Proceedings of FIKUSZ '13 Symposium for Young Researchers, 2013, 33-44 pp © The Author(s). Conference Proceedings compilation © Obuda University Keleti Faculty of Business and Management 2013. Published by Óbuda University http://kgk.uni-obuda.hu/fikusz

Organizational Innovation through Living Labs for Optimizing the Energy Usage of Blocks of Flats

Katalin Kovács

Budapest University of Technology and Economics,

Department of Management and Corporate Economics

katalinkovacs84@gmail.com

Abstract: Interactive value production through Living Labs means interactive development of products/services in real-life milieus by involving the end-users in the development process from the early stage. The aim of Living Lab initiations includes efforts, by way of following their suggestions in the whole process of developing new technologies and services, to integrate the behaviour of household consumers as well as the most important factors that influence their behaviour changes. Consumers can save energy or enhance energy efficiency by the implementation of renewable energy technologies. This way, for companies working together with consumers in innovation, therefore mutual added value can be created and higher added value products provided for the end-user. I assume that only minor changes are initiated by the end-users in a Living Lab collaboration, therefore organizational innovation is relevant in the renewable energy industry through Living Labs. This hypothesis was tested by conducting interviews with Living Labs operating in the renewable energy industry.

Keywords: interactive value production, Living Lab, renewable energy innovation, end-user involvement

1 Introduction

Day by day try companies to find solutions for upgrading their products and technology. They want to survive increased competition and create a sustainable competitive advantage with their innovation activity. Beside this general tendency fostering the optimal usage of energy and enhancing energy efficiency is a relevant field of policies targeting economic development. It is an actual issue and challenge for the economies, that there are alternative solutions developed already to subsitute the traditional fossil energy sources. These alternative solutions are not widely used because of the long time

required for the investment to return, recently. The installation of renewable energy technologies are supported by the government in several countries (e.g. in Austria) but their installation and cost of maintenance is generally higher than that of the traditional fossil energy sources. There are several solutions targeting this problem. Innovative business models exist for providing better technology for the owner of family buildings. For example in Austria[1] city residents can buy a share of a photovoltaic field. Then by using the electricity produced their energy bills are decreased in align with their share. But if we figure out and use new business models and install renewable energy technologies it is still not sure that we have done everything for saving the maximum amount of energy. The reason is that the majority of renewable energy installations into households are not harmonized with the already existing heating/electricity systems. The majority of companies provide only one type of renewable energy solution for the users and convince them to install their technologies into homes. Most of the time users are not aware of possibilities of combining renewable energy technologies either, even if there are services of engineering companies targeting this need.

A special type of innovation in the renewable energy industry is explored in this article, as a possible solution for this problem. As the Oslo Manual defines, "innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations." [4] There is a global tendency from the traditional way of innovation to open innovation. As Henry Chesbrough introduced the term of open innovation: "Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology." [6] The more active role, increasing self-consciousness and more sophisticated needs of end-users reasoned the emergence of the research and innovation concept called Living Labs, itself a special type of open innovation. Living Labs are generally not domain-specific [2]. Interactive value production through Living Labs means interactive development of products/services in real-life milieus by involving the end-users in the development process from the early stage.

I assume that the Living Lab method especially as organizational innovation[2] is relevant in the renewable energy industry. Because of the wide variety of working conditions in households I think providing valuable feedback for the innovation of renewable energy technologies requires inclusion of specific knowledge from the user's side possibly into

1 Based on the research executed in the frame of the fellowship program of the "IFZ - Inter-University Research Centre for Technology, Work and Culture", Graz in the 01.01.2012-30.04.2012. period. Because of shortage of the available communication space only very basic results are written down here, without details.

2 "...organisational innovation is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations." [4]

the whole of the 'innovation chain'. For this purpose I analyzed the Living Labs in the domain of renewable energy by preparing interviews and conducting desk research. I focused on the aspects of user involvement, the type of technologies, the business model of companies participating in the Living Labs and the added value they can gain. Beside these fields of analysis I highlight on some examples by introducing their working/business model and show what in this kind of collaboration form exactly happens.

2 Structure of research

2.1 Hypotheses

As already introduced, Living Labs are a special and new form of collaboration for innovation with a special role of end-users in the innovation process of technologies.

First, I assume that Living Labs in the field of renewable energy do not immediately target technology or process innovation. When starting the research I assumed that no renewable energy technologies are really modified by manufacturer-user interaction even if several Living Labs exists in the renewable energy industry. This hypothesis was based on two reasons:

- Renewable energy technologies are too complex to be modified by the users, as they require specific technical knowledge. To say it differently, so called lead users are seldom technical experts of the field.[3]
- That is why, renewable energy technologies are hard to be modified by the end-users from the beginning of the development process in an interactive way. The experiences gained by end-user involvement in Living Lab collaboration are translated by the engineers to identify the necessary changes on the technologies/services.

Secondly, based on the first hypotheses, Living Labs dealing with renewable energy technologies are relevant and have added value in organizational innovation. I suppose, that a Living Lab way of interactive value production provides therefore a possibility for companies for organizational innovation. The aim of this kind of collaboration is to harmonize their products with the products of other companies/other technologies at the place of end-users (or at test-houses) and provide the perfect and best combined solution for them to save the maximum amount of energy, instead of developing the technologies they provide.

3 Eric von Hippel defines lead users of a novel or enhanced product, process, or service as those who display two characteristics with respect to it: 1. Lead users face needs that will be general in a marketplace, but they face them months or years before the bulk of that marketplace encounters them, and 2. Lead users are positioned to benefit significantly by obtaining a solution to those needs." [3]

2.2 Method of my Research

The first step of the analysis was to identify the Living Labs operating in the renewable energy domain. It was done through the database of ENoLL (European Network of Living Labs), therefore those members of the organization were listed. In order to identify possible non-members also, Google search was executed with the combination of the key words “Living Lab”, “renewable energy” and also “energy efficiency”. After identifying these organizations a desk research and deep interviews were conducted and the main aspects of a Living Lab working method were identified. Setting of the working method was in align with the main elements of the Harmonization cube, leading conscious Living Lab approaches.

The analysis also focused on describing the present and possible added value of Living Labs in the development and commercialization of new energy-efficient building technologies interactively. The core component of Living Lab analysis was about the possible role of users and the method of user involvement into the development process of technologies.

Harmonization cube is a general methodology to harmonize and exchange best practices of LLs. It was developed by Mulder and colleagues in 2007. The harmonization cube defines the main interoperability elements from organizational, technical and contextual points of view, and by the stages of Living Lab maturity. It details the main elements of the evaluation methodology divided by the development stages - and direction of further development- the stages of setup, sustainability and scalability put on the vertical axe.” [7] The harmonization cube provides the theoretical base of the research by creating the main focus of the interview guideline in align with its six sides. It has the following structure:

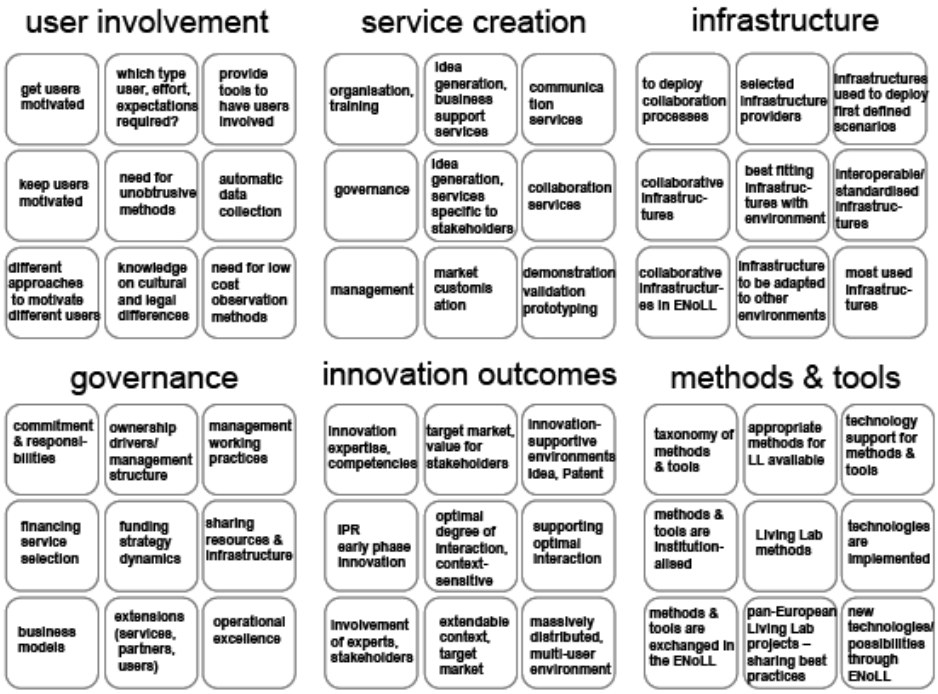

Figure 1

The elements of the harmonization cube [7]

The quideline of the research was formulated after some preliminary interviews with the representatives of Living Labs. Based on the experiences gained the above detailed structure of the harmonization cube was simplified and the following guideline used during the research:

General questions, RE field of activity
What kind of technologies are developed in co-creation?
Why exactly these technologies?
What kind of services do you provide? (technical services, customer services, intra network services)
What kind of infrastructure do you use in the Living Lab activity?
What is/Is there a governance model in the Living Lab?

Added value, aims
How much is the development by co-creation with the end-users more effective /quicker, cheaper, more useful, etc... / than the traditional development methods?
What is its added value? How do you think it can be sustained or developed further?
What kind of modifications have been provided by the users?
Does the activity enhance social acceptance of the renewable energy technologies?
What is its added value? How do you think it can be sustained or developed further?
What kind of modifications have been provided by the users?
Does the activity enhance social acceptance of renewable energy technologies?

User involvement method
What are the methods of user involvement you are using in your Living Lab?
How do you select, convince and motivate the end-users to participate in your Living Lab? Do you choose a definite group of users to participe in co-creation?
How many end-users are participating in your Living Lab?
What are the next steps after co-creation? How much time is still needed to introduce the technology in the market?

Results achieved so far
Could you please mention some exact technologies, products/services developed in co-creation with the end-users?

Establishment, sustainability of the Living Lab
How was the Living Lab established? What kind of organizations as partners are collaborating together?
What is the business model of the Living Lab?
How do you finance it, do you use any grant from EU?
What was the added value of the Living Lab concept over the traditional development?

Table 1

Interview guideline on analysing the operation of Living Labs

Source: Own editing

The analysis were focused on the main added value of Living Labs, their role in renewable energy innovation and their contribution to the realisation of sustainable households.

The data collected through the interviews and desk research were grouped and structured in align with the quideline categories and the main elements, sides of the harmonization cube. These notes, sentences, remarks and opinions were analyzed by creating answer categories also. Answer categories and linkages were structured and then summarized in this paper.

2.3 The sample

There were altogether 27 Living Labs operating in the field of renewable energy identified. I have to emphasize that the Living Labs involved in the analysis were also targeting the development of sustainable, "green" buildings, where the development of renewable energy technologies is just a small, but a very important part. Most of them deal with the development of energy efficient technologies as well. Regarding their geographical relation, 3 of them was located in the USA, while 24 in Europe.

3 Results

3.1 Aims of Living Labs

While traditional PPP partnerships aim at cost outsourcing and seldom realise strong interaction with the later users neither in the planning and nor in the realisation process, Living Labs aim at innovation by learning from the users in real life interaction. The involvement – as described by the theoretical explanation on Living Labs – have to be interactive in order to gain information about the existing preferences of the end-users. The aim of Living Labs identified is to develop technologies/services as perfectly as possible to realise the efficiency of energy utilization of buildings by exploiting user knowledge of the existing heating/electricity system.

Renewable energy Living Labs aim to decrease the fossil energy usage of buildings and enhance energy efficiency. While in general Living Labs in their most developed form realise interactive value production already in the planning and development 'phase' of innovation. In order to develop prototypes, most of the Living Labs in the renewable energy technologies field aim at implementing in homes prototypes, developed in labs, only in order to gain experience of the end-users from their normal living environment. Information about the renewable energy technologies are gained by sensors using the smart grid concepts in the Living Lab building. The managers of Living Labs are to monitor the interactions of the users with the new technologies implemented at home. Therefore they can gain information to test and evaluate the technologies for providing the best combination for each building.

Existing renewable energy Living Labs therefore aim to develop sustainable, renewable energy innovations by monitoring the interaction of users/customers with their homes and the technologies. They intend to prototype, validate and co-create innovations and

try to execute longitudinal testing as well. For this purpose they use so called Living Lab "test houses" and install technologies into homes. The core of user-involvement in technologies on renewable energy innovations generally can be summarized easily by citing Digital Lifestyles Centre Living Lab about its description on its user trial process: "User trials (...) generally make use of the naturalistic environment to help participants relate the prototype, product or service to their normal patterns of living in their own home. When a user trial is about to take place, the researchers will recruit willing volunteers to use the prototype, product or service. Some trials have very specific requirements for the lifestyle, age group or needs of participants. For example, if a prototype service for people with a particular disability was the focus of the trial, then only people with the particular disability would be recruited. Other trials might require a cross section of participants from different backgrounds and lifestyles." [1]

3.2 Methods

The interactive co-creation with the end-users are executed by the involvement of different groups of actors including SMEs in the development process. The role of SMEs and research institutes is to provide inputs for testing, stimulate discussion and creativity by leaving space for creativity and interactivity with the end-users. The role of the Living Lab "management" is to organize co-creation with the users in a possible way to gain information about the usage of technologies in their normal, natural environment.

Users are also involved into Living Labs by interactive workshops. They are recruited and motivated to participate and give their opinion of their need on new developments. At the later stages of the development process, when a first prototype is available, the co-development, co-creation and interaction can be executed interactively with the end-users. They use the technologies/prototypes everyday in its normal working environment. Technologies are sometimes tested at homes in order to perform longitudinal research using observation equipments and collect the reports of the users.

As for financing, Living Labs are mostly initiated in the frame of government or EU programs, and their sustainability is established by their business models for this purpose. The collaborative "testing" or co-creation decrease the costs of the firms, therefore provide benefit to sustain the Living Lab.

3.3 Results

These homes, as Living Labs can demonstrate significant carbon reduction in their buildings by the usage of these "green" technologies and understanding the utilisation of the real human behaviour for improving the efficient working of technologies in real life situations. Mostly universities, innovation centres, SMEs providing technologies for testing and councils and citizens collaborate together to interact and co-develop innovative technologies. The smart-grid concept also help users to optimize their energy usage.

4 The added value of Living Labs in renewable energy innovation

Living Labs are a possibility for SMEs as well as research institutes to demonstrate their latest development in an interactive forum in order not only to get pieces of critical expert opinion from the relevant fields but first of all opinions from the end-users. Innovations can be co-developed from the early stage with the involvement of end-users by the above detailed methods. This is a possibility to target different market segments with different products developed co-creatively. There is an example for this, as "Habitat" Living Lab especially targets the communities of low-income in order to target them with technologies meeting their needs and improve their living environment and energy efficiency in their house. [5] Beside experiential learning, involving users into the development process also might enhance engagement for the technologies. This provides long-term added value for companies and research institutes. Living Labs might enhance the commitment and raise awareness of the community towards renewable energy technologies. Therefore it has a specific role in enhancing the social acceptance of these technologies as well. As clearly demonstrated by several studies, one of the significant problems of enhancing the usage of renewable energy technologies resides in their social acceptance. [8] Living Labs, by their close interaction with the end-users are a specific tool for this purpose.

As there are several agents in the Living Labs from different discipline, they also have the opportunity to share their ideas and learn from each other in a real life milieu. The Living Lab testing environment, besides fostering the development of energy efficient, renewable energy technologies, has a role to contribute to the realisation of sustainable households and decrease the costs of energy and dependence on fossil energy. During the Living Lab co-creation process there is the possibility for the developers to identify interventions points in domestic environment. It gives a detailed understanding on the behaviour of household customers. By the long-term collaboration new business partnerships and user engagement can be also achieved. The added value of Living Labs on renewable energy is manyfold.

- It helps enhancing energy saving and reducing greenhouse gas emission by fostering the development of renewable energy technologies.
- The cost and risk of partners for testing can be decreased.
- Jobs can be created directly by the Living Lab organizations as well as indirectly by the development of innovations in the renewable energy field.
- As users can be involved in the early stage of the development process, ideas, concepts, prototypes and also services are the focus of experiment and testing, therefore even so far unexpressed needs can be discovered.
- Users may provide reliable information about new markets.

- Companies participating in Living Labs need shorter time from concept to market because of the interactive development as well as the engagement of the end-users. Engagement speeds up the acceptance of technologies and early adopters are mainly from the testing groups.
- Living Labs help to develop a perfect combination of technologies in order to realize the maximum level of energy efficiency in buildings.

Conclusions

There are much more possibilities to use renewable energy than just putting the well-known, standard and mass-produced solar panels on the roof. There are several products under testing in order to provide comfort with low energy-usage and energy efficiency. In the Living Labs mapped, there are materials under testing for heating, cooling and insulation. The focus of testing are also building operation scheduling technologies, special PV panels and automated controlling of heating or lighting systems into households. The aim of Living Lab initiations is to understand the behaviour of household consumers as well as the most important factors that influence their behaviour changes in order to save energy or enhance energy efficiency by the implementation of renewable energy technologies. For companies working together this way, mutual added value can be created by realising the perfect combination of their technologies and providing a higher added value product for the end-user.

Acknowledgement

I acknowledge the contribution of all interviewees participating in the research and contributing to this work with their work experience. This work was executed in the frame of the fellowship program of the "IFZ - Inter-University Research Centre for Technology, Work and Culture", Graz in the 01.01.2012-30.04.2012. period. The research on which this article is based on, received funding from the Austrian Agency for International Cooperation in Education and Research, Centre for International Cooperation and Mobility, Austria (http://www.oead.at/).

References

[1] Digital Lifestyles Living Lab website: http://digital-lifestyles.weebly.com/

[2] EC INFSO: Living Labs for user-driven open innovation, An overwiew of the Living Labs methodology, activities, achievements, 2009, pp 19

[3] Eric von Hippel: The Sources of Innovation, Oxford University Press, 1988

[4] European Communities Statistical Office, Organisation for Economic Co-operation and Development: Oslo Manual. Guidelines for collecting and interpreting innovation data: The measurement of scientific and technological activities / by: - 3. ed. - Paris: OECD 2005.

[5] Habitat Living Lab website: http://www.habitat.ufes.br/

[6] Henry Chesbrough: Open Innovation: The New Imperative for Creating and Profiting from Technology. Boston, Harvard Business School Press, 2003

[7] Mulder, I., et al: Towards harmonized methods and tools for Living Labs. Paper to be presented at e-Challenges, The Hague, The Netherlands, October 24-26, 2007

[8] Wüstenhagen, R., M. Wolsink, M.J. Bürer: Social acceptance of renewable energy innovation: An introduction to the concept; Energy Policy. 35 (5), 2683-2691, 2007