22nd DMI: Academic Design Management Conference
Impact The Future By Design
August, 2020

Co-designing the Knowledge Management Model

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This work-in-progress study reviews co-designing processes through the lens of possibility-driven design (PDD). A knowledge management model (KMM) is co-designed by facilitating the development work of senior and regional innovation actors who share ideas, experience and information in the development of smart products and services for an age-friendly smart living environment.

The empirical part is divided into three stages: an orientation workshop, two panel meetings and three co-design and validation workshops where an appropriate knowledge management model is co-designed through iteration rounds. The first stage maps the regional innovation actors, relevant organisations in the region and data flows between all the parties. Ideas of suitable ways to manage knowledge are gathered from the panel meetings of the second stage and are methodologically supported by the strategic options development and analysis (SODA) approach. At the time of writing this paper, the third stage consisting of three workshops with appropriate iteration rounds is on-going.

The findings of the study provide insights regarding the use of PDD activities with an inclusion of the SODA approach when facilitating the co-design of a KMM with a multi-professional group of experts. The study contributes to the theory of PDD by integrating systematic methodological aspects to it when working on complex problems.

Keywords*: Smart living environment, knowledge management model, possibility-driven design, SODA*

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Introduction

Governments and businesses in developed world are facing the challenge of meeting the needs of an ageing population, particularly in the provision of senior housing, social welfare and healthcare services (UN, 2019). Furthermore, there is an abundance of information regarding age-friendly living and well-being and the related technologies, but these are of limited use unless the information is in the appropriate format and easily located and accessible (McGinley, 2012; Goodman, Langdon and Clarkson, 2007). This work-in-progress paper describes the co-designing processes of a knowledge management model (KMM) that attempts to actively involve all the senior and regional innovation actors in the building of an age-friendly Smart Living Environment (SLE). The purpose of the KMM is to foster the emergence of early concepts, which can lead to innovations and their faster market uptake, by connecting innovation actors and enabling them to share ideas, experience and information in the development of smart products and services for the age-friendly SLE in the Häme region, Finland.

The concept of a smart environment has been around for quite some time; it is equipped with networked products such as computers, sensors and personal devices configured to provide services (Weiser, Gold and Brown, 1999). SLE is a physical space where these services for senior people are provided through the Internet-of-Things (IoT) and communication technologies for ageing well (Alliance for Internet of Things Innovation – AIOTI, 2019). Importantly, building the SLE needs a supportive open innovation ecosystem, which comprises multiple actors and stakeholders, to facilitate a more open, demand-driven and user-centric approach to innovations in the development of technology–based products and services. Due to the complexity of connecting all actors and stakeholders within open innovation ecosystems and the fast development of technology solutions such as sensors, personal devices and IoT-based systems (De Lange and De Waal, 2019), for example, collaboration between stakeholders of an elder care system, technology producers and seniors is critical for the prompt adoption of these innovation solutions (Weck, Helander and Meristö 2020). However, there is currently a lack of KMMs that are aligned with relationships between all collaborating stakeholders of the ecosystems. In this regard, lack of coherency and manageability of such ecosystems were addressed in several studies (e.g. Gastaldi and Corso, 2016). Moreover, participatory design (PD) research has recognised the need for an information structure to support an organised way of working and even the innovativeness of the public (e.g. Le Dantec and Di Salvo, 2013; Huybrechts, Benesch, and Geib, 2017; Seravalli, Eriksen and Hillgren, 2017).

The constructivist epistemological stance of this study places subjectivity and interpretation into it. The stance enables the sharing of knowledge, opinions, experiences and values, as well as producing an authentic and realistic outcome. Therefore, the co-designing processes included in this study comprise tacit and explicit knowledge in the format of discussion, dialogue and writing. There are three separate stages of events that are applied in the co-design processes of this study, and the processes are viewed through the lens of possibility-driven design (PDD). PDD stems from the idea that if people can participate in the design process with their own strengths, knowledge and skills, they flourish and thrive, which in turn increases their well-being (Desmet and Pohlmeyer, 2013; Tamminen and Moilanen, 2016). PDD can be seen as a process, and it has been studied in an open design community where it was divided into four phases from both individual and group perspectives (Tamminen and Moilanen, 2016). However, there is scant research looking at PDD as a way for co-designing KMM in the context of an open innovation ecosystem. In recognition of this, the present empirical study aims to understand how PDD can bring value to this process. The study intends to find an answer to the question of how the use of PDD can support the co-design processes of KMM when the co-design activities are scattered in various workshops and panel meetings.

The paper at hand is structured as follows. The following section offers a theoretical background focusing on knowledge management and a co-design process that aims to create a shared KMM through the lens of PDD. The third section presents the methods used in the study to co-design various factors and their relationship with KM for the preliminary KMM. The fourth section presents the preliminary findings. The last section includes conclusions and implications of the current state of the work and sketches directions for future research.

Theoretical Background

Knowledge can be considered as actionable information that has a multidisciplinary nature. For example, a designer perceives it as a starting point for various artistry options (Schön, 1983), whereas a scientist perceives it as a fact upon which to build the right solutions after a thorough analysis (Lawson, 2005). Knowledge allows people to make better decisions, gives adequate input to dialogue and creativity in organisations (Jashapara, 2004). Exploitation of knowledge takes place by presenting information in the right place, at the right time and in a suitable format (Tiwana, 2000). Knowledge management (KM) is “the key asset to drive organisational survival and success” (Jashapara, 2004, p.9). In this study, knowledge collaboration (KC) is an activity that aims to advance synergies between people and an honest exchange of knowledge and ideas on outstanding research achievements and development topics. Knowledge sharing (KS) is a process in which people’s knowledge, skills and experiences are distributed. From the regional development perspective, the body of literature on KMMs to support and enable efficient decision making by providing the right information in the suitable format for the people who need it is inadequate.

The basic thought of PDD is in the positive development and opportunities of people’s everyday practice and needs (Tamminen and Moilanen, 2016). PDD is based on a conception that people want to design artefacts, because the action and its outcome produce happiness, which in turn brings about a mentality and culture of innovation, and this causality in design activities improves people’s lives (Desmet and Hasselzahn, 2012; Tamminen, 2016). PDD focuses on finding long-term solutions, and it aims to find solutions instead of removing existing problems (Desmet and Pohlmeyer, 2013; Jimenez, Pohlmeyer and Desmet, 2014). Tamminen and Moilanen (2016) recognised four dynamic phases when an open design process is viewed through the lens of PDD (Table 1).

Table 1 Four phases of possibility-driven design viewed from an individual and a community perspective (Tamminen and Moilanen, 2016).

Phases of PDD	**Acts of sharing**	**Derived work**
1st phase	Filling	Ideation
2nd phase	Deep thinking	Opportunity seeking
3rd phase	Extracting	Sketching and sharing of working designs
4th phase	Showing	Prototyping

The individual perspective is named ‘Acts of sharing’ and the community perspective is named ‘Derived work’ (ibid.). ‘Derived work’ refers to the use of previous intentions and ideas upon which the design work is built (ibid.) The four phases of the individual perspective—‘filling’, ‘deep thinking’, ‘extracting’ and ‘showing’—have counterparts in the community perspective,—‘ideation’, ‘opportunity seeking’, ‘sketching and sharing of working designs’ and ‘prototyping’ (ibid.). In the ‘filling’ phase, ideas are collected and reviewed from many perspectives to establish a better understanding of the matter at hand. In the ‘deep thinking’ phase, the ideas are refined with individual’s own creative thinking. Only the essential is left in the ‘extracting’ phase. A result of the design process is revealed in the ‘showing’ phase with the purpose of gaining more contributions to the result. The ‘ideation’ phase in the community context is similar to the ‘filling’ phase in the individual context, but there are several actors who participate in the collection and review of ideas. In the ‘opportunity seeking’ phase, interesting ideas and topics are discussed to clarify a shared interest and subject to be co-designed further. Sketches are exposed to community members in the ‘sketching and sharing of working designs’ phase. In the ‘prototyping’ phase, a prototype of the designed artefact is created. It is noteworthy that the phases are not sequential, but can happen simultaneously in an iterative manner (ibid.).

Research Methodology

The overall logic of the study is inductive, given that the aim was to develop further the design theory and depart from the reflection and observation of the PDD phenomenon specified theoretically in advance. However, the initially defined theoretical framework added a deductive element into this inductive research. Accordingly, the data analysis incorporated both the data-driven inductive approach and previous theoretical knowledge. The empirical part of the study was divided in three stages. The first stage comprised an orientation workshop, the second stage contained two panel meetings and the third stage dedicated to the modelling of KMM through co-design and validation workshops. When choosing participants in the workshops and meetings, the aim was to bring together knowledgeable and experienced representatives of the key stakeholder groups or innovation actors of the open innovation ecosystem for building an age-friendly SLE. To achieve well-focused results, these innovation actors included researchers, product and service developers, decision makers involved in regional economic and business development, financiers and senior citizens' associations in the Häme region of Finland.

Stage 1. Orientation Workshop

The orientation workshop acted as a pilot study for the next stages. The pilot workshop was organised in December 2019, and there were twelve participants. The purpose and target of the workshop, as well as the definitions of the used notions, were introduced to the workshop participants at the beginning of the group work. After a short introduction, the workshop participants were divided into two focus groups (Kitzinger 1995), and four leading questions were used to steer participants' thinking and discussions. Four questions were used in the workshop. First, the participants identified the regional innovation actors working and developing an age-friendly SLE. Next, the participants focused on who the stakeholders seek information from. After that, the participants considered with whom they share information in the regional open innovation ecosystem. The final question covered constraints and challenges which could inhibit or slow down information flows. After the focus group discussions, one person from each group stayed next to the A3sized worksheet the group had been using and the rest of the group moved to the work sheet of the other group. The person who did not move presented the work of her original group to the members of the other group, and the other group members could ask questions to the presenter and improve the work of the other group if they so wished. Having familiarised themselves with the work of the other group, both groups moved back to their original work sheets and were given a chance to complement and make changes to their work based on the insights they had gained by studying the work sheet of the other group (Aldred, 2009; Lagrosen, 2019).

When reviewing the co-design process of the workshop through the lens of PDD, the four phases with individual perspectives called acts of sharing – 'filling', 'deep thinking', 'extracting' and 'showing' – were intertwined with the four phases of the community perspective – 'ideation', opportunity seeking', 'sketching and sharing of working designs' and 'prototyping' – called 'derived work' (see Table 1). Each participant first gathered information, i.e., 'filling' during the introduction. 'Deep thinking' took place almost simultaneously as the participants combined the information presented in the workshop with their own knowledge and experiences. 'Extracting' and 'showing' took place during discussions with other group members. In a similar manner, 'ideation', 'opportunity seeking' and 'sketching and sharing of working designs' happened in both groups as participants shared their thoughts and wrote down their ideas on the work sheets. In particular, the phase 'sketching and sharing of working designs' took place when the groups were given the possibility to review ideas and outcomes of the other group and improve their own working designs.

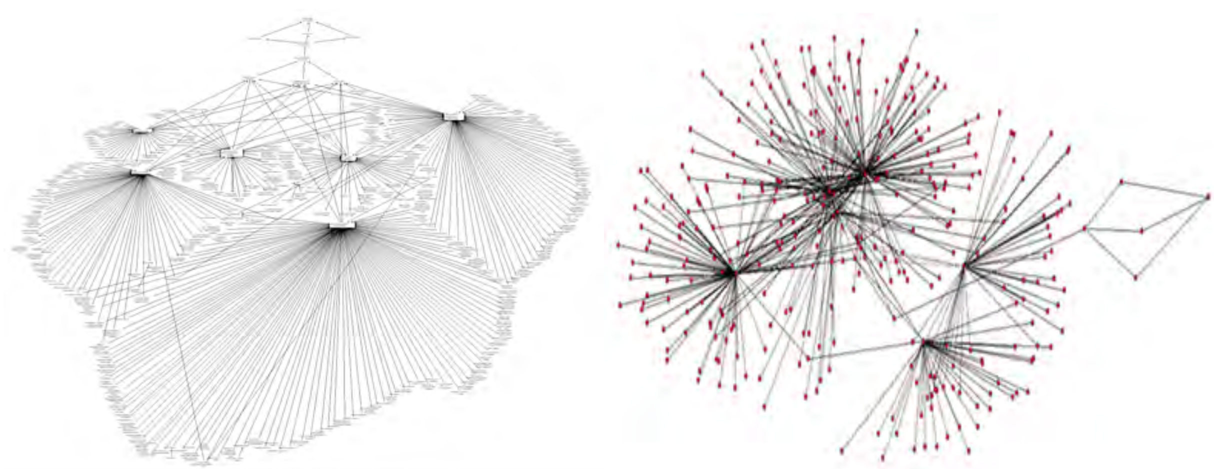
Innovation actors or representatives of the regional relevant organisations, as well as data flows between all parties, were mapped during the first stage by using a conventional co-design process with leading questions and brainstorming techniques. Based on the output of the workshop, researchers were able to build an initial understanding of the structure of the open innovation ecosystem, which connects innovation actors for building an age-friendly SLE in the Häme region, and the seniors' important role related to the KMM within the SLE. In addition, the workshop provided a background to better comprehend the context and research questions of the second stage.

Stage 2. Panel Meetings

The second stage of the study comprised two knowledge panel meetings in which a collective cognitive map was created (Eden, 2004). Eight experts participated in both panel meetings, which were also held in December 2019. The strategic options development and analysis (SODA) approach, introduced by Ackermann and Eden (2001), was utilised in the panel meetings of the second stage. A collective cognitive map was created based on panel members' ideas of appropriate ways to manage knowledge.

The first panel meeting focused on issues related to KMM among innovation actors in the regional open innovation ecosystem. The experts were asked to consider an initial trigger question (i.e., "Based on your values and personal experience, how do you describe the 'best' way to manage knowledge in an open innovation ecosystem?") and, furthermore, think of conditions which enable KC and KS, as well as benefits and limitations of KS. The brain storming technique was used with help of sticky notes (Eden and Ackermann, 2001) to generate 331 ideas or determinants of KC and KS within the open innovation ecosystem. The ideas were clustered into six key concept criteria – 'involved innovation actors', 'motives and benefits', 'barriers and limitations', 'improvement actions and initiatives', 'general skills, capabilities and competences' and 'resources and knowledge-based activities'. The experts organised all the ideas considering the cause-and-effect relationships between determinants. After this means-ends procedure, a collective cognitive map (Figure 1a) was developed using Decision Explorer software (www.banxia.com). Due to the size limitations in this paper, only the collective cognitive structure is presented in this paper (a larger version is available upon request).

The second panel meeting focused on validating the collective cognitive map. In addition, the outcome of the panel meeting was converted into a fuzzy cognitive map (FCM) to quantify the intensity of the cause-and- effect relationships and, furthermore, analyse the dynamics of the decision problem that was the topic of the panel meetings (Carvalho, 2013). According to Kosko (1986) and Misthos, Messaris, Damigos, and Menegaki (2017), fuzzy cognitive mapping extracts knowledge to describe and investigate the model and behaviour of decision problems. Nodes represent concepts/determinants, and cause-and-effect relationships between nodes are shown by arrows (Figure 1b). (due to size limitations in this paper, labels have been removed, but a larger/editable version is available upon request).



a) Collective cognitive map b) Fuzzy cognitive map

Figure 1 Collective and fuzzy cognitive maps.

The structure of the fuzzy cognitive map was discussed and validated at the beginning of the second panel meeting. Further, the experts were asked to quantify the cause-and-effect relationships of the determinants (identified in the first panel meeting) by estimating an interval from -1 to 1; a minus sign indicating a negative cause-and-effect relationship and a plus sign indicating a positive causal relationship, respectively (Kosko, 1986; Ferreira, 2016). The experts discussed the intervals in order to accept the degrees of intensity collectively. A focus group discussion regarding the seniors' contribution to KC and KS within the regional open innovation ecosystem took place in the concluding phase of the second panel meeting. Nominal group technique (NGT) and multi-voting were used to facilitate the experts' brainstorming session and obtain qualitative information related to the topic at hand (Van de Ven and Delbecq, 1972).

When reviewing the co-design process of the panel meetings through the lens of PDD, the three first phases, 'filling', 'deep thinking' and 'extracting' from the individual perspective, as well as 'ideation' and 'opportunity seeking' from the community perspective, could be identified (see Table 1). In the first panel meeting, each expert experienced the first phases 'filling' and 'ideation' while brainstorming ideas on sticky notes. All the sticky notes were placed on a nearby wall and after the ideation, the experts were asked to group the ideas into six key concepts, which were thought out beforehand according to the SODA approach (Ackermann and Eden, 2001). The last action in the first panel meeting was the prioritisation of the ideas in each concept group. During the grouping and prioritisation work, 'deep thinking' took place but due to time constraints the 'deep thinking' phase was not sufficiently thorough. A collective cognitive map was developed by one of the researchers after the first panel meeting. The second panel meeting started with a discussion on the results of the first panel meeting. The individual 'deep thinking' phase started at that point. After the back-on-track discussion, the experts were asked to quantify the ideas listed in the previous meeting in pairs. The pair work enabled the experts to do individual 'deep thinking' and 'extracting'. A focus group discussion was organised at the final stage of the second panel meeting. The topic of the discussion was the seniors' contribution to KC and KS within the regional open innovation ecosystem. The community perspective of the PDD phases 'opportunity seeking' and 'sketching and sharing of working designs' took place at this stage.

Although group dynamics and various negotiations allowed individuals to confront different opinions, learn from expertise of the other meeting members, enhance perceptions, fine-tune and clarify own and group understanding, all four phases of PDD (Table 1) did not occur in the panel meetings. The core idea of PDD is that people thrive while being able to use own knowledge, skills and creative thinking during a co-design process, which leads to not only sustainable products and services, but also the well-being of the people involved in the process (Tamminen, 2016). Interruption of the co-design process caused by converting the ideas and determinants into collective and fuzzy cognitive maps with help of a SW program might make experts lose track of their own thinking process. An impact of the technical interruption could be revealed in the upcoming validation workshops to which all experts who participated in the panel meetings are also invited.

Stage 3. Co-design and validation workshops

The last stage will consist of three workshops, which are still in the planning phase during the time of writing this paper. The first workshop will be dedicated to analysing identified stakeholders of the open innovation ecosystem and actions they perform within the KMM's main pillars while integrating and consolidating the results of the both previous stages. The aim will be to develop recommendations and possible solutions for the KMM and to define the selection criteria of the best model. A visual representation and short description of KMM draft is expected to be one of the main outputs of the first workshop. The second workshop will be dedicated to verification of the KMM draft by stakeholders of the open innovation ecosystem who are also the owners and users of the model. The workshop should end with a clear vision of the stakeholders regarding the KMM that could be verified against issues such as the usability of the model and solutions to overcome constraints to information flow. The third workshop will be dedicated to the validation of the developed KMM and possible adjustments. The aim will be to determine the accuracy of the model in meeting its objectives, stakeholders' needs for KM as well as the selection criteria of the best model in the context of the open innovation ecosystem.

The workshops are planned to support PDD since it can ensure long-term positive effects on the use and further development of the fit-for-purpose KMM (Tamminen and Moilanen, 2016). Therefore, the last phases of PDD – 'showing' from an individual perspective, as well as 'sketching and sharing of working designs' and 'prototyping' from a community perspective (Table 1) are emphasised.

Findings

Co-design processes are viewed through the lens of PDD in this study. The aim of the used co-design processes and SODA is to develop a KMM to support building of a Smart Living Environment (SLE) for seniors. This paper is based on an assumption that the knowledge and experiences of the seniors and regional innovation actors who were invited to co-design the KMM are critical because the expertise and different perspectives of the participants of the workshops and panel meetings lay the foundation for a solid and realistic KMM. An interesting insight or question related to the inclusion of SODA methodology and software analysis into the co-design process used for co-designing a complex system such as KMM with a multi-professional group of experts arose in the study: how systematic methodologies and technical instruments such as analysis software could be integrated into the co-design process without disrupting the positive sphere embedded into PDD .

It is noteworthy that the role of facilitator can be tricky as s/he is the head of the process, but also serves the people involved. Stickdorn and Scheider (2018) states that the best way to minimise this kind of dilemma is to take advantage of the evolving status and act according to the situation. In addition, each person has his/her own view of neutrality, hence if the facilitator seems biased according to the group, consensus can be lost. 'Most important is to remain fair and follow the content of the group's work to ensure progress' (Stickdorn and Scheider, 2018, p. 393).

Conclusions and Implications

The co-designing activities used in this study refer to a collaborative process where users and other stakeholders, i.e., seniors and regional innovation actors, are invited to design a KMM by generating potential directions for designing the model and consequently producing a new solution (Mattelmäki and Sleeswijk Visser, 2011). Several different types of benefits have been found when involving users and experts in a co-design process. For example, a better fit between the system and users' needs, unique benefits and better value for users, improvement of mutual learning and understanding, combination and integration of different people's ideas, enhancement of communication and collaboration between people (Alam, 2002; Muller, 2002; Kujala, 2003; Steen, Manschot and De Koning, 2011). It is noteworthy that the seniors are experts of their experiences, such as social circumstances, habits and attitudes to values and preferences (Cottam and Leadbeater, 2004). In addition, co-design activities can improve the efficiency and effectiveness of the created solution because the activities facilitate continuous improvements of the solution and reduce the risks of its failure by producing a better match for users' needs, which in turn improves users' perceptions of the solution (Hoyer, Chandy, Dorotic, Krafft, and Singh, 2010). Based on PDD, the outcome of the research could provide long-term positive effects on people's lives since the regional innovation actors and the senior co-designed the KMM for themselves.

A constructive and consistent KC between seniors and regional innovation actors is vital when building an age-friendly SLE (Weck et al., 2020). Furthermore, Weck et al. (2020) recognised knowledge sharing (KS) to be another important building block for an age-friendly SLE. The study contributes to the theory of PDD by adding knowledge management aspects to it. Regional authorities and policy makers can benefit from the practical implications of the used co-design processes while creating a KMM. The used approaches can be taken into account while making strategies and decisions related to an age-friendly SLE.

Acknowledgements

We are grateful for the support from the Finnish Foundation for Economic Education for participation in the 22nd DMI: Academic Design Conference. The empirical data used in this study is collected in the Interreg BSR OSIRIS – 'Supporting the Smart Specialization Approach in the Silver Economy to Increase Regional Innovation Capacity and Sustainable Growth'.

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