

The Role of SMEs and User-Involvement in Influencing Innovation in the Renewable Energies Sector

Katalin Kovács

Abstract

The innovation of renewable energy technologies have special attributes, as social acceptance and high investment is also required for enhancing their spread and use as a substitute of traditional fossil fuel technologies. Hungary - in spite of its high level of resources - has a low level of renewable energy usage. It is hypothesized, that in general, the usage of renewable energy technologies can be enhanced by increasing public participation and the level of user-involvement in the innovation process of renewable energy technologies. The aim of the research was to conduct an explorative analysis on the practice of innovation and tendencies towards open innovation and interactive user involvement in a country showing a high-level of renewable energy usage, while otherwise having comparative parameters, leading to research in Styria. The results of this explorative analysis in Styria can be summarized by stating that open innovation is present in the renewable energy industry, leading to an enhanced innovation and usage level.

Keywords: renewable energy, open innovation, interactive user involvement, biomass, solar

1. Introduction

Enhancing energy efficiency, promotion of renewable energy sources and reduction of energy consumption has become a primary concern due to climate change and the high dependency on energy. This concern is tackled from different perspectives. The Living Lab (LL) approach for involving users at all stages of the RDI (Research, Development and Innovation) process has significant potential for enhancing innovation effectiveness in energy-intensive sectors such as construction. Main goals of the European Union are to reduce energy consumption and promote the usage of renewable energy sources.

The research aims at creating effective methods and procedures of integrating the LL approach (focusing on the effective modes of user-involvement, interactive value creation and the collaboration of small and medium sized enterprises (SMEs)) in order to increase energy efficiency and spread the utilization of renewable energy technologies. LLs, by involving end-users even at early stages of the development process of new technologies and mobilize and enhance collaboration among the most important actors of the economy and society (government, citizens, universities, research institutions, industrial actors including multinationals and SMEs) are a breakthrough opportunity for achieving energy efficiency purposes and promote the usage of renewable energy. “Living Labs are open innovation environments in real-life settings, in which user-driven innovation is fully integrated within the co-creation process of new services, products and societal infrastructures” (DG INFSO 2009), with the European Commission having identified several domains where the LL approach can be particularly advantageous.

Designed as an explorative analysis, the aim of the research was to create a basis for a Hungarian-Austrian comparative analysis in the field of renewable energy innovation. Therefore, it details the collaboration forms, interactive value production and innovation process of Austrian companies active in the field of renewable energy. Utilizing these results, the aim is to determine possibilities for the adoption of the European practices of open innovation to the Hungarian economic situation, the main goal being to strengthen the innovativeness of SMEs.

2 The relevance of the research topic

Over a quarter of Austria’s total power consumption comes from renewable energy sources, making Austria one of the best on the global stage. The know-how of Austrian companies, their expertise and technological leadership all enjoy high international demand. Furthermore, the market for sustainable power from renewable energies is growing steadily. With 32% of overall primary energy consumption coming from renewable energy sources, Austria is widely considered to be one of the leading countries

in renewable energy production and technologies (Advantage Austria 2014, Facts and figures).

In contrast, Hungary is currently in the bottom ranks of the EU nations with regards to its percentage of renewables (9,6% in 2012; Eurostat 2014, 3). Additionally, Hungary has almost the lowest (13%) target for renewable energy for 2020 out of all EU member states (Eurostat 2014, 3).

I want to get a clear overview about the innovation activity of Austrian companies operating in the domain of renewable energy and identify target communities to execute user-involvement. The purpose of this research is to determine opportunities, measures and strategies of utilizing the advantages of open innovation; such as establishing collaboration between relevant partners of the economy in the energy sector in order to achieve more efficient use of energy.

3. Methodology

3.1 Literature analysis

Based on existing research on open innovation and/or renewable energy innovation, a literature analysis was conducted. Summing up, there is a more dominant role of users determined by Ornetzeder and Rohracher (2006); they highlighted, that “under certain conditions a higher degree of user involvement or self-building groups might lead to a successful mode of innovation which has often been neglected and which could contribute to the design and diffusion of certain energy technologies” (Ornetzeder & Rohracher 2006, 139).

Schreuer et al. in 2009 also carried out research on the topic of renewable energy innovation networks in Styria, leading to the finding that there is a very active and tight network of biomass and solar research institutes in Styria; simultaneously there is a problem with SMEs, as their strong R&D potential is not utilized to its maximum. They emphasized that biomass and solar energies are the most developed industries in Styria, while wind energy has less importance in the region (Schreuer et al. 2009, 8).

In 2010, Schreuer et al. carried out an analysis of the regional innovation system of renewable energy technologies in Styria. Their research showed that the overall R&D network is dominated by SMEs and research institutes, while policy actors have a peripheral role in the network (Schreuer et al. 2010, 11). They highlighted the strong role of testing laboratories and research institutes for agricultural engineering as a knowledge base for biomass heating system development. Schreuer et al. mention the high-level of R&D activities, especially in the biomass and solar field. The study emphasizes the importance of competence centres targeting the collaboration between business/industrial actors and research institutes. They also highlighted that entrepreneurial activity is more relevant in the biomass than in the solar industry as a result of the self-build groups on solar collectors (Schreuer et al. 2010, 7).

Further research on open innovation was conducted by the Centre for Social Innovation (Zentrum für Soziale Innovation 2008). They stated that "the market success of sustainable products should rather be achieved by involving users and other relevant social groups as early as possible and by considering their ideas in the design, than by marketing campaigns in the dissemination phase. From this perspective it is of crucial importance that future innovation processes consider not only ecological criteria [...] but also social aspects" (Centre for Social Innovation/Zentrum für Soziale Innovation 2008, iii).

In contrast to the findings mentioned above, the CHIC (Central Hungarian Innovation Centre Nonprofit Ltd.) led a two-year project set up as an explorative analysis on open innovation. As a result, it was found that in Hungary, companies' willingness for open innovation, as well as a tendency for channelizing outside knowledge into the innovation process of a specific company, is either non-existent or very rarely experienced (See CHIC Nonprofit Ltd, "Open innovation, Living Lab and stimulating societal dialogue in Hungary project"). The present analysis aimed at the conduction of an explorative analysis as regards Hungarian practice on this question, on a very general level. It did not go very deeply into details or reasons as to why there are only a few initiatives on open innovation in Hungary, which, in turn, are also only in their early stages.

Given that this tendency might be country or region specific, as well as possibly influenced by certain policy action, the idea leading the present research was to conduct a comparative analysis on open innovation in a country on a higher level of development, while at the same time having comparable parameters otherwise. Besides the development level, the analysis was focusing on a specific sector in which the performance level of the two countries are significantly different, supposing that the different level of development might be a result of the current and previous innovation practice of the companies active in the given industry. Building up on this concept, Austria, and more specifically, one of its most innovative and developing regions, Styria, was chosen as the target of this analysis. Styria's high level of commitment toward renewable energy and innovative technologies played a major role for this decision.

The studies mentioned so far highlight that the biomass and solar industry have a major role in the renewable energy industry in Styria. However, to date no research analyzed open innovation in Styria, especially not focusing on analyzing the role of end-users in the innovation processes.

3.2 Institutions targeted in the research

The companies involved in the present research were divided into groups, the dominating number being alliances and municipalities, as well as manufacturing and research institutions. The rest of the interviewees represented companies in consulting, trading and universities. The reason behind this is that manufacturing and research institutions have a significant role for innovation, as they work on developing new products, meaning that on a day-to-day basis, they are close to innovation processes in the renewable energy industry. Their role and attitude on open innovation was expected to be of high relevance. Besides manufacturing and research, the role and attitude of the alliances and municipalities were also expected to be very important due to the fact that networking and the services provided by these groups might foster innovation, especially open innovation activity in an industry. I did not want to fix selection criteria, neither as regards the turnover of the companies, nor the number of employees; Rather, I chose to focus on SME development, which is

why I selected only SMEs to participate in the study. During the selection process, I wanted to involve all actors relevant in the biomass and solar industry in order to analyze the attitudes of institutions having different roles as a target of analysis.

Altogether, the total number of interviews conducted with the member companies of Eco World Styria was 17, including 8 interviews with companies active in biomass and/or solar business, and 9 interviews with institutions from the energy efficiency group. Besides the interviews targeting members of Eco World Styria, additional institutions were requested for interviews after negotiating with the representative of the cluster and following suggestions made by several interviewees. Altogether, there were 16 interviews conducted besides the ones with cluster members, two of which being institutions, where 2 representatives were targeted; on the whole, a total 31 institutions were involved in the research.

The role of alliances/ municipalities is mostly to enhance the collaboration among actors of the renewable energy business and their main aim is to develop the economy. I tried to focus on involving all relevant actors and networks into the analysis, as their role in business development and innovation is very important in the economy. All institutions – members as well as non-members of Eco World Styria – were targeted for interview on a local as well as on country/ government level. The companies involved in manufacturing and/or research carry out professional work on product development, and are mostly involved in the development of projects at an early stage. They were expected to have most of the information on product and service development, as well as about the preferences of end-users and the specifications of renewable energy products. Their attitude and opinion is essential in terms of open innovation, as they might have all technical competences required for the innovation of renewable energy technologies.

The consultants are mostly the partners of manufacturing companies; they have the knowledge on renewable energy technologies, and mostly provide services for the companies, and every actor in the industry. Their role is mainly enhancing the knowledge level in this field, for the companies as well as in society. Trading companies are in close contact with

the end-users, therefore they might have an intermediate role between manufacturers and the end-users of renewable energy technologies. They provide a channel for the information flow. There was only one university involved, the technology transfer office of TU Graz, which has a great role in utilizing the knowledge coming from the university, as well as building networks of university start-ups.

The interviewees were located in the region Styria, or in case of government institutes in Vienna. Each in-depth interview was conducted in person, and lasted an average of 45 to 60 minutes. The interviews were qualitative, as several new questions arose during the interviews. After the interview series, the answers were consistently organized and categorized; scales were created in order to quantify the data for further analysis.

3.3 Interview topics

During the design process of the research method, the Living Lab harmonization concept (Mulder, Velthausz & Kriens 2008, 6) was changed and configured in order to match the special features of the renewable energy industry and to finally create a useful research strategy. For this purpose, the already existing Living Labs in the field of energy efficiency or renewable energy (as members of the European Network of Living Labs) were mapped and, whenever possible, interviewed by phone, in order to be asked about their innovation practice and activity on energy efficiency.

The interviews focused on the following questions:

- Does user-involvement (if existent) foster the innovation process of renewable energy companies to provide additional value?
- Do the incentives of the government help to spread renewable energy technologies?
- Is there a tendency towards service innovation in the renewable energy field?
- What source of knowledge is dominated in the company innovation? Did it change in the past, and what was the reason/result for/of the change?

In order to find answers for these questions, and determine the open innovation/user-involvement activity of SMEs in the Styrian renewable energy industry, the following topics were analyzed during the interviews:

1. Recent and past innovation activity (the innovation process, projects of the company, knowledge creation, diffusion and exploitation, sources of innovation, networking activity);
2. The role of the user (modifications suggested so far, user interaction forms, lead users identified, interactive user involvement executed so far, possibilities of user-involvement, services for the users);
3. Business models (social acceptance of renewable energy innovations achieved, individual business models created, projects on public participation initiated, tendency towards service innovation);
4. The role of government (utilized incentive forms, determining the main innovation actors in the industry);
5. Importance of intellectual property rights and the relevance of intellectual property in the innovation processes;
6. Opinion on open innovation, and user involvement and main obstacles of/for the company.

The interview summaries were consistently organized and structured in groups; subsequently, the main points for further analyses were determined. A 3-scale coding was created in order to prepare quasi-quantitative data. The scales were then determined in align with the level of commitment or on the attitude toward a specific topic.

4. Results

4.1 Alliances, municipalities

If we focus on SME development, the role of alliances and municipalities is mainly to enhance networking and help to utilize the synergies among SMEs in an industry. They organize events and manage the collaboration with the

end-users for the SMEs. They intend mostly to build PPP models with the active collaboration of end-users. Most of the interviews of the alliances/municipalities group are trying to foster open innovation activity intentionally, and are also active in networking. They focus on end-users and have a positive opinion on open innovation. Their operation towards open innovation activity might foster the innovation in the frame of SMEs.

4.2 Manufacturing companies

In the innovation process of the manufacturing company research group the role of external sources of knowledge is important, but not dominating. There were only SMEs involved in the research, therefore consequences can be explained in consideration of this fact. There is no tendency toward service innovation; also, they do not foster searching for new services in order to provide them to the end-users. Their open innovation activity is not very strong recently; however, they are open towards it and try to foster it in their activities as they see a very positive tendency regarding open innovation in the renewable energy sector, while regarding IP as an important factor in innovation.

The roles of end-users in the innovation processes were analyzed in more detail. Most of the companies, as SME representatives, stated that they received modifications from the end-users so far. The companies participating in the research, did not identify lead users actively, or find user involvement of high relevance in the innovation process. They regard user-involvement as being important as the users are more and more aware of the technologies they need.

4.3 Consultants – Trading-installer companies – Universities

The role of consultants is mainly to enhance the knowledge level on renewable energy. Tendencies toward open innovation are regarded as being positive. Trader companies are in direct contact with the end-users; therefore, they have a significant role in open innovation in order to channelize user ideas back to the manufacturers.

5. Some remarks on the Hungarian practice on renewable energy usage

The interviewees were also asked about their opinion on the Hungarian-Austrian comparative analysis focusing on how open innovation can enhance the usage of renewable energy. An expert in the field working at an institute of the municipality agreed that the renewable energy sectors should be separated in the study, and that the already mentioned geographical differences between the countries should be taken into consideration. An expert of a consultant institution highlighted that the biomass resources in Hungary are not completely utilized, but that Hungarians use fossil fuels instead, even if there are subsidies from the government for this purpose. Instead, Hungarians sell their resources, such as wood, abroad. A manufacturing company emphasized that, based on its knowledge, Hungary uses biomass mostly for commercial usage on a large scale, because in this case there is a short payback time. An expert of an alliance emphasized that the Hungarian biomass resources are exported and used in Austria, and the possibilities of Hungary in terms of renewable energy usage are not fully utilized. An expert employed by a consultant organization pointed out that the usage of solar collectors could be enhanced in Hungary by specific business and financial models in PPP construction. She also sees great chances for Hungary in terms of biomass.

6. Conclusion

In order to find the appropriate sources of knowledge and ideas for innovation, companies have to do continuous work and think outside of their company's innovation department. They should change their corporate strategy and business model for this purpose. Based on the results of the Hungarian explorative analysis conducted by the Central Hungarian Innovation Centre Nonprofit Ltd., this tendency of innovation is at present still at a very early stage in Hungary as, based on their research, only some of the initiatives work in line with the open innovation theory. This research gave ideas for a broader analysis of the topic, the main aim being the determination of the obstacles on the low level of open innovation in the Hungarian economy.

For achieving this final aim, an Austrian research was conducted focusing on the open innovation activity and roles of different actors in the economy. In order to be able to create a base for a real comparative analysis regarding Austria and Hungary, the research focused on a specific sector, namely renewable energy; because of existing geographical differences, the focus was narrowed down to biomass and solar energy, where the differences in the innovation and development level of the countries are significant. Based on the assumptions that the reason behind the differences could be a result of the different tendencies towards open innovation, this field of activity as well as attitudes and present practices were analyzed. This involved all relevant stakeholders of the related Styrian industry, and specified target research groups.

Based on the already developed methodology on analyzing the operation of Living Labs, the research concept and focus were specified to target the renewable energy industry and all the circumstances of the mentioned research. It can be stated that the main role in enhancing open innovation in an industry is in the hand of the alliances, as they collect several members and foster their collaboration and knowledge on a specific area. The enhancement of their activity either by policy actions, or by their self-organization and consciousness in this direction can have a great added value directly for the SME sector, as well as indirectly for the economy; especially as the innovation of renewable energy has several positive effects on the economy as a whole, with SMEs also playing a great role. The mentioned tendency on service innovation is not present in the industry as of yet, but there is a significant role of traders-installers in this phenomenon in the future. The intermediary role of traders-installers is therefore significant, and their present activity has to be urged to create a focus on the possibilities in service innovation.

A tendency towards the self-consciousness of end-users can be observed, which is why manufacturing/research companies also try to change their field of innovation in order to accommodate themselves to this new situation. Thus the “N=1 and R=G” theory described by Prahalad on the target of individual consumers while using resources from wider sources (Prahalad & Khrisnan, 2008) can be confirmed.

The results obtained from the Styrian research were sufficient to draw a clear picture about relevant factors that should be targeted by a detailed analysis conducted in Hungary in order to determine the role and obstacles for open innovation in the Hungarian economy. Taking my personal impressions into account, the cultural differences between the countries, the attitude of the interviewees toward innovation and the economic situation of SMEs in general are the most important factors as regards innovation. This experienced positive attitude in Austria should not be neglected when continuing this research in Hungary in order to establish a comparative analysis.

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