

Eco-innovative construction business models for social development

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1. Abstract

ecobim project has already identified a number of business opportunities for eco-innovation within the construction sector. Opportunities related to BIM, PLM, LCA and Monitoring are being developed through real case studies in Finland, France and Germany. Other opportunities not related to BIMs and ICTs are explored through co-creation workshops with different stakeholder groups supported by ecobim networking platform.

This paper focuses on the findings of the methodology followed in the workshops to develop eco-innovative services for social development and their corresponding business models, seen from the perspective of service research theory and in terms of service development.

2. Introduction: ecobim context

The main expected outcome of ecobim, Value Driven Life Cycle Based Sustainable Business Models (Eco-Innova 1st Call) is the development of a set of guidelines based on indicators for sustainable eco-innovative construction business models. As a result, this process will also provide a roadmap for enterprises, particularly SMEs, at a European level, and easy-to-understand recommendations for policy makers. It has also established an online networking platform with SMEs to discover new innovation fields within the construction sector and develop the required methodologies and tools to serve the whole value network.

ecobim project has already identified a number of opportunities for eco-innovation within the construction sector and is currently working on the following: BIM checkers and assessment, Product Life Management (PLM), Life Cycle Analysis and Production of Eco-Indicators, Monitoring of Buildings and other business opportunities not necessarily related to BIMs and ICTs. Opportunities related to BIM, PLM, LCA and Monitoring are being developed through real case studies in Finland, France and Germany. However, other opportunities not related to BIMs and ICTs are being explored through co-creation workshops with different stakeholder groups supported by ecobim networking platform (see Figure 1).

This paper focuses on the findings of the methodology followed in the workshops to develop eco-innovative services for social development and their corresponding business models, seen from the perspective of service research theory and in terms of service development.



Figure 1: Opportunities for eco-innovation identified by ecobim project. (Pekka Huovila & Carmen Antuña, VTT)

3. Innovation models

3.1. Innovation systems

Innovation systems analysis has been performed by several authors in recent decades (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Edquist; Johnson, 1997). Currently one of the most well-known international innovation systems is SRI International's *Five disciplines of innovation*® (Carlson, Wilmot, 2006). VTT has also developed its own *3i Innovation System*. Both systems have been analysed for the development of proposals in the ecobim project. SRI International system offers 5 basic starting points for a market success. These five points are:

- Important Customer and Market Needs
- Value Creation
- Innovation Champions
- Innovation Teams
- Organizational Alignment

“Knowing the Important Customer Needs” represents about 50% of SRI Enterprise Innovation Index; although the numerous workshops made with governments, universities and investors have shown that only 10-20% of the key actors have had a clear idea of the customer needs. “Value Creation” is the most important point for SRI International and represents 60% of their Enterprise Innovation Index. The process

for value creation of the product or service does not follow a straight timeline, and in the end always a lower value product/service is obtained instead of the desired one. How to measure value creation is critical to business success. Carlson and Wilmot (2006) proposed a series of concepts easy to understand but difficult to perform to achieve business success. One of the concepts is to have a toolbox of best practices, which focus on the customer's needs, both internal and external, that creates using a common language, a set of tools for the value creation in a process to rapidly develop customer value. Few leading companies use these types of practices as an important source of competitive advantage (e.g. Medtronic, IDEO, Baldor, P&G, etc.), but their results are impressive. "Innovation Champions" represents 60% of the Index and the correct choice of Innovative Team 70%. It is very important to choose good partners who have unique capabilities for better value creation. Finally, Organizational Alignment represents another 60% of the Index for a total of innovativeness of 7.56%.

VTT's *3i Innovation System* is similar to SRI International's *Five disciplines of innovation*®, though it is a system based on continuous learning by doing and developing their own Innovation System. The 3 "i" are Identification, Invention and Implementation.

To identify an important need, VTT proposes to use the customer whenever is possible, create a Market Map, target the potential customer segments for the product/service and try to identify the important needs of those. When it comes to inventing or proposing services or products to the customer, VTT considers doing it together with the customers whenever possible. VTT also promotes value creation through the NCBA system, using a unique approach to meet the important needs of the customer, locate the benefits that will result as well as the differentiation between competitors and disruptive elements. Also the implementation phase is meant to be done together with the customer whenever possible. During the implementation, it is considered of major importance to create value for the customer according to the value proposition. It is important to have a champion team and find out if there is a need of support from other organizations to implement the product or service.

3.2. Eco-innovation

Innovation processes have suffered a change since the Earth Summit in Rio in 1992 (Rennings, 2000, 319-320) and accelerated a shift in mentality so that innovation would be used for sustainable development. In 1996 Claude and Peter James Fussler defined for the first time eco-innovation as "*the process of developing new products, processes or services which provide customer and business value but significantly decrease environmental impact*" (Fussler; James, 1996). If the definition of innovation is fairly neutral on the content of change and open to all directions, the eco-innovation goes on a one-way progress through sustainable development. There is a recent European programme, more strictly focused on eco-innovation, namely the Eco-Innovation Action Plan (EcoAP) that pursues also reducing pressure on the environment through innovation within the framework of the Europe 2020 strategy. This programme will help to mobilize financial instruments and support services for small and medium-sized enterprises (SMEs) to improve investment readiness and networking opportunities related to eco-innovation (Triguero et al., 2013, 25)

The eco-innovations can be developed by firms or non-governmental organizations, can be traded on markets or not, their nature can be technological, organizational, social, or institutional (Rennings, 2000, 322). Changes in lifestyle and consumption behaviour (Scherhorn et al., 1997, 16), a shift in the modal split from private car transport toward bicycling or the creation of environmental awareness in firms (Rennings, 2000, 324) could be considered as social eco-innovations.

The need for eco-innovation is increasingly recognised and viewed as becoming even more urgent in a world of a growing population and changing consumption patterns (The Royal Society, 2012), and the construction sector can be considered as one of the most responsible for material and energy consumption and emissions in the environment (Allione, 2007, 1).

“There is limited understanding of how initial new ideas and concepts develop..., and how these ideas become the basis for product development. Moreover, there is little understanding of organisational mechanisms, tools, activities and techniques employed within innovation projects, which enable environmental-specific innovation to arise and commercialise in particular in the early stages of the innovation process”. (Bocken et al., 2014, 44)

After analysing different innovative systems and based on the results of the SRI International’s workshops showing that only 10-20% of the key actors clearly knew which were the customer needs (Carlson; Wilmot, 2006), and that customers are the most important source of innovation (Von Hippel, 1988), it was appropriate to then locate groups of key actors in order to obtain a clear idea of the needs they might have in the construction sector and thus to develop an eco-innovative social service.

For ecobim project, the initial standpoint was that paradigm change towards eco-innovation within the construction sector means more than technological innovation. Systemic approaches including LCA and ICTs are needed to cover social, environmental and economic aspects. Novel business models are needed to create clear advantages for all actors (particularly SMEs) in the value network. Effective and easy-to-use tools are needed for the implementation of the developed model.

3.3. Life cycle of a building

Different phases during the building life cycle may typically have differently defined, even changing objectives, different data management processes and formats, and most of the time they also involve different actors (see Figure 2).

The phases of the life cycle of a building considered by ecobim project are: brief phase, design phase, construction phase, commissioning phase and operation and maintenance phase. These phases are seen to overlap concurrently. Different actors as structured in ecobim project can be seen to contribute to these phases as follows:

- Brief phase: regulators, city planners, professional associations, real estate developers, owners, building occupants, neighbourhood associations, universities and research centres.
- Design phase: engineering and architecture firms and service providers.

- Construction phase: construction companies, system suppliers, manufacturers and services providers.
- Commissioning phase: construction firms, system suppliers, manufacturers, engineering and architecture firms and services providers.
- Operation and Maintenance phase: regulators, city planners, professional associations, construction firms, owners, building occupants, neighbourhood associations, universities and research centres.



Figure 2: Key actors in the different phases of the building's life cycle. (Pekka Huovila & Carmen Antuña, VTT)

Results from different research studies show the importance of bringing the environmental concerns at the initial phase or Front End of Eco-innovation (FEEI) process (Bocken et al, 2014), which for building's life cycle are the brief and design phases, when the parameters are still flexible.

Eco-innovative business models as identified in ecobim at this stage may address different life cycle phases, e.g. BIM checkers in design, PLM in construction, LCA and indicators in commissioning, monitoring during operation and maintenance, but all of them could be considered already in the brief phase. It is also important to keep seamless continuity of data management across phases and actors. Core indicators assist in succeeding with this challenge.

3.4. Business model development

The construction sector is traditionally focused on minimizing the investment costs of buildings at an acceptable quality level, primarily regulated by authorities from the health and safety aspects, instead of maximizing the value over service life, i.e. improving the performance against whole life costs and environmental impacts. This leaves very little space for innovation if the client’s business model focuses on competing who delivers “the same product” at a lowest price.

When agreeing on the definition and defining aspects of business models in ecobim context, one may use well-known approaches for the development, such as business model canvas by Osterwalder (Osterwalder et al, 2005, see Figure 3) that was used in ecobim workshops.

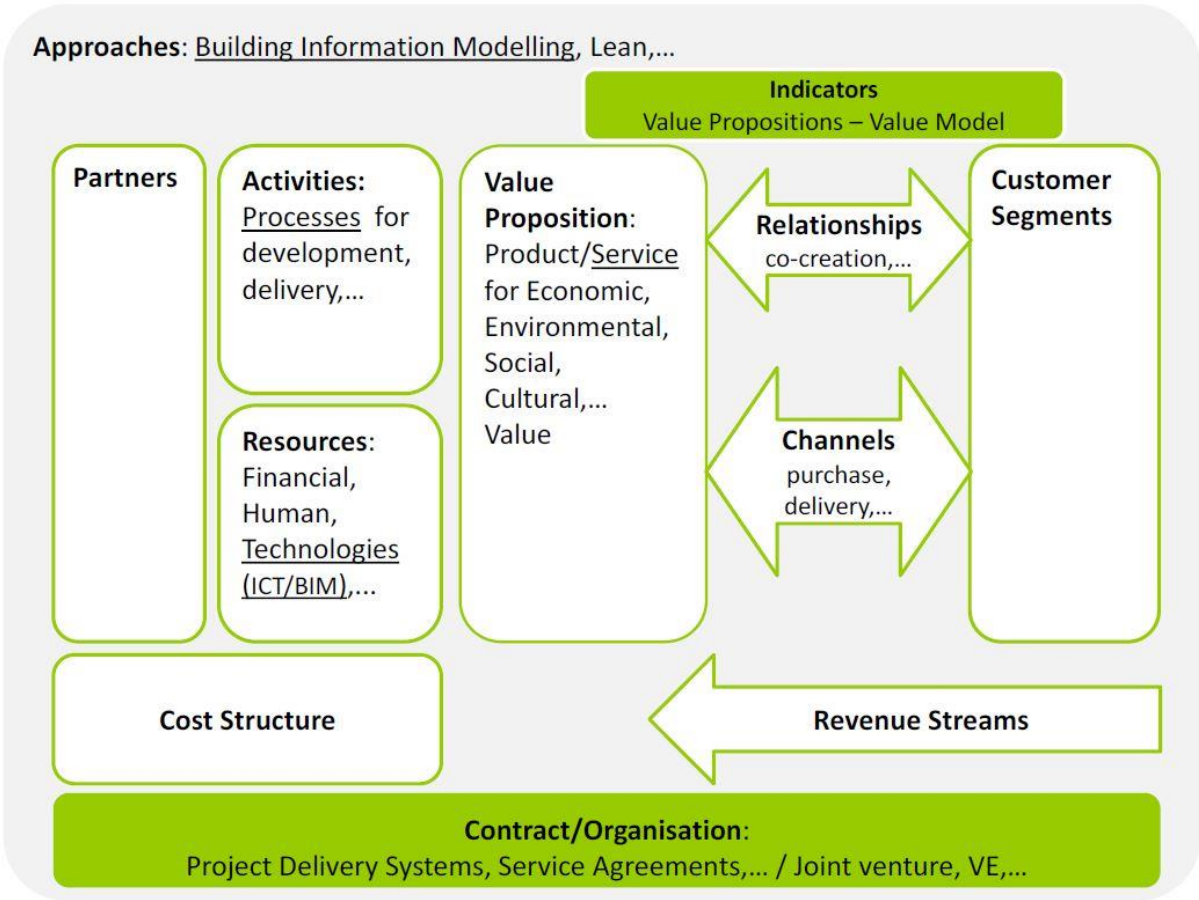


Figure 3: ecobim focus on business model canvas (adapted from Osterwalder & Pigneur, 2010)

In the core of the business model canvas method is the value proposition that explains how the service provider aims to solve a problem of its customer with a given service, fulfil a need or create value. However, how to prove that such value would be created with the given service and how to monitor if such value is actually created is often a more difficult task. Such methods are needed to promote service providers that are willing to provide services that help to achieve higher performance than the minimum requirements or that promote life cycle approach instead of only short-term profits. Huovila, P. et al (2013) propose a more thorough analysis of what value actually is in construction projects and how it manifests and can be verified at different phases (see Figure 2) of building’s life cycle. Performance indicators can be used to

promote the value to be created and to monitor at later stages to which extent the promised value is actually achieved. That approach is also adopted in ecobim project. In order to create true benefits to all committed value network actors, the value propositions need to be written in the contracts in a construction project. Performance indicators help assessing the value propositions in different procurement models spanning up to life cycle contracts (Huovila, P., et al., 2013). Such approach should be part of future construction business models of different service providers to promote sustainable and profitable construction business development.

3.5. Principles of service development

The change from goods based manufacturing economy to service oriented economy – that has been called “servitization of business” (Vandermerwe & Rada, 1988) – is a trend that has been seen since long time. Goods suppliers become service providers and services account already for around 70% of total employment in Europe (Pro Inno Europe, 2010; Kettunen et al. 2012). In the core of the new way of doing business is the customer instead of the product. Companies tend to outsource their upstream activities (e.g. sourcing, production, logistics) and network with key partners. The downstream activities, instead, are becoming the main source of competitive advantage. The main focus of today’s successful companies is on customers’ needs and the company’s position relative to customers’ purchase criteria. The competitive advantage is often embedded in the processes for interacting with customers, in marketplace information, and in customer behaviour. (Dawar, 2013, 100-102) For services this trend means a shift from “operand resources” (value in property) to “operant resources” (value in use) (Kettunen et al., 2012, 26). For companies the change from goods provision to service provision is huge since services are about facilitating and supporting a customer’s everyday processes, and through that the customer’s goals in life and in business in a value creating way, i.e. helping customers to successfully reach their goals (Grönroos, 2012).

Service science aims to create a basis for systematic service innovation (Maglio & Spohrer, 2007, 18). A key foundation (Kettunen et al., 2012, 26) underpinning the previously mentioned customer and value oriented business logic for services is Service-Dominant-Logic (SDL) (Vargo & Lusch, 2004; Vargo, 2009). SDL theory explains why and based on which principles today’s economy and society are concerned with exchange of services rather than goods. Being widely acknowledged, this theory is used here as the premise for service development. In this approach value is co-created with customers and partners instead of the company marketing to the customer. According to Vargo (2013, 9), service-driven innovation provides input into customers’ value-creation processes by linking firm-available resources to peoples’ purposes. Innovation is then about finding novel and useful ways of enhancing own value co-creation activities by participating in ecosystems through resource integration and service provision to assist other actors in their value-co-creation (Vargo, 2013, 10).

SDL is based on ten foundational premises (FPs) (Vargo, 2009, 375):

1. Service is the fundamental basis of exchange.
2. Indirect exchange masks the fundamental basis of exchange.

3. Goods are distribution mechanisms for service provision.
4. Operant resources are the fundamental source of competitive advantage.
5. All economies are service economies.
6. The customer is always a co-creator of value.
7. The enterprise cannot deliver value, but only offer value propositions.
8. A service-centered view is inherently customer-oriented and relational.
9. All economic and social actors are resource integrators.
10. Value is always uniquely and phenomenologically determined by the beneficiary.

Most of these premises (FPs 1, 4, 6, 7, 8, 9, 10) have guided the approach taken in the different ecobim project's co-creation workshops to develop social services together with end-users (see chapters 4-5). Citizen involvement and collaborative workshops have lately proven to be successful (if not necessary) methods in urban service development and innovation (Ahvenniemi et al. 2013; Huovila, A. & Nykänen, 2013).

A method that has inspired the approach used in ecobim workshops is Service Blueprinting which is commonly used in service innovation (Bitner et al., 2008). It is a practical method to concretely analyse the service interface from the customer's point of view. In ecobim workshops, the participants started by defining user profiles. After that customer journeys (Nenonen et al., 2008) were developed for the user profiles in order to understand the aims, frustrations and needs related to different service interfaces during a typical day.

4. Co-creation workshops around eco-innovation: from idea to business models

In order to discover other business opportunities for eco-innovation, ecobim project has organized a number of co-creation workshops in Finland and Germany in collaboration with the following partners:

- White Lobster GmbH (Germany), an agency for sustainable communication based in Berlin. **Workshop 1**
- ARTOVA (Finland), a very active neighbourhood association based in Helsinki. **Workshop 2**
- Mattliden School in Espoo (Finland), interested in introducing sustainable development as part of their curricular activities. **Workshop 3**
- SYKE (Finland), the Finnish Environment Institute. **Workshop 3**

The aim of the workshops was to identify and map opportunities for eco-innovation and social development. The ideas proposed were discussed and categorized. The most promising ones were further developed into eco-innovative services along with the corresponding business models, including the definition of business model can-

vases. The stakeholders taking part in the workshops represent ecobim's main target groups:

- Policy makers, practitioners (SMEs and large companies) and researchers. **Workshop 1**
- Users. **Workshops 2 and 3**

Workshop 1 was conducted in several phases, face to face and online, and supported by an e-networking platform. Workshop 2 was carried out in two evenings (from 17.00 to 21.00) with the same participants, whereas Workshop 3 was carried out in one day (from 8.15 to 14.30). In Workshop 1 some of the participants already knew each other, in Workshop 2 none of the participants knew each other and in Workshop 3 all the participants knew each other.

4.1. Co-creation set-up

As already explained, the aim of the workshops was to identify opportunities for eco-innovation and social development within the built environment leading to new services that in turn would lead to new businesses. Preparatory discussions with ARTOVA, ecobim project's collaboration partner for Workshop 2, focused the attention on the importance of social development and the potential offered by this area based on their experience. Linking social development and eco-innovation was perceived as a novel approach capable of yielding promising results and therefore worth trying through the workshops.

For the sake of consistency and comparison, the three workshops followed the same set-up with slight variations in relation to the content and the programme. The common steps shared by the three workshops were:

- Presentation of ecobim project's objectives
- Introduction of the participants
- Description of the programme and objectives of the workshop
- Definition of user profiles
- Definition of customer needs through customer journeys
- Service idea selection through identification of common needs
- Business model canvas for the selected service idea (see Figure 4)
- Eco-innovation in the service provision

Variations related to the content

- Workshop 1 focused on the sustainable neighbourhood of the future trying to identify existing gaps for sustainable social development and eco-innovation.

- Workshop 2 focused on innovative services, businesses and spaces for social development that are environmentally friendly and economically viable.
- Workshop 3 focused on the development of eco-innovative services specifically for the youth.

Business model canvas for:

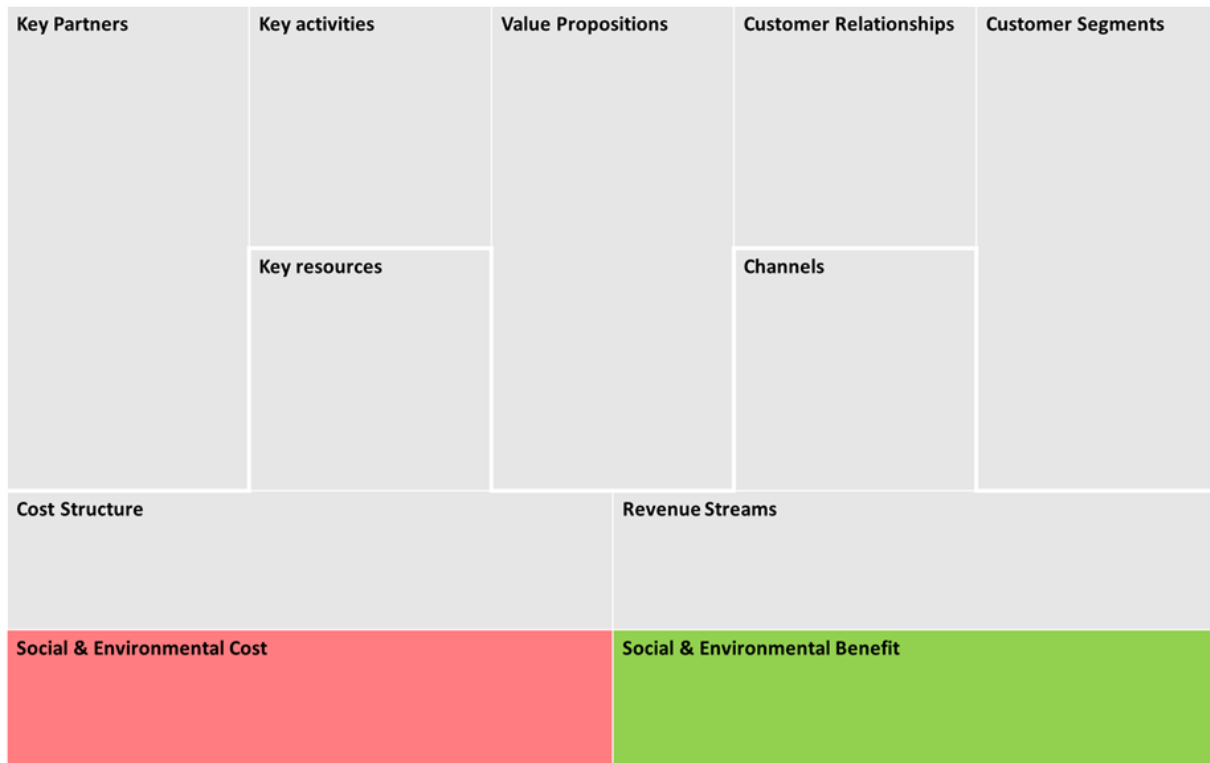


Figure 4. Osterwalder's business model canvas adapted for ecobim project to include social & environmental costs and benefits of the service (Aapo Huovila & Carmen Antuña, VTT)

Variations related to the programme

- Workshop 1/Phase I included the development of the showcase outline previous to the definition of the user profiles. Phase III included development of services and businesses within a sustainable neighbourhood so that the different user profiles or professionals acted either as service provider or customer.
- Workshop 2/Evening 1 included the description of the participants' ideal neighbourhood in terms of personal, social and physical structure. Workshop 2/Evening 2 included a final discussion about opportunities for research on social innovation.
- Workshop 3 included a final group discussion about the developed businesses and their feasibility. In this case, the customer journeys were described through a very detailed day schedule and track-mapping of the user profiles defined.

4.2. Practical realization

The differences in the practical realization of the workshops depended on the different number, background, age of the participants and their availability:

Workshop 1

- Developed in 3 phases: Phase I face to face in Espoo; Phase II online through Owela for ecobim networking platform; Phase III face to face in Berlin.
- 6 participants in Phases I and II from the Ministry of the Environment (policy maker), minigram Studio für Markendesign GmbH (SME), VVO Group Plc. (large company), YIT (large company), VTT (researcher) and Aalto University (researcher), and 5 participants in Phase III from VTT (researchers), White Lobster GmbH (SME), Ingenieurbüro Trinius GmbH (SME) and Federal Ministry of Education and Research (German research funding organisation) / ECO-INNOVERA (European research programme) (policy maker).
- Phase II online allowed the participants to review and refine the user profiles defined in Phase I, and also to compare them with the research findings of Prof. Marketta Kyttä from YTK Land Use and Urban Studies Group at Aalto University (Kyttä et al, 2013).

Workshop 2

- 7 participants representing the users of different age and professional background.
- Developed in 2 evenings with the same participants.

Workshop 3

- 12 participants from Mattliden School in Espoo (8th and 9th grades). During the first part of the workshop they were divided in 3 groups, and during the second part in 2 groups.
- The user profiles developed were their same age.

4.3. Main outcomes

User profiles

- In Workshops 1 and 2 the definition of the user profiles included: name, gender, age, occupation, story/background, goals and frustrations.
- In Workshop 1/Phase II (online), the user profiles defined were compared against the “tribes” found by Marketta Kyttä’s research on the human aspects of urban planning and the methodology of participatory planning. Those “tribes” were the Neighbourer, the Busybody and the Homebody. The user profiles/tribes were also mapped against the developed neighbourhood services by specifying the service provider and the customer.
- In Workshop 3, since the eco-innovative services to be developed were meant for the youth, in particular for teenagers, the definition of the user profiles was slightly different and included: name, gender, age, family, type of house (the family lived in), living neighbourhood and hobbies.

Customer journeys

- In Workshops 1 and 2, the goals and frustrations of the user profiles defined were used to determine the services that those user profiles could need or provide.
- In Workshop 3, the definition of the customer journeys consisted of a typical day of the user profile described hour by hour focusing on the itinerary followed, services used and problems encountered. Positive and negative feelings related to the activities described in the customer journeys.

Service idea selection

- In Workshop 1, one service idea was selected for further development.
- In Workshop 2, two service ideas were selected for further development, one of them being particularly promising. Given their numerous touch points, it was decided to combine them in one service idea.
- In Workshop 3, two service ideas were selected for further development.

Business model canvas

- All the service ideas selected were developed further through Osterwalder's business model canvas adapted for ecobim project (see Figure 4).

5. Lessons learned

Participants

- Finnish participants in Workshop 1 knew each other beforehand and even collaborated in the past at some point. However, the interaction with the German participants attending the workshop, who brought a different perspective, enabled a "new" approach towards "old" problems.
- Workshop 2 gathered a quite heterogeneous group of users in terms of age, origin, personal and professional background, etc. As a result, the discussion leading to the definition of user profiles and customer journeys was full of nuances and in-depth analysis. The good atmosphere created among the participants helped the communication.
- Workshop 3 was carried out with a group of teenagers, not typically chosen for this type of workshop. Even though (or perhaps due to) they were not familiar with the substance of ecobim project or some concepts related to the tasks they were asked to perform, they were not scared by the challenge and showed great willingness to contribute. They clearly valued their opinion being heard.

User profiles and customer journeys

- In all the workshops, the definition of user profiles and customer journeys was very detailed and showed considerable observation skills and understanding of the motivations of different types of customer groups. This was even more the case of the students taking part in Workshop 3.

Service ideas

- The service ideas selected for development seem to respond to clear gaps in social development.
- Enormous eco-innovation potential can be unlocked through collaboration with non-experts, normal users, different age groups, etc.
- Developing solutions “together with” instead of just “for”, or even worse “despite of” those affected by them, may be a better way to solve complex problems in the future. This approach should be more consistently used by companies, policy makers and researchers.

Business models

- Workshops 1 and 2 proved the difficulty of finding the right business models for the novel service ideas developed. This coincides with Curt Carlson’s opinion. When discussing innovation, the CEO and President of SRI International believes that the stress should be on sustainable business models. In his own words “*people have lots of ideas and those ideas morph and go through transformations. Often-times the hardest part is coming up with that business model*” (Carlson & Mark, 2013).
- The young participants in Workshop 3 (14 and 15 years old) showed a fresh approach to all the tasks, and succeeded even when developing the business models for their selected service ideas.

6. Acknowledgements

ecobim project team wishes to thank all the participants and partners that have collaborated in the realization of the workshops.

Workshop 1

- Co-organizer and facilitator: Nils Bader, Managing Director at White Lobster GmbH (Germany)
- Participants: Holger Grünewald, Scientific Officer Responsible for Research on Eco-Innovation, Projektträger Jülich; Harri Hakaste, Senior Architect at the Ministry of the Environment (Finland); Samy Hamadeh, Managing Director at Minigram Studio für Markendesign (Germany); Juha Kostainen, Senior Vice President for Urban Development and Corporate Relations at YIT Corporation (Finland); Marketta Kytä, Associate Professor in Land Use Planning at Aalto University School of Science and Technology (Finland); Niina Savolainen, Research Manager at VVO Group Plc (Finland); Wolfram Trinius, Managing Director at Ingenieurbüro Trinius GmbH (Germany)

Workshop 2

- Co-organizer: Janne Kareinen, Manager at ARTOVA (Finland)
- Participants: Rob van der Capellen, Software Engineer at eCraft Oy (Finland); Álvaro Corredor Ochoa, Research Assistant at SYKE (Finland); Anna-Kaarina

Kairamo, Training Manager at Aalto University (Finland); Anna Kääriäinen, Owner at Vilnis (Finland); Riitta Korhonen, Geologist emerita at Geological Survey (Finland); Lassi Raunio, Teacher in Adult Education (Finland); Kristina Westerholm, Safety Coordinator at City of Helsinki (Finland)

Workshop 3

- Co-organizers: Álvaro Corredor Ochoa, Research Assistant at SYKE (Finland); Susanne Bergström-Nyberg, Teacher at Mattliden School (Finland); Katja Wide, Teacher at Mattliden School (Finland)
- Participants: Victoria Ahlstedt, Kristina Causton, Anna Helin, Maria Krogius, Lola Lerche, Johanna Lindstedt, Valmire Mlinaku, Nathalie Nyström, Frida Oinonen, Amanda Porko, Sabina Siren, Maria Trendafilova, Benina Uotinen. All students at Mattliden School (Finland)

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