Setting up a living lab for innovation in the dementia care chain, a case study of the PhysiCAL
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Introduction

Dementia is an irreversible disease in which the mind deteriorates gradually. The number of people living with dementia is increasing with the aging population. This is one of the societal challenges for Europe in the near future. The population of people suffering from dementia is expected to double by 2050 (Kinsella et al, 2009). As the pressure on the healthcare system continues, people with dementia are expected to extend living in their own home, rather then moving to a healthcare institute. For this reason there is a need to improve the quality of life of people living with dementia in the home environment. We intend to achieve this by developing innovations specifically for an unmet need.
Innovation in products for people with dementia differs from regular new product development for two reasons. First, people with dementia are impaired and cannot partake in regular user-driven design methodology. Second, in dementia healthcare there are no regular customer/supplier relationships. A complex stakeholder network of care providers and business stakeholders surrounds innovations in the dementia care chain. This means that the business case of an innovation needs to be extended to a social value model that reflects the value perspectives for the different stakeholders. This paper describes the set-up of a LivingLab approach to provide an answer to these complicating factors in innovating for people living with dementia.

In our LivingLab setup we support both networked innovation for dementia and provide an opportunity to evaluate innovations in a real-life context. To achieve this an iterative evaluation methodology is proposed. This iterative approach involves stakeholders of the dementia care chain on several levels. Including the people living with dementia (consisting of both people suffering from dementia and their caregivers), dementia care providers and potential business stakeholders. For the success of the innovation it is important that not only the users support the concept, but also that its value is recognised by the affected actors in the dementia care chain and the potential business stakeholders (potentially) operating in it. In this iterative approach the aim is the evaluation of propositions contributing to the challenge as well as the discovery of new innovation opportunities. The aim of this methodology is to get an early evaluation of the acceptance and usability of the design propositions by the users, as well as a viable social value case. The approach is piloted and developed through a case study of an activity reminder calendar. The calendar is designed for people with onset dementia to improve their day structure and independence.

2 Theory

Open Innovation in the dementia care chain

Societal challenges like dementia are complex and typically ‘ill-defined’ problems (Cross, 2006). The nature of ill-defined problems is that collecting and synthesizing information directly cannot solve them. It is not possible to predict all the relevant information and ensure its availability in the design process. Nor is it very likely all the relevant information is available to a single stakeholder or company. As a result the required innovation process is much more of an ‘open’ or ‘networked’ kind, where various organisations collaborate to bring together complementary expertise and resources in the development process (Lee et al, 2010). When looking for relevant approaches for the dementia context, a literature review was conducted. This revealed that much innovation management literature uses a company-centred view of networks (Ramirez, 1999), in which companies seek collaboration to develop new products (Ledwith & Coughlan, 2005). Also open innovation is mostly seen from the perspective of one organisation (Chesborough, 2003, Chesborough et al, 2006). Companies embarking on open innovation do so to allow ideas flowing into as well as out of the organisations innovation funnel, so called inbound and outbound innovation (Dahlander and Gann, 2010). But this company-centric view is an inadequate basis for understanding the business context of innovation in the area of dementia. For the dementia case, the focus has to shift from the company itself to offerings for the
customer. It then becomes clear that combining internal and external resources is a key issue for strategic survival and a determining factor for successful business models (Ballon, 2007). It requires the replacement of the sequential, unidirectional ‘value chains’ by ‘value co-production’, where value creation is synchronous, interactive and involves co-creation by customers. The focus is then no longer on the company, but on the co-produced offerings, which build on relations with multiple actors (Ramirez, 1999). The network becomes the means to create more value by integrating offerings or competences from different organisations into better solutions for customers. This is especially important in the case of innovation for dementia. As there is no single customer for the products or services, but rather a complex stakeholder network surrounding the dementia care chain. Networks generate economic and social good by tangible and intangible value exchanges between groups, organisations and businesses (Allee, 2008). Individual and collective interests need to be aligned and a ‘win together’ approach is used in partnerships and in connection with society at large (Van Marrewijk, 2004).

When proposing a new design in a multi-stakeholder network looking at a value model for a single party is insufficient to find a suitable business case. Instead multi-stakeholder values, reciprocal values (Ballantyne et al, 2010) have to be addressed. All members in the network are to have fruitful relationships and it is important that they all contribute to and benefit from the innovation. All members have to build on their own competences and stay authentic in their offerings (Gilmore and Pine, 2007). In a joint effort, people from different sectors (large and small businesses, non-governmental organisations, public organisations and citizens) are creating shared value by conceiving new solutions. In these hybrid networks, the concept of shared value blurs the line between for-profit and non-profit organisations (Porter and Kramer, 2011). Value exchange in the context of innovations for dementia is not just direct exchange between a company and a customer, but between stakeholders in the ecosystem as well (Payne et al, 2005). The stakeholders are all those groups and individuals who affect or are affected by the accomplishment of the innovation (Freeman, 1984). The exchange of the mutual beneficial value goes beyond the immediate or straightforward market transactions that are common in traditional products or services sold directly to customers. The value proposition should address what customers really value and how the service or product offering will satisfy those needs (Teece, 2010). However in the case of innovations for dementia, this becomes inherently more complex as there is not one single customer. Proven methodologies to find user values are personas and customer journeys (a.o. Zaltman, 2003), but they need to be extended to an interactive experience flowchart that addresses the perspectives of a wider range of stakeholders covering the social context of people with dementia over the entire disease process (Alblas et al, 2011).
LivingLabs for user-driven innovation

A commonly mentioned approach for innovation in networks is LivingLabs. In literature many definitions of LivingLab are used, but they all share the common notion of exposing people to new experiences in an as real as possible context. As this definition is still ambiguous Bergvall-kareborn (2009) et al. have defined five principles to which LivingLabs should comply, which are:

1. Openness: Sharing information and results with stakeholders and partners.
2. Influence: of users and other stakeholders on the products developed for them.
3. Realism: Testing in an as real as possible setting
4. Value: For the test subjects and the evaluated design
5. Sustainable: Knowledge transfer and self-supporting for future development

These principles give a strong definition of LivingLabs on an abstract level, yet fail to capture the specific actions and methodology. In our living lab we explore, evaluate and validate new innovations in their natural context over longer periods of time with relevant stakeholders. This kind of LivingLab, which is taking place in everyday life, in people’s natural environment, is becoming more common (ENoLL 2013). Still the term “LivingLab” can refer to the methodology, the experimental setup or the agency in which these (near) real-life studies occur (Almirall et al. 2008). In our definition the LivingLab includes all open innovation activities with stakeholders, covering the entire process from the first explorations to the final delivery of an innovation with a fitting business case. During this process there is continuous interaction with stakeholders, which can be, in the case of dementia, users, care providers or potential business stakeholders. Leminen et al (2012) state that LivingLabs have been successful in providing networks that can help to create innovations that match with users’ needs and have the ability to be brought to a market level. In this view the LivingLab is no longer a single environment, but rather a research structure for developing innovations throughout. In this way the LivingLab links the design process to the innovation management process. The term LivingLab then no longer refers to the methodology itself as different methodologies can be applied. In an user-driven LivingLab structure it is important that users influence the design process as co-designers (Almirall et al, 2012) as this will reflect in the acceptance and usability of the design by the user. This is in line with other researchers defining co-creation as an important factor for new product development (Bilgram et al, 2008). It is complementary to the open innovation approach described earlier.

Co-creation is suggested as a way to deal with ‘wicked problems’, which we also face in design for dementia: ill-formulated problems that require special attention to the understanding of the problem itself (Martin, 2009). Design concepts are then used as a means to explore and understand the problem definition in an iterative process. Prototypes in any form (sketches, storyboards, scenarios, movies, scale models, dummies or functional prototypes) can support the iterative process together with the users and stakeholders and support the process of learning faster, cheaper and better. The development process has an explorative nature (Gunther McGrath and MacMillan, 1995): along the way new discoveries are made that either lead to upgrading the concept or rethinking the assumptions (Brown, 2009). However, in the case of people with dementia, the inherent impairment of the users requires adaptations to this co-design process.
(Brankaert, 2013). For example using the caregiver’s perspective as a substitute for the perspective of the person with dementia. And not demanding heavy research protocol’s for the evaluation of the propositions.

With our LivingLab approach we aim to make the innovation process not only user driven, we also integrate other stakeholders. Thereby we create a new kind of innovation approach suited for an impaired user in the context of a complex care chain. By capturing various perspectives we look at the effects of the disease in the entire social context of people with dementia. The stakeholders are influencing and being influenced in this process, and it is important for them to try to understand the perspective of others (Hakanson and Ford, 2002). A facilitator can support this process by visualising half-formed ideas, and supporting the process of jointly reflecting on them from the different backgrounds and disciplines. Although there is no hierarchical structure (as in developing new ecosystems), there is a need for a leadership role to enable all participants to invest towards a shared future in which they can all benefit together (Moore, 1996). In our project the designer, who integrates the different views into the value proposition, is taking up this role. The process allows for stakeholders to co-design while maintaining a user-driven perspective.

3 Methodology

Research question

This paper focuses on a new development process to design and realize innovative products and related services for people living with dementia. This includes the identification of needs of various stakeholders beyond the direct product attributes, as well as the combination of various perspectives to choose a new opportunity area. A new iterative LivingLab evaluation process is proposed to involve the user and the stakeholder network, to address the issues of innovation in the context of dementia. The aim is to know early in the innovation process whether the target users accept an innovation and if there is a viable business case. The end goal is the creation of a product or service with a sustainable business model, which increases the quality of life for people living with dementia. In this paper we use a case study to pilot our proposed approaches and learn for future innovation tracks.

Research design

In our LivingLab structure stakeholders will be involved on three levels; the first level stakeholders are the people with dementia and their caregivers (or users), the second level stakeholders are the dementia care providers, the third and final level stakeholders are the potential business stakeholders looking for providing a product or service in the healthcare domain. An interactive experience flowchart approach (Alblas et al. 2011) was used to identify a validated opportunity area. Thereafter, a Living Lab evaluation process (Bergvall & Stahlbrot, 2009) was defined inspired by the experiential design landscape methodology (van Gent et al, 2010) with several iterations involving different stakeholders. We use an innovative product proposition to go through these evaluation sessions in people’s natural context and evaluate how it fulfils a need. While (design) research in the real world compromises the experimental control (Koskinen et al. 2011), the ecological validity is improved. The focus of the LivingLab approach is on evaluating
an innovative proposition in a complex stakeholder network, rather than the actual effectiveness of the evaluated prototype.

As described the Living Lab approach is used to evaluate the design through three iterations. In each of these iterations there is room for reflection, allowing for a better understanding of the opportunity area, and allowing discovery of new opportunities as an evaluation of the presented innovation. By evaluating the proposition through these iterations we learn how to improve the concept, and the value for the different stakeholders in the care chain to continue development and conduct a consecutive iteration of the approach.

The iterative approach allows for the gradual reduction of uncertainties, which are inherent to these kinds of innovations, by addressing the utility and relevance of the product for people living with dementia. But it also include moments of learning by evaluating innovations much earlier in the process, and thus being able to judge the actual value in the potential market early in the process.

4 The case study: Results

Iterative design approach using the LivingLab structure

The proposed process is developed along with an innovation project: the PhysiCAL, an activity reminder calendar. Developing the project and the process simultaneously requires a better understanding of the context and allows for more specific adaptation of the process to the application area. Figure 2 shows visually how a concept grows through the process, taking away risks and identifying adjustments and new design opportunities.

The process is piloted in the PhysiCAL project and will be further developed by more of these innovation evaluation tracks in subsequent projects. The process will be adapted according to these insights and experiences, ultimately resulting in an appropriate and valid LivingLab approach.

![Figure 2 The iterative process and the long-term development in the project.](image)

The user-driven design of the PhysiCAL

The PhysiCAL is an activity reminder in the shape of a calendar (see figure 3). The design process (Brankaert, 2013) focussed on the user-driven design methodologies, adapted to deal with an impaired user. The calendar provides a memory cue in the home environment for crucial activities and tasks at home.
Figure 1 The PhysiCAL being used in the LivingLab, with an attribute description.

The PhysiCAL calendar shows an entire week with the weekdays clearly visible in a schedule (E). On this calendar activity tags (B) can be placed, representing things to remember, like for example taking medicine. The arm bar (C) moves vertically to indicate the current day, along this arm bar a time indicator (A) moves horizontally to represent the time. When the time indicator passes an activity tag, a signal is provided at two sensorial levels. Visually the time indicator shows light, and an audio signal is played through the speakers (F).

The system notices when somebody is in front of the system, through a sonar sensor (D), and if someone is sensed the signal to attract attention stops. In this way the device knows whenever attention is given to the activity.

The design introduces a familiar shape, based on the regular whiteboards already used, and adds intelligence to it. Without taking over control it provides a tool to maintain independence. The system works as a platform, and the people living with dementia can decide for themselves what they would like to remember.

The user evaluation of the PhysiCAL

As mentioned in the theory, our LivingLab structure facilitates evaluation in the home environment of the prospected user group, people living with dementia. In this pilot case study, the PhysiCAL is evaluated within four home environments. In all of these home environments there was one person diagnosed with dementia and their partner provided informal care. For the evaluation with users it was decided to jointly interview the person with dementia and their partner to provide a third person co-reflection perspective, as a solution to deal with mentally impaired people (for more details on the co-design process with mentally impaired people see Brankaert (2013)). In this paper we focus on the evaluation results which affected the overall LivingLab approach. Among individual anecdotes about the PhysiCAL we found some interesting aspects that related to the market potential of the product. First of all, they commented the product design: the
actual size of the product would need to be reduced for common households. Secondly, they reflected on their need for the product: all people with dementia mentioned they didn’t need the device, but half of the caregivers mentioned they thought it actually was valuable. Furthermore three out of four caregivers in the home environment mentioned they could relate to the goal of the PhysiCAL and judged it as possibly relevant for people with dementia. This highlighted that the target group for such a product might be the caregiver rather than the people with dementia themselves.

For this pilot evaluation the limited group of users was sufficient. Some results of the evaluations were valuable for the further development of the PhysiCAL. Yet the most important insights related to the influence of this evaluation on the LivingLab approach. By providing the product evaluation to the other stakeholders, in reflective sessions, the value of the home sessions is evaluated.

Consulting care providers in the dementia care chain

To get insight from the professional care perspective we consulted care providers in the dementia care chain. The care providers play an important role in the acceptance, recommendation and adoption of innovative solutions in dementia care. Depending on the type of product it may affect their care process directly or indirectly. In three workshops we consulted different levels of care professionals: 1) Case managers, 2) Mixed care professionals and 3) Client advisory.

In these workshops we presented our LivingLab approach and three concepts developed based on user needs (among them the PhysiCAL). Initially the session’s goal was to get feedback on the innovations, as well as the LivingLab approach. Some interesting results from these discussions, valuable for the reflection on this phase can be seen in table 1.

Table 1 Results from the care chain consultations

<table>
<thead>
<tr>
<th>Opinion on:</th>
<th>Case managers</th>
<th>Mixed care prof.</th>
<th>Client board</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhysiCAL concept</td>
<td>Positive on concepts and describe them as potentially valuable.</td>
<td>Interested in concept as is, started to develop the concept on the spot.</td>
<td>Surprised by the concept and interested in trying it, some immediately convinced.</td>
</tr>
<tr>
<td></td>
<td>Approach of LivingLabs very clear and valuable, yet practical implication still unclear for them.</td>
<td>Interested in approach, positive curiosity. No insight in actual implications.</td>
<td>Interest in participating and open for discussion about concepts in general. No insight in LivingLab approach.</td>
</tr>
</tbody>
</table>

Source: Series of three workshops for the Innovate Dementia project.
In general people valued the concepts and the way it addressed a specific need positively. People appreciated the fact that concepts were presented in an early stage, and that there was still room for development. The discussions did contribute majorly to the development of the PhysiCAL concept.

For the LivingLab all three care provider groups thought it was useful to develop and evaluate innovations with and for people living with dementia.

At the end of the workshop we also asked participants to suggest potential business partner stakeholders to be involved in the third iteration. All participants had a difficulty to identify other than the obvious stakeholders (a production company or a retail store). Related to this most participants couldn’t imagine the possible business cases. Especially the client board mentioned they only care about the direct implications for the user (benefits and costs). This highlighted that the care providers have no clear insight in the business environment for health care innovations. However, they provided valuable suggestions on concept level.

Consulting the potential business stakeholders

Through two workshops with potential business stakeholders insights are gathered on the business context of the PhysiCAL. Business cases and stakeholder networks vary among innovations and depend on the specific area of the dementia care chain. The main question of these sessions was what information on the proposition is required to judge whether it has business potential. Like in the previous iterations, we aim at evaluating the LivingLab approach as well as the product itself.

First we started the workshop with a discussion on the company’s main drivers. For this step we use the value framework (den Ouden, 2011), which distinguishes an economic perspective, psychological perspective, sociological perspective and ecological perspective. By discussing the companies view on these perspectives and having them indicate their main driver, we can put their input in perspective.

For the workshop sessions we used a similar workshop structure as during the care provider sessions. Yet the intention is very different as we are dealing with a business perspective compared to a care value perspective.

Potential business stakeholder 1 (BPS 1), is a company that has developed and launched a successful product/service combination for use in the home care situation recently. He emphasized that a business case that would involve support from an insurance company would take at least 4 years, as they had recently experienced with their own new business development. This company wants to stay very close to their core business, and did not aspire to adopt the PhysiCAL proposition.

Potential business stakeholder 2 (BPS 2), runs a business that started around 10 years ago, targeting the informal care providers. The company was acquired by a larger player in the industry, mainly because of its positive imago in the market. Despite the proposition that is very much appreciated, the business is still not on the aspired level. He emphasized the complexity of the business environment in health care, and the continuous struggle in the healthcare to realize innovations. The company strongly believed in social values, which engages the people working for the company. BPS 2 recognized the value of PhysiCAL and could see further developments to make a fit with their own product family, but hesitates to embark on further development as long as the health care industry in the Netherlands is resisting innovations.
Table 2 Results from the potential business stakeholder consultations

<table>
<thead>
<tr>
<th>What:</th>
<th>PBS 1</th>
<th>PBS 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhysiCAL concept</td>
<td>The concept is not convincing: it has to be clear what current value</td>
<td>The concept has potential and if the pilot evaluations are positive this would be sufficiently convincing. There are potential additional services that would increase the value further.</td>
</tr>
<tr>
<td></td>
<td>flows the PhysiCAL makes obsolete.</td>
<td></td>
</tr>
<tr>
<td>LivingLab value</td>
<td>The traditional “fake” lab has no value; but this approach with a test panel of a user case backed up by needs is valuable.</td>
<td>Unsure if the concept of a LivingLab is needed: the resistance to propositions that disrupt existing business is the tough part of innovation.</td>
</tr>
<tr>
<td>What do you need</td>
<td>Need a match with core values; currently the value for the care chain is not evident making it hard to “sell” or develop: a clear “buyer” with a convincing business case is needed.</td>
<td>There has to be a clear customer willing to pay: this could be the informal carer. The LivingLab might help in showing the positive effect of disruptive innovations, which would be true added value.</td>
</tr>
<tr>
<td>to be convinced of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the concept/LL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Two workshops for the Innovate Dementia project.

As can be seen in the workshop results (table 2) the workshops were very different, and therefore interesting for evaluating the concept and the LivingLab approach. For example BPS (2), believed in the concept, yet sees limited value in a LivingLab approach as he sees the biggest challenge in realising the business in the health care context in the Netherlands. He had no lack of valuable propositions, but emphasized that the resistance to change is very big, especially when it involves shifting care tasks from professional care to home care.

The other stakeholder, PBS (1), didn’t really believe in the concept of the PhysiCAL but thought the co-creation with end-users is really interesting for many companies with an interest in developing for people with dementia.

5 Conclusions & discussion

Contributions

The new methodology proposed, challenges our current understanding of how to design for and with elderly living with dementia and the complex dementia stakeholder network. In this paper we propose an adapted LivingLab approach to explore opportunities for innovations in a complex social environment, as well as adapt the approach to design for a mentally impaired target group. The case study shows that a series of co-reflection...
sessions with subsequently the target group, care providers and potential business stakeholders, reveals relevant information. As well as that dividing a complex stakeholder network into separate parts, allows addressing these stakeholders on their specific role, in which they provide most value.

From the three iterations we learn that the PhysiCAL adds value for the end users and has the potential to support the reduction of integral care costs by lengthening the period a person can stay at home with dementia. For some professional care providers this will mean a decrease in their current business. For such innovations to be successful in fact a new stakeholder network or ecosystem will need to be build to replace the existing ecosystem. Some parties that have a very profitable position in the current ecosystem will loose this comfortable position in the new situation. Organisations react differently to the threat of obsolescence: some try to slow down the growth of a new ecosystem, some fundamentally restructure themselves to try coping with the new reality (Moore, 1996). The potential business partners in our workshops have experienced the resistance in the health care industry to change and emphasize the need to carefully map the stakeholders that are affected by the change, and design pathways to the market involving supportive organisations.

In the subsequent co-reflection sessions we have found no conflicting feedback. By starting with the users the first reflective results stayed on product design level. In the second round, the stakeholders in the dementia care chain; we could further improve the concept in general for improving care in the home environment and show the value for care in general. In the third round, the business stakeholders, we got valuable feedback on the business potential and the possible business cases. This process of zooming out seems appropriate to gain insights from the various perspectives, as they are all necessary for an accepted and successful innovation.

Practical implications

As shown in other research the iterative approach in the LivingLab reveals the strengths and weaknesses in a potential proposition early in the design process. This paper shows how such an approach can be adapted to cater for the more complex dementia case. And revealed that solely focusing on the user doesn’t reveal all uncertainties and eventual innovation implications. The approach might be applicable for other complex business areas as well. Examples of such areas are: healthcare in general, smart energy and mobility solutions as well as other innovations that aim to address a societal challenge. Innovation managers and designers active in various fields that involve a more complex stakeholder network can adapt the proposed methodology in this paper to their specific situation. In such other networks one can in most cases also split the complex stakeholder network in separate parts, each with their own role and motivation.

The user evaluations with people living with dementia proved to be useful and contributed majorly to the user-driven aspect of the design process. We realised users fail to evaluate the LivingLab approach directly but did it indirectly, as the result were used in the two follow-up sessions. The care providers put the design in context of their organisations, but agreed the user needs were most important. Interesting would be to see if a more concrete representation of the proposition like for example user interaction movies would create similar
commitment. Asking for a business perspective seems to be invaluable, and should be avoided in future sessions. The potential business stakeholder sessions proved to be very valuable for evaluating the proposition as well as the LivingLab approach. During the sessions we discovered these sessions can have two purposes; firstly to provide advice and feedback on the propositions and secondly to embrace a concept and adopt it within their company. In future sessions we should facilitate these two aspects stronger.

During the sessions we also learned some practicalities about business partners, they spoke more freely because they were alone. Which means a group discussion is potentially less valuable. Furthermore the concept part should be explained more from a value creation perspective rather then an interaction perspective. As this first perspective evoked more results.

Over the sessions we can see that the care providers and the potential business adopted the user perspective seamlessly. This seems to be an interesting hypothesis for future iterations of this LivingLab approach in the context of user-driven design. In continuation of this we didn’t come across conflicting aspects, showing these three groups can provide insights in their own domain, as long as they are facilitated.

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