* for products, services, and systems (cf. Bajgier et al., 1991; Bengtson, 1994; Lasher et al., 1991)
- *A business activity and operational mode* (cf. Schuurman et al., 2012, Schuurman et al., 2013; Veeckman et al., 2013)
- *An innovation management tool* (cf. Edvardsson et al., 2012; Leminen et al., 2012b)

Westerlund and Leminen define living labs as: "physical regions or virtual realities, or interaction spaces, in which stakeholders form public-private-people partnerships (4Ps) of companies, public agencies, universities, users, and other stakeholders, all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts" (Leminen, 2013; Westerlund & Leminen, 2011). As such, living labs are used *by communities* and *for innovation.*

Characterizing Living Labs

The definition above highlights seven key characteristics of living labs:

1. The innovation activities take place in *real-life environments* (cf. Ballon et al., 2005; Intille et al., 2005, 2006).
2. *Public-private-people partnerships* (4Ps) are formed by the participants, which include companies, researchers, authorities, and users (cf. Westerlund & Leminen, 2011).
3. *The importance of users,* including citizens and customers, is emphasized (cf. Ballon et al., 2005; Følstad 2008; Leminen, 2011).

Q&A. What Are Living Labs?

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4. They are *different* from testbeds, field trials, and other forms of innovation (cf. Almirall et al., 2012; Ballon et al., 2005; Bergvall-Kåreborn et al., 2009;). They feature innovations that are more mature than in-house R&D, where prototyping and field trials are more appropriate, but the innovations are less mature than would be found in pilot projects (Ballon et al., 2005).

5. *Multiple stakeholders* are employed in living labs (cf. Ballon et al., 2005; Leminen et al., 2014b; Leminen & Westerlund, 2012; Westerlund & Leminen, 2011).

6. *Multiple roles* are pursued by stakeholders in living labs (Leminen et al., 2014a; Nyström et al, 2014).

7. *Collaboration* between stakeholders is an essential feature of living labs, which are grounded in the principles of open innovation (cf. Leminen & Westerlund, 2012; Niitamo et al., 2006).

Categorizing Living Labs

The term "living lab" has been applied to many different types of innovation activities; however, even within the definition proposed above, there can be different types of living labs. In particular, the type of participant that is driving the innovation activities can be used to categorize living labs into utilizer-driven, enabler-driven, provider-driven, and user-driven (or user-community-driven) living labs (Leminen et al., 2012). The characteristics of each type are shown in Table 1.

Benefits of Living Labs

The living labs approach offers benefits to companies, users, developers, and public financiers. Companies benefit through cost-efficient access to end-user data and user experiences. They also save money by being able to make changes to a product much earlier in the devel-

Table 1. Characteristics of different types of living labs (Reproduced from Leminen et al., 2012)

Characteristic	**Type of Living Labs**			
	Utilizer-driven	***Enabler-driven***	***Provider-driven***	***User-driven***
Purpose	Strategic R&D activity with preset objectives	Strategy development through action	Operations development through increased knowledge	Problem solving by collaborative accomplishments
Organization	Network forms around an utilizer, who organizes action for rapid knowledge results	Network forms around a region (regional development) or a funded project (e.g., public funding)	Network forms around a provider organization(s)	Network initiated by users lacks formal coordination mechanisms
Action	Utilizer guides information collection from the users and promotes knowledge creation that supports the achievement of preset goals	Information is collected and used together and knowledge is co-created in the network	Information is collected for immediate or postponed use; new knowledge is based on the information that provider gets from the others	Information is not collected formally and builds upon users' interests; knowledge is utilized in the network to help the user community
Outcomes	New knowledge for product and business development	Guided strategy change into a preferred direction	New knowledge supporting operations development	Solutions to users' everyday-life problems
Lifespan	Short	Short/medium/long	Short/medium/long	Long

opment process based on user feedback. Over the long-term, living lab activities also tie customers to a company and its activities.

Users gain opportunities to influence the development of products. They also benefit from the solutions that are developed, which in many cases are solving problems that affect their everyday lives and which may have been otherwise unsolvable. Users also may perceive the new, user-driven products to be more functional because of the co-creative development process.

Living labs also contribute to the core activities of developers; the living labs brings opportunities and resources, and the developers bring their capabilities to develop real-world solutions to the users' problems. And, finally, public financiers benefit from activities and outcomes that support their objectives.

In addition to the benefits to participants, living labs also provide advantages over other types of innovation activities. Table 2 lists the advantages of a living labs approach.

Table 2. Advantages of living labs (Modified from Leminen, 2015)

Area	Advantage
Innovation	• Enhance learning (Abowd, 1999; Bajgier et al., 1991) • Tackle complex real-life problems (Bajgier et al., 1991; Mulder et al., 2008) • Foster vertical integration (Eriksson et al., 2005) • Enhance dialogue between different stakeholders (Schaffers & Kulkki, 2007) • Share experiences (Schaffers & Kulkki, 2007) • Enhance SME incubation (Van Rensburg et al., 2007) • Filter problems (Schuurman & Marez, 2009) • Enable open collaboration between actors (Bergvall-Kåreborn et al., 2009) • Enhance multi-organizational collaboration (Kviselius et al., 2009) • Act as a focal point for multi-organizational collaboration (Kviselius et al., 2009) • Engage all key actors for innovation (Mulder & Stappers, 2009) • Understand innovation (Mulder & Stappers, 2009) • Enable unique knowledge (Dutilleul et al., 2010) • Access real interaction data and real application contexts (Azzopardi & Balog, 2011) • Motivate users (Ståhlbröst & Bergvall-Kåreborn, 2011) • Enhance sustainable solution development (Liedtke et al., 2012)
Context	• Can be used in different contexts (Eriksson et al., 2005) • Provide an environment to study richness of complex user behaviour and use of technology in home (Intille et al., 2005, 2006) • Integrate multi-contextual sphere, i.e. regional and cultural diversity (Feurstein et al., 2008) • Catalyze rural and regional systems of innovation (Schaffers & Kulkki, 2007) • Integrate fundamental and applied research (Mulder & Stappers, 2009) • Empower rural communities in developing countries (Mutanga et al., 2011) • Advance smart city operations (Ballon et al., 2011) • Upscale urban development (Ballon et al., 2011) • Provide assets for the innovation environment (Schaffers et al., 2011)
Business Opportunities	• Create new business opportunities (Kviselius et al., 2009; Niitamo et al., 2012) • Localize products (Feurstein et al., 2008) • Lead to unexpected market opportunities (Mavridis et al., 2009)

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Living Labs vs Traditional Projects

Although there are many advantages of living labs, as listed in Table 2, they do bring certain management challenges in relation to traditional projects. To achieve the benefits of the living labs approach, participants should be aware of these differences and adjust their actions and roles accordingly (Table 3).

Roles in Living Labs

The literature provides a broad variety of rich descriptions on multiple and different stakeholders intertwined in innovation activities in real-life environments. Acknowledging the richness of such studies, the discussion offers many conceptualization of living labs. Such conceptualizations include roles and role patterns (Leminen et al., 2014a, 2014b; Nyström et al., 2014), but also how creative consumer roles explain the emergence of innovation outcomes (Leminen et al., 2015a) and how network structures and driving parties increase the likelihood of targeted innovation outcomes (Leminen et al., *forthcoming*) in living labs.

Conclusion

A living lab is one form of emerging open innovation network that provide many benefits for companies and other organizations, and it offer many research opportunities to scholars. As our understanding of the phenomenon expands and our usage of the terminology converges, we will further maximize the benefits of the living labs approach to innovation.

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Table 3. Differences between the traditional project model and the living lab model (Westerlund & Leminen, 2011)

	Traditional Project	**Living Lab**
Objective	Targeted to a preliminary defined project goal	Targeted to an undefined objectives; final objectives change based on the needs of users
Role of Project Manager	Management and control of resources	Management and control of own resources; facilitation and encouragement of users
Control Point	Adjustment points are based on a predefined project plan	Adjustment can be flexible; in extreme cases, adjustments can even be made daily
Role of Users and User Communities	Users are an object of study; they may test and verify products and services	Equal and active participants in the project; co-creators of products or services
Resources and Capabilities	Project resources are used efficiently, including resources from the network	Readjustment and redefinition are the next steps; flexibility in integrating different types of knowledge in the living lab network/community; facilitation of end users and user communities
Tools	Project management tools and methods	Facilitative methods and group work tools

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About the Author

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TIM Lecture Series

Improving the Self-Service Customer Experience: The Case of IBM Watson and Purple Forge

Brian Hurley

"The future is closer than you (or your computer) think."

Brian Hurley
President and CEO of Purple Forge

Overview

The TIM Lecture Series is hosted by the Technology Innovation Management (TIM; timprogram.ca) program at Carleton University in Ottawa, Canada. The lectures provide a forum to promote the transfer of knowledge between 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.

The fifth TIM lecture of 2015 was held at Carleton University on August 24th, and was presented by Brian Hurley, President and CEO of Purple Forge (purpleforge.com). Hurley described his company's use of IBM Watson (tinyurl.com/o3olq6c) and how cognitive computing systems such as Watson will transform how people interact with technology, business, and government. He also discussed how technologies such as Watson will transform how organizations deliver services, reduce costs, and improve customer experience.

Summary

In the first part of the lecture, Hurley outlined the path his company's management took to arrive at its present strategy of integrating cognitive computing systems into its customer service platform: what led them to the technology; how they determined that it can be transformative in the industry and complementary with their products; and why it can add value to customers and users.

Part I: The path

When looking for new business opportunities, Purple Forge considered its own starting point, which Hurley described as follows:

1. Purple Forge is an award-winning Software as a Service (SaaS) provider of mobile-first community engagement and self service solutions.

2. Our customers include: governments, venues, telecommunications service providers, financial institutions, and healthcare and membership-based organizations.

3. Purple Forge's platform and smart connected apps offer a comprehensive set of features that span web, mobile, wearables, social, location-based services, iBeacons, cognitive computing, and the Internet of Things.

4. Purple Forge helps our customers increase their community engagement, gain insights into unmet needs, and reduce service delivery costs.

Next, Purple Forge's management analyzed today's technology and trends to visualize an expected future state. Then, they determined what technologies would be the building blocks needed to reach that future state. And, finally, they looked for business opportunities for related disruptive innovations that would complement their existing technology platform, both in the short term (i.e., from their current starting point) and in long term (i.e., as future technologies and opportunities become available).

Improving the Self-Service Customer Experience: IBM Watson and Purple Forge

Brian Hurley

The analysis of technology and trends began by considering the ubiquity of smartphones and their increasing dominance as a preferred means of accessing the Internet. Through smartphones and other devices, our lives have become "always connected". As Hurley indicated, this degree of access is relatively new, but it is critical in terms of the new possibilities it creates in the very near term. Being always connected amplifies the capabilities of devices, especially through reliable access to data centres that can perform work way beyond the standalone computation and storage capabilities of mobile devices. It opens possibilities for greater interaction with the environment, which are enabled through identity (and authorization), location, and context. "In the always connected world, where you have your identity and you have connected devices around you, based upon who you are and your authorization, you can change what capabilities are available to you at any given instance," says Hurley.

Thus, understanding the future capabilities of devices is facilitated by comparing today's view of an "app" with a more pragmatic view. An app has been traditionally viewed as a program running on a smartphone, and indeed, today's apps are tightly integrated on such devices (Figure 1). The connectivity to cloud services amplifies the capabilities of such devices, as described above, but even greater capabilities will be enabled in the future as these building blocks become disintegrated, enabling functions to be created dynamically through interactions between devices and the environment (Figure 2). Increasingly, "we are seeing individual functionality being broken down into standalone devices, which serve a purpose by themselves, but which also have the potential to be connected by an application at an aggregate level," says Hurley.

Hurley's more pragmatic view of an app is simply "something a person interacts with to get information,

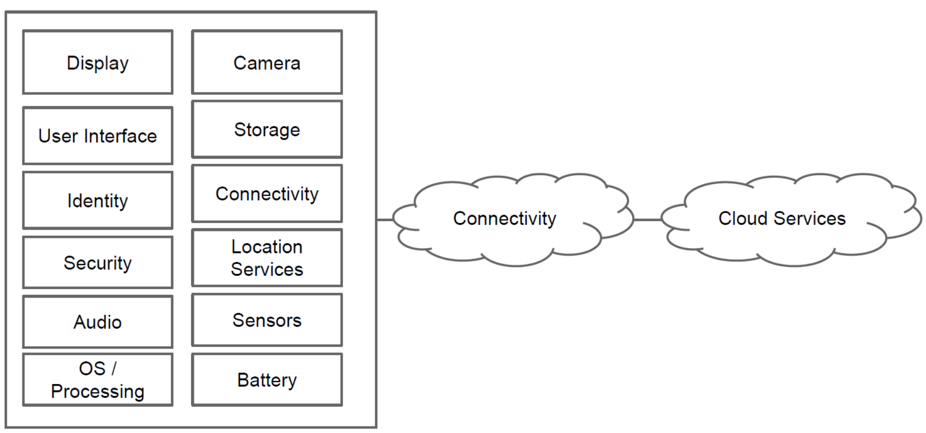

Figure 1. The building blocks of today's apps, showing tight integration within devices

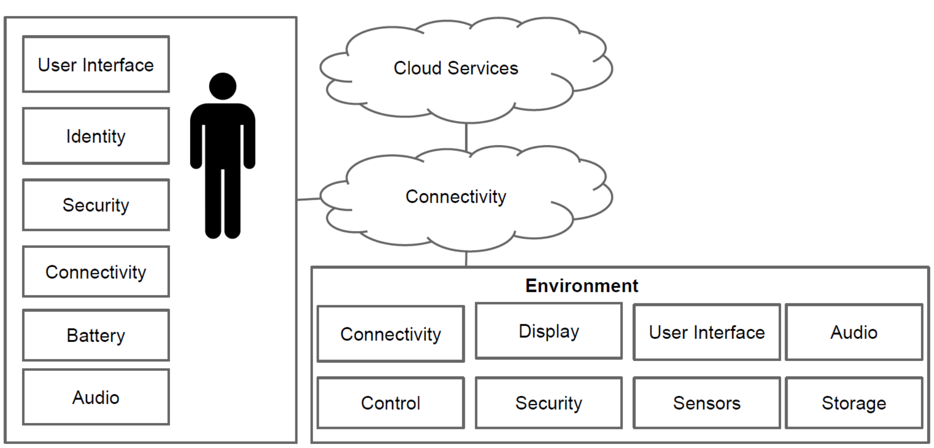

Figure 2. The building blocks of the future, enabling dynamic apps

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Brian Hurley

access a service, or make an transaction". This simpler definition helps facilitate a visualization of the future, which includes apps that are much different than today. In the future, apps will be dynamic; an app at any given time and location will be the sum of the functions and services that are available and authorized. There will be a dynamic formation and dissolution of these apps based on where you are at any given time.

In this context, Purple Forge considered what technology elements would be most important in terms of: i) enabling the transformation to their visualized future state and ii) providing business opportunities for Purple Forge. They identified the following three technology building blocks:

1. **Voice recognition and speech-to-text:** the primary form of interaction will be through speech. Sufficiently mature versions of this technology already exists today.

2. **Natural language understanding for a knowledge domain or application function domain:** the ability to talk to a computer or system and have it understand what you are asking, recognize the context, and take appropriate action.

3. **Question and answer for arbitrary interactions and function activation for a domain:** the user can ask any question (about a particular domain) and receive an appropriate answer.

Once they had identified these technology building blocks, Purple Forge conducted a search of current technologies that might contain some or all of these building blocks. Considering the issues remaining in the self-service domain and what is needed to unlock the kinds of capability visualized in the future state, one clear technology stood out: the IBM Watson (tinyurl.com/o3olq6c) cognitive computing system. Even as demonstrated back in 2011, when it appeared on – and won – the television game show Jeopardy (tinyurl.com/nseo44r), Watson integrated all three key building blocks identified by Purple Forge: i) voice recognition and speech-to-text, ii) natural language understanding, and iii) question and answer capabilities. Moreover, Purple Forge could see how Watson's capabilities could be integrated into their existing platform and could see numerous business opportunities arising from this integration. As described by IBM:

"Watson is the first commercially available cognitive computing capability representing a new era of computing. The system analyzes high volumes of data, understands complex questions posed in natural language, and proposes evidence based answers. Watson continuously learns, gaining in value and knowledge over time, from previous interactions."

Part I: The product

In the second part of the lecture, Hurley described the key challenges Purple Forge wishes to overcome in the customer service domain and provided uses cases for integrating IBM Watson into Purple Forge's platform. He then provided an overview of the resulting solution and detailed a case study of their first product featuring this integration.

Based on their experience in the customer service domain, Purple Forge have identified three key challenges:

1. More than 50% of users have issues finding answers to their questions on government and commercial websites.

2. 50-80% of requests to service centres are for common questions and each call, social message, SMS, web chat, service request ticket, or email costs money to handle.

3. Smaller organizations often staff service centres using volunteers or shared duty agents, which limits the expertise available.

Purple Forge seeks to address these challenges using its self-service software-as-a-service solution, thereby reducing service delivery costs, increasing customer experience, and providing the organization with insights about their customers unmet service needs. By integrating IBM Watson in the Purple Forge platform, the intention is to amplify resources and experience and increase both internal engagement and customer engagement.

Typically, an organization will have hundreds or thousands of unstructured data documents describing the services they offer, and they may also have a service centre that includes email, telephone, a website, chat, customer relationship management, etc. The idea is to use Purple Forge's software-as-a-service tools to create both public-facing components (e.g., a web widget, an app for mobile clients) and internal-facing components (e.g., a service centre agent portal, an IT administrator portal). Within both components, there is an "Ask Watson" function through which users can ask questions about the organization and receive appropriate an-

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swers drawn from the pool of documents. Once these documents had been processed by Watson, its voice recognition, natural language processing, and question and answer capabilities would enable this function, and feedback from users and staff helps it improve its performance over time. The default function of asking open questions is complemented by a list of favourites and frequently asked questions (FAQ). The internal-facing portal enables staff to gain insights about: channel engagement; what questions were answered well, poorly, or were not answered; common questions and themes; and key performance indicators.

The mobile portal offers blocks of basic functionality (e.g., branding, advertising, information directories, live messaging, analytics, news and events, social media integration) and advanced features (e.g., proximity awareness, map overlays, gamification, surveys, push notifications, and the IBM Watson virtual agent) that can be selected by customers, enabling Purple Forge to offer flexible solutions customized to the needs or a particular customer as well as pre-packaged solutions for common use cases.

Finally, Hurley described Purple Forge's integration of the IBM Watson technology into the "My Surrey" app for the City of Surrey in Ontario, Canada (Figure 3). The city's wishes to offer "anytime, anywhere" customer access to services through desktop, web, mobile, and wearable devices. The solution features six different mobile apps integrated through the My Surrey app from Purple Forge. The IBM Watson integration draws upon 4,000 documents within 15 service categories.

The Watson integration into Purple Forge's solutions is now in use in Surrey, with other integrations to follow. According to Hurley, the early feedback from customers and users has been encouraging.

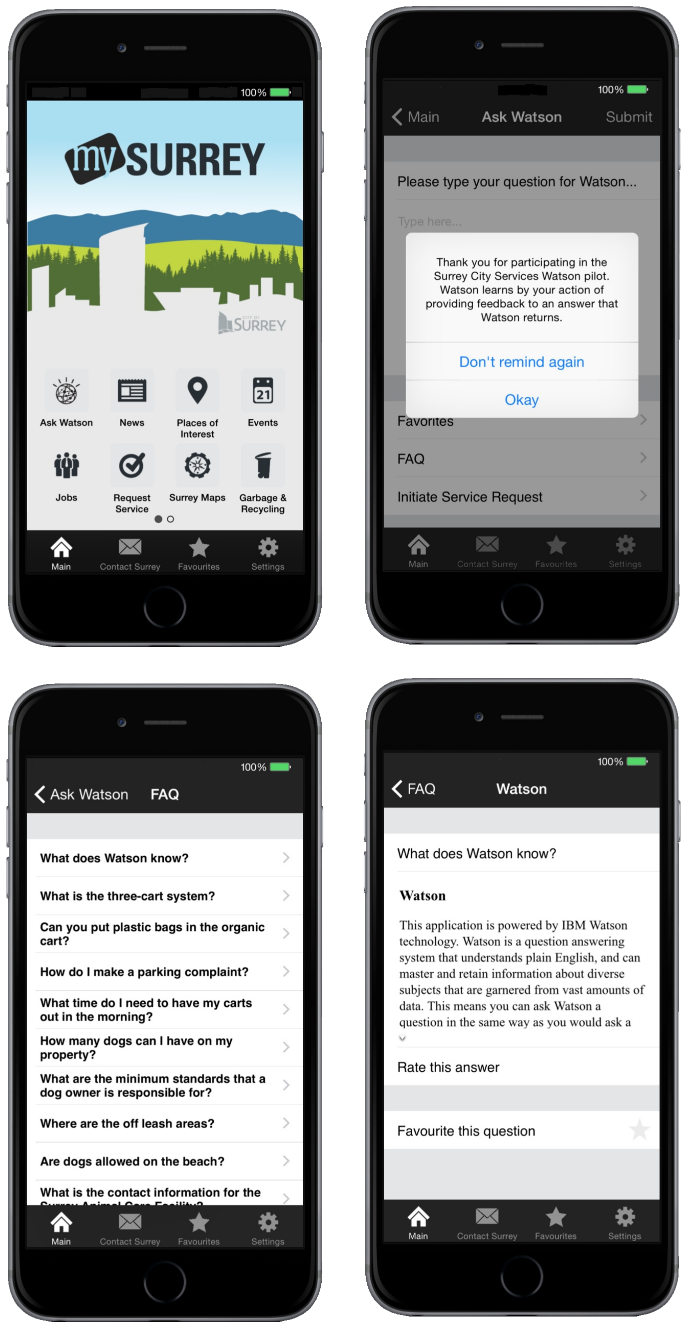

Figure 3. Screenshots of the "Ask Watson" question and answer function in the "My Surrey" app for information about public services in the City of Surrey in Ontario, Canada.

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About the Speaker

Brian Hurley is the President and CEO of Purple Forge. He is an entrepreneurial leader with over 30 years of experience in building strong teams, innovative products, and international businesses. He previously founded Liquid Computing in 2003 and, as its CEO, raised over $44 million in venture financing, built a world-class team, delivered an award-winning product to market, and won international sales. He has built and led numerous successful business teams in Nortel, Bell-Northern Research, and Microtel Pacific Research. Brian is the author of the bestselling book *A Small Business Guide to Doing Big Business on the Internet*. He was the 2007 winner of the OCRI "Next Generation Executive" award. Brian is a member of the GTEC SCOAP Honouree Selection Committee, and he is a past member of the Ottawa Chamber of Commerce board of directors. Brian graduated from Carleton University in Ottawa, Canada, with a Bachelor of Engineering.

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- Write in a formal, analytical style. Third-person voice is recommended; first-person voice may also be acceptable depending on the perspective of your article.

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