Knowledge Management in Ecolabnet Project: Practical and Theoretical Utilisation of Eco-Innovations

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Abstract: The underlying objective of the paper is to analyse the process of managing theoretical and practical knowledge about eco-innovations, utilising it in ECOLABNET project. A network of project partners consisting of RDI institutions, Intermediary Organisations, and universities was established to promote exchange and dissemination of knowledge on eco-innovative solutions and services among Small and Medium-Sized Enterprises (SMEs) in the countries of the Baltic Sea Region. The paper presented the principles applied in the knowledge management (KM) process within the project with a particular stress on the research conducted on the group of European SMEs form the Baltic Sea Region (BSR), first stage of ECOLABNET project implementation. The research provided much needed knowledge on the project's beneficiaries – SMEs form the BSR region and facilitated the adjustment of the offer of the project consortium. Expert knowledge, eco-innovative products and services that have been provided by the network of partners assist SMEs in implementing and commercialising eco-innovative solutions. In this way they significantly contribute to practical application of sustainability principles by expanding the offer of project beneficiaries (SMEs) with environmentally-friendly products and services. In addition, the author also, highlights the advantages of a combined approach including expertise in the form of theoretical knowledge being supported by prototypes of eco-innovations. Their particular role in strengthening the eco-innovative capabilities of the entire network and the overall success of the project have been detailed as well.

Key words: Eco-innovative products, Eco-innovative services, Knowledge management (KM), SMEs

1. Introduction

Successfully implemented projects in the area of eco-innovations that aim to achieve their strategic objectives are increasingly taking on the form of combined efforts of various actors, frequently formal organisations. Their strategic achievements require the integration of expertise, experience and efforts of all engaged stakeholders, despite the fact that such projects tend to be temporarily joint conglomerates that are united by common goals and cease to exist once these goals have been achieved. Nonetheless, projects of this type are thought to combine knowledge and resources stimulating development of innovations by bridging actors from various geographical locations and providing in this way all of them with a possibility to achieve their individual goals thanks to functioning of the whole network (Czarniawska, 2018; Dougherty & Dunne, 2011; Nisula et al., 2018). Increasing the level of eco-innovations uptake by manufacturing Small and Medium Sized Enterprises (SMEs) was also the underlying goal of the consortium of partners from six Baltic Sea Region (BSR) countries that carried out the ECOLABNET project in the years 2019-2021 (while the duration of the project's results continues until 2025). The key intention of the ECOLABNET project was to foster dissemination of sustainable eco-innovations among the SMEs from the Baltic Sea Region, e.g. in medical diagnostics and electronics. Exploiting the joint potential of research, development and innovation institutions, universities and businesses comprising the network, the project aims to demonstrate new business opportunities for those enterprises that that would like to apply sustainability principles while developing eco-innovative services and products (Interreg – ECOLABNET, 2021). The project consortium ECOLABNET comprised academic institutions and RDIs from six Baltic Sea Region countries, namely: Design Centre MUOVA (Finland) – project leader, Centria University of Technology (Finland), Kaunas University of Technology (Lithuania), Vilnius University (Lithuania), University of Tartu (Estonia), Estrotech Ltd (Estonia), Lithuanian Business Confederation, Sustainable Innovation (Sweden), VIA University College (Denmark) and Czestochowa University of Technology (Poland).

The underlying objective of this paper is to analyse how the process of knowledge management (KM) in the ECOLABNET project combined with prototypes of eco-innovative products translated into its overall success. In brief, the paper seeks to answer the research question:

- RQ1 – Do examples of practical application of eco-innovations in the form of prototypes constitute a significant value added of a project?

In addition, the paper contributes to the literature on the subject through the analysis of the role of knowledge management in transnational projects and practical demonstration of its applicability in the eco-innovations area. The paper is organised in the following way:

First, in the introduction, the role of projects in supporting development and implementation of eco-innovations has been characterised in brief. The role and objectives of the ECOALBNET project and its participants have been presented in this context. This constituted the basis for raising the research question to be answered in further sections of the paper. Then, the literature review has been presented, which focuses in particular on the role of SMEs in the European economy. At the same time, the author emphasises the major problem for poor innovativeness of the enterprises from this sector, namely insufficient access to expert knowledge. In this part the notion of proper knowledge management in projects has been presented and the impact of the networking form of collaboration on enhancing projects' effectiveness has been highlighted. The empirical part is divided into two parts. The first one analyses the process of knowledge management in the ECOLABNET project. The second part seeks to answer the raised research question by analysing the advantages of utilising prototypes as examples of eco-innovative solutions, demonstrating in this way project's practical value. The paper finishes with the conclusions and directions of future research.

2. Literature Review – Links Between KM, Networking, and Innovative Activeness of SMEs

Despite the fact that SMEs are frequently referred to as "a backbone of Europe's economy" these enterprises do not perform equally well in the area of innovativeness as large enterprises. Partly to blame for this state of affairs are the limited capabilities and resources that are available to SMEs. However, the primary disadvantage they have to struggle with while comparing their R&D activeness with big enterprises is diseconomies of scale and also the current state of their development (e.g. start-up or established firm, niche or market producer) (Ortega-Argilés and Raquel & Voigt, 2009). The literature on the subject points out that one of the inhibiting factors to successfully scale up eco-innovations by the European SMEs is limited access to expert knowledge, which prevents them from commercialisation of eco-innovative products and services. It needs to be stressed here that it was this lack of collaboration between SMEs and research centres that was the major incentive for setting up the ECOLABNET project. The network of project partners integrates product-service system designers, bio-based material researchers, 3D print technology providers, eco-branding specialists and business developers. One of the advantages of such an approach mentioned in the literature on the subject is the observed link between implementing innovations and doing so in the networking form. This is because networks provide resources for innovation processes. When innovations are developed according to the network-based concept both organisations from the local community and from other geographies provide important tangible and intangible resources. Thus, such networks that include non-local actors are said to be very effective in gaining and diffusing knowledge. In addition, they also attract resources that have not been prior available within the locality and scale up innovations (Ferreiro and Lourenco, 2019). It is important that European SMEs are aware of the fact that they are lagging behind in terms of R&D activity. For this reason, they frequently resort to open innovations. According to Cavallo et al. (2021), open innovations refer to the strategy of seeking information through collaboration and partnerships with other organizations, institutions, and experts, which companies adopt when they are aware of their limitations. This outward-oriented process of seeking new knowledge and ideas is referred to as innovation-seeking behaviour of SMEs. It is conceptualised as a form of information-seeking behaviour, drawing also from the concept of open innovation (Lichtenthaler and Lichtenthaler, 2009). The literature on the subject is also abundant in the examples of the role knowledge plays in achieving competitive advantage by SMEs. More importantly, however, it is believed that proper knowledge management in case of project involving partners from several countries results in internationalisation and effective utilisation of knowledge. This in turn, supports organisations in achieving improved innovation and overall performance (Zia and Shafiq, 2017). Such projects are especially suited to SMEs as given their smallness, these enterprises tend to have limited capital for expansion (Roolaht, 2017). Griffith (2007), argues that scarcity of material resources in the context of small economies can be compensated for by having superior knowledge resources. This seems to be one of the stimuli for the European SMEs to engage actively in the area of eco-innovations and at the same time seek for collaboration with the academia to ensure their unique knowledge allows them to win a competitive advantage on local and global markets. In the era of globalization, SMEs can use their specialist knowledge and networking skills to facilitate international expansion despite the limited availability of other resources. This, in turn, leads to the issue of knowledge generation and its management, both in the projects that provide external knowledge to SMEs as well as the latter themselves. Generation of knowledge generation that is further transferred to enterprises seemingly is the key benefit of managing projects in accordance with KM principles. To be competitive, which frequently involves introducing innovative and eco-innovative products to the market, firms must anticipate market surprises, be flexible and adaptable to quick market changes, and overcome product development issues as part of their competitiveness strategy (Galli & Lopez, 2018). It is also stressed that KM induces innovations, and as such is of key importance in the process

of developing new products (Lazzeretti et al., 2016). Hence, the role of project supporting uptake of eco-innovations by SMEs lies with providing these enterprises with expert knowledge. This can be perceived as a major support for the managerial personnel of SMEs (which are frequently one-man firms), who being preoccupied with running the firms themselves, rarely find time to expand the knowledge about eco-innovations on their own. This in turn leads to introduction of new, frequently innovative and eco-innovative improvements in the manufacturing technology, which in turn translates into a more profound environmental and social impact. As a consequence, SMEs can become more competitive on global markets by enhancing the appeal of their offer and matching the expectations of increasingly environmentally-concerned customers by introducing products and services characterised by significantly reduced environmental impact and greater customer satisfaction. Thus, it can be stated that presently, it is necessary to stress in the area of sustainable management the importance of combing the actions of the beneficiaries of the created values – enterprises, and also intermediary organisations and scientific units, whose role is growing in importance as contemporary eco-innovations frequently require expert knowledge, which can be only provided by the RDI units (Chmielarz et al., 2020).

3. Knowledge Management Stages in the ECOLABNET Project

It was assumed at the very beginning that the process of proper knowledge management in the ECOLABNET project was going to be essential for its further success. Generally, it was agreed that KM should comprise the three subsequent stages: knowledge accumulation, knowledge processing, and knowledge implementation. In the graphic form these have been presented in Figure 1.

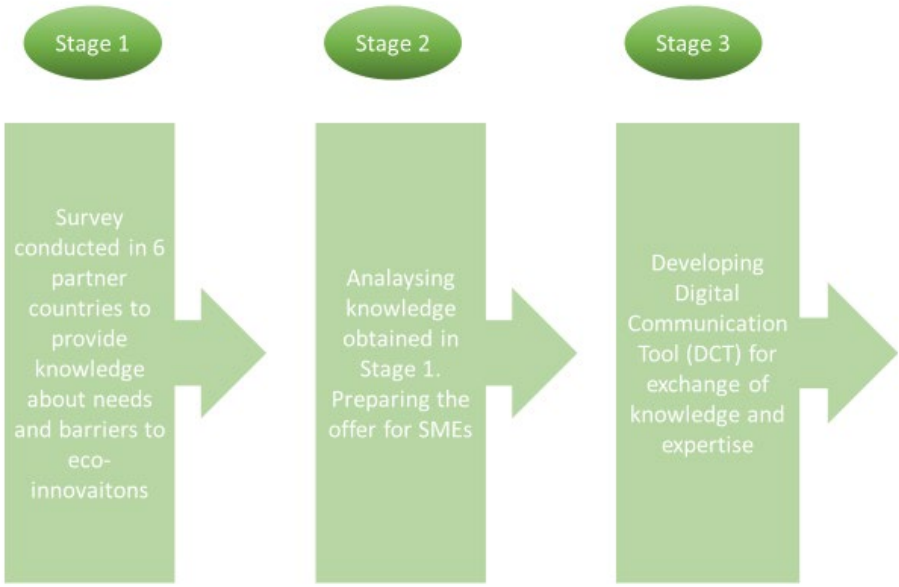

Figure 1: Stages of KM in ECOLABNET Project

As one can observe in Figure 1, the first step in the project involved, among other things, the investigation of what needs and barriers related to access to expert knowledge hinder the activeness of SME from the BSR in the eco-innovations area. This was done by means of a survey that was conducted in all six partner countries of the project with the use of the CAWI (Computer Assisted Web Interview) method. This method enabled the partners to accumulate the data necessary for further processing. This in turn resulted in drawing up a knowledge management strategy ensuring that the project goals are achieved. The survey questionnaire prepared with the use of CAWI method is displayed in the browser in the form of a web-page, so it can be reached by the respondents in different ways, the only prerequisite being access to the internet. The questions to be answered by the respondents appear on the screen while the processing of answers occurs in the background. The answers for the questionnaire are sent immediately to the main server, which allows for continuous tracking of data collection and the results (DJS Research, 2008). The survey questionnaire included 27 questions that were divided in five categories. In the graphic form they have been presented in Table 1.

Table 1: Categories of Questions in the Survey Questionnaire

Name of category	Brief characteristics
1. Metrics	Questions 1-5. Basic details about an enterprise
2. Eco-innovative engagement	Questions 6-15. Enterprise's level of current awareness and involvement in eco-innovative activity
3. 3D printing	Questions 16-21. Enterprise's acquaintance with 3D printing technology as well as potential demand for such solutions
4. Lack of expertise	Questions 22-24. Enterprise's gaps of expertise in the area of eco-innovative activity
5. Contact details	Questions 25-27. Enterprise's interest in further contact and its details

Source: Own analysis based on internal materials of the ECOLABNET project

As Table 1 demonstrates, the five questions in the first category were supposed to provide basic information about the surveyed enterprise and its profile of operation. The second category of questions (questions 6-15) was devoted to gathering information about issues purely related to eco-innovations. This pertained to knowledge about eco-innovations, existence of motivating factors as well as barriers hindering implementation of eco-innovations in manufacturing SMEs of the BSR region. The questions in the third category (questions 16-21) examined the whether the surveyed SMEs possessed any knowledge about 3D printing as an eco-friendly alternative to be applied in manufacturing processes and replacing the ones that had a negative impact on the natural environment. Then, the questions 22-24 (fourth category) were supposed to investigate the extent of the demand for expert knowledge among the surveyed enterprises. The survey questionnaire finished with the 3 questions concerning the possibility of future cooperation and address details (fifth category). The research was conducted on the group of 296 enterprises located in the six partner countries of the project, including : Estonia 69 - 23,31%, Poland 57 - 19,26%, Finland 54 - 18,24%, Lithuania 15,88% - 47, Sweden 12,84% - 38, Denmark 10,47% - 31.

Then, the knowledge accumulated in Stage 1 was processed and conclusions were drawn in Stage 2, so as to prepare the consortium's offer in a manner that will best address the indicated needs and barriers of the SMEs with regard to eco-innovative activity. The top five indicated incentives for eco-innovative activity (rated on 5-point Likert scale where 1 meant not important and 5 very important) included: satisfying customer needs – 53.19% of indications, efficient use of resources – 50.21%, strengthening the brand image – 43.40%, compliance with legislation – 42.13%, differentiation from competitors – 40.00%. On the other hand, the top most frequently indicated barriers to developing eco-innovations according to the surveyed SMEs include: lack of capital – 31.44%, lack of in-house expertise – 30.57%, limited access to external knowledge – 35.37%, lack of suitable tools and methods – 28.82%, capability to collect and process data – 35.37%. The survey allowed all the partners to analyse the level of eco-innovative advancement of SMEs in each partner country and constituted a basis for working out the final offer of the project consortium, with regard to indicated needs and barriers of developing eco-innovations. In addition, it was also in this stage that the project partners analysed their own competency gaps in the scope of providing eco-innovative services to SMEs, with a particular emphasis on the persistent problems related to lack of expertise in the area of eco-innovations. It should also be stressed here that it was Stage 2 where the offer of the project consortium was tailored to support the SMEs from the BSR in their eco-innovative efforts. The knowledge processing stage resulted in elaboration of eight categories of services to be offered to SMEs under the name of Service Packages. Each of the Service Packages includes thematically grouped services that project partners have capacity to provide. The Service Packages were elaborated based on cards of eco-innovative products and services that had been prior prepared by all the project participants. These detail their expertise in a given area of eco-innovations being also a tool that facilitates the search for particular services in the main output of the project the Digital Collaboration Tool (DCT).

Development of the DCT took place in the third stage of KM in the project. It utilises in practice the knowledge on the needs and barriers to eco-innovative initiatives indicated by the surveyed enterprises and solutions proposed by the project partners. The tool has been developed by the project partner Czestochowa University of Technology and is made available to all the remaining partners within the network. The main objective of the DCT is the dissemination of knowledge on eco-innovative products and services offered by the project

consortium to SMEs and Intermediary Organisations (IOs). Access to the DCT is free. Any business entity, Intermediary Organisation or RDI institution can register in the DCT and by doing this offer and seek for eco-innovative solutions accumulated in the tool's database.

4. Practical Demonstrators of Eco-Innovative Capabilities

One of the distinctive features of the ECOLABNET project was its utilisation of practical examples of applying eco-innovative solutions in manufacturing processes alongside with the expert knowledge about eco-innovations. This was meant to strengthen the message sent to the project beneficiaries and simultaneously increase the appeal of the ECOLABNET's offer. For this reason, the project partners were supposed to develop their proposals of eco-innovative products and services that were intended for demonstration of project consortium's capabilities in this area. Internal specification of the requirements for prototypes specified functional features they needed to possess, properties of material for their production, creation of the digital model, 3D printing trials, and final product testing. It needs to be stressed here that as the competences of the network included primarily: materials for biocomposites, product prototyping based on 3D printing, eco-product designing, designing services, life cycle assessment (LCA), eco-branding and developing business models, the underlying assumption of the project was that prototypes were produced with the use of 3D printing technology, emphasising their biodegradability and ease of production. There were five prototypes developed in the course of the project's duration, such as: optical 3D printed medical fittings made of bioresins, bio-derived 3D printable resin for medical parts, 3D printing of composite moulding tool, bio-based 3D printed chocolate box, bio-based dental 3D printing resin. Due to the limited content of the paper as well as due to the fact that the paper's author participated in the development of one of the prototypes, a biodegradable package, the process of utilising demonstrators will be presented on this example. Generally, it can be stated that the process of developing demonstrators followed the same stages. The example for the biodegradable package has been presented in the graphic form in Figure 2.

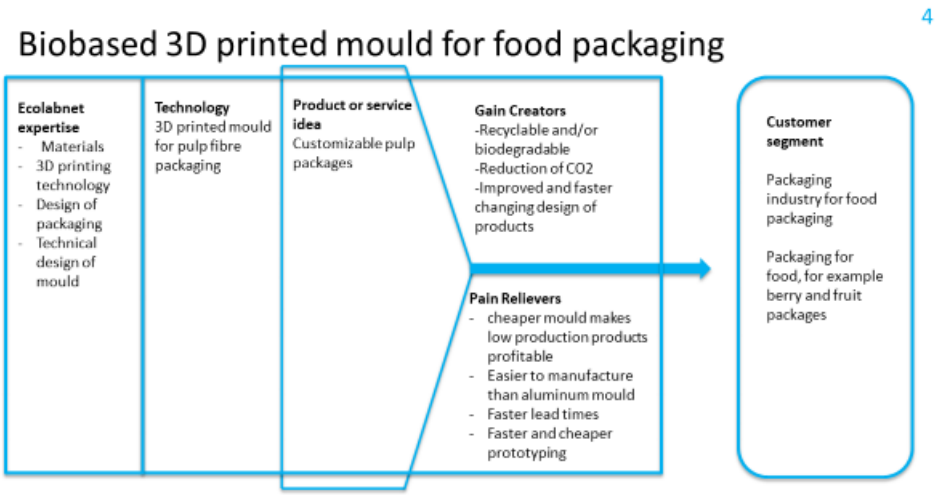

Figure 2: Biodegradable Package in the Graphic Form

Source: Internal materials of the ECOLBANET project

As one can observe in Figure 2, the first stage for developing a biodegradable package was an analysis of the expertise possessed by the project partners indispensable for manufacturing the demonstrator. The technology in the case of all the items was 3D printing. Then, the most important stage included the evaluation of the potential benefits of the item with regard to being environmentally-friendly as well as innovative in terms of production and cost. The final stage of the demonstrator's development was determination of the target customers and ideas for particular products that can be manufactured within the given demonstrator's category. Having been 3D printed, the demonstrators became an essential element of publicising the network and its eco-innovative message to the target group of beneficiaries. The promotion of the ECOLABNET's goals through demonstrators took various forms. The most important of them have been summarised in Table 2.

Table 2: Use of demonstrators in Advertising Project's Capabilities

Form of presentation	Brief description
LinkedIn platform	a group of the project was created to disseminate all the information related to the project (https://www.linkedin.com/groups/8773874/). project partners have been actively promoting ECOLABNET in their own LinkedIn profiles,
Newsletter	newsletters have been sent through the project's messaging centre, they have also been distributed to partners to use them in their own communication channels,
Presentation to different stakeholders	demonstrations conducted during personal contacts, meetings and events with different stakeholders,
Online workshops	online events for the target group of SMEs,
Scientific papers and conferences	project results have been published in conference materials and used in presentations.

Source: Own analysis based on the internal materials of the ECOLABNET project

As Table 2 demonstrates, the examples of practical application of eco-innovations in the form of demonstrators have been used extensively throughout the project. Being a showcase of project network's capabilities, they have been used the attract attention to the project's goals in the LinkedIn social platform on the project's profile as well as LinkedIn profiles of other partners. Similarly, newsletters that were distributed by partners in their communication channels spread the news of the project's capabilities. The circulation of such newsletters is difficult to measure in case of all the partners as they do not run the exact statistics. Nevertheless, it is enough to point out that the newsletter that is distributed by just one of the project partners, digital Centria News newsletter, has more than 8000 viewers. Another important issue is also the willingness of readers of social media posts and newsletter to get engaged with the content. According to extensive research in this field, just some of the results being referred to in this paper (Grönroos and Voima, 2013; Prodromou, 2015; Dong and Wu, 2015), if posts or messages are to be appealing to the target audience, the content of messages is an important element to drive engagement and reach a broader audience leading to new followers and an increase in the firm's sales potential. In this respect, it can be postulated that the demonstrators played a vital role in increasing the appeal of the project's offer and attracting the attention of the target audience, and so significantly contributed to the recognition of the project, its objectives and offer. In the case of personal meetings with various stakeholders, the demonstrators were usually used to present the practical implementation of the project's assumptions. All of these meetings have been registered and the documentation confirms that their participants expressed their further interest in utilisation of 3D printing technology especially through being eye-witnesses of its capabilities. The offer of the ECOLABNET has been presented in several online workshops and internal events of partner organisation internal events like the R&D event for the R&D Program for Creative Business and Sustainable Development in VIA. The ECOLABNET was also introduced regularly to companies in KTU Startupspace community and presented to interviewed organisation representatives and in meetings with suppliers and potential customers. In addition, the project organised an open online event Serving SMEs – Designing research, development and innovation services for eco-innovation for RDI actors and a dissemination event "Advances in developing bio-based materials and 3D printing technologies for environmentally sustainable products". During both the events the demonstrators constituted a key factor of presenting the eco-innovative potential of 3D printing technology offered by the project consortium's members as well as enhancing the pro-environmental aspect of project's goal.

In the light of the above, it can be concluded that the research question (RQ1) whether examples of practical application of eco-innovations in the form of prototypes constitute a significant value added of a project can be answered positively. This can be justified by the following reasons:

- demonstrators constituted a key element of advertising materials presenting the expertise of the ECOLABNET project consortium – the literature on the subject stresses the importance of the content of advertisements on increasing audience's engagement with the message,

- instead of just promising environmental benefits they presented real examples of working solutions in the field of eco-innovations, being therefore more credible than frequently treated by entrepreneurs as vague, lofty plans for environmental improvements in publicity materials,
- SMEs frequently indicate the issue with commercialisation of eco-innovations as they may find it difficult to assess the level of novelty and the degree of technological readiness for the commercialisation of a R&D product, how much the consumers are receptive to it, and, how the added value of the product will develop under market effects (Wang et al., 2021). Developing demonstrators alongside preparing the consortium's offer of expertise shows SMEs feasibility of leveraging the potential of eco-innovations and commercialising them on the market.
- due to the COVID-19 pandemic and restrictions introduced by all the countries of project partners the dissemination of the projects objectives, capacities adopted the form of online meetings and workshops. This meant extensive use of ICT to reach the target audience. At the time of digital revolution it is believed that interactions and relationships between organisations and stakeholders that use digital technologies to introduce new products and services that create value (Suseno et al., 2018) contribute to the development of new types of networks and create digital innovation ecosystems (Xu, 2020). As the tangible examples of an effective utilisation of eco-innovative methods of manufacturing in the form of demonstrators have become showcases of project's potential within the Digital Collaboration Tool, they played a key role in developing the ECOLABNET digital ecosystem.

In conclusion, it can be stated that the demonstrators utilised during the ECOLABNET project contributed significantly to an increase in the project's appeal both through their visual impact and power of attracting the attention of target audience. It had a measurable impact on an increase in the awareness of the managerial personnel of the SMEs from the BSR with regard to possibilities of developing eco-innovations, and what is of particular importance from the business perspective, also the way of their successful commercialisation. This in turn can lead to launch to the market of new, environmentally-friendly products and services that will be broadly accepted by the society, transforming in this way the previous lifestyle to include to a greater extent the principles of sustainability. This practical experience can be utilised in other projects to increase their persuasive message to target audiences and positively enhance the theoretical assumptions of expected project outputs.

5. Conclusions

Organisations that implement projects in the area of eco-innovations increasingly join their efforts to achieve their strategic objectives. This results in a need to combine the knowledge, expertise and experience of various stakeholders. By doing so, they stimulate development of eco-innovations not only in the local perspective, but frequently in the national or even international one. Actors that come from various geographically diverse locations bring into the project resources that would not be available otherwise. At the same time, numerous research into the innovativeness of European SMEs find out that they are unable to reach their full potential and successfully develop eco-innovations due to unsatisfactory access to expert knowledge offered by RDIs and academia. This is a serious incentive for the European Union to support projects that are meant to bridge the gap between the demand for expertise on the side of SMEs and the offer of specialist knowledge by universities and research centres. With this end in view, the ECOLABNET project united within the network of six partners from the BSR research, development and innovation institutions, universities and businesses effectively demonstrating new business opportunities for enterprises still uncertain about engagement into eco-innovative activities. Generation of knowledge that is further transferred to enterprises is believed to constitute a part and parcel of managing projects in with the use of KM principles. It is advantageous if theoretical knowledge can be accompanied by practical examples of its application. This was one of the reasons for developing prototypes, also called demonstrators, showcasing application of sustainability principles while developing eco-innovative services and products. Being a showcase of project network's capabilities, they have been used the enhance the project's appeal to the target group of stakeholders. The demonstrators that have been developed in the project to give evidence of practical application of the ECOLABNET's offer are an excellent example for European SMEs that it is possible to exploit successfully the potential of eco-innovations and commercialise them on the market. This in turn can lead to enriching the market offer of products manufactured by SMEs with new, environmentally-friendly products and services that will be broadly accepted by the society.

Future research on the role of demonstrators in projects aimed to support eco-innovativeness of SMEs may well focus on evaluating their impact by the target audience. This is the focus area of the author in the future research.

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