The effect of digital healthcare and well-being platforms on the capabilities of elderly

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Abstract

In Europe there are many countries that are experiencing issues with an aging population. In fact, many countries are changing their welfare and healthcare systems in order to facilitate the change. Consequently, elderly people are required to remain in their own homes for as long as possible and organize their own healthcare. Doing so can be a complex process and assistance in the form of a digital platform can offer the solution for elderly to age in their own households. This type of social innovation and other social functions enabled by a platform can enable elderly to age in place. This research proposes to set up an experiment in order to measure the effect a digital platform has on the capabilities of elderly to live at home. The results show that a digital platform will in fact increase capabilities of elderly. Such a digital platform has not only a positive effect on elderly, but also on their voluntary caretakers. Thereby, the platform enables social innovation by lowering thresholds for users to participate in healthcare tasks. Based on the results, recommendations are made that can be used to further the development of platforms for health and well-being and increase their effectiveness and potentially facilitate widespread societal change.

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Executive summary

Background
Many countries in Europe are confronted with an aging population. As a consequence, the welfare and healthcare systems of these countries will experience pressure and difficulties in order to sustain them. People are supposed to be more self-reliant with organizing and receiving health and well-being services. Moreover, elderly people are expected to remain in their own homes for longer instead of moving to an elderly home. This trend places an extra burden on the caretakers of the elderly.

Innovative ICT solutions, in the form of a platform for health and well-being in combination with social innovation is seen as a solution to this widespread societal problem. Platforms for health and well-being can assist elderly and their caretakers in organizing healthcare and well-being activities. Thereby, social innovations can provide possibilities in receiving voluntary care from people that somebody originally would not receive help from.

Problem statement
Developing a digital health and well-being platform through social innovation could enable elderly to age in place for an increased period of time. However, due to a lack of such service platforms there is not much know on the effect these platforms have on the capabilities of elderly, in particular in their capability to age in place with dignity. Therefore, this study aims to determine which effect a digital platform for health and well-being has on the capabilities of elderly to age within their own household.

Theory
This study builds upon the capability approach and theory on social innovation. The capability approach provides a theoretical lens through which the evaluation of the platform for health and well-being developed and studied in this thesis can be performed. The approach provides insight into determining relevant measures to meet the research objective. It is a high level framework that can be used to determine the well-being of elderly or at least provide argumentation as to how the well-being is affected by a platform for health and well-being.

Additionally, this study uses theory on social innovation to examine the role a platform for health and well-being can have in enhancing social innovation and thus providing an environment in which more voluntary caretakers can be found.

Methodology
Experimental design is used in this study to determine the main research question, namely: "How do digital platforms for health and well-being enable elderly people to age in their own household?". Additionally, a platform for health and well-being is developed in this study that is evaluated during the experiment. The experimental design consists of two experimental groups that undergo similar treatments. These treatments are designed so participants can experience how a platform for health and well-being can be used when providing care tasks for an

elderly person. Measurements are conducted with a questionnaire at three points in the experiment. First a pre-test is conducted to establish a base line, then after the first and second treatment other measurements are conducted. Thereby, both qualitative and quantitative results are gathered.

The results of this study will be described according to the sub research questions and finally according to the main research question that guides the entire research.

How does a platform for health and well-being enable social innovation?
Social innovation emerges where solutions are developed in order to address a social need. The main driver for the social innovation can be due to a social entrepreneur, an individual that exhibits strong communication and leadership skills. Or on the other hand, by the combined effort of individuals. The movement as a whole drives the social change towards a solution.

Social change is required in order to provide elderly with the healthcare they require in order to stay at home for as long as possible. A platform for health and well-being can be a driver of social change by providing an environment through which people can more easily receive or request help from others. The results show that the platform enables the capabilities of users to more easily provide voluntary care for family, friends or acquaintances. Additionally, participants argued that they would not be quick to help complete strangers however, they did comment that they might be willing to assist neighbors in certain daily tasks.

How can capabilities and thus well-being be measured?
The capability approach provides a framework through which individual well-being can be evaluated. Whether capabilities can be measured is however still open for debate amongst capability researchers. However, quantitative research is being performed by researchers such as Robeyns (2005a). Surveys are conducted through which capabilities can be evaluated. Thereby, indexes like ICECAP-O and ASCOT have been developed to measure capabilities, in particular the health and well-being capabilities of elderly. Consequently, capabilities and thus well-being can be measured through quantitative surveys as well as other empirical data. The survey should preferably be designed with this specific goal in mind.

How can an IT artefact that demonstrates a platform for health and well-being be developed?
In order to answer the main research question, a digital platform for health and well-being is required. The living lab research project already has determined user-centric requirements for the platform. Thereby, the research also produced visuals in the form of mock-ups and even a clickable demo. Moreover, the requirements are based on the target audience elderly and voluntary caretakers, which is the same target group for this research. Therefore, the requirements are taken over and used as guidelines for the development of an IT artefact.

One of the requirements in particular namely, matchmaking between users and product and service providers relies on technology by IBM to enable a Dialog service. The Dialog service enables developers to design and build chat bots. Altogether this requirement was leading in determining the software stack, as the available demonstration application by IBM greatly reduced development time.

As a result of the development efforts a web application is built that demonstrates a platform for health and wellbeing. The most important features are interactive, so users can physically engage with them, whilst other features are merely static representations.

How can the effect a health and well-being platform has on capabilities of elderly be measured?
An experimental design is proposed to measure the effect a platform for health and well-being has on the capabilities of elderly. A platform is used as a treatment for the participants. The participants are randomly assigned to either one of two groups. As part of the treatment the participants are requested to perform scenario tasks, which ensures that the participants truly get a good experience how a platform for health and well-being would work in real-life. Before and after each treatment participants are evaluated through a questionnaire. Due to the described experimental setup capabilities enabled by a health and well-being platform can be measured.

The experiment shows that the combination of quantitative and qualitative results provides richer insights into the effect of capabilities, rather than using either of the two methods. In this case the quantitative results showed that voluntary caretakers are significantly positive to the idea that a platform for health and well-being will have a positive effect on enabling elderly to live at home for longer. The quantitative results on the other hand show that even though voluntary caretakers are positive, they do have reservations and preconditions that have to be met in order for the platform to be truly effective.

"How do digital platforms for health and well-being enable elderly people to age in their own household?"
The study finds in particular how features of the platform developed and studied enable capabilities for elderly. The following four main features are implemented; Feature 1) matchmaking between providers of smart living products and services and end-users, Feature 2) finding local activities, Feature 3) information about health and well-being and Feature 4) connecting with others (e.g., family, caretakers). The study shows that it is expected that these features can have a positive effect on the capabilities of elderly in enabling aging in place. In particular features that allow end-users to find information about health and well-being and features that facilitate communication between caretakers have an expected positive effect on the capabilities of elderly. That said, it is expected that a platform for health and well-being that implements the previously mentioned features can enable capabilities of elderly that allow them to age in their own household.

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1 Introduction

1.1 Research Background

Many countries in Europe are confronted with an aging population. As a consequence, the welfare and healthcare systems of these countries will experience pressure and difficulties in order to sustain them. Especially in times of austerity governments have to adapt and implement policies that relieve budgetary stress and thus improve economic stability of their countries (Rechel et al., 2013).

For instance, the Dutch government is implementing policies aimed to reduce State involvement in certain health and well-being cases. As a result, people are supposed to be more self-reliant with organizing and receiving health and well-being services. Moreover, elderly are expected to remain in their own homes for longer instead of moving to an elderly home (Rijksoverheid, 2015). However, as soon as an elderly person suffers from health issues a first priority is to assure that they can receive the proper care at home instead of moving to a healthcare center.

Elderly increasingly need to rely on their family, friends and neighbors as soon as they become more vulnerable due to increasing health issues (W. J. Keijzer-Broers, de Reuver, & Guldemond, 2013). Especially since health services organized from the government are being reduced. Organizing healthcare and well-being support services are not trivial activities for volunteers to handle by themselves. In doing so, there is consensus that innovative ICT services are required to enable this more social form of healthcare (W. J. Keijzer-Broers et al., 2013).

Therefore, in particular Smart Living solutions could be an answer for many people that are increasingly supposed to independently live at home and organize their own healthcare services. By utilizing Information Technology (IT), specially designed for improving health and well-being inside the homes of people, healthcare at home and independent living could be improved. Moreover, these types of applications should enable elderly or voluntary caretakers to organize their own healthcare services from the comfort of their own homes.

Smart Living is a concept that encompasses more than just digital healthcare services. In fact, smart living services are generally developed in order to enhance the comfort of people inside their own homes. These services are generally also connected to the Internet, which enables households to monitor their own homes through sensory data from remote locations. Smart Living solutions aim to provide value amongst several domains such as health, energy, safety and entertainment (Nikayin, 2014).

1.2 Problem statement

Currently, Smart Living concepts have not yet reached mass-market adoption, even though there is a lot of research being performed in this field. A reason for a lack of adoption by end-users could be due to the fact that currently most research on smart living is technical of nature. Thereby most studies focus on user requirements and are of a design-driven nature. Hence, there is a lack of studies that are of a non-technical character (Solaimani, Keijzer-Broers, & Bouwman, 2013). Although increasing design-research makes use of user-centered design in order to overcome mismatches in expectations, it has yet to overcome misalignment between promises and expectations between service providers and end-users.

However, research suggests that in order to overcome these issues a common service platform is required (W. J. Keijzer-Broers et al., 2013). This platform should have two main objectives. First, enable service providers to create awareness amongst end-users about the smart living solutions that are available and secondly, offer a matchmaking service between service providers and end-users in order to bridge the gap between technology and end-user needs.

From a technical point of view a platform can be defined as a technical foundation on which service providers are equipped with a set of "building blocks" that enable them to develop complementary services and technologies and products (Nikayin, 2014).

While a service platform for health and well-being could be a solution to enable elderly people to age with dignity in their own homes, such services still rely on societal input in order to provide a cost-effective solution to a widespread social problem. Namely, how can society increase or enhance the capabilities of elderly so that they can age in place with dignity for an extended period of time.

Moreover, developing such an innovative solution – a service platform for health and well-being – for a given social problem in order to create value not only for individuals but also to a society as a whole can be seen as a social innovation (Phills, Deiglmeier, & Miller, 2008). While social innovations can be useful in addressing societal problems, they are in fact scarce in the healthcare domain. In fact in the Netherlands, only three service platforms (Zorgdiensten Online[1], Zorg voor elkaar[2], and MijnZorgnet[3]) are available that bring together caregivers and end-users (W. J. Keijzer-Broers et al., 2013). Due to the lack of such service platforms, there is not much known on up to what extent such a platform can increase the capabilities of elderly, in order to enable them to live at home.

Practical problem:
Developing a digital health and well-being platform through social innovation could enable elderly to age in place for an increased period of time. However, due to a lack of such service platforms there is not much know on the effect these platforms have on the capabilities of elderly, in particular in their capability to age in place with dignity.

[1] http://www.zorgdienstenonline.nl/
[2] https://zorgvoorelkaar.com/
[3] https://www.mijnzorgnet.nl/

1.3 Theoretical background

Due to the research context, the two concepts social innovation and the capability approach will be briefly addressed. That said, theoretically this study mostly builds upon concepts from theory on the capability approach, in order to understand what effect a digital service platform has on the capabilities of elderly. Whereas social innovation theory will be used to describe contextual factors.

1.3.1 Social innovation

At the core of social innovation lies a societal problem in need of an innovative solution in order to not only advance the individuals affected by the problem, but the society as a whole. More precisely, Phills et al. (2008) define social innovation as: *"A novel solution to a social problem that is more effective, efficient, sustainable, or just than existing solutions and for which the value created accrues primarily to society as a whole rather than private individuals."*

Social innovation can take place within different types of organizations and sectors. For instance, within governments, non-profit organizations and within the private sector. The common denominator amongst these sectors is however that these organizations are not primarily focused on profit-maximization (Mulgan, Tucker, Ali, & Sanders, 2007). Thereby, improving societal problems is a challenging task, especially in an era of economic stagnation. However, social innovation provides opportunities to enhance society despite economic challenges.

Existing research provides insight in mechanisms of social innovation, for example; an economic crisis or change in public mind set (demanding more corporate social responsibility from the private sector) can be triggers for social innovation. In particular insights are gathered with respect to leadership and facilitating social change (Mulgan et al., 2007). Moreover, social innovation research focuses mainly on organizations or social systems as a whole, rather than social innovation promoting platforms.

1.3.2 Capability approach

The capability approach provides a framework to evaluate the capabilities of elderly that are required to extend their ability to live in their own household. The normative framework can be used, amongst others, as a tool to evaluate various aspects of individual people's well-being. In general the approach focuses on what people are able to do (are capable of) (Robeyns, 2003a). By focusing on what people are actually able to do it is possible to get proper information about a person's well-being. For example, a standard car should be able to provide transportation, however if the person that needs to use the car does not have the characteristics needed to use the car, this person still lacks the capability of transportation.

Due to the broad application of the capability approach it is used in a wide range of research fields. It is mostly used as a social policy and political philosophy tool to evaluate wellbeing, inequality and poverty. While it can be discussed in abstract and philosophical terms, the capabilities approach also can be used to gather empirical data (Robeyns, 2003a).

While the capability approach is hardly applied to the ICT domain, it certainly provides a theoretical lens through which ICT solutions, or in this case digital service platforms can be evaluated. The approach is also able to capture pitfalls in ICT development. The first pitfall is not focusing on the actual well-being of users and simply assuming that ICT will improve a person's well-being. Secondly, it is often assumed that ICT developments are intrinsically good and therefore valuable for human development as a whole, while this is not necessarily the case (Zheng, 2007).

1.4 Research objective and research questions

Societies that are reducing public healthcare services could benefit greatly from digital health and well-being platforms which in particular emerge out of the efforts of social innovation. Moreover, these platforms are expected to increase the capabilities of elderly, which in turn enables them to age in place. However, while requirements and needs can be collected beforehand, it is currently not yet possible to know which effect such a platform actually has on the capability of elderly people to age within their own households. Therefore, the purpose of this study is:

> *"To determine which effect a digital platform for health and well-being has on the capability of elderly people to age in their own household."*

The following research question is devised in line with the research objective in order to guide the entire research process:

> *"How do digital platforms for health and well-being enable elderly people to age in their own household?"*

Based on the research question, the unit of analysis in this study is the elderly people that require a health and well-being platform in order to increase their capabilities in order to remain in their own households when in need of healthcare services.

The following sub questions will be answered in order to be able to answer the main research question:

1. *How does a platform for health and well-being enable social innovation?*
   Social innovation drives the development of the platform for health and well-being studied in this study. Additionally, such a platform aims to enable social innovation. In order to determine whether these objectives are met it is necessary to first of all understand how social innovation emerges and in particularly how a platform can enable social innovation.

2. *How can capabilities and thus well-being be measured?*
   The capability approach is used to understand how to measure the required capabilities to age in place. Besides understanding which

capabilities are required this research aims to measure them. The platform is used as an intervention in order to determine which effect it has on the well-being of elderly. Moreover, the capability approach provides insights and suggestions as to the way they can be measured.

3. *How can an IT artefact that demonstrates a platform for health and well-being be developed?*
   An IT artefact is used as an intervention instrument to measure how a platform for health and well-being affects the capabilities of elderly. Existing research will provide requirements and use-cases to develop the artefact that will be studied in this research. As the main goal of the artefact is, to determine which effect it has on the capabilities of elderly, it is necessary that the artefact resembles a fully operational.

4. *How can the effect of a health and well-being platform on the capabilities of elderly be measured?*
   The main research question sets out to determine how elderly can age in their own homes. This thesis proposes an experimental design, that uses an IT artefact resembling an operational platform for health and well-being as a treatment for target users namely, elderly and voluntary caretakers.

1.5 Theoretical relevance

This research mainly builds upon the capability approach. Additionally, theory from social innovation is used, as this study aims to study a potential solution for a societal problem. This section will provide insight into the theoretical relevance of this study and which theoretical contribution the study aims to achieve.

Limited research is performed on smart living platforms. Notably health and well-being platforms. This thesis aims to contribute to a better understanding of how platforms for health and well-being affect their end-users. The capability approach will be used to determine measures for health and well-being. The capability approach is currently being used in ICT for development (ICT4D) studies to measure the effect of ICT on developing countries and in particular poor populations. However, there is limited research performed that uses the capability approach to measure the effect a platform for well-being has on the capabilities of its end-users. Moreover, while this study focuses on a socially weak group in society, it cannot be said that elderly people are necessarily poor. Thereby, they are not situated in a developing country. In particular, this study aims to provide a link between features of a platform for health and well-being and they capabilities it affects. Additionally, insights are gained with regard to the use of the capability approach in a developed country.

Thereby, social innovation is gaining popularity amongst scholar. However, research mainly focuses on organizations or social systems as a whole. A knowledge gap is present in research regarding the role of platforms in facilitating social innovation. This research will in particularly be interested in how a platform for health and well-being can trigger its users to participate in social innovation.

1.6 Research approach

The research approach is designed in line with the research objective. In order to determine a cause-and-effect relationship between a platform for health and well-being and the effect it has on the capabilities of elderly, this study suggests an experimental design (Sekaran, 2006). Through an experiment, empirical data is collected to determine the effect between a platform for health and well-being and the capabilities of elderly.

Participants of the study are randomly allocated to either one of the two experimental groups. Accordingly, each experimental group receives a treatment in order to determine the effect of a platform on the capabilities of elderly. The data is collected through a questionnaire that the participants have to answer before and after receiving the treatment. The experimental setup ensures internal validity moreover; the effect of disturbing factors is reduced. After the treatment, participants are requested to participate in a voluntary interview. The goal of the interviews is to gain insight into experiences of the participants that might not be captured in the qualitative questionnaire. Both the qualitative and quantitative results are utilized to determine how the platform developed and studied in this study effects the capabilities of elderly.

Additionally, observations are made by observers that are not part of the current research team. The observations are used to provide contextual backing to the findings. Observers are asked to record behavior and actions that stand out of the ordinary. An observation protocol describes precisely what the observers are to record and how to behave during the experiments.

The capability approach provides a theoretical understanding of what capabilities are and how they can be measured. This will be used as a lens through which the results of the experiment will be analyzed. Additionally, theory on social innovation will be used to explain results concerning social innovation functions on a platform for health and well-being.

Furthermore, an intervention tool is built according to specifications and requirements developed by Wally Keijzer-Broers, Florez-Atehortua, and d Reuver (2016). Section 3.2.2 will provide a detailed overview of the features and requirements that will be used for the development of a platform for health and well-being within this study. Thereby, participants of this study will perform tasks on the platform developed for this study as part of the experimental treatment. Details concerning the specific tasks are detailed in Section 5.4.2. Moreover, the tool resembles a functioning digital platform for health and well-being. It provides the possibility to set up a survey and determine the effect a platform for health and well-being has on the capabilities of elderly.

1.7 Thesis structure

First, literature research is performed in Chapter 2 to understand how social innovation emerges and to attain deep knowledge of the capability approach and how it can be operationalized. Then Chapter 3 describes the research domain to get an understanding of the context in which the research is conducted. Chapter 0 will then proceed to describe the process of developing the IT artefact. The artefact will be used as a treatment tool in the experiment. The research methodology and experimental design will then be described in Chapter 5. Afterwards in Chapter 6, the results of the experiment will be described and discussed. Finally, Chapter 7 will conclude with the conclusions and recommendations of this study. In particular, the main findings will be addressed as well as a discussion concerning the findings. The theoretical implications will be described and the implications for practice. Then recommendations for the problem owner will be stated. The chapter concludes with the limitations of this research and ends with recommendations for further research.

2 Literature Research

Literature research is performed to get a broad understanding of key concepts concerning the capability approach and social innovation. The following combinations of at most three keywords have been used in Google Scholar: 'capability approach', 'capabilities approach', Likert, scale, operationalizing, social innovation, capabilities approach, smart living, smart homes, independent living, digital platform, ICT-platform, health platform, e-health, assisted living. Thereby, forward and backward snowballing is used to collect valuable literature.
Altogether, the chosen keywords encompass the practical and scientific problem.

Further selection criteria for selecting papers are that the paper needs to have at least one of the key words mentioned in the keywords list, title or abstract. And the papers concerning smart living should be written from a socio-technical perspective.

2.1 Social Innovation

This thesis will not explicitly build upon social innovation theory. However, due to the contextual background of the research topic, social innovation is nonetheless interesting to discuss. As it could provide insight into observations made during the that might be observed during the experiment. This section will be structured as follows. First, an introduction into social innovation, which will give an overview of what social innovation is and how it can be defined. Second, different research approaches will be discussed as to explain who actually does social innovation. Third, the social innovation process will be illustrated in order to understand which phases a social innovation typically goes through. Finally, a conclusion will be provided that will summarize this section.

2.1.1 What is social innovation?

Social innovation relates to addressing social needs with innovative activities that are mainly motivated by the goal of solving a social issue (Lettice & Parekh, 2010; Mulgan, 2006; Mulgan et al., 2007). While different researchers propose different definitions, all agree that the innovation should fulfill a social need and also be socially motivated (not profit motivated). Whereas, the main motivation for (for profit) businesses to innovate, is to maximize an organizations profit therefore, these type of businesses are not socially motivated. However, this does not mean that social innovation cannot take place with businesses; business innovations may indeed complement social innovation (Mulgan, 2006). In doing so a chance exists of conflicting interests between business motives and social motives (Dawson & Daniel, 2010). Examples of social innovations can be as small as self-help groups, up to healthcare initiatives to reduce obesity or even micro-credit banking (People can apply for small loans in order to start a business and thus be self-reliant).

Moreover, it is important to realize that even though social innovation aims to solve a social problem, it is even more important to understand the actual social change that the social innovation brings about. However, even though social innovation aims to solve a social problem, it is important to realize that the actual

underlying sought after consequence is the social change that the innovation brings about. This however does not mean that all social change is social innovation. The social changes should be brought by an intended, purposeful, goal-oriented actions that are geared towards establishing social change (Cajaiba-Santana, 2014).

2.1.2 Who does social innovation?

There are two main lenses through which social innovation is researched, in particular to understand how change happens. The first lens looks at how a small number of individuals initiate social change. Usually these people have energetic, impatient and even 'heroic' personalities (Cajaiba-Santana, 2014; Mulgan, 2006). In fact, these individuals drive social innovation, because they can envision solutions to social problems and have strong communication skills in order to explain their complex ideas in a comprehensive manor. Moreover they are able to facilitate social change due to sheer determination, dedication and perseverance (Mulgan, 2006).

The second lens has a totally different view as to explain who actually drives social change. When viewing through this lens, individuals have a far less prominent place in explaining the drivers of social innovation. In fact, individuals are reduced to merely carriers of ideas and not as much the originators of them. For example, when looking at the feminism movement, the social change is mostly contributed to the actions of all individuals and not necessarily contributed to a single individual. The entire movement is thus responsible for the social change and not simply an inspiring individual (Mulgan, 2006).

Both lenses provide insights into social innovation, either by focusing on individuals or an entire movement. Even more so, both ways illustrate how important good ideas and visions are in order to set in motion social change. In fact the idea itself is the most powerful concept for social innovation, surpassing individuals, organizations or institutions altogether (Mulgan, 2006). That said great leadership is in fact necessary in order to kick-start the change process, however this thesis will focus more on technology as an enabler/facilitator of social innovation. Namely, people need to be convinced of a new way and up to some point people might need to change old habits. Accomplishing these tasks thus requires a strong leader to begin with.

2.1.3 The process of social innovation

Social innovation processes spread in a so-called "S-curve", as occurs with (standard) business innovations (Mulgan, 2006). The curve shows the diffusion of a technology offset against the time. By realizing that even social innovation behaves according to an S-curve social entrepreneurs can accordingly adjust their strategy to best fit the phase they are currently in.

As mentioned in 2.1.2, social innovation, or any innovation for that matter has to start with an idea. The idea involves a missing need and thereby should be accompanied with a solution to address the need. For instance, elderly need to organize their own healthcare in order to live at home. Or a need that is conceptually simpler, like addressing hunger. Needs arise in all different areas, for

instance they can arise within individuals, groups, politics or even religion, therefore social innovation can occur within many different places.

A successful strategy to solving a social problem is to look at the individuals that experience the problem themselves and figure out the methods they already use in order to solve their own problem. This can be done under the presumption that people are in fact often capable of solving their own problems (Mulgan, 2006). Another strategy is to look at people that are solving problems even though the odds are not in their favor. Mulgan (2006) gives the example of an 18 year old that is able to find work without qualifications regardless of having a prison sentence behind him. These anomalies can provide insight into solving certain social problems with the added benefit that these bottom-up approaches are often more cost effective than top-down approaches (Mulgan, 2006).

During the first phase of the innovation process, most ideas will be adapted. This trial and error process allows innovators to make adjustments and errors in order to come to the final idea that can be implemented into practice. Notably, these innovations are rarely radical innovations, often these innovations rely on creative combinations of existing technologies or ideas (Mulgan, 2006). For example, combining a platform with healthcare services. Obviously, creativity plays an important role in generating new possibilities, some companies therefore use formal creativity methods in order to generate new ideas and identify new patterns that can be used to creatively address a problem (Mulgan, 2006).

The second phase requires testing the idea in practice, which is the same for any innovation process. Therefore, quickly developing a prototype is of utmost importance to gather feedback. By quickly developing a prototype there is now room to learn from it in practice. This feedback loop ensures that less time and money is wasted on developing ideas that are not beneficial and thus ensuring that the end product/service aligns more with the end-users' needs.

The prototype phase then has to end and hopefully the product or services can cross over into the mainstream. This figuratively crossing is also called the "chasm" in business marketing (Mulgan, 2006). The chasm is a place where many products or services die and not reach maturity. There are ways to speed up this period, however it is not possible to totally avoid crossing the chasm. And even with the growing assistance of governmental assistance or incubators, there is no guarantee that all ideas become a success.

The third stage of the process occurs as soon as the idea has crossed the chasm and now needs to be scaled up and diffused throughout the market. Successfully scaling the innovation requires strategic thinking and support from other organization, that have distributive networks in order to quickly capture mass markets. Social innovations need to organize the organization in such a way that it can actually facilitate growth. Unfortunately many social innovations are not capable of doing so, and thus the innovation fails to reach mass markets (Mulgan, 2006).

2.1.4 Conclusion

Social innovation is defined as, innovation with the purpose of addressing social needs through innovative activities that are mainly motivated by the goal of solving a social issue. In short, the innovation should address a social need and the and should be socially motivated (not profit motivated).

The literature shows two lenses through which social innovation can be researched. The first lens focusses on individuals as drivers of change. These 'heroic' individuals are capable of facilitation social change due to their communication skills and strong leadership. The other lens dismisses the idea that individuals are the key drivers of change. Their claim is that social innovation is realized through the combined effort of individuals. The movement as a whole is thus responsible for driving social change.

Three main phases are identified for social innovation. The phases encompass the idea generation, prototyping and scaling and diffusion processes. Many social innovations are not capable of ultimately reaching a mass market and successfully diffusing the innovation.

The research project can be classified as a social innovation, since it aims to address a social need. Therefore, observations made during the experiment could be explained due to the social innovation context. However, this thesis will not explicitly build upon social innovation theory.

2.2 The capability approach

This chapter provides an overview of the conceptual foundations of the capability approach. Thereby, it gives insights into the way researchers can partake in the determination and selection of relevant and valuable capabilities. The operationalization of the capability approach will be discussed and lastly, insight will be provided into measuring health and well-being aspects for elderly.

2.2.1 What is the capability approach?

The capability approach is a framework that can be used to evaluate the capabilities of people in terms of their actual ability to achieve several valuable functionings as a part of living their lives (Sen, 1993). The researchers Sen and Nussbaum developed the roots of this approach, however a concise definition is provided by Robeyns (2003a), whom defines the capability approach as *"a broad normative framework for the evaluation of individual well-being and social arrangements, the design of policies and proposals about social change in society."* The approach focuses in general on what people are actually capable of doing with the resources they have at the moment. For instance, one could have a library full of books, however if the person cannot read, they are not capable of actually reading the books. Focusing on capabilities as a measurement tool, makes it is possible to attain useful information about a person's well-being.

The capability approach makes a large distinction between the means and ends of well-being and development. Namely, the means are merely seen as instrumental (a tool) to achieve an intrinsic (elemental) end. In this explanation the ends are of more importance than the means in achieving the goals. It is therefore important

to understand how something is valued, either instrumentally or intrinsically, in order to determine the level of importance (Robeyns, 2003a). The discussion of well-being and development is concerned with people's capability to function. Hereby, functioning is related to the ability of people to do what they want to do or achieve. Moreover, as soon as a person is able to achieve these 'functionings' their life becomes valuable (Robeyns, 2003a).

Notably the capability approach cannot be considered to be a theory however, it is considered to be broader like a paradigm. In fact, it is a general framework of thought, through which an individuals' well-being can be measured with. The concepts related to the capability approach will be explained in more detail in the following sections of this chapter.

2.2.2 Functionings and Capability

The core concepts of the capability approach are related to functionings and capability. Both concepts provide a perspective to assess a person's well-being and freedom to seek well-being. Sen (1995) describes that the well-being of somebody can be viewed as the quality or 'wellness' of that person's being. He proceeds by explaining that living can be seen as a set of interrelated 'functionings', which consists of a person's beings and doings. Robeyns (2003a) explains that functionings can be seen as different states of being and activities one can engage in when leading their lives. Whereas capability consists of various combinations of functionings that a person can achieve, and in particular from which a person can choose one collection (Nussbaum & Sen, 1993). Capability is thus defined by Sen (1992) as "a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another". The functionings and capabilities together reflect the freedom a person has to lead his life in a particular way. Moreover, they represent the opportunities one has to determine how they live their own life (Robeyns, 2003a; Sen, 1992). Hence, the approach views living as a combination of several 'doings and beings', for which an individual's quality of life can be determined by the capability to achieve valuable functionings (Nussbaum & Sen, 1993).

Functionings can be both very basic and very complex. Basic functionings are for example, being healthy, being well-fed, etc. These basic functionings can in turn be highly valued by individuals from different backgrounds. Thereby more complex functionings such as, achieving self-respect, or being socially integrated can also still be highly valued by individuals (Nussbaum & Sen, 1993). However, the way each individuals weights these functionings can be substantially different from each other. Therefore, assessments of functionings must be conscious of these variations (Nussbaum & Sen, 1993).

The amount of functionings and corresponding capabilities needed to perform an analysis, depends for a great deal on the context. For example, when investigating poverty in developing countries, a short list of basic functionings and capabilities (e.g. the ability to be well fed and well sheltered, the capability of escaping avoidable morbidity and dying too soon, etc.) could be sufficient. While the list may have to be longer for other contexts that include more general problems of economic development (Nussbaum & Sen, 1993).

During the delineation of relevant functionings, researchers need to make elemental choices with regard to selecting and defining functionings. For instance, some functionings are not that interesting to people, like using a specific toothpaste, since it is similar to different toothpastes. Altogether, when selecting functionings the focus must be on the underlying concerns and values, in determining whether they are valuable or trivial and thus insignificant (Nussbaum & Sen, 1993).

Furthermore, the capability approach makes a distinction between commodities (e.g. goods and services) and functionings. People might be interested in commodities due to their characteristics as a whole and not necessarily in the individual components. For example, one could be interested in a bicycle, because it is a mode of transport (quicker than walking), while you would be less interested in the object simply because it is made of a certain material and color (Robeyns, 2003a).

2.2.3 Well-being and Agency

Sen (1993) shows two core differences to be made when evaluating a person's human advantage. From these two distinctions, there are four classifications to be made for evaluation purposes. The first core difference is, the promotion of a person's *well-being* and second, the person's overall *agency* goals. Agency goals are all the goals an agent (person) has set out to achieve in order to increase their own well-being. Further distinctions are to be made between *achievement* and the *freedom to achieve* and between *well-being freedom* and *agency freedom*.

The well-being of a person can be seen in terms of the quality (the 'well-ness', as it were) of the person's being. Living may be seen as consisting of a set of interrelated 'functionings', consisting of beings and doings. A person's achievement in this respect can be seen as the vector their functionings (Nussbaum & Sen, 1993).

2.2.4 Capability and Freedom

The capability set of a person depicts the amount of freedom somebody has to lead different types of lives and thus be the person they want to be (Nussbaum & Sen, 1993; Robeyns, 2003a). Ultimately the capability of a person depends on various personal and social conversion factors, which will be explained more thoroughly in section 2.2.5. Thus, the total individual freedom of a person does not solely rely on their own personal living capabilities but must also extend to other goals that are not necessarily related to their own life (Nussbaum & Sen, 1993).

Altogether the concept freedom remains a difficult concept to define, this is mainly due to the ambiguities embedded in the concept (Nussbaum & Sen, 1993). For example, people could have a capability set that enables them to live a certain life. However, if one does not have the fortitude to make certain choices in order to accomplish that life, do they still in fact have the freedom to do so? Nussbaum and Sen (1993) explain that the ambiguity is central to freedom and thus one must try to capture the ambiguity rather than hide or try to remove it.

2.2.5 Conversion factors

Another important element in the capability approach is the term conversion factor. Commodities and functions in relation to each other allow people to achieve certain beings and doings. This relation between the two is called the conversion factor. There are three conversion factors. First, *personal characteristics* related to the individual (e.g. sex, intelligence, physical condition, age). These characteristics are important since they show whether or not a person can 'convert' a commodity into a functioning. Second, *social characteristics* (e.g. public policies, social norms, gender roles) and lastly *economic characteristics* also play a role in converting characteristics of the commodity into a functioning. For example if a society does not allow women to vote or a society does not have access to drinking water, it makes it difficult, or even impossible to utilize a functioning (Robeyns, 2003a).

2.2.6 Means and Ends

In the capability approach there is a large difference between means and ends of well-being and development. In fact, only the ends are of importance, while the means are simply instrumental to achieving the ends (Alkire, 2005). However, in practice the difference is not always as clear, since certain ends could simultaneously be means to achieve a different end. Although, one should focus on the ends and not the means when applying the capability approach. Furthermore, the ends are conceptualized in a person's functionings (Robeyns, 2005a).

2.2.7 Selecting capabilities

Sen intentionally developed the capability approach to be underspecified. By doing so, room is left for researchers to make their own choices to determine which capabilities are valuable. Nussbaum (2003) on the other hand does not entirely agree with the lack of a predefined list of capabilities and thus developed a list of ten central human capabilities as is shown in Table 15. Additionally Table 15, which can be found in Appendix provides a description of the capability meanings. While the list is still open ended it can still be used as requirements of a life with dignity. Thereby the list should be important to every person, and should treat everybody as an end. Notably one cannot be a means to the end of somebody else (Nussbaum, 2003). Thereby Anand et al. (2009) developed statistical indicators based on the ten central human capabilities. Moreover, the questions they developed can be used by researchers in surveys in order to collect data.

Table 1- The Central Human Capabilities (Nussbaum, 2003)

Capability
1. Life
2. Bodily health
3. Bodily integrity
4. Senses, imagination, and thought
5. Emotions
6. Practical reason
7. Affiliation
8. Other species
9. Play
10. Control over one's environment

Notably, Sen does not endorse the list developed by Nussbaum, claiming that people should be able to have the freedom to decide by themselves. Even saying that by developing a central list of capabilities would restrain democracy and also reduce freedom, which he holds as an important social good (Nussbaum, 2003). Robeyns (2005a) argues that the main reason for the different standpoints is due to their different theoretical assertions and understanding of the necessity of such a list. Nussbaum's list for instance is prescriptive of nature and can be applied to the world as a whole. Whereas Sen argues that different contexts could require different capability sets, which means that a general overarching list is not possible. That said, Nussbaum's list seems to be a good starting point when considering relevant capabilities in the context of health and well-being. This is illustrated by Grewal et al. (2006), which determined attributes to assess the quality of life of elderly. The research showed five conceptual attributes: attachment, role, enjoyment, security and control. These attributes can to some extent be seen in the more general Nussbaum's list.

Moreover, the capability approach asserts that capabilities and functionings enable the opportunity to make comparisons between individual people. However, the approach does not provide any specification as to which capabilities need to be selected and who should decide upon this, which results in researchers selecting functionings and capabilities in an ad hoc manor (Robeyns, 2005b).

In order to provide some structure in developing a list with functionings and at the same time respecting Sen's views on capabilities, Robeyns (2003b) developed five criteria that should be met, as follows:

First, the criterion of explicit formulation: This simply means that the list should be explicitly discussed and defended. Robeyns (2003b) explains that while this criterion might seem obvious, empirical quantitative research in welfare economics use functionings that are found in datasets without defending a predetermined list. *Second, the criterion of methodological justification:* The method used for developing a list should be scrutinized and the appropriateness should be justified for the specific case. *Third, the criterion of sensitivity to context:* It is important that the capability list uses the same language as the domain in which it operates. *Fourth, the criterion of different levels of generality:* When one wants to develop an empirical application, or the result should be an implementable policy proposal, then the capability list should be determined in at least two stages. During the first stage a list should be composed that is not limited by constraints such as data, measurement design or feasibility issues. This ideal list forms a basis for the second stage. Namely, during the second stage a more pragmatic list is determined, by incorporating all limitations that were omitted during the previous stage. The distinction between both lists is important, foremost because constraints could change over time, for example due to new knowledge or changes in feasibility issues. Moreover, by developing the list in two stages aids in the reduction of socially situated biases brought in by researchers and policy-makers. *Fifth, the criterion of exhaustion and non-reduction:* This last criterion states that the capability list should include all important elements.

Altogether the goal of the given criteria is to prevent researchers or policy-makers to bring in their own biases, which might be caused by their gender, age, academic level, etc. (Robeyns, 2005b).

2.2.8 Conclusion

The capability approach is a framework that enables researchers to assess a person's well-being and freedom to seek well-being. The following two concepts are core to the capability approach. First, *functionings* reflect a person's beings and doing's. Second, *capability* consists of a set of vectors of functionings and ultimately reflect a person's freedom to lead a particular life. Together, functionings and capabilities reflect the amount of freedom one has to live in a particular way.

Sen developed the capability approach to be intentionally underdeveloped. As a consequence, Sen does not provide any list of capabilities or functionings that are of importance, since he states that each context might require a different list. Nussbaum however developed list of ten capabilities (see Table 1) which allow to assess a person's life. Interestingly, Robeyns is a proponent of Sen's philosophy and also does not approve of a general list of capabilities. That said a general list could provide researchers with a reference tool as to start developing their own, more specific, list of capabilities and functionings that are of interest within their scope.

2.3 Operationalizing the capability approach

The previous sections provide an overview of the theoretical concepts belonging to the capability approach. However, this thesis aims to use the capability approach in a practical, experimental setting. Therefore, this section will discuss whether or not the capability approach can be operationalized. Thereby, Comim (2001) defines operationalization as the process of transforming a theory into a form of practical value.

First, there are researchers that believe the capability approach cannot be fully operationalized. They argue that due to the multidimensional, context dependent and normative nature of the capability approach might prevent it from having any practical value (Comim, 2001). For instance, the approach does not take into account how to value different capability sets, which complicates the operationalization. These claims are to some extent acknowledged by advocates of the capability approach acknowledge, however they view the claims as difficulties and challenges that are expected to arise when trying to operationalize the capability approach (Comim, 2001; Sen, 1995).

There are however researchers that do believe that the capability approach can be operationalized. Robeyns (2003a) constructed an overview empirical applications that used the capability approach as a basis. The overview shows several quantitative studies performed, two of which were conducted by Sen himself. Mainly development studies used quantitative applications to study human development. For example, to develop indicators and/or indices that can be utilized to measure different forms of human development. A similar approach is used by these studies, namely that they use a dataset to measure at a functionings level in order to measure either inequality or poverty (Robeyns, 2003a). Other studies did not use an entirely similar approach; they mainly differ in the sense

that they did not simply measure inequality or poverty in a quantitative way. In addition to collection available data and statistics other resources were used in a way to provide more insightful application beyond merely quantitative measurement (Robeyns, 2003a; Sen, 1995).

Interestingly the studies mentioned by Robeyns (2003a) all made use of surveys that were not solely intended for the use of measuring functionings. Therefore, the applications could still be limited by construction biases in the available data (Robeyns, 2003a). In conclusion Robeyns (2003a) states that it is unfounded to determine that the capability approach is not operational. However, a limitation of the existing research is that it is predominantly descriptive in nature. It is therefore still open for debate to determine up to what extent the capability approach can be used to develop more theoretical and formal models that have predictive power. Especially in determining policy changes on the capabilities of people affected by the policy (Robeyns, 2003a).

2.3.1 Measuring health and well-being for elderly

As described in paragraph 2.2.1, the capability approach is originally developed as an alternative to welfare economics. Thereby, paragraph 2.3 showed that the capability approach is in fact operational. Specifically, this thesis aims to use the capability approach in a health and well-being domain and in particular applied to elderly. This section thus intends to provide an oversight of several uses of the capability approach in the health and well-being domain. In particular measurement tools that utilized the capability approach will be considered.

Economic evaluation studies provide instruments to measure the quality of life (QoL), in particular elderly in health and social care domains. In this case these instruments aim to measure the health-related quality of life (HrQoL), which can be seen as a subset of the encompassing QoL. Thereby, in the current context QoL is the same as well-being (Makai, Brouwer, Koopmanschap, Stolk, & Nieboer, 2014). A further distinction is made between standard HrQoL instruments, which tend to measure physical, social and psychological dimensions, and between well-being instruments, which also measure other dimensions such as purpose in life and achievement, security, and freedom (Bulamu, Kaambwa, & Ratcliffe, 2015; Makai et al., 2014). That said well-being instruments tend to have a closer relation to the capability approach than HrQoL tools, since they tend to measure variables that extend the health aspect of elderly.

Makai et al. (2014) identified four instruments that are capable of measuring well-being. However, only the following two well-being measures used the capability approach as an underlying principle therefore, the other two instruments (Ferrans and Powers QLI and the WHO-Qol OLD) will not be discussed.

The first instrument, Adult Social Care Outcomes Toolkit (ASCOT) was initially developed to measure the quality of life within community and social care setting (Bulamu et al., 2015; Malley et al., 2012). The toolkit measures the following eight dimensions: control over daily life, personal cleanliness and comfort, food and drink, accommodation cleanliness and comfort, safety, social participation, occupation, dignity and additionally a question on living situation (Makai et al., 2014; Malley et al., 2012).

The second instrument, ICEpop CAPability index of capability for older people (ICECAP-O) focuses on quality of life in general and thus encompasses health issues and other influences on the quality of life (Coast et al., 2008). Altogether the instrument measures five of the seven most frequently identified dimensions of well-being namely, attachment, security, role, enjoyment and control. Notably, a potential disadvantage of the instrument is that it does not directly measure a physical health dimension (Makai et al., 2014). However, empirical findings suggest that the physical health aspect is indirectly captured by other dimensions (Makai et al., 2014). Therefore, health is indeed part of the measure even though it is not measured directly.

Both instruments share quite similar limitations. First, they both (possibly) measure health aspects indirectly and second, further research is needed to extend their validation, specifically they lack explicit assessments of their reliability and sensitivity to change (Makai et al., 2014). However, the ICECAP-O instrument has been more widely validated than ASCOT. It has also been more widely applied, for instance in different contexts as well as cultures such as the UK, Australia, The Netherlands and Canada.

2.3.2 Conclusion

Economic evaluation studies provide instruments that enable researchers to measure the quality of life. In particular instruments that have drawn from the capability approach to design their measures are of interest for this thesis. Two instruments are identified namely, ASCOT and ICECAP-O. Altogether they share quite similar limitations. While both do not explicitly measure health, research suggest that the health component is captured indirectly by the other variables. Moreover, both instruments need to extend their validation research.

3 Research Domain

This chapter will provide an overview of the research domain in which this study sits. A brief introduction into smart living domain provides context towards developments in smart living and service platforms. Then in particular the Living Lab research project is described, as this study builds upon research that is part of this project. The organizational setting of the research projects is described as well as stakeholders involved in developing a platform for health and well-being in The Netherlands. The chapter ends with specific details concerning specific features that are required on a platform for health and well-being. The description of these features will drive the implementation of a platform for health and well-being within this study.

3.1 Smart Living domain

Different terms are given by researchers to describe advanced automated devices (Nikayin, 2014). Amongst these terms are, 'integrated home', 'connected home' and 'networked home', thereby all these terms generally mean the same thing. Since these terms do not provide a precise definition to what they actually are, the term 'smart living' is proposed to provide a specific definition to this domain.

3.1.1 What is Smart Living?

Before discussing the definition of smart living, first a description of 'smart homes' is given since smart living is derived from it. A smart home is defined by Aldrich (2003) as a household that is equipped with Information Technology and computing resources, which allows the household to predict and respond to the needs of its inhabitants. In doing so it should provide comfort, convenience, security and entertainment with the help of technology inside the home and through connections with e.g. the Internet.

The definition given by Nikayin (2014) is quite similar as that of smart homes. Nikayin (2014) defines 'Smart Living' as "a bundle of ICT-enabled services offered to households, accessible within and outside the house that combine value drivers of energy, health, surveillance and entertainment services to facilitate comfort living for households". The main difference between both definitions is the notion that the technology is not merely connected the home itself, but provides value to its users even outside their household walls.

Important for smart living domain is to realize that it spans several different domains, thus making research interdisciplinary. Moreover, it focuses on services that enable comfortable living in their own homes. Notably these services should also be accessible from beyond the household, expanding the value of services to anywhere in the world.

3.1.2 Smart living service platforms

Smart living services are similarly delivered through systems or architectures to households, thus being a specific smart living service platform (Nikayin, 2014).

Each industry sector has different service platforms that touch upon the categories for which smart living services provide value.

3.2 The Living Lab research project

The Living Lab research is focused on products and services with regards to living healthcare and well-being and with getting in touch with the direct environment of the user (W.J.W Keijzer-Broers, 2015). In particular the focus is on developing an online platform that can enable people in need of health care to receive adequate care at home and in turn reduce the load on municipalities in facilitating healthcare at home (W.J.W. Keijzer-Broers, De Reuver, & Guldemond, 2014). In order to ensure that the research project does not halt due to commercial interests the project is placed within a non-profit foundation.

The main goal of the project is to develop a multi-sided platform for health and well-being, that enables elderly to age comfortably in their own homes. The platform itself should provide users with features that enable them to organize their own healthcare. And provide them with a reliable matchmaking service between product and service providers. Whilst the platform itself is to be a result of social innovation, the platform also aims to enable social innovation amongst its users.

The project has completed the first design phase and as a result a clickable model is developed. During the design phase all the relevant stakeholders are analyzed and requirements have been elicited for the end-users. The next phase is to actually build the user interface for the end-users in order to further test the functionalities and evaluate how much the platform will increase health and well-being capabilities of people that are being taken care of at home. While the research is mainly focused in the municipality of Rotterdam within the Living Lab project, the research should provide insights on how to develop such a platform so that it is not only relevant for the municipality of Rotterdam, but so that other municipalities within can benefit from its findings.

Altogether municipalities need to rethink the way they provide care to their inhabitants in order to inhibit the ability to be taken care of at home due to budget cuts from the State. The municipality of Rotterdam has responded by cooperating with the Living Lab research so that an organizational framework could be set up in which developing such a health and well-being platform would be possible. The multi-sided nature of the platform shows that there are at least three stakeholders that also can be considered the main problem owners, as follows. In particular, the following problem owners have been identified, the municipality of Rotterdam, the foundation Zo-Dichtbij and the elderly that will receive care through the platform and thus be able to live at home for a longer period of time. Even though the research is based in Rotterdam, other municipalities face the same problems and thus could benefit from the conducted research.

Moreover, the development of the health and well-being platform Zo-Dichtbij offers a unique research opportunity to researching the effects of social innovation

through a digital platform. Thereby, the Living Lab provides access to the relevant end-users that are required to participate in the study.

3.2.1 Stakeholders

Many different stakeholders are required in the process of developing a multi-sided platform for health and well-being. Therefore, the Zo-Dichtbij platform in particular relies on different types stakeholders to become successful.

In particular, two general types of stakeholders can be identified. First, organizational & development stakeholders. These are stakeholders such as municipalities, possible enablers like ICTU and IBM and financiers, these can be private or public funds. Secondly, content generators are required to keep the platform up to date with the most relevant and recent information. Here the municipality also has a role. End-users themselves are important stakeholders to ensure the success of a platform. Other local and national platforms can be used to gather input. As well as other organizations that provide healthcare and well-being services or products.

Altogether the platform sits within a complex web of different stakeholders. Thereby, managing all the stakeholders is of great importance in ensuring the development of a successful platform. However, the management of stakeholders is not within the scope of this thesis.

The purpose of the platform for health and well-being that is being developed in the Living Lab project by Zo-Dichtbij is to enhance the capabilities of elderly to live at home for a longer time. The platform provides features that can be used by elderly themselves and (voluntary) caretakers. Since the objective of this study is to determine the effect a platform for health and well-being has on the capabilities of elderly, this study will focus mainly on the end-users, elderly and/or voluntary caretakers.

3.2.2 Features for a platform for health and well-being

W Keijzer-Broers, Atehortua, and De Reuver (2015) determined five main features for a platform for health and well-being. Additionally, a survey is conducted with a panel of 400 voluntary caretakers from the Tympaan institute in order to validate the determined requirements for a platform for well-being amongst its end-users (Wally Keijzer-Broers et al., 2016).

The following features are the result of 2 focus groups and 70 interviews. Main feature 1) matchmaking between providers of smart living products and services and end-users, 2) finding local activities, 3) connecting with others (e.g., family, caretakers), 4) information about aging-in-place and, 5) integration of successful, existing platforms in the health and wellbeing domain (W Keijzer-Broers et al., 2015). This study will design and develop a demonstration platform for health and well-being that can be used in the experimental design, based upon these main features.

The main features are a combination of retrieving static information and dynamic interaction such as communicating with other end-users and reviewing products and services for health and well-being. Hence, besides the information exchange

functionality, the platform developed for this study needs to capture the dynamic nature of the platform. From these main features, specific application features are determined alongside the development of the user interface (UI) and other styling decisions. Chapter 4 will build upon the features mentioned previously and provide an overview of the development of a platform for health and well-being that is developed and evaluated in this study.

4 Developing the IT Artefact

This chapter will provide an overview of the actual development of the platform studied in this research. First, Section 4.1.1 will provide insight in the specific application features that are implemented in the platform developed in this study. Then the application architecture will be described in Section 4.1.2, as it contains key features that enable for instance the development of a chat bot. The software stack will then be described in Section 4.1.3 and details regarding the implementation of specific features will be provided in Section 4.1.4 accompanied with screenshots of the platform used in this study. Then Section 4.2 ends with a detailed description of the development of the chat bot used in this study. In particular theory with regards to a natural language conversation is provided in Section 4.2.1 and the chapter ends in Section 0 with details regarding the implementation of the actual chat bot called Ann.

4.1 Developing the platform demo

As explained in Section 3.2.2, the development of the platform for health and well-being in this study builds upon previous research conducted within the Living Lab research project. Main features are extracted from previous studies as well as specific application features, as will be described in Section 4.1.1. Use-cases, mockups and other styling decisions made in previous studies guide implementation decisions.

Moreover, the main goal of the IT artefact developed in this study is that it can be used to demonstrate to users how a platform for health and well-being can be used in a real life situation. Due to time constraints not all features can be fully developed, in particular feature 5) integration of successful, existing platforms in the health and wellbeing domain, is considered out of scope for this study. However, by pre-loading demo data into the application the appearance of a fully working platform can be sustained.

The application is built on top of the cloud platform IBM Bluemix. The cloud platform provides modules that enable developers to quickly develop and deploy applications to a production environment (IBM, 2016b). The choice for IBM is mainly driven by the Watson services, that they provide. Watson is the name given in the past to a supercomputer developed by IBM which is capable of understanding natural language questions and returning correct answers. Today IBM uses the name Watson to encompass a collection of web services that aim to provide cognitive computation to their clients (IBM, 2016d). Amongst the services in particular, a dialog service and a natural language classifier service are of interest for the project. The dialog service can be used to develop a chat bot, through which users can interact with. Both services will be described in more detail in section 4.2.

Thereby, IBM provides sample applications in order to demonstrate the functionality of their services. In order to speed up the development time, the

dialog service sample application is used as a basis for the demo application. This in turn determines a majority of the software stack for the project.

4.1.1 Main application features

In Section 3.2.2 five main features are presented that should be implemented on a platform for health and well-being. This study will implement the first four features namely, 1) matchmaking between providers of smart living products and services and end-users, 2) finding local activities, 3) connecting with others (e.g., family, caretakers), and 4) information about aging-in-place. The fifth feature, 5) integration of successful, existing platforms in the health and wellbeing, will not be included due to time constraints and the implementation effort falls beyond the scope of this study.

From the given main features, Wally Keijzer-Broers et al. (2016) determined specifically five key elements that a care plan for a platform for health and well-being should contain. Consequently, the following application features are derived from the main application features. First, a left-sided menu with all main features on the platform. Second, the agenda; this contains all assigned tasks and planned activities for the 'patient'. Third, the diary; caretakers of the patient can keep record of observations and experiences. Fourth, insurance and medical information. Lastly, a matchmaking service, which allows users to find products and services nearby accompanied with reviews. Figure 1 shows a mockup of a care plan for the platform. Most important features or at least the main references to those features are seen in Figure 1.

Figure 1 - Mockup of a care plan on "Zo-Dichtbij" for the Dutch market (Wally Keijzer-Broers et al., 2016)

The mockup in Figure 1 also provides the guidelines for the visuals. The color scheme is extracted from the mockup as well as other view design elements. This

mockup in combination with other predefined mockups serve as a basis for the implementation of the demo application.

4.1.2 Application architecture

The demo application is designed as a three-tiered architecture. Figure 2 shows a graphical representation of the application architecture. The tiers are basically layers of the system that could be run on different systems. The three different tiers will be explained accordingly. First, Tier 1 represents the user interface tier. This tier is responsible for all user interaction from the web interface. Second, tier 2 is the actual application tier where all business logic is present. Third, the services tier is responsible for handling the applications calls to the Dialog service on Bluemix. While each tier should be able to run on different systems, in this case both tier 1 and tier 2 are run on the same server. However, one could imagine a mobile interface in tier 1 is run on a users' phone and still makes use of the same web-application to retrieve data.

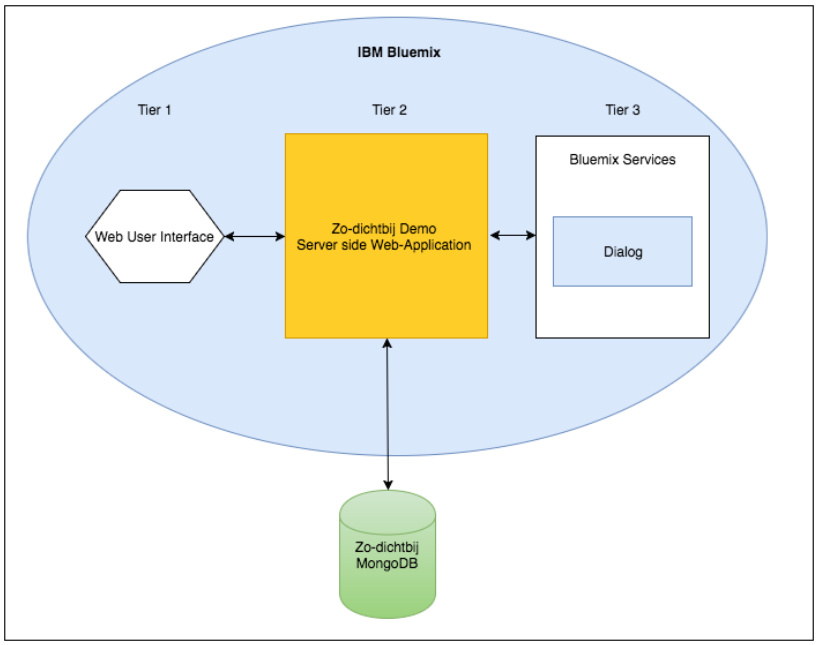

Figure 2- Three-tiered application architecture Zo-Dichtbij demo

4.1.3 Software stack

This section will provide an overview of the software stack used in the demo application and the design choices that were made in the process.

The following software choices are determined by the dialog sample application provided by IBM. The demo web application is built using JavaScript on top of the Node.js runtime. The web framework of choice is Express, which is a minimalistic framework built for Node.js. Both Node.js and Express are open source projects and purposely built for the web, which make them an excellent choice to develop a web application. The dialog service is used to properly respond to Q&A inputs from users.

Additionally, the web application should be able to persist data, which requires a database. Mongo DB, a non-relational and document-based database is selected

for the persistence of data. Persisting data with Mongo DB is 'easier' in comparison to a relational database like MySQL, simply because there are less restrictions to adding data into the database. Thereby, the format of data can be more quickly adapted without breaking the application. Altogether the flexibility of the database increases development speed and robustness of the application, for this project.

Further important design choices are made for the user interface. In order to quickly create a professional looking website a front-end CSS, HTML and JS framework is used in combination with an open source CSS theme, which was adapted to match the Zo-Dichtbij color scheme. The front-end framework provides modules and styling options to quickly build a 'good looking' website. The view templates are additionally built using a templating system Handlebars, which ensures a proper abstraction between view templates and business logic. The maintainability of views is increased with the use of a templating system.

4.1.4 Implementation of the demo application

In the final implementation users are able to create tasks, activities and diary entries. By storing these user inputs it is possible to review what users have submitted during the experiment. Thereby the user experience increases, since users can browse the website and see their own input set in place. This increases the perception of being on an active platform.

A selection of screenshots will be provided in order to see how the web application looks and feels. Figure 3 shows the final version of the care plan homepage, based on the mockup presented in section 4.1.1.

On this page users are able to add tasks to the planning board and activities to the activity list, as well as adding diary entries. On the left side the distinct green side-bar provides oversight for the users when browsing the platform. In the top-navigation users are able to switch between the care plan and the help chat. Thereby, links to their personal messages and profile are provided.

Adding tasks, activities and diary entries have been fully implemented. Users are actually able to use that functionality. Screenshots of these forms and other webpages can be seen in Appendix B.

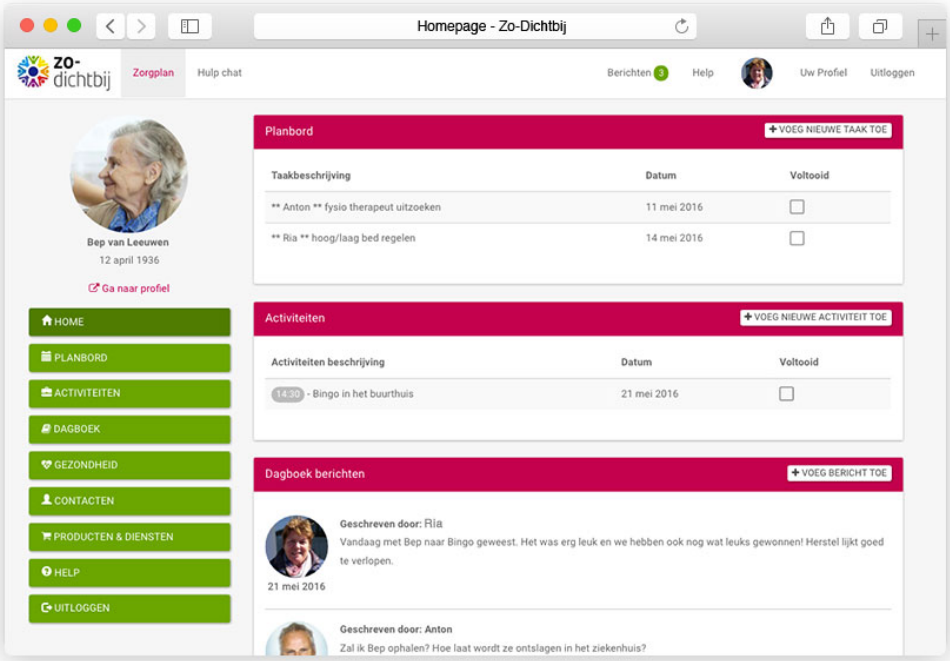

Figure 3 - Demo care plan homepage Zo-Dichtbij

The products and services page as seen in Figure 4 shows an overview of products and services that have been filtered according to the patients' location. In this case products and services are filtered to the region Rotterdam. Users can at a glance see ratings other users have provided for certain services and products. Thereby, users can save items to their favorites list.

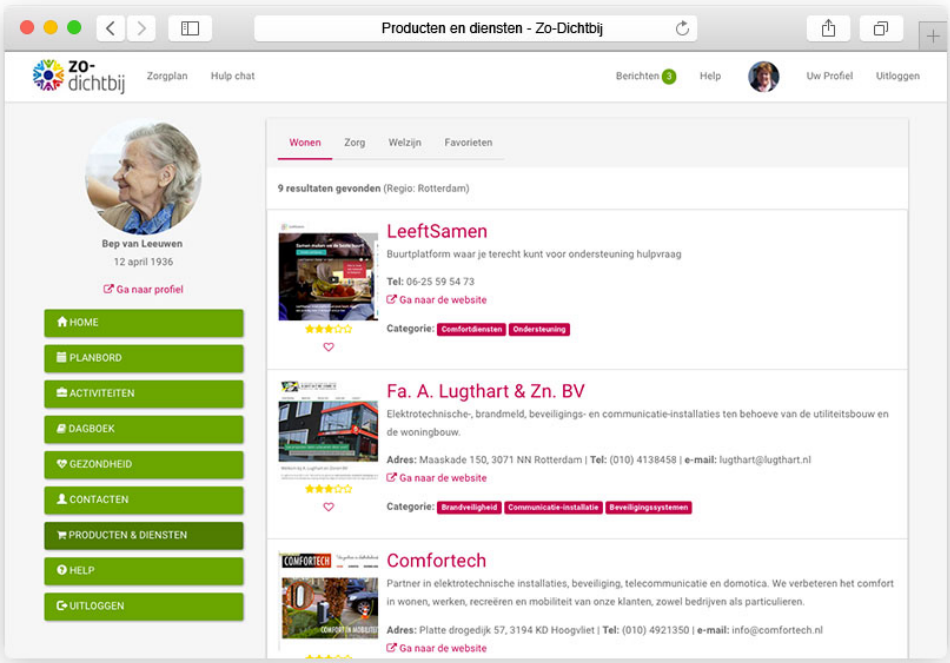

Figure 4 - Products and services page Zo-Dichtbij

4.2 Developing a chat bot

IBM provides a service called Dialog, that provides a platform to manage conversations between users and a digital system. The conversations are referred to by IBM as dialogs, hence the Dialog service (IBM, 2016c).

The service itself is quite basic. Developers are supposed to program an entire conversation in XML[4]. Hereby is meant that not only the systems response has to be programmed, but the developer also has to anticipate which types of input users might put into the system, in order to couple the correct response.

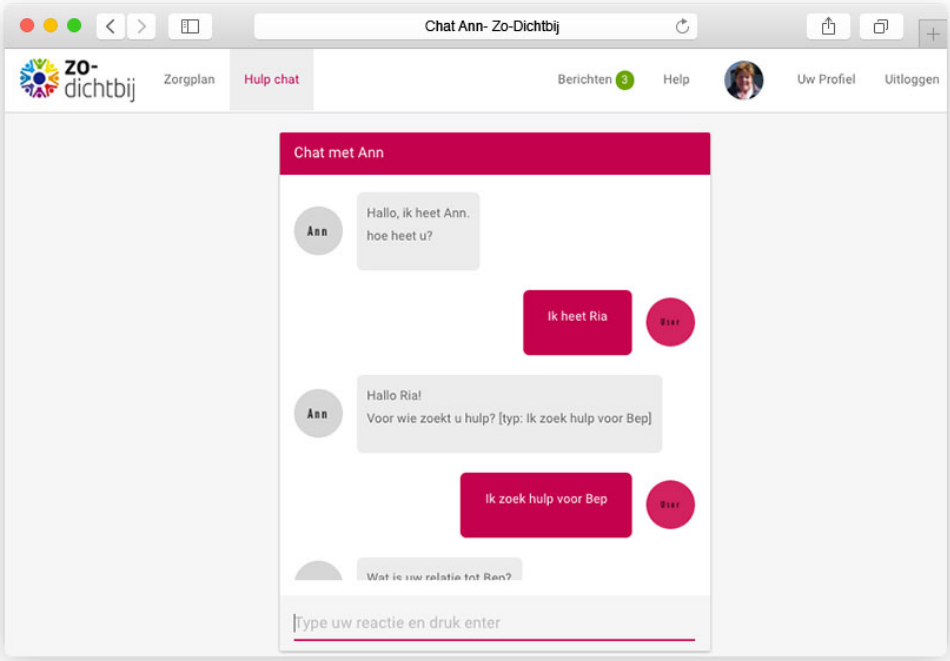

Figure 5 - Chat bot Ann on Zo-Dichtbij

Figure 5 shows a partial conversation of a user with the chat bot called Ann. Users (colored magenta) are able to input reactions at the bottom of the screen. And receive reactions from Ann (colored grey).

Developing dialogs that can answer a wide range of inputs is a laborious process. However, the XML files are arranged according to a natural conversation template in order to enable designers to develop a natural language conversation. Section 4.2.1will provide a more detailed explanation of how such a template is structured.

4.2.1 Designing a natural language conversation

The default XML template provided by IBM is adapted according to general models that are provided in the field of conversation analysis (CA). The models are representative in both casual and professional conversations and hold in multiple languages and cultures. There are three general models namely,

[4] Extensible Markup Language

adjacency pairs, sequence expansion and repair, which will be briefly discussed (IBM, 2016a).

Adjacency pairs are the most common frequent types of conversational sequences. Generally, these can be seen as question-answer pairs. From which the question and answer are not produced by the same agent. The following shows an example of an inquiry-answer pair:

Speaker A: "Hi, how are you?"
Speaker B: "I'm good thank you."

Sequence expansions occur when either of the two speakers in a conversation require extra information before a final answer can be given. For example:
Speaker A: Do you have information about hip fractures?
Speaker B: I have information about hip revalidation, would you like to see that?
Speaker A: Yes
*Speaker B: *Provides information*

Finally, repairs occur when either speaker does not understand a response from the former. In this case, the speaker that does not understand the other will ask for additional explanation or provide additional information to clear up the misunderstanding. For example:

Speaker A: "Hi, what is your name?"
Speaker B: "My name is Kim."
Speaker A: "Hello, Tim, nice to meet you."
Speaker B: "My name is not Tim, it is Kim."
Speaker A: "Excuse me, Hi Kim."

4.2.2 Implementing Ann's conversations

The natural language template provides structures to develop a natural language conversation. However, developing a complex conversation is cumbersome, as every singly expansion or interpretation of a user's needs to be pre-programmed.

The easiest way to developing a chat bot was to start with base adjacency pairs. Users are then able to quickly retrieve answers when they as simple questions. However, this type of interaction with the chat bot is static and quite unnatural. To improve this experience, repair and expansion sequences need to be added.

Repair sequences can be used to allow users to update faulty input. For instance, when a user has entered a wrong name, they have the option to easily adjust it. The conversation can then be improved by predicting certain expansion questions, in order to guide users to the right answers. For example, as soon as a question of a user cannot be understood, the system can guide the user to a response that explains which types of questions can be understood. In doing so, users can get to learn how to interact with the chat bot.

In order to increase the cognitive capabilities of the Dialog service, developers can use the Natural Language Classifier service of IBM. This service provides increased cognitive capabilities and is capable of 'understanding' user input and classifying it to the correct adjacency pairs. Unfortunately, this service is not yet available for the Dutch language and thus could not be used.

5 Research methodology

This research aims to explore which effect, a digital platform for health and well-being that emerged through social innovation, has on the capabilities of elderly people in order to enable them to live longer in their own home. Basically, performing a case study or survey to explore the effect of such a digital platform on the capabilities of elderly is challenging. Mainly due to the limited availability of digital platforms for health and well-being. Thereby, the objective requires a high internal validity in order to explain which effect a digital platform has on the capabilities of elderly. Hence, experimental research is appropriate to achieving the research objective.

Moreover, performing experimental research requires an experimental condition. The health and well-being platform that is being developed in The Living Lab, as discussed in Section 3.2, provides this study with the experimental condition necessary to perform the research. Thereby, Chapter 0 explains in detail the IT artefact that will be used during the treatment. Due to the rich demo application, it is expected that users will be able to experience how the platform will operate when in fact it is fully operational. Therefore, it provides a unique opportunity to perform an experiment with a target user group. And be able to measure the effect of a platform for health and well-being on the capabilities of elderly. The following section will provide a detailed overview of the experimental design.

5.1 Experimental design

Users are randomly assigned to an experimental condition (R) in order to minimize the effect of confounding factors (Sekaran, 2006). The only difference between both groups is the order in which they receive the treatment as is seen in Table 2. The experiment starts with either treatment (X_1) or with treatment (X_2). By doing so order effects are prevented. Thereby, due to the short time between pre-test and treatment there are minimal threats to mortality. Observations in the form of a questionnaire will be made before and after the treatment. The treatment will consist of the tasks as presented in the scenarios in section 5.4.

Table 2- Experimental design setup

Group	Pre-test	Treatment	Post-test	Treatment	Post-test
R_1	O_1	X_1	O_2	X_2	O_3
R_2	O_4	X_2	O_5	X_1	O_6

The experimental setup ensures internal validity thereby; the effect of disturbing factors is reduced. In a repeated measures design order effects could play a role. However, by changing the order of treatment for both experimental groups, this effect should be minimized. That said, learning effects and fatigue effects could play a role, since participants will increasingly become familiar with the platform during the study. However, fatigue effects should be minimal, since the time necessary for the experiment is approximately 2 hours.

A selection bias could occur as participants are selected according to a specific profile. However, by selecting participants with minimal to no knowledge of the previous Living Lab research a selection bias should be minimal amongst participants.

Besides the questionnaires that the participants need to fill out, other (unconcealed) observations will also be made, which will be explained in more detail in Section 5.5.2. Consequently, this means that the experiment will not control measurement effects. Concealed observations would be preferred over unconcealed observations, as it would minimize the effect observations have on the participants during the experiment. However, by reassuring participants that the observations are purely meant for context and not an individual assessment, it is expected that the participants experience minimal influence from the observers. Thereby, observers are not allowed to interact with participants during the experiment. Moreover, the Hawthorne effect could however be an issue amongst participants in the event that they feel a sense of importance in being selected for the experiment (Sekaran, 2006).

5.2 Selection of subjects

The end-user interface of the platform is currently aimed towards two main user groups; elderly that live at home and voluntary caretakers. However, the experiment will require subjects have some affinity with using computers in order to perform a summative evaluation of the platform. Therefore, users will be selected preferably between the ages of 55 and 75 years old and have (or had) a caretaker role of some sort. In doing so the homogeneity of the group can be managed.

Further selection criteria for the sample participating in the experiment is as follows. Different occupations/cognitive level of participants is required. As well as a varied computer skill level. Participants need to be able to have experience using the computer by themselves. While, usability is not the scope of this research, it is relevant to study end-users from a wide spectrum of IT knowledge and cognitive level. As the end-users in practice will also have a varied skill level. Preferably some participants need to have some affinity with the health and well-being domain, such as nurse, hospice, or even from within the municipality. Domain knowledge might provide different insights in comparison with other end-users. Moreover, both male and female participants are preferred to participate in the experiment.

Additionally, it is preferred that participants are of a 'sandwich generation' which means that they take care of children and parents or relatives. This provides participants with the actual situational context and enabling them to more easily place themselves in the provided persona in the study. Additionally, it allows them to reflect on their own life, and envision the situation where their children might at some point have to perform the same care tasks.

At least 30 subjects are required for the experiment in order to perform a t-test. Thereby, more users would in fact increase the internal validity. The amount of subjects is obviously dependent of the amount of volunteers that are able to participate in the experiment.

5.3 The experimental procedure

This section will give insight in the contextual setting as well as provide a general overview of the experimental setup, for the experiment that is held on May 11th 2016. During the day, three time slots are allocated to which participants can apply. The experiments are planned to start respectively at 12:30, 15:00 and 17:00 hours. Each experimental session is expected to take approximately 1,5 to 2 hours to complete. Table 3 provides an overview of the different time slots and the expected amount of subjects during the experiment.

Table 3 - Time schedule Zo-Dichtbij experiment on the 11th of May 2016

Description	**Date**	**Time**	**Subjects**
Experiment #1	11 May 2016	12.30-14.30	6-15 voluntary caretakers
Experiment #2	11 May 2016	15.00-17.00	6-15 voluntary caretakers
Experiment #3	11 May 2016	19.00-21.00	6-15 voluntary caretakers

The setting of the experiment is artificial. A computer room in the faculty of Technology Policy and Management (TPM) at the TU Delft will be arranged. Each subject will be seated behind a desk with a computer that has a connection with the internet. Beforehand subjects will be randomly assigned a participant number. This number will accordingly correspond to a particular computer. The numbers 0 – 20 are assigned to experimental condition R_1 whereas numbers 21-40 are assigned to experimental condition R_2. References to specific participants will be made in this thesis by pre-fixing the participant number with a capital P, so P01 is a reference for participant with number 01.

Each experimental session will be structured the same way. First, subjects will be welcomed with a drink and snack. During the registration subjects will be provided with their participant number. A plenary introduction will follow, which will brief subjects on the procedure of the day. In particular subjects are requested to be critical when filling in the questionnaire. Thereby, they are notified that participants will be observed during the experiment. Details concerning the observations will be provided in Section 5.5.2.

After the introduction the pre-test will be administered. Followed by the first set of scenario tasks, after which a post-test will be conducted. Users will perform two different sets of scenario tasks and thus perform two post-tests. Afterwards, subjects will be asked if they would like to participate in an interview, to run through the experiment and provide some feedback on their experiences. Figure 6 provides a graphical representation of the experimental procedure.

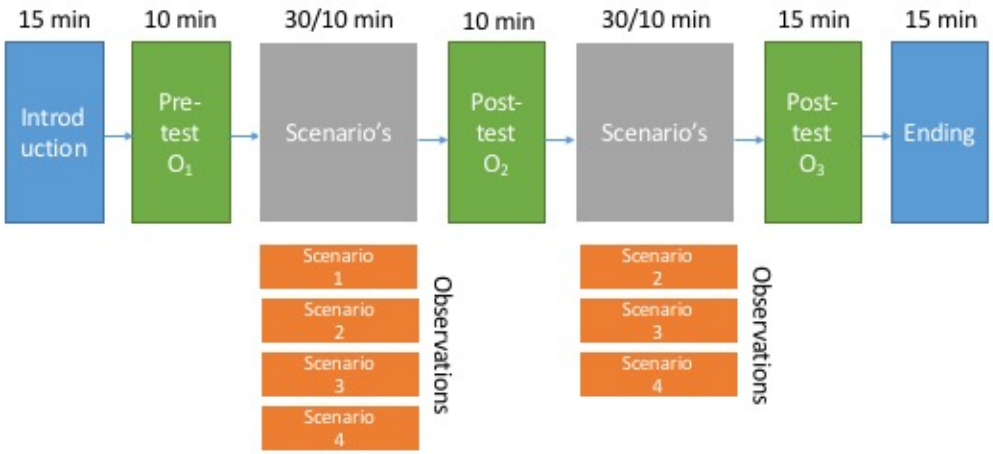

Figure 6 - Experimental procedure for each session

Scenario tasks will be devised with actionable steps, in order to ensure that the subjects experience the platform in a similar manor. Thereby, a task list is provided which the subjects need to accomplish while using the web application. The scenario's will be explained in more detail in section 5.4.

Moreover, the order of performing different scenarios will ultimately determine the different treatments that the groups will undergo. Both groups will perform the same scenarios, however by changing the order of the scenarios we can still speak of a control group and thus use the different results to mitigate treatments effects.

5.4 Experimental treatment

It is important that the treatment for each subject is generally the same in order to ensure a homogenous treatment effect. Therefore, scenarios are developed that allows users to at least experience the most important aspects of the platform in a similar manor. Additionally, each subject will be provided with a persona. The persona will be described in more detail in Section 5.4.1. However, the persona will be leading in the constructed tasks. Additionally, the persona will determine which data will be pre-loaded into the platform used in this study. Each participant is thus presented with exactly the same data to start with.

Wally Keijzer-Broers, Nikayin, and De Reuver (2014) developed several personas of which one will be selected and adapted for the current experiment. The other personas will be used in the platform as characters that are part of the personas life story. Section 5.4.1 will describe the persona used during the experiment. Scenarios are developed according to the use-case presented in Section 5.4.1. Tasks are created in coherence with the use-case, which allows all participants to engage with the platform in a meaningful and homogenous manor.

5.4.1 Persona

Two personas are selected to be leading during the experiment. The first persona is Ria van Marrewijk, users will use the platform as if they are her. Ria is a caring

mother of 55 years' old who lives in Rotterdam. She does not have any time for hobbies, because besides her job she takes care of her family and her parents Bep and Jan van Leeuwen. More details about Ria are provided in Figure 7.

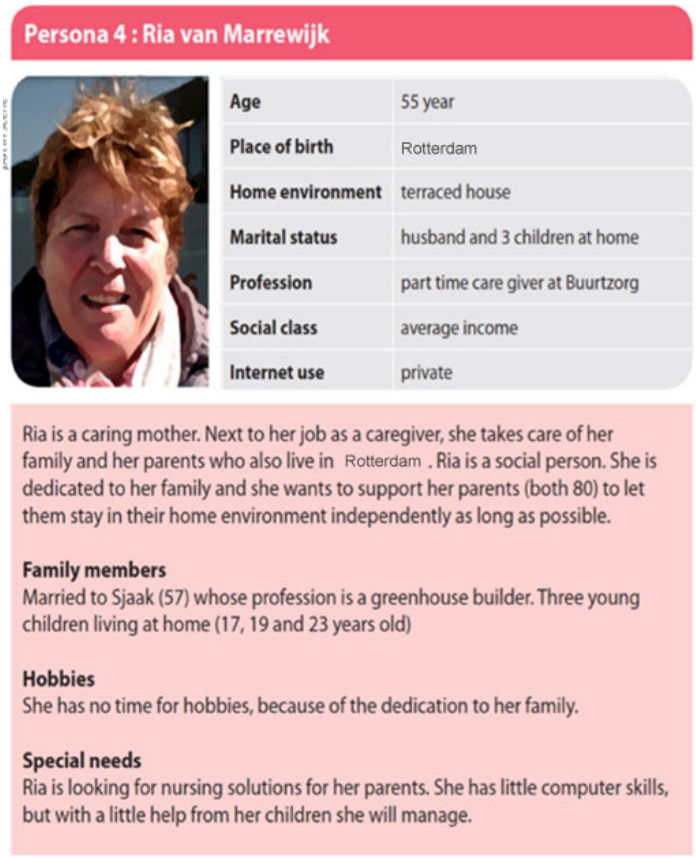

Figure 7 - Persona Ria van Marrewijk

The following situation will be guiding the scenarios presented in section Scenarios; Her mother Bep fell in the bathroom and unfortunately broke her hip in the process. After her operation, the hospital has advised the family to let her revalidate in a nursing home. The family however preferably want her to revalidate at home.

A transfer nurse is aware of the situation and advises the family to use the platform Zo-Dichtbij. At the moment of the experiment, the platform is already being used by the family. Accordingly, subjects are required to step in as Ria and help with organizing health and well-being tasks in order to arrange for Bep to come home.

5.4.2 Scenarios

This section will provide insight into the rationale behind the development of the scenarios used in the experiment of this study. Thereby, the scenarios are developed in accordance with the previously mentioned persona.

The main goal of the scenarios is to guide participants through all of the main features of the platform developed and evaluated in this study. Thereby, the specific tasks are designed to mimic actual tasks caretakers might perform when encountered with a similar situation of having to provide healthcare tasks for an elderly person that has broken their hip and want to recover at home. In

particular, the scenario tasks are clustered around three main tasks a caretaker can perform on the platform studied in this research. Namely, organize practical tasks, organize products or services for health and well-being and find information on the platform.

Additionally, the experiment aims to mimic a platform for health and well-being that is already in full production. Therefore, the platform is pre-filled with other users (such as family members) that already have interacted with the platform. The participant is then asked to perform tasks in succession of pre-defined remarks made by other characters on the platform.

Altogether the scenarios aim to provide a realistic and complete experience of how a platform for health and well-being can be used for an actual situation where an elderly person needs the help of a (voluntary) caretaker.

Two scenarios will be described in further detail to provide an overview of the specific tasks. The complete scenario set is provided in Appendix C. In particular scenarios regarding general platform features and the help chat will be provided. Participants are requested to perform the scenario tasks as provided in Table 4. These tasks allow users to get acquainted with the digital platform and experience the workflow of organizing care tasks. Additionally, each scenario is color coded, in order for observers to see at a glance which scenarios are performed by the participant.

Table 4 - Scenario task list example, organizing practical issues

	Translated (English version)
Scenario 2 – Praktische zaken regelen	Scenario 2 – Organize practical issues
Taak 3: Houdt de naasten op de hoogte van de conditie van Bep via het dagboek.	**Task 3:** Inform the family on the condition of Bep via the diary.
Taak 4: Plan voor vandaag dat Frans boodschappen gaat doen voor Jan (de man van Bep).	**Task 4:** Plan for today that Frans will do grocery shopping for Jan (the husband of Bep).
Taak 5: Ria heeft bericht gekregen van haar neef. Voeg een bezoek toe aan in het planbord van Bep voor komend weekend.	**Task 5:** Ria received a message from her cousin. Add to the plan board that he will visit Bep oncoming weekend.
Taak 6: Zoek de zorgverzekeringspolis van Bep op en noteer hieronder haar polisnummer. Polis nummer |	**Task 6:** Find the insurance policy of Bep and write down her policy number.
Taak 7: Plan voor over twee weken een activiteit, waar zowel Bep als Jan aan kunnen deelnemen.	**Task 7:** In two weeks plan an activity, which both Bep and Jan would like to participate with.

The following Table 5 shows tasks users were supposed to perform whilst using the help chat Ann. Tasks are designed so users are more likely to interact with the chat bot in a way that will provide valuable answers.

Table 5 - Scenario 4C, finding information whilst using the chat bot Ann

Original (Dutch version)	Translated (English version)
Scenario 4C – informatie opzoeken op het Zo-Dichtbij platform	Scenario 4C – Finding information on the Zo-Dichtbij platform
Taak 10: Bep houdt van zwemmen. Gebruik hulpchat Ann. Vind en noteer waar ze kan gaan zwemmen als ze gerevalideerd is. organisatienaam |	**Task 10:** Bep likes to swim. Use help chat Ann. Find and write down where she can go swimming as soon as she is recovered.
Taak 11: Gebruik hulpchat Ann. Zoek achtergrondinformatie over "valpreventie bij ouderen" en noteer de website hieronder. website |	**Task 11:** Use help chat Ann. Vind background information about "fall prevention for elderly" and write down the website.

5.5 Measurement instrument

Ultimately a survey will be conducted amongst both experimental groups containing identical questions in the pre- and post-test questionnaire. Wally Keijzer-Broers et al. (2016) developed and conducted a survey (Tympaan survey) to determine/evaluate requirements for a platform for health and well-being. This study will build upon the survey and extract a selection of relevant questions and use similar scales from the given survey. Additionally, perceived usefulness will be measured by asking subjects to indicate how features of the platform would be considered useful. An adaptation of the questionnaire used by Davis (1989) will be used to measure perceived usefulness. The scales used in this study are adapted to be in line with the scales used in the Tympaan study. Furthermore, the survey will be administered in Dutch. Results and examples will however be translated to English.

5.5.1 Questionnaire

The questionnaire is built up out of three parts. Respectively, the pre-test O_1, post-test O_2 and post-test O_3. Each part has a set of identical questions, which will be used to measure the treatment effect during the experiment. Additionally, the pre-test O_1 will contain demographics questions and the post-test O_3 will contain general questions about the experiment.

Subjects are provided with a hard-copy of the questionnaire instead of a digital copy. Participants can thus solely use the computer screens to experience the platform. There might be a chance that participants, due to their limited computer skills, might get confused with switching between platform and questionnaire screens.

The entire questionnaire will be provided in Appendix C. However, in particular the repeated measures will be discussed in more detail. The repeated measures are divided into four different sections. Capabilities, Perceived Usefulness and Social innovation. With the capabilities measures we can determine how participants perceive the effect a platform for health and well-being has on the capabilities of elderly. The perceived usefulness measures can be used as a predictor of user acceptance of digital platforms for health and well-being (Davis, 1989).

Measuring Capabilities

The features provided by a platform for health and well-being determine which capabilities are to be measured. Thereby, the features of the platform can be split into two main categories. First, features that assist in organizing healthcare and secondly, providing information about healthcare, municipality procedures and products and services regarding healthcare.

The focus of the measures differs slightly between users that are voluntary caretakers and the elderly person that is being taken care of. Obviously the features are not mutually exclusive, meaning elderly can use all of the features of a digital platform to take care of themselves.

Measures are on the one hand split between functionings to help voluntary caretakers, or elderly themselves in organizing health and well-being tasks. And on the other hand functionings that enable more central human capabilities as

mentioned by Nussbaum (Nussbaum, 2003). When considering the central human capabilities list provided by Nussbaum (2003), it can be said that the platform has a focus on three main capabilities namely, Affiliation, Play and Control. However, in this case the definition of control is more similar to that used in the ICECAP-O index, which is aimed to measure independence (Makai et al., 2014).

In short, the platform aims to enable elderly to live with and towards others in the comfort of their own homes, allowing them to have social interactions. Which is the affiliation capability. Through the platform, elderly is able to find fun and social activities nearby which allows them which is the play capability. Lastly, the platform enables users to be able to find proper products and services that can assist in being independent, which is the control capability.

Question 15 shows the individual functionings that will be measured. Additionally, six variables are highlighted that represent the actual ends, which the platform aims to achieve. The non-highlighted variables are to be considered means in order to reach the given ends. However, according to the capability approach the focus of an intervention should be mostly on the ends.

Question 15 - I expect a digital platform to help, me or the person I'm taking care of to…

	Totally not help			**Neutral**			**Absolutely help**
Be socially concerned	○	○	○	○	○	○	○
Add extra comfort at home	○	○	○	○	○	○	○
To have interaction with others	○	○	○	○	○	○	○
Unburden myself or others	○	○	○	○	○	○	○
Arrange daily schedule	○	○	○	○	○	○	○
Find information about health and well-being	○	○	○	○	○	○	○
Filter local demand and supply	○	○	○	○	○	○	○
Help others in an easy way	○	○	○	○	○	○	○
Share a care plan with others	○	○	○	○	○	○	○
Live in a comfortable way	○	○	○	○	○	○	○
Avoid moving to another place	○	○	○	○	○	○	○
Age in place	○	○	○	○	○	○	○
Stay independent as long as possible	○	○	○	○	○	○	○
Monitor my relatives	○	○	○	○	○	○	○
Be totally independent as much as possible	○	○	○	○	○	○	○

The rationale behind question 15 is to measure how elderly voluntary caretakers expect a platform for health and well-being to help themselves or the people they care for, to enable them to age in their own household. The rationale behind the highlighted variables will be discussed in further detail.

The rationale behind 'To have interaction with others' is to measure, up to what extent a platform for health and well-being can help in facilitating interaction with other people. Being able to affiliate with others is considered by Nussbaum as one of the main 10 human capabilities. Additionally, this end can have implications for the capability of play, as interaction allows for the possibility to arrange playful activities with others.

'Avoid moving to another place' and 'Age in place' are variables that measure the main goal of the platform. Namely, enabling elderly to live at home for as long as

possible. In a way it can be argued that the goal is to enhance the capability of control.

Lastly, 'stay independent as long as possible' and 'be totally independent as much as possible' are variables that aim to measure the effect a platform for health and well-being has on the control of independence for elderly. Altogether these measures aim to measure the effect a platform for health and well-being has on the capability for elderly age in their own household.

Perceived usefulness

In order for meaningful changes to occur in real-life the platform should obviously be taken into use. While this study does not build theoretically on perceived usefulness theory, it can be a helpful measure within this study. Simply measuring the effect, the platform has on capabilities is not enough to predict whether end-users will use the platform in real life. The capability approach does not provide insight as how this can be measured, therefore perceived usefulness will also be measured.

The perceived usefulness is according to Davis (1989) strongly related to the usage of an IT system. There are two statements that explain this relationship. First, simply because users are more likely to adopt an application because of the useful functions it performs. Second, how difficult it is for a user to perform the functions. The latter is however merely a hindrance to users for adopting a system. Namely, in general users are more likely to put up with a difficult system if it provides essential functions. Obviously there are limits to this assertion, an application that is perceived to be too difficult will not be useful and thus not adopted by users (Davis, 1989). The following questions measures five different aspects of usefulness.

Question 16a - If my help is required by another, then I believe a digital platform for health and well-being will help me to…

	Totally not help			**Neutral**			**Absolutely help**
Accomplish my tasks more quickly	○	○	○	○	○	○	○
Increase my productivity	○	○	○	○	○	○	○
Take better care of the person I care for	○	○	○	○	○	○	○
Make my job as a voluntary caretaker easier	○	○	○	○	○	○	○
Be useful during my job	○	○	○	○	○	○	○

Social innovation
The platform itself is a product of social innovation. Additionally, the platform could be used in order to facilitate social innovation within its users and amongst local communities in general. For instance, with the platform users might be more easily triggered to partake in local voluntary caretaking tasks. The following questions aim to measure the willingness of users to be part of a social innovation. The rationale behind *Question 16b* is that social innovation is stimulated on a platform for health and well-being when users are willing to provide voluntary care to people beyond their friends and relatives. The measures aim to determine up to what extent users are willing to provide healthcare for others in the neighborhood, in order to at least keep the distance locally.

Question 16b - If my help is required by another, then I believe a digital platform for health and well-being will help me to…

	Totally not help			**Neutral**		**Absolutely help**	
Easier to provide care for another	○	○	○	○	○	○	○
Be more concerned with providing care to others	○	○	○	○	○	○	○
Assist in care tasks of strangers	○	○	○	○	○	○	○
Be more concerned with help questions from the neighborhood	○	○	○	○	○	○	○
Enlist myself as a volunteer to assist with care in the neighborhood	○	○	○	○	○	○	○

5.5.2 Experimental observations
Participants will be observed whilst performing the scenario tasks. Every six participants will be observed by a single observer. This limit is based on the account that observers will somewhat comfortably be able to notice changes in a participants' behavior.

Each observer will be provided with an observation protocol which can be viewed in Appendix D. The observation protocol is an adaptation of the protocol used by Zuiderwijk (2015). Two type of observations will be made. First, time measurements will be conducted to track the required time to complete certain scenario tasks. Hereby it is possible to check afterwards if differences between groups can be connoted to a difference in task completion time. Second, observers are required to report general visual or audial changes. As well as anything else that stands out of the ordinary.

5.5.3 Closing interviews
After completing the experiment subjects are asked to participate in a short closing interview. Notably participation is not mandatory. The goal of the interview is to evaluate the platform in a semi-structured manor. Participants are firstly asked what their general opinion is of the platform for health and well-being. Secondly, users will be asked more specifically about how they experienced the chat bot Ann. Thirdly, participants are asked about whether or not they would be enticed to apply as a volunteer to take care for other people (they not necessarily know). In conclusion users are asked whether such a platform for health and well-being can in fact allow elderly to live at home for longer periods of time.

6 Results

This chapter presents the results that were gathered during the experiment as described in Chapter 5. First the quantitative survey results are presented. Then the observations and interviews are described, which represent the qualitative results. Both results give an overview of the information gathered during the experiment. The last section will wrap up the chapter with the main conclusions.

6.1 Quantitative survey results

This section will report the quantitative results collected during the experiment. During the experiment 27 different repeated measures are collected from the participants at 3 different points in time. The repeated measures consist of measures about capabilities, social innovation and perceived usefulness. First the demographics of the participants will be described. Then significant means will be presented in the following section. Lastly, treatment effects will be presented in the final sub-section.

6.1.1 Participant demographics

On May 18th 2016 36 subjects took part of the experiment conducted by this study. The group was made up out of in total, 12 (33.3%) male and 24 (66.7%) female participants. The average age of the participants is about 61 years old with a standard deviation of 6.5. Figure 8 shows a boxplot of the age distribution of the participants. Thereby participants fit the selection criteria of being elderly and/or voluntary caretaker.

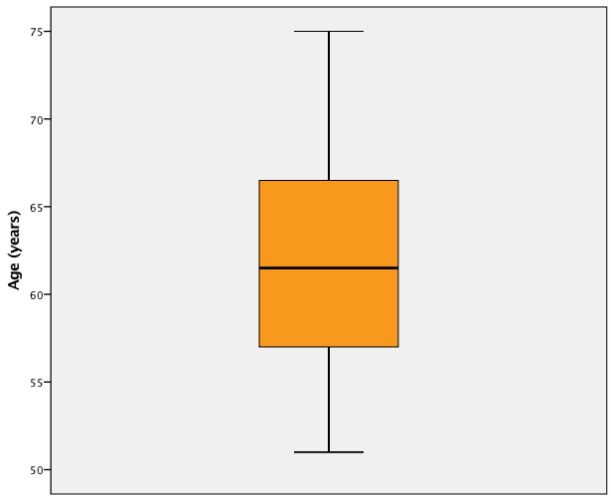

Figure 8 - Boxplot showing ages of participants (n=36 participants)

From the participants 61% perform volunteering work on a daily basis. Thereby, 44% is retired whereas 47% still has a daily job to attend to. The division between reported daily activity frequencies can be seen in Table 6.

Table 6 - Daily Activity Frequencies

		Responses		Percent of Cases
		N	Percent	
activities [a]	Daily activity work	17	26.2%	47.2%
	Daily activity study	3	4.6%	8.3%
	Daily activity retired	16	24.6%	44.4%
	Daily activity volunteer	22	33.8%	61.1%
	Daily activity other	7	10.8%	19.4%
Total		65	100.0%	180.6%

a. Dichotomy group tabulated at value 1.

When considering participants that perform voluntary care we see that about 39% need one to 3 hours per week for their tasks and another 39% four to eight hours per week. The smallest group of participants (6%) needs 9 to 12 hours to perform their tasks. And another 15% requires more than 12 hours per week for their care tasks. Here we see that the largest part of the participants requires on average not more than eight hours per week. However, a considerable group of 21% of participants requires on average from nine hours onwards for their tasks.

Table 7 - Amount of hours per week providing voluntary health and well-being support (hours per week)

In hours per week		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 hours	13	36.1	39.4	39.4
	4-8 hours	13	36.1	39.4	78.8
	9-12 hours	2	5.6	6.1	84.8
	More than 12 hours	5	13.9	15.2	100.0
	Total	33	91.7	100.0	
Missing	System	3	8.3		
Total		36	100.0		

The professions of the participants are varied. In fact, the professions of the participants are amongst the following: work in horticulture or a flower nursery, a car mechanic, participants that are primary school teachers, managers of several disciplines, nurses or doctors' assistants, up to a chemical technician. Additionally, participants reported that they performed daily activities other than listed, they mostly mentioned hobbies in general or sport as the other activity.

Thereby, most participants, about 80% have children. In combination with the 61% performing voluntary care, the participants satisfy the selection criteria namely, that participants are preferred to be of a sandwich generation (taking care of children and parents/relatives).

Table 8 - Demographics for participants, do they have children?

Do you have children?		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	7	19.4	19.4	19.4
	Yes	29	80.6	80.6	100.0
	Total	36	100.0	100.0	

Hence, participants perform volunteering work as a daily activity and mostly combine it either with their daily job or with their retirement. From the different types of professions, it can be argued that they require different levels of education. Therefore, it can be said that the participant group is quite varied in their daily activities and in particular their professions and thereby education level. Additionally, it can be argued that participants have different levels of computer knowledge, simply based on the amount of time they might require to use a computer at their work place. The observations as described in Section 6.2.2 show that participants indeed have a varied level of computer knowledge.

6.1.2 Determining significant means of repeated measures

One sample t-tests are performed to determine whether the variables for the repeated measures differ significantly from the 7-point likert scale with (neutral point) mean = 4. Since the variables listed in Table 9 all score significantly higher for test value = 4, the test is run again with test value = 5. The statistics show that all measures still score significantly higher than the test value = 5 and thus greater than the neutral point of test value = 4.

Table 9 - Capabilities (Post-test) descriptive statistics together with one sample t-test

Test value = 5	Post-test 2						
Variables	N	Mean	t	df	Std. Deviation	Sig. (2-tailed)	Mean difference
Be socially concerned	35	5.86	5.37	34	.94	.00	.86
Add extra comfort at home	36	6.00	6.09	35	.99	.00	1.00
To have interaction with others	35	5.66	3.89	34	1	.00	.66
Unburden myself or others	35	5.74	4.12	34	1.07	.00	.74
Arrange daily schedule	35	5.69	4.68	34	.87	.00	.69
Find information about health and wellbeing	36	6.28	8.69	35	.88	.00	1.28
Filter local demand and supply	35	5.74	3.35	34	1.31	.00	.74
Help others in an easy way	35	5.69	3.23	34	1.13	.00	.69
Share a care plan with others	35	5.89	3.77	34	1.39	.00	.89
Live in a comfortable way	36	6.17	9.08	35	.78	.00	1.17
Avoid moving to another place	35	5.89	5.28	34	.99	.00	.89

Age in place	36	6.08	7.73	35	.84	.00	1.08
Stay independent as long as possible	35	6.09	7.53	34	.85	.00	1.09
Monitor my relatives	35	5.71	3.15	34	1.34	.00	.71
Be totally independent as much as possible	36	6.06	7.36	35	.86	.00	1.06

The effect a platform for health and well-being has on social innovation functions is measured according to the variables listed in Table 10. One sample t-test is performed with test value = 4. Table 10 presents descriptive statistics, together with the one sample t-test results. When considering test value = 4, there is only one variable that is not significantly higher than the test value namely, 'Assist in care tasks of strangers'. Notably, no other values score significantly higher than a mean of 5.

Table 10 - Social innovation (Post-test) descriptive statistics together with one sample t-test

Test value = 4	Post-test 2						
Variables	N	Mean	t	df	Std. Deviation	Sig. (2-tailed)	Mean difference
Easier to provide care for another	35	5.31	6.20	34	1.26	.00	1.31
Be more concerned with providing care to others	35	5.17	4.80	34	1.45	.00	1.17
Assist in care tasks of strangers	35	4.23	0.85	34	1.59	.40	.23
Be more concerned with help questions from the neighborhood	35	4.80	3.26	34	1.45	.00	.80
Enlist myself as a volunteer to assist with care in the neighborhood	35	4.69	2.92	34	1.39	.00	.69

The perceived usefulness measures all score significantly higher than test value = 5. The pre-test values also show significantly high values, which is surprising considering participants did not have any notion of the platform beforehand, other than it being a platform for health and well-being. Table 11 shows the descriptive statistics combined with the one sample t-test results for the perceived usefulness measures.

Table 11 – Perceived usefulness (Post-test) descriptive statistics together with one sample t-test

Test value = 5	Post-test 2						
Variables	N	Mean	t	df	Std. Deviation	Sig. (2-tailed)	Mean difference
Accomplish my tasks more quickly	35	5.83	4.17	34	1.18	.00	.83
Increase my productivity	36	5.56	2.66	35	1.25	.01	.56
Take better care of the person I care for	36	6.31	9.96	35	.79	.00	1.31
Make my job as a voluntary caretaker easier	35	6.11	6.64	34	.99	.00	1.11
Be useful during my job	35	6.14	7.16	34	.94	.00	1.14

Finally, Table 12 shows the measures concerning the organization of the experiment. On average participants agreed that the experiment was conducted properly and had a clear structure. Thereby, participants did not feel influenced by the observers during the participation of the experiment. When considering a high test value of 4 all variables are significantly higher than the test value. Therefore, the table shows results based on a test-value of 5. Here we see that three variables are not significantly higher than a value of 5.

Table 12 - Post-test 2 - Descriptive statistics organization of the experiment

	Post-test 2 - Organization of the experiment						
	Test value = 5						
Variables	**N**	**Mean**	**Std. Deviation**	**t**	**df**	**Sig. (2-tailed)**	**Mean diff.**
The experiment is properly organized.	34	6.29	.91	8.33	33	.00	1.29
The test had a clear structure.	34	5.79	1.15	4.03	33	.00	.79
I understood the role I got during the session.	34	5.79	1.45	3.19	33	.00	.79
The instructions were clear enough to fulfill the tasks.	34	5.74	1.29	3.33	33	.00	.74
I received enough information to perform all of the tasks.	34	5.71	1.45	2.85	33	.00	.71
The observers influenced my behavior during the session.	34	1.85	1.54	-11,92	33	.00	-3,15
The scenario's resemble how I would use the platform.	34	5.35	1.15	1.79	33	.08	.35
The scenario's gave me a clear picture of the platform Zo-Dichtbij.	34	6.12	.88	7.41	33	.00	1.12
Participating made me consider living at home comfortably.	34	5.09	1.75	.29	33	.77	.09
Participation reassured me about living at home comfortably.	34	4.71	1.32	-1,30	33	.20	-0,29
Participating was an interesting experience.	34	6.41	.96	8.60	33	.00	1.41

6.1.3 Measuring treatment effects

In order to determine the treatment effect, one-way repeated ANOVA provides insight in determining significant differences between means that have been collected from the same participants (Field, 2005). However, such a statistical test assumes normally distributed data. Therefore, normally distributed variables are selected for further analysis (at least a skewness and kurtosis between -1 and 1).

However, from all measurement points only one variable (Accomplish my tasks more quickly) is normally distributed at all three measurement points in time. Nonetheless, variables with two normally distributed measurement points will also be selected to perform further statistical tests, to gain some insight into the difference between means. Notably, the assumption of normally distributed data is violated for all other one-way repeated.

When performing a one-way repeated ANOVA with at least three measurement points, a test for sphericity needs to be performed as is seen in

Table 13. Here is seen that see the variables '`relieve_care`' and '`total_independence`' confirm sphericity, with respective values p = .09 and p = .07.

Table 13 - Mauchly's Test of Sphericity

Within Subjects Effect	Measure	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a] Greenhouse-Geisser	Huyn Feldt	Lower-bound
time	socially_concerned	.64	14.54	2	.00	.74	.76	.50
	relieve_care	.87	4.73	2	**.09**	.88	.93	.50
	comfortable	.64	14.98	2	.00	.73	.76	.50
	grow_old_at_home	.45	26.31	2	.00	.65	.66	.50
	total_independence	.85	5.44	2	**.07**	.87	.91	.50

Table 14 shows the main result of the performed one-way ANOVA. Here the only variable that shows a significant difference between means is the 'Be useful' variable (within-subject effect $F(1) = 3.94$ and $p = .04$). This variable measures how useful participants regard a platform for health and well-being during their tasks as a voluntary caretaker. Participants increasingly valued the usefulness of the platform higher after each treatment.

Table 14 - Tests of Within-Subjects Effects

Measure		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
socially_concerned	Sphericity Assumed	1.02	2	.5	.56	.58	.02
	Greenhouse-Geisser	1.02	1.48	.69	.56	.53	.02
	Huynh-Feldt	1.02	1.53	.67	.56	.53	.02
	Lower-bound	1.02	1.00	1.02	.56	.46	.02
relieve_care	Sphericity Assumed	1.49	2	.75	.78	.46	.02
	Greenhouse-Geisser	1.49	1.77	.84	.78	.45	.02
	Huynh-Feldt	1.49	1.87	.8	.78	.46	.02
	Lower-bound	1.49	1.00	1.49	.78	.38	.02
comfortable	Sphericity Assumed	3.31	2	1.66	3.28	.04	.09
	Greenhouse-Geisser	3.31	1.45	2.29	3.28	.06	.09
	Huynh-Feldt	3.31	1.49	2.29	3.28	.06	.09
	Lower-bound	3.31	1.00	3.31	3.28	.08	.09
grow_old_at_home	Sphericity Assumed	.06	2	.03	.07	.93	.00
	Greenhouse-Geisser	.06	1.19	.05	.07	.83	.00
	Huynh-Feldt	.06	1.21	.05	.07	.84	.00
	Lower-bound	.06	1.00	.06	.07	.79	.00
total_independence	Sphericity Assumed	1.55	2	.78	1.48	.23	.04
	Greenhouse-Geisser	1.55	1.75	.88	1.48	.24	.04
	Huynh-Feldt	1.55	1.85	.84	1.48	.24	.04
	Lower-bound	1.55	1.00	1.55	1.48	.23	.04
task_quicker	Sphericity Assumed	1.02	2	.51	.81	.45	.02
	Greenhouse-Geisser	1.02	1.89	.54	.81	.44	.02
	Huynh-Feldt	1.02	2.00	.51	.81	.45	.02
	Lower-bound	1.02	1.00	1.02	.81	.38	.02
more_productive	Sphericity Assumed	.84	2	.42	.88	.42	.03
	Greenhouse-Geisser	.84	1.76	.48	.88	.41	.03
	Huynh-Feldt	.84	1.85	.46	.87	.42	.03
	Lower-bound	.84	1.00	.84	.87	.36	.03
be_useful	Sphericity Assumed	5.47	2	2.74	3.94	.02	.11
	Greenhouse-Geisser	5.47	1.56	3.52	**3.94**	**.04**	.11
	Huynh-Feldt	5.47	1.62	3.38	3.94	.03	.11
	Lower-bound	5.47	1.00	5.47	3.94	.056	.11
socialcare_other	Sphericity Assumed	4.84	2	2.42	2.29	.11	.07
	Greenhouse-Geisser	4.84	1.37	3.53	2.29	.13	.07
	Huynh-Feldt	4.84	1.41	3.43	2.29	.13	.07
	Lower-bound	4.84	1.00	4.84	2.29	.140	.07

Figure 9 shows the plots of all normally distributed variables that measure a capability. The measurement points in the graphs correspond with the results from the pre-test, 1st post-test and 2nd post-test. The measurement points are all significantly greater than a mean of 5. Additionally, it is also visible that there is a slight increase in expected effect on capabilities.

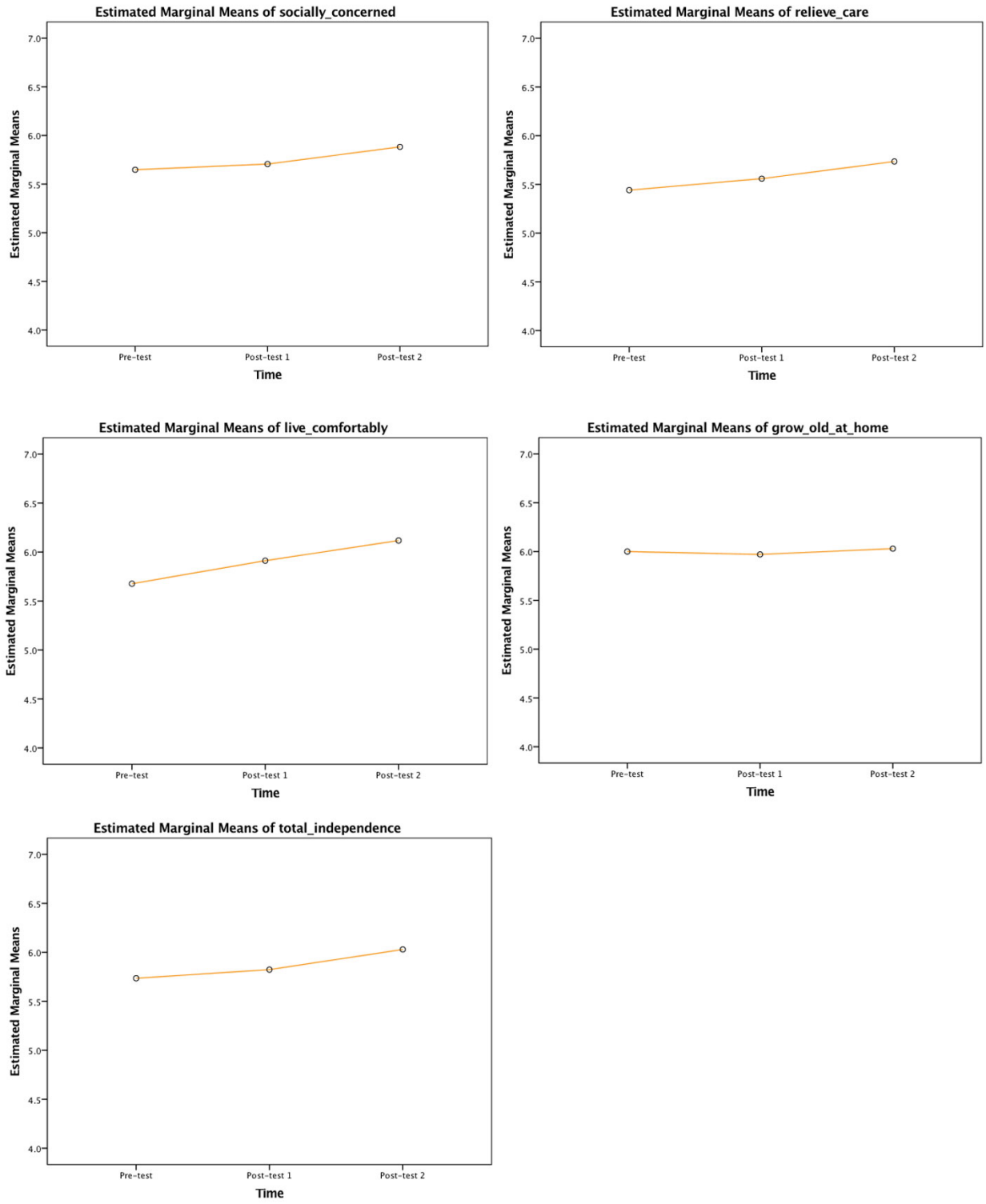

Figure 9 - One-way repeated ANOVA graphs showing means of Capability variables at different measurement points

Figure 10 shows the plots of all normally distributed variables that measure perceived usefulness and social innovation. The measurement points in the graph correspond with the results from the pre-test, 1st post-test and 2nd post-test. The plot for the variable 'social_care_others' that measures whether participants are willing to provide social care for others is the only plot that shows different values. The variable 'social_care_others' is not significantly higher than the mean of 4. Participants are thus most skeptical about the platform influencing people in providing social care for strangers.

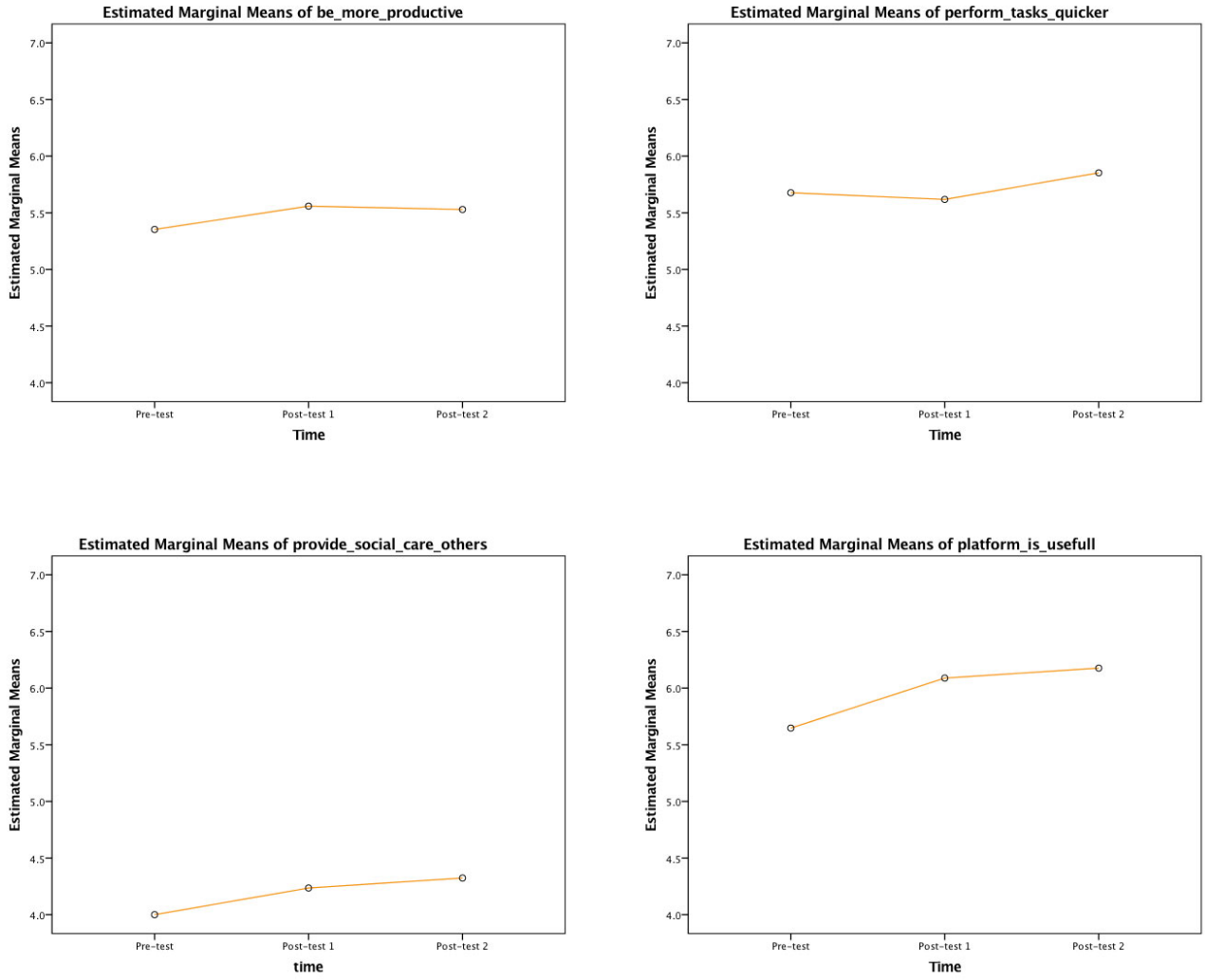

Figure 10 - One-way repeated ANOVA graphs showing means of Perceived usefulness and Social innovation variables at different measurement points

6.2 Qualitative survey results

This section will provide an overview of the qualitative results. Insight will be provided into the expectations participants had beforehand the experiment on platforms for health and well-being. Then the observations made during the experiment will be discussed. Followed by an overview of the closing interviews conducted at the end of the experiment. And finally conclusions are drawn based on both results.

6.2.1 Expectations of a platform for health and well-being

As part of the questionnaire participants were asked beforehand what their expectations were of a platform for health and well-being. These expectations guided the participants in the pre-test questions about a platform for health and well-being.

Participants were mostly expecting a platform for health and well-being to provide information/advice about health and wellbeing. The type of information participants expected was mostly split between information about which organizations one should go to in order to receive healthcare. And between which local health and well-being services are best to be used. Thereby, participants also commented on issues regarding communication amongst the caretakers of the patient and activities or social contacts for the patient.

In particular, specific advice as to which steps one should take to organize healthcare for their personal situation is what people expected. Participants mostly require referrals to organizations/professionals with their addresses and telephone numbers. Two participants, P06 and P39 in particular stated that they also expect to receive financial advice with regards to taxes, subsidies, etc. Thereby, participants expected advice on which healthcare products and/or services are best to be used. A rating of different health and well-being services with reviews from other users is also expected. The advice should also preferably consider local health and well-being providers. Participants P03, P04 and P17 specifically expected to be able to apply for products and or services through the platform directly, without having to be referred to a different provider.

Besides simply expecting information some participants (P03, P06, P07, P14, P28) also expected the platform to facilitate communication between caretakers (also medical professionals) of the patient. Thereby, participants (P25, P35, P37, P39) also expected to be able to share their experiences with other people that share the same situation.

Lastly, participants (P07, P10, P13, P14, P23, P28) stated that they expected the platform to also provide information about activities or possibilities for social contacts for the patient.

These expectations are in accordance with previous research where features for a platform for health and well-being are determined (Wally Keijzer-Broers et al., 2016). The implemented features on the platform used in this study overlap with the expectations the participants have on the features a platform for health and well-being requires.

6.2.2 Observations during the scenarios

Participants are observed during each experimental session by two observers. Thereby, observers reported similar observations during each session. This section will provide insights into the most notable observations made during the experiment regarding the participants.

First of all, participants experienced issues trying to navigate to the demo URL (demo.zo-dichtbij.nl). Most users experienced problems because they entered the URL into the Google search bar inside of the Chrome browser. So instead of navigating to the actual demo page, users found themselves browsing Google search results. From these users, most navigated to the Zo-Dichtbij homepage and were able to find a different (iPad) demo. As soon as the experiment-instructors noticed this behavior, participants were assisted in navigating towards the correct webpage.

Additionally, participants were instructed to login to the demo with the given credentials. However, instead of logging into the platform, participants tried to register a new account with the given credentials. The platform would show an error, as the account already is registered. Instructors stepped in when these events were observed and assisted participants with navigating to the login page.

Besides issues with logging into the platform for the first time, participants also had trouble with accidentally logging out of the platform. In the event that participants were not able to logout by themselves, they were assisted by an instructor.

During the first 15 minutes of the experiment, participants were hesitant and unsure about their ability to fulfil the tasks. This was noticeable since most questions were asked during these fifteen minutes. Examples for the type of questions are, "how am I supposed to add a diary task" up to, "I'm not skilled with computers, please help me". In both cases instructors would provide assuring feedback, that the participants are in fact allowed to try out functions of the platform and should not be afraid of breaking anything. As soon as unsure participants were able to fulfil a task their confidence grew and most were able to continue without any additional help.

Participants were sensitive towards the actual naming of certain features. The plan board and activities are examples of confusion. Since both features offer similar functionality, participants were unsure where certain tasks were meant to be registered. Additionally, the naming of other pages such as health was not clear for many of the participants. At the moment, the health page is a summary of healthcare snippets gathered by the caretakers and a repository for important documents like the health insurance policy. Participants suggested that both functions should be split and health should only be used for medical information regarding the patient's status and needs.

Participants were very quiet and focused during the experiment. Some would actually sit on the tip of their chair when performing a scenario. Thereby, participants were thoughtful and did their best to find an answer that was satisfactory to them. Some participants took the tasks so serious that they went on

to search Google to find an answer to a question that was even better than the platform would provide at the moment.

Observations showed a division between computer skilled participants and those that are not skilled in using a computer. The former was able to navigate through the platform with ease and minimal assistance. Thereby, it seemed that this user group is less likely to become confused by a feature name. In the occurrence that they did not entirely understand a feature name, they were able to quickly make decisions on what actions to take nonetheless. That said, even this more skilled group had trouble logging in, instead of navigating to the 'Login page', these participants mostly navigated to the 'Register page'. It could be that registering to a website is such a strong pattern in people's behavior that as soon as somebody visits a new website they navigate to the register page to create a new account, even though the instructions state that they should go to the login page.

The latter group of unskilled computer users required visibly more effort when performing the treatment tasks. Some participants were not only visibly but also verbally frustrated (mumbling in themselves) during some of the tasks. However, at the end of the experiment most participants said that as soon as they were familiar with the platform most of the tasks were in fact quite easy to perform, as is mentioned in Section 6.2.3.

Moreover, participants interacted in two different ways with the help chat. One group quickly understood that short replies would result in quick and correct answers. While others would interact with the chat as if it was a human conversation. Much longer questions would be formulated before entering them into the chat service. In particular interesting is that some participants simply do not actually respond to the first few introduction questions by the chat bot. Instead they immediately send their request for particular information. Combining the name of the patient together with the type of help they are searching for. For instance: "I'm searching for somebody that wants to walk with Bep". These type of queries cannot yet be resolved with the help chat, and thus resulted in unnatural conversation dialogs.

6.2.3 Closing interviews

After the experiment nine participants (P01, P09, P14, P18, P22, P23, P27, P31, P34) volunteered to participate in a closing interview. Participation of the interview was not mandatory for the participants. During this semi-structured interview four different topics are briefly discussed. First, participants are asked in general about their experience with the platform. Second, the chat Ann is discussed. In particular, whether they were able to have a natural conversation. Third, social innovation was touched by asking about the willingness to engage in voluntary caretaking of strangers. Lastly, what their opinions are on if a platform for health and well-being can help elderly age in place.

General perception

In general, participants stated that they had a positive experience on the platform. Participants explained that they in fact did need a few minutes to get acquainted with the system, both the platform as well as the chat bot, which is in agreement with the observations made. After the participants were familiar with the platform

they were able to browse the platform easily and find what they were searching for. In particular, P27 explained that due to their limited computer skills, some of the tasks were a bit more difficult to perform in the beginning of the experiment. However, the tasks got easier as soon as the realization kicked in that the platform web page was the only important screen to focus on. In the end the platform was built up logically and it was clear where certain information could be found. Additionally, P27 mentioned that part of the difficulty was the amount of new information that needed to be processed. For instance, remembering the names of the persona's and chat bot. As soon as all the context information was clear, the rest of the tasks made more sense.

Participants experiences difficulties with the naming of certain features on the platform. For instance, P31 explained that the naming 'plan board' and 'activities' caused confusion. Because some tasks could be placed in either category, and it was unclear when to choose which category. Moreover, the feature 'health' was not living up to expectations, a clearer division of information was expected. For instance, contracts and important documents needs a specific page as well as doctors and medicine information. For instance, P31 explains: "At the health page I expect a list with doctors that are treating you. Maybe doctors should be on a different heading. Medicine use should be there, etc." Altogether it seems that properly categorizing each feature would increase the usability for this target group.

Chat bot

In particular chat bot Ann was received well by participants. Even with the limited functionality, people were intrigued by the possibilities. Participants were most of all impressed by the speed of receiving answers from the chat bot. For instance, when participants requested information about a grocery shopping service nearby, the chat bot would immediately present a selection of answers.

The communication style of the chat bot resulted into split (positive and negative) opinions. For instance, P23 said that the chat felt as if you were talking with a human. Thereby, P14 pointed out that the chat responded friendly and not in a cold manor at all. In particular, the responses of the chat bot, when a question was not fully understood, made it have a human touch.

Moreover, even when considering that the conversation mostly felt natural, some participants were in fact aware that they were chatting with a computer program. For instance, P01 said that the chat was obviously controlled by a computer program. Thereby, participants P01, P09, P22, P23 and P34 did express that they needed to get used to the communication style with the chat bot.

Altogether participants stated that if the chat bot is able to respond to a richer and broader array of questions, it will in fact be really helpful tool to find information. P18 expressed the excitement of the chat with the following: "If it really works, as it currently works, then it's amazing, it returns answers so quickly!" Additionally, P09 explained that such a chat bot, if developed further, could even provide solace for people that are looking for some (human) interaction.

P27 reported mixed feelings about the chat bot. Interacting with the chat bot did not feel natural, especially since the participant did not realize that the chat bot was not a real person. The participant noted, that users that are more used to computers potentially might not have the same feeling.

Voluntary caretaking

Participants P01, P09, P18, P31 and P34 responded least positive on using the platform as a stepping stone to either start or increase voluntary caretaking. Mostly, the reason given was that they had enough tasks to perform as a voluntary caretaker. Taking up even more tasks for somebody else would, according to the participant, not be beneficial for their own well-being.

P27 would be triggered to help a neighbor or an acquaintance in the neighborhood if the platform would show that they need extra help. P14 notes that such a platform would lower the threshold to assist in the care of family or good acquaintances. In particular, because you can divide tasks amongst others and thus not have to take care of somebody by yourself. Sharing the burden of taking care for somebody else would be appreciated.

Elderly should be aware to invite strangers into their homes. P34 reported that it would be a tricky situation to allow strangers into an elderly person's home. Namely, this would create possibilities for people to take advantage of the elderly they are taking care of. Such functionality should thus only be considered in conjunction with a thorough screening process to protect the vulnerable elderly. And even then a platform for health and well-being should be conscious that the service should be tightly monitored to reduce the risks of elderly to be in harm's way.

Capability to age in place

As a closing statement, the interviewees were asked if they felt such a platform for health and well-being would increase the capability of elderly to live at home for longer. While the statistics as presented in Section 6.1 showed that participants were overall quite positive. During the interviews more mixed feelings arose. Participants P09 and P18 made clear that the capability for patients to live comfortable at home is mostly determined by their own health. If the health of a person is deteriorating, then it is in their best interest to receive full-time care in an elderly home. P01, P09, P31 and P34 also expressed their reservations on whether such a platform will help with staying at home longer. For instance, P09 explains that besides their health, patients are also dependent on their network of voluntary caretakers in order to live at home comfortably. If you do not know anybody that can assist with structural tasks, then it is significantly more difficult to live at home.

P18 and P34 explicitly state that such a platform helps with organizing different healthcare tasks in order to assist people to live at home. Additionally, P01, P23 and P14 explain that the platform will be able to relieve the burden of the caretaker and in some cases might even assist in the ability to take up more tasks, since it helps structure the healthcare organization.

P34 lastly explains that such a platform can provide a streamlined process for users to apply for health services and products. Especially since healthcare

regulations are different for each municipality. By being able to locally filter information on healthcare providers people can more effectively arrange their own care. And the municipality itself can benefit from having a single entry point for receiving healthcare forms.

6.3 Conclusions

The quantitative results show that participants expect that a platform for health and well-being can have a positive effect on the capability of elderly to live at home for an extended period of time. However, the qualitative results show a more nuanced image. While participants do feel that a platform does have a positive effect on the capabilities of elderly to live at home however, the health of an elderly person is seen as a major pre-condition for this to hold. Thereby, social innovation in the form of assisting strangers with healthcare tasks is not seen as a likely change in behavior caused by the platform.

7 Discussion and conclusions

The main objective of this thesis was to determine which effect a digital platform for health and well-being has on the ability of elderly people to age in their own households. In particular, this research set out to answer the following main research question:

> **"How do digital platforms for health and well-being enable elderly people to age in their own household?"**

This chapter will present the main findings of the study with regard to the main research question in Section 7.1. The following Section 7.1 will provide a discussion and alternative explanations to the main findings. The theoretical contributions are then presented in Section 7.3. Then, the implications for practice will be described in Section 7.4. Recommendations for the problem owner 'Zo-Dichtbij' will then be provided in Section 7.5. Then, the limitations of the research will be described in Section 7.6. Lastly, recommendations will be provided for future research in Section 7.7.

7.1 Main findings

The findings of this study show that platforms for health and well-being can enable elderly to age in their own household. With the platform developed and evaluated in this study, elderly people expect that certain capabilities required to age at home can be improved. The following paragraphs will explain how and which capabilities are improved by the platform and thus allow elderly to age in their own household. And what the expected effect is of the implemented on enhancing social innovation.

The study finds in particular how features of the platform developed and studied enable capabilities for elderly. The following four main features are implemented; Feature 1) matchmaking between providers of smart living products and services and end-users, Feature 2) finding local activities, Feature 3) information about health and well-being and Feature 4) connecting with others (e.g., family, caretakers). The study showed that it is expected that these features can have a positive effect on the capabilities of elderly in enabling aging in place.

From the results we find that elderly mostly value features on the platform that facilitate information about health and well-being and communication between all parties involved with the care of an elderly person. And features that enable direct communication with all caretakers involved as well as other relevant people. Both findings will further be explained. Additionally, a link will be made between the features and the capabilities that were measured during the research and which effect the platform developed and studied has on enhancing social innovation.

Finding information about health and well-being
Relevant information about health and well-being is provided through the platform via several specific features namely features 1,2 and 3. Each feature will briefly be discussed with its findings.

During this study elderly responded in particular strong towards feature 1 (matchmaking between providers of smart living products and services and end-users) and feature 3 (information about health and well-being). Feature 1 specifically provides overview of relevant and local product and services providers for elderly. End-users are able to make a choice between providers with the help of reviews users are able to make a choice of what they consider to be the best product or service, without the need for specialized knowledge or a thorough search of the Internet. While feature 3 provides more general information related to the medical condition of an elderly person or for instance providing tips/tasks for when visiting a hospital. Additionally, feature 2 assists end-users in locating local activities that are suitable for elderly people. These activities are filtered according to the specific interests, hobbies and location of an elderly person in need of care, thus only showing relevant activities nearby.

Moreover, the platform used in this study additionally implemented an automated chat bot that can respond to questions related to health and well-being. The results showed that even though elderly needed some time to get used to the new form of interaction with the computer, this form of interaction was appreciated by the participants and found useful. In particularly the fact that the chat was able to quickly return relevant answers was helpful in quickly and easily retrieving relevant information from the system. Moreover, the combination of speed combined with relevant and useful answers are expected to be helpful in more easily providing care for elderly.

Altogether we find that elderly expect most benefit from features that provide information. Hence, features 1, 2, and 3 are expected to have the strongest effect amongst the other features implemented on the platform in enabling elderly to live at home.

Communication between involved caretakers
The results show that besides finding information, elderly also value the possibility to easily communicate between involved caretakers. In particularly the possibility to communicate with both professional and voluntary caretakers at the same time and in the same environment is valued by elderly. Feature 4 (connecting with others) is implemented on the platform for this study by allowing access to a central agenda and diary through which involved caretakers can communicate with each other. The functionality allows caretakers to easily share information about their 'patient' with each other without having to contact everybody individually.

Capabilities
This study draws upon the capability approach. The capability approach provides a framework through which individual well-being can be evaluated. In order to measure the effect of the platform on the capabilities of elderly to live at home for an extended period of time, this study used experimental design (pre-test, post-test)

combined with a questionnaire. The results did not show a significant difference in the measured capabilities during the study. However, this study did find that elderly expect that a platform for health and well-being have positive effects on the capability of elderly to age in their own household.

In particular, this study measured the effect of the platform for health and well-being developed in this study had on the following capabilities; 1) Live in a comfortable way, 2) Stay independent as long as possible', 'Age in place', 'Be totally independent as much as possible' and 'Be socially concerned'. Notably, all capabilities mentioned scored significantly higher than the neutral point on the 7-point likert scale that was used in the questionnaire of this study.

This study finds that it is expected that implementing the four main features previously mentioned on a platform for health and well-being, will have a positive effect on the capability of elderly to age in place.

Social innovation

Additionally, this study measured the effect the platform developed and studied in this research had on social innovation functions. Social innovation occurs when a novel solution is found for a social problem. In this study, the platform for health and well-being is seen as a possible solution for elderly that are expected to live at home for an extended period of time. This study finds that the platform enables caretakers to more easily provide healthcare services to elderly. Thereby, the results show that people are more likely to be concerned with providing care to others. For instance, a family member that is not directly involved in the daily care of somebody, would be more likely to get involved, simply because they are aware of the situation and tasks that other caretakers are performing. Thereby, we find that caretakers are not likely triggered to perform healthcare services for strangers, however helping neighbors might be an exception.

Altogether it is expected that a platform for health and well-being that centrally manages communication between caretakers and other relevant people, would result in more relatives/friends being involved in the care of elderly. Which would reduce the burden faced by the main caretakers.

In summary, this study finds that four main features implemented in the platform for health and well-being that is used in this study, are expected to have positive effects on five main capabilities that were measured during the research. The four main features are; Feature 1) matchmaking between providers of smart living products and services and end-users, Feature 2) finding local activities, Feature 3) information about health and well-being and Feature 4) connecting with others (e.g., family, caretakers). Whereas the five capabilities measured are; 'Live in a comfortable way', 'Stay independent as long as possible', 'Age in place', 'Be totally independent as much as possible' and 'Be socially concerned'. In particular, the features that provide information for health and well-being as well as communication amongst caretakers and other relevant people are expected to be main drivers in enhancing the capabilities of elderly. Additionally, the study finds that it is expected that a platform for health and well-being will have positive impact on stimulating social innovation through the platform. Namely, in making it easier for people involved in the care of an elderly person to become more

concerned in providing healthcare and thus potentially unburdening the main caretakers.

7.2 Discussion of findings

This section will provide a discussion concerning the findings of this study. Alternative explanations of the findings will be discussed as well as reflecting on the study performed in this thesis.

The quantitative pre-test results show that participants had high expectations towards a platform for health and well-being. This may be attributed towards the fact that voluntary caretakers generally have difficulties finding the right information for providing or arranging services for health and well-being. In particular, procedures within municipalities for acquiring healthcare products or services are complicated and different for each municipality. Thereby, communication amongst caretakers can be a cumbersome process, a lot of coordination is necessary in ensuring that everybody involved is up to date with the latest information. As a result, not everybody will receive the latest information. Thereby, the results showed that participants expected from a health and well-being platform to assist in both functionalities. Apparently participants expected beforehand that these features would have a positive effect on the capabilities of elderly. The post-test further confirms that the expectations of the participants of the study where met and indeed positively affect the capabilities of elderly in staying in their own household for as long as possible.

Due to the high expectations of the participants the study did not find any significant difference between the pre-test and post-test measurement points. However, the expectation was that there would be a significant increase in expected capabilities. Perhaps the research would benefit from utilizing a sample that is made up of more elderly that did not have much affiliation with providing voluntary or professional care for others. Namely, it is more likely that such a sample is less inclined to have high expectations of a platform for health and well-being, since it is likely that they have not yet encountered the frustrations regarding providing healthcare services for somebody. Thereby, the questionnaire might have produced more significant differences by providing participants with more extreme labels accompanying the likert scale. Instead of only using the current labels, which explain the neutral point and the 2 most extreme outliers, the questionnaire could benefit from applying labels to each likert point. The labels would need to explicitly explain the difference between each point. Potentially participants would be less inclined to fill in such a positive expectation beforehand. However, if the population in general is positively biased towards ICT interventions, this method would probably not yield different results.

The qualitative results showed an overall positive view of the expected positive effect the platform in this study has on the capabilities of elderly to be able to age in their own home. However, the quantitative showed that participants were more reserved in stating that the platform in this study would directly affect the capability of elderly to allow elderly to live at home for an extended period of time. Participants stated that such a platform for health and well-being would only help if the health of the patient allows it. Basically, health is the most important

variable for elderly in being able to live at home. And if the health of an elderly person is strong enough to live at home, a platform for health and well-being is expected to enable elderly in living at home for an extended period of time.

7.3 Theoretical contributions

This study provides a theoretical contribution to the capability approach. The capability approach is a framework through which an individual's well-being can be measured. The capability approach is used in this study to determine measures that allow to determine the well-being of elderly when provided a platform for health and well-being to facilitate healthcare and well-being tasks. The capability approach is not necessarily developed to be applied to IT artefacts. However, research using the capability approach is being conducted specifically towards ICT4D, which links the capability approach with IT in developing (poor) countries. Thereby, this study is conducted in a wealthy country. However, the well-being of a socially weaker group namely, elderly is studied.

This research shows that the capability approach can be applied to other domains beyond developing countries and/or poor people. In this study the capability approach is used as a lens to measure the well-being of elderly. In particular, the study shows a link between features of a platform for health and well-being and specific capabilities. This knowledge can be used in further research to how platforms for health and well-being affect the capabilities of elderly. And help determine the set of features required on a platform for health and well-being.

Additionally, this research studied how a platform for health and well-being can facilitate social innovation. In particular, how can such a platform enable more people to volunteer and provide health and well-being tasks for elderly in need. At first glance it does not seem that such a platform would encourage people to take up care tasks for strangers. However, we find that platforms for health and well-being can potentially play a role in facilitating social innovation by providing a central communication portal between main caretakers and other people close to the elderly person. Simply by being involved in the daily tasks others that are currently not directly involved might be triggered to step up and take up tasks.

Moreover, the high reported expectations participants have on a platform for health and well-being, might be the result of a bias amongst participants to providing socially acceptable answers. Further research is needed to determine whether this is the case or not.

Ultimately this study developed a measurement instrument to determine the effect a platform for health and well-being has on the capabilities of elderly. It has shown how certain reusable features can improve certain capabilities. With reusable is meant that the features could be implemented in different IT projects. The features and expected improvement of capabilities are potentially generalizable towards other health and well-being IT projects or even towards other IT projects situated within different domains. The study provides a starting point for other IT projects to develop measurement tools in capturing the effect it has on the capabilities of people.

7.4 Implications for practice

Platforms for health and well-being can enable elderly to age in their own household. Such a platform realizes this by, on one hand enabling capabilities of their caretakers and on the other hand the capabilities of the elderly themselves. The following paragraphs will provide suggestions as to how a platform for health and well-being should function in practice.

Capabilities

First of all, the health of elderly determines whether they are able to live at home. However, if their health is good enough, a platform for health and well-being can enhance capabilities to be able to live at home for longer. The platform developed and studied in this thesis utilizes features that on one side enable information sharing between the caretakers of a patient and others close to the patient. And on the other hand providing meaningful matches between local and national product and service providers and information about health and well-being.

Information about health and well-being

This research shows that a platform for health and well-being should provide two distinct features in order to enable elderly people to age at home. First, the platform should provide information and advice about health and well-being. Information or advice provided should however be specific to the municipality of the elderly person, as procedures with regards to applying for health and well-being products or services differs amongst different municipalities. Through a 'matchmaking' feature on such a platform users are thus able to quickly determine which product/service providers best match their situation. The platform on one hand shows the providers within a municipality and on the other hand reduces the uncertainty users have when selecting a provider, by providing a transparent ranking and reviewing system to determine the quality of a provider.

Communication between involved caretakers

Second, a platform for health and well-being should facilitate communication between all of the people involved with the care of an elderly person. Communication can be enhanced through three different features. A platform should provide a central repository where all relevant contact persons can be listed. All caretakers can then quickly find correct contact information for either other caretakers, medical professionals or even a contact person at the municipality. Additionally, a platform needs to provide a solution where caretakers can share their experiences through a shared diary. Caretakers are then able to easily share their thoughts and care activities with other involved caretakers. Allowing for a database through which one can quickly get up to speed with the latest developments. Thereby, a shared agenda should be provided through which all planned activities related to an elderly's care plan can be managed.

By facilitating at least these two features it is expected that a platform for health and well-being can enable elderly to live at home for a longer period of time. Relevant and correct information about health and well-being allows elderly and caretakers to make better informed decisions. By being able to make better decisions it is expected that the well-being of elderly will also profit. Thereby, communication between caretakers is essential in providing a seamless and proper

care program for an elderly person. The platform can play a central role in allowing all caretakers to be up to date with the latest information regarding the health and well-being of the elderly person.

7.5 Recommendations to Problem Owner

This section will provide recommendations for the problem owner 'Zo-Dichtbij'. Specifically, points will be addressed with regard to the implementation and operation of a platform for health and well-being. In particular recommendations will be provided with regard to features on the platform, the chat bot and enhancing social innovation through the platform.

First of all, this study recommends the foundation 'Zo-Dichtbij' to continue with the implementation of the platform developed and evaluated within this study. The results show that end-users evaluated such a platform to be beneficial towards assisting elderly in living at home for longer. As this is one of the main goals of the platform it thus can be seen as a positive evaluation.

Platform features

During the experiment conducted in this study, participants from both experimental groups required approximately fifteen minutes to get acquainted with the platform. After which participants felt confident enough to perform the required tasks that were described in the questionnaire. The group that started with tasks that required the chat bot needed to learn how to communicate with the chat bot in order to receive the correct answers. While the other group that started immediately on the platform itself first needed to find their way through the system. During this period the assistants were required to answer simple questions from the participants. In real life this type of feedback would be difficult to provide for every user. However, providing an extensive manual for users to find their way is not necessarily helpful. It is thus suggested that end-users are provided with a simple tutorial that guides users through the platform. Such a tutorial should be easy and unobtrusive as well as complete. As soon as users feel they are familiar with the platform they showed to be more confident in using the functionality. As a result, users will be able to use the platform to its full extent. The tutorial should also be sensitive towards different computer skill levels of users. Less skilled users would require more assistance, while more skilled users should be able to skip parts.

Surprisingly users had trouble with logging in to the platform used in this study. Users were confused between the login and registration forms, as they are quite similar in design. In order to prevent this kind of confusion it is advised that forms are designed to be easily distinguishable amongst each other. These user experience (UX) issues need to be monitored closely, as less skilled end-users can be put off by a feature if it takes too long to understand how to use it.

That said, it is advisable to gradually increase the information provided on the platform. First ensure that the platform is able to fully accommodate a specific topic. Information was seen as one of the main features that users mostly appreciated. However, if the information is not complete or of high quality users will not be able to see the full benefit of using a platform for health and well-being

as opposed to simply using a search engine. Expectations of users are then more easily manageable if they do not expect that the platform is fully operational from the start. This period allows platform developers to quickly iterate and learn from the user behavior on an active platform, without losing focus.

Chat bot

A chat bot can be an effective way to accomplish matchmaking between product and service providers and consumers. Additionally, a chat bot can reduce the interaction required for users to retrieve relevant information about health and well-being. However, developing a chat bot that is able to answer a complex and broad range of questions is a daunting task. Without a Natural Language Classifier (NLC) service, such a question and answer (Q&A) task does not seem practical. A NLC service is a digital service that is able to interpret the meaning behind text and return a corresponding classification. This allows a chat bot to be able to more easily 'understand' what a user means with their input and respond with better answers. Due to the limitations of a chat bot in understanding what a person means, it is advisable to not entirely rely on a chat bot for core features on a platform as users could quickly become disappointed when the bot is not able to answer their questions. In fact, it is advisable to have a fallback system to a human being within the chat environment. As soon as the chat bot falls short, a human can take over and ensure that the user receives a proper answer that is useful.

Additionally, it is advised to use the chat bot for specific topics, as developing a natural language conversation is a laborious process. The current technology is not able to automatically adjust to the different way of communication of users and thereby provide relevant answers. The designer of the conversation has to manually provide all possible branches of a conversation and include the corresponding answers. Hence, the chat bot is probably most useful as an entry point for users to be guided towards the proper web interface. Instead of solely relying on the chat bot to retrieve the best answer possible, the chat bot can be a guide and assist users in finding the right location to find the data themselves. This would make the chat bot easier to maintain as the different branches in a conversation can be limited to the features of the platform itself.

Social innovation

Lastly, a platform for health and well-being can trigger social innovation, simply by including more relevant people in the communication and planning of healthcare and well-being tasks of elderly. The platform could in particularly play a role in providing voluntary caretakers for vulnerably elderly. Specifically, elderly that do not have a network to fall back to for daily healthcare tasks. However, these elderly are in particularly vulnerable for people with bad intentions, as they cannot rely on family or friends to look out for them. The platform could have a leading role in assisting this elderly group. In particular, by strictly screening and selecting volunteers, the platform could create a safe and trusted network of volunteers.

Consequently, the success of a platform is determined by the amount of end-users on the platform. The capability approach is expected to be useful in determining meaningful marketing campaigns in attracting more users. The capability approach allows more focus to be placed on the ends and not necessarily on the

means. The results show that while the means are important, users are in particularly focused on the well-being of the person they are taking care of. Therefore, on should emphasize how the functionality of a platform for health and well-being enables certain capabilities.

7.6 Limitations

This section will provide an overview of the limitations of this study. Constraints on the generalizability of this study will be discussed. In particular, the method of this study and how it may have influenced the results will be described.

First of all, the experiment is conducted with a relatively small sample. Thereby the participants were highly positive, which resulted in rightly skewed data. Moreover, most one-way repeated ANOVA results are violating the assumption of normality. The research assumes that the data is consistent with the population and therefore the results can be interpreted as meaningful. However, performing the experiment with a larger sample might yield different results.

Secondly, a limitation of the research is that the experiment was conducted in an artificial setup. While the persona and scenario tasks were designed to mimic real life as much as possible, participants did not use the platform for their own real life situation. Thereby, the IT artefact is not yet fully functional and loaded with demo data. A fully functional platform might provide other insights regarding capabilities and usefulness.

Thirdly, the elderly voluntary caretakers functioned as a proxy to measure the effect a platform for health and well-being has on capabilities for elderly in general. Thereby, the caretakers are assumed to be capable of determining the well-being of their 'patients'. The results of this study are based around the assumption that the voluntary caretakers themselves are elderly people. Therefore, their proxy input can be seen as a representative result. That said it, caretakers have specific knowledge with regard to the actual tasks required to properly take care of somebody. These experiences could introduce bias into the results. However, it could be argued that specific knowledge with regard to healthcare and well-being can be beneficial in determining whether or not a platform for health and well-being can in fact increase the well-being of elderly.

Thereby, the experiment is conducted over a time schedule of approximately two hours. In such a short time, it is not possible to measure the long-term benefits a platform has on capabilities. Hence, the experiment is only able to capture the expected effect a platform for health and well-being has on the capabilities of elderly. Thereby, participants are aware that the platform used in the study is a demonstration platform and therefore not complete in functionality. Users thus expect that certain functions do not entirely work as intended. When using an expected fully functional platform user would probably not be as understanding when faced with an incomplete feature and/or information.

Currently this research mostly builds upon core literature regarding the capability approach. This core literature provides a lens through which the results of this study can be analyzed. However, a broader view of more current research

adopting the capability approach in for instance the evaluation of IT projects could provide a stronger argumentation into the generalizability of the results found in this study. Thereby, the study is conducted in The Netherlands and specifically towards the municipality of Rotterdam. While it is expected that the platform developed and evaluated in this study will perform similar in other municipalities, additional research needs to be conducted towards determining the generalizability of the effect of a platform for health and well-being has on the capabilities of elderly in different countries.

Additionally, the effect of a platform for health and well-being is determined by the actual usage of end-users as soon as the platform is fully operational. Several factors that are not included into the experiment probably also have an effect on the capabilities of elderly. For instance, the information provided on the platform needs to be correct and relevant, disappointing results would probably result in users dropping out of the platform, as it does not improve their situation. Thereby, the platform needs to attain a central position within municipalities as they are responsible for organizing health and well-being services for their constituents. When such a platform is part of an official process with regard to health and well-being, it is more likely that users will first of all know about the platform and secondly, use the platform.

The more seamless such a platform is imbedded within institutions, the higher quality service it can deliver. On the other side a major threat for a platform is when imbedding is blocked by institutes since it increases barriers for such a platform to provide the required services. However, additional research is required to determine how all these different stakeholders would affect the platforms capability to improve well-being for elderly, which will be explained further in Section 7.7.

7.7 Recommendations for future research

This section will provide recommendations for future research. The previous section provides areas of improvement upon this study.

The platform developed and studied in this research provided the possibility to measure the expected effect of such a platform on the capabilities of elderly. However, the artificial setup has its limitations in determining the effect of a platform for health and well-being in a real life situation. Thereby, the studies are focused towards a single municipality in The Netherlands. Generalizability can be determined by studying the platform in different regions and maybe even internationally. For instance, how does culture influence the effectiveness of a platform for health and well-being on improving capabilities for elderly to live at home?

Future research should thus be conducted on a platform for health and well-being where users are able to use the platform for their own specific case. Additionally, the time period should be for an extended period of time, as it is important to know how a platform for health and well-being impacts capabilities over an extended time frame. Thereby such research can determine the actual effect a

platform for health and well-being has on the capabilities of elderly, instead of simply determining the expected effect.

Such a pilot project allows for further research with regards to the effect other stakeholders of a platform for health and well-being, such as municipalities and insurance companies, have on the capabilities of elderly. Research can then be done to determine how their influence be managed and therefore ensure that the platform remains objective and neutral in order to facilitate to the best interest of elderly.

Additionally, the link between platform theory and social innovation can be studied in more detail. Further research can determine how the mechanics of a platform enable social innovation. And how social innovation can provide a solid solution for the social problem of increasing need for caretakers amongst a growing population of elderly people.

Altogether, theoretically the features of a platform and well-being and its expected effect on the capabilities of elderly has been studied and shows promising results to providing a solution for the social problem elderly people increasingly face. However, further research needs to be done to determine whether these effects are still present when such a platform for health and well-being is fully operational. Only then can for certain be determined

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Appendix A

Table 15 - The Central Human Capabilities, with description (Nussbaum, 2003)

Capability	***Description***
1. *Life*	Being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living.
2. *Bodily health*	Being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter.
3. *Bodily integrity*	Being able to move freely from place to place; to be secure against violent assault, including sexual assault and domestic violence; having opportunities for sexual satisfaction and for choice in matters of reproduction.
4. *Senses, imagination, and thought*	Being able to use the senses, to imagine, think, and reason – and to do these things in a ''truly human'' way, a way informed and cultivated by an adequate education, including, but by no means limited to, literacy and basic mathematical and scientific training. Being able to use imagination and thought in connection with experiencing and producing works and events of one's own choice, religious, literary, musical, and so forth. Being able to use one's mind in ways protected by guarantees of freedom of expression with respect to both political and artistic speech, and freedom of religious exercise. Being able to have pleasurable experiences and to avoid non-beneficial pain.
5. *Emotions*	Being able to have attachments to things and people outside ourselves; to love those who love and care for us, to grieve at their absence; in general, to love, to grieve, to experience longing, gratitude, and justified anger. Not having one's emotional development blighted by fear and anxiety. (Supporting this capability means supporting forms of human association that can be shown to be crucial in their development.)
6. *Practical reason*	Being able to form a conception of the good and to engage in critical reflection about the planning of one's life. (This entails protection for the liberty of conscience and religious observance.)
7. *Affiliation*	A. Being able to live with and toward others, to recognize and show concern for other human beings, to engage in various forms of social interaction; to be able to imagine the situation of another. (Protecting this capability means protecting institutions that constitute and nourish such forms of affiliation, and also protecting the freedom of assembly and political speech.) B. Having the social bases of self-respect and non-humiliation; being able to be treated as a dignified being whose worth is equal to that of others. This entails provisions of nondiscrimination on the basis of race, sex, sexual orientation, ethnicity, caste, religion, national origin.
8. *Other species*	Being able to live with concern for and in relation to

	animals, plants, and the world of nature.
9. Play	Being able to laugh, to play, to enjoy recreational activities.
10. Control over one's environment	*A. Political.* Being able to participate effectively in political choices that govern one's life; having the right of political participation, protections of free speech and association. *B.* Material. Being able to hold property (both land and movable goods), and having property rights on an equal basis with others; having the right to seek employment on an equal basis with others; having the freedom from unwarranted search and seizure. In work, being able to work as a human being, exercising practical reason, and entering into meaningful relation- ships of mutual recognition with other workers.

Appendix B

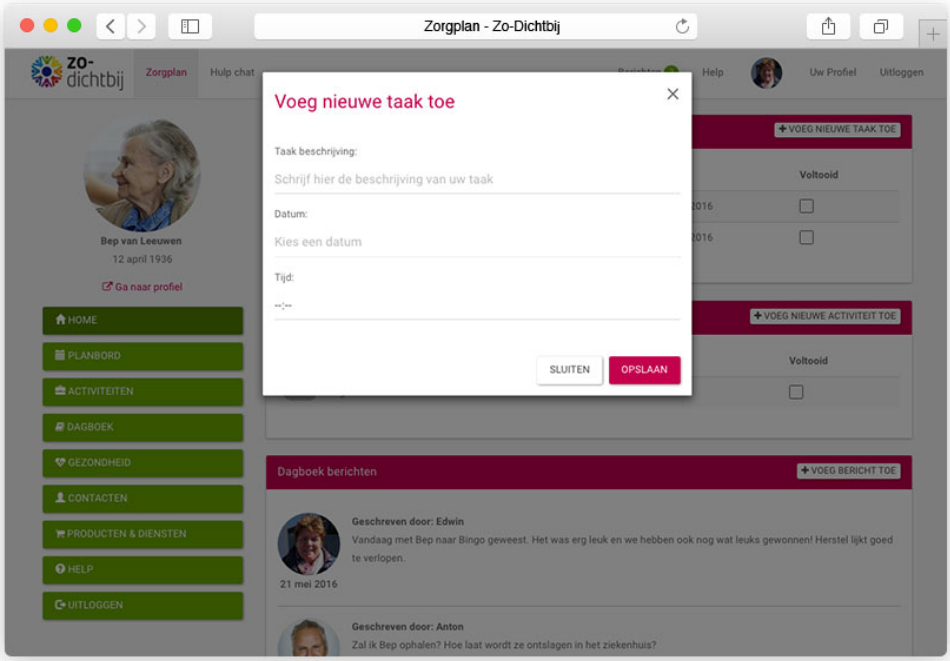


Figure 11 - Adding a task to a care plan

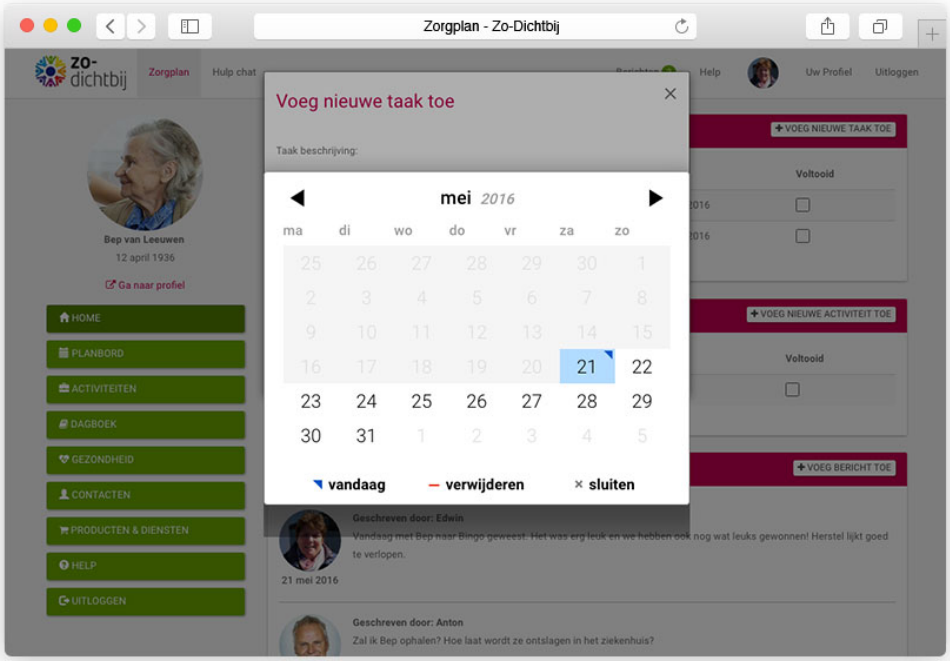


Figure 12 - Selecting a end date to a task on a care plan

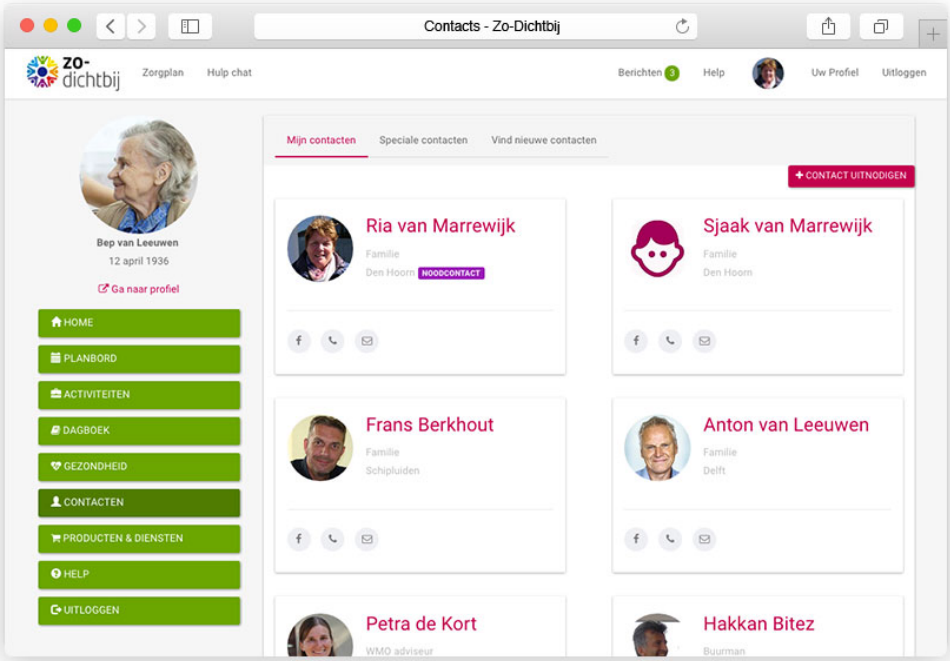


Figure 13 - Contacts page Zo-Dichtbij care plan

Appendix C

Delft, 11 mei 2016

Geachte heer/mevrouw,

Allereerst wil ik u hartelijk danken voor uw deelname aan dit onderzoek. Mijn naam is Edwin van den Houdt, masterstudent Management of Technology (MOT) aan de TU Delft. Als afstudeerproject doe ik onderzoek naar hoe ICT ouderen kan ondersteunen om zo lang mogelijk thuis te blijven wonen. Dit als onderdeel van een promotie-onderzoek van Wally Keijzer.

De resultaten van deze testdag worden ingezet om een platform te ontwikkelen dat helpt om ouderen langer comfortabel thuis te laten wonen.

Het programma voor vandaag is als volgt. Deel 1 bestaat uit een korte vragenlijst. Vervolgens krijgt u een aantal taken om uit te voeren op het platform Zo-Dichtbij, gevolgd door een tweede vragenronde. Deel 2 bestaat wederom uit een reeks taken, gevolgd door een aantal afsluitende vragen.
Het totale onderzoek neemt ongeveer 1,5 uur in beslag. Wij begrijpen dat dat een lange zit is. Daarom ben ik bij voorbaat dankbaar voor uw inzet en geduld.

Alle gegevens die tijdens het onderzoek worden verzameld zullen anoniem worden opgeslagen. Mocht u na afloop interesse hebben in de uitkomsten van vandaag, dan kunt u uw mailadres bij ons achterlaten.

Indien u nog vragen of opmerkingen heeft, ben ik bereikbaar via edwin@vdhoudt.nl of
06-51765138.

Met vriendelijke groet,

Edwin van den Houdt

Zo lang mogelijk comfortabel thuis wonen

Deel 1

Algemeen

Vraag 1
Bent u man of vrouw?
○ Man
○ Vrouw

Vraag 2
Wat is uw geboortejaar?

_____

Vraag 3
Heeft u kinderen?
○ Ja
○ Nee

Vraag 4
Wat is het aantal thuiswonende kinderen?

_____

Vraag 5
Wat is het aantal uitwonende kinderen?

_____

Vraag 6
Waar houdt u zich in het dagelijks leven mee bezig?
☐ werken
☐ studeren
☐ met pensioen
☐ vrijwilliger/mantelzorger
☐ Anders: _____

Vraag 7
Wat is (of was) uw beroep?

_____ ○ n.v.t.

Hulp aan anderen

Vraag 8
Bied u weleens ondersteuning aan een ander op het gebied van zorg en welzijn? (Eventueel in het verleden). Bijvoorbeeld: boodschappen doen, huishouden, financiën, meegaan op doktersbezoek, aanschuiven bij gesprekken, invullen van vragenlijsten etc.
○ Ja
○ Nee (LET OP**:** Indien nee, dan mag u vragen 9 t/m 12 overslaan)

Vraag 9
Hoeveel uur besteed/besteedde u gemiddeld per week aan dit soort taken?
○ 1 - 3 uur
○ 4 - 8 uur
○ 9 - 12 uur
○ Meer dan 12 uur

Vraag 10
Kunt u een specifiek persoon in gedachten nemen en beschrijven wat u zoal doet/deed?

_____

_____

_____

_____

Comfortabel leven

Vraag 11
Met welke aspecten van de dagelijkse bezigheden heeft degene waarvoor u (weleens) zorgt in uw ogen moeite?

	Totaal geen invloed			**Neutraal**			**Zeer veel invloed**
Genieten van eten en drinken	○	○	○	○	○	○	○
Buiten de deur komen	○	○	○	○	○	○	○
Onderhouden van sociale contacten	○	○	○	○	○	○	○
Veiligheid in en rondom het huis	○	○	○	○	○	○	○
Mobiliteit in en rondom het huis	○	○	○	○	○	○	○
Vrijetijdsbesteding (sporten, hobby's)	○	○	○	○	○	○	○
Maken van reizen of uitstapjes	○	○	○	○	○	○	○
Geheugen	○	○	○	○	○	○	○
Bereiden van eten	○	○	○	○	○	○	○
Opstaan, douchen en aankleden	○	○	○	○	○	○	○
Huishoudelijke taken	○	○	○	○	○	○	○
Tuinieren en klusjes in en rondom huis	○	○	○	○	○	○	○

Anders: _____

Vraag 12

Hoe gaat de persoon waarvoor u zorgt om met deze veranderingen?

☐ Nog niets gedaan
☐ Advies ingewonnen voor hulp met dagelijkse bezigheden
☐ Familie en vrienden ingeschakeld voor hulp
☐ Hulpmiddelen aangeschaft ter ondersteuning
☐ Diensten ingekocht ter ondersteuning zoals huishoudelijke/persoonlijke hulp
☐ Aanpassingen gedaan aan het huis
☐ Alarmeringssysteem richting familie, buren etc.
☐ Alarmeringssysteem richting centraal meldsysteem

☐ n.v.t.
Anders: _____

Vraag 13

Bij wie zou u advies/informatie inwinnen met vragen over zorg en welzijn?

	Zeer onwaarschijnlijk			**Neutraal**			**Zeer waarschijnlijk**
Familie	○	○	○	○	○	○	○
Vrienden en kennissen	○	○	○	○	○	○	○
Zorgverzekeraar	○	○	○	○	○	○	○
Zorgprofessional (arts, therapeut etc.)	○	○	○	○	○	○	○
Zorgwinkel	○	○	○	○	○	○	○
Adviseur op het gebied van zorg en welzijn	○	○	○	○	○	○	○
Lokale zorg- en welzijnsaanbieder	○	○	○	○	○	○	○
WMO-loket (gemeente)	○	○	○	○	○	○	○

Extra toelichting: _____

Digitaal platform

Wat als er een digitaal platform zou bestaan dat u (of degene waarvoor u zorgt) ondersteunt om zo lang mogelijk comfortabel in de eigen omgeving te blijven wonen?

Vraag 14

Wat verwacht u te vinden op een digitaal platform voor zorg en welzijn?

_____

_____

_____

_____

_____

_____

Vraag 15

Ik verwacht dat een digitaal platform, mij of degene voor wie ik zorg, gaat helpen om….

	Totaal niet helpen			**Neutraal**			**Zeker helpen**
Sociaal betrokken te blijven	○	○	○	○	○	○	○
Extra comfort in huis toe te voegen	○	○	○	○	○	○	○
Interactie te hebben met anderen	○	○	○	○	○	○	○
Mezelf of anderen te ontzorgen	○	○	○	○	○	○	○
Dag invulling te vinden	○	○	○	○	○	○	○
Informatie over zorg en welzijn vinden	○	○	○	○	○	○	○
Lokaal vraag en aanbod te filteren	○	○	○	○	○	○	○
Anderen eenvoudiger te kunnen helpen	○	○	○	○	○	○	○
Zorgplan te delen met mijn naasten	○	○	○	○	○	○	○
Comfortabel te kunnen wonen	○	○	○	○	○	○	○
Niet te hoeven verhuizen	○	○	○	○	○	○	○
Thuis oud te kunnen worden	○	○	○	○	○	○	○
Zo lang mogelijk zelfstandig te blijven	○	○	○	○	○	○	○
Mijn naasten te kunnen monitoren	○	○	○	○	○	○	○
Zo veel mogelijk volledig onafhankelijk te zijn	○	○	○	○	○	○	○

Anders: _____

Vraag 16

Als mijn hulp voor een ander wordt verwacht, dan denk ik dat een digitaal platform voor zorg en welzijn gaat helpen om…

	Totaal niet helpen			**Neutraal**			**Zeker helpen**
Mijn taken sneller af te ronden	○	○	○	○	○	○	○
Mijn productiviteit te verhogen	○	○	○	○	○	○	○
De persoon voor wie ik zorg beter te kunnen helpen	○	○	○	○	○	○	○
Mijn taak als mantelzorger te vereenvoudigen	○	○	○	○	○	○	○
Bruikbaar te zijn tijdens mijn mantelzorgwerk	○	○	○	○	○	○	○
Makkelijker zorgtaken voor een ander op te pakken	○	○	○	○	○	○	○
Meer betrokken te voelen bij zorgverlening van anderen	○	○	○	○	○	○	○
Meer zorgtaken op te pakken van onbekenden	○	○	○	○	○	○	○
Meer betrokken te voelen bij hulpvragen vanuit de buurt	○	○	○	○	○	○	○
Mijzelf op te geven als vrijwilliger, bij hulpvragen in de buurt	○	○	○	○	○	○	○

Vraag 18

In welke mate verwacht u (nu of in de toekomst) gebruik te maken van een digitaal platform voor zorg en welzijn?

Totaal onwaarschijnlijk				Neutraal				Zeer waarschijnlijk
○	○	○	○	○	○	○	○	○

Vraag 19

In welke mate denkt u een digitaal platform voor zorg en welzijn aan te raden aan vrienden/familie/collega's?

Totaal onwaarschijnlijk				Neutraal				Zeer waarschijnlijk
○	○	○	○	○	○	○	○	○

Scenario's

De volgende scenario's graag voltooien zonder gebruik te maken van de hulp chat.

Scenario 1 – Inloggen op Zo-Dichtbij

Probeer eerst de taken te voltooien die in het meest linker kolom hieronder staan beschreven. Kies daarna per taak hoe moeilijk de taak was om te voltooien.

	Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Taak 1: Open Google Chrome op uw bureaublad en ga naar: `demo.zo-dichtbij.nl`	○	○	○	○	○
Taak 2: Login op het zo-dichtbij platform, gebruik de onderstaande gegevens.	○	○	○	○	○

Inloggegevens (Zo-Dichtbij)	
Email	`riaNR@experiment.nl`
Wachtwoord*	`RiaNR`

**Met een hoofdletter*

Scenario 2 – Praktische zaken regelen

Probeer eerst de taken te voltooien die in het meest linker kolom hieronder staan beschreven. Kies daarna per taak of dit al dan niet te doen was.

	Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Taak 3: Houdt de naasten op de hoogte van de conditie van Bep via het dagboek.	○	○	○	○	○
Taak 4: Plan voor vandaag dat Frans boodschappen gaat doen voor Jan (de man van Bep).	○	○	○	○	○
Taak 5: Ria heeft bericht gekregen van haar neef. Voeg een bezoek toe aan in het planbord van Bep voor komend weekend.	○	○	○	○	○
Taak 6: Zoek de zorgverzekeringspolis van Bep op en noteer hieronder haar polisnummer. Polis nummer	○	○	○	○	○
Taak 7: Plan voor over twee weken een activiteit, waar zowel Bep als Jan aan kunnen deelnemen.	○	○	○	○	○

Overige opmerkingen:

Scenario 3 – Producten en diensten organiseren

Probeer eerst de taken te voltooien die in het meest linker kolom hieronder staan beschreven. Kies daarna per taak of dit al dan niet te doen was.

	Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Taak 8: Kies een dienstverlener die in het huis van Bep een traplift kan installeren. Dienstverlener:	○	○	○	○	○
Taak 9: Kies een zorgverlener die Bep kan ondersteunen met haar herstel, zodra ze weer naar huis mag. Zorgverlener:	○	○	○	○	○

Overige opmerkingen:

Scenario 4 – Informatie opzoeken op Zo-Dichtbij

Probeer eerst de taken te voltooien die in het meest linker kolom hieronder staan beschreven. Kies daarna per taak of dit al dan niet te doen was

	Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Taak 10 Zoek en noteer het telefoonnummer van een buurthuis, waarbij hulp geregeld kan worden voor dagelijkse ondersteuning telefoonnummer	○	○	○	○	○
Taak 11 Zoek het noodnummer van Zo-Dichtbij en noteer dat hieronder. telefoonnummer	○	○	○	○	○

Overige opmerkingen:

Deel 2

Digitaal platform Zo-Dichtbij

U heeft nu een voorproefje gehad van Zo-Dichtbij. Wilt u nu opnieuw de vragen invullen.

Vraag 1

Ik verwacht dat een digitaal platform, mij of degene voor wie ik zorg, gaat helpen om….

	Totaal niet helpen			**Neutraal**			**Zeker helpen**
Sociaal betrokken te blijven	○	○	○	○	○	○	○
Extra comfort in huis toe te voegen	○	○	○	○	○	○	○
Interactie te hebben met anderen	○	○	○	○	○	○	○
Mezelf of anderen te ontzorgen	○	○	○	○	○	○	○
Dag invulling te vinden	○	○	○	○	○	○	○
Informatie over zorg en welzijn vinden	○	○	○	○	○	○	○
Lokaal vraag en aanbod te filteren	○	○	○	○	○	○	○
Anderen eenvoudiger te kunnen helpen	○	○	○	○	○	○	○
Zorgplan te delen met mijn naasten	○	○	○	○	○	○	○
Comfortabel te kunnen wonen	○	○	○	○	○	○	○
Niet te hoeven verhuizen	○	○	○	○	○	○	○
Thuis oud te kunnen worden	○	○	○	○	○	○	○
Zo lang mogelijk zelfstandig te blijven	○	○	○	○	○	○	○
Mijn naasten te kunnen monitoren	○	○	○	○	○	○	○
Zo veel mogelijk volledig onafhankelijk te zijn	○	○	○	○	○	○	○

Anders: _____

Vraag 2

Als mijn hulp voor een ander wordt verwacht, dan denk ik dat een digitaal platform voor zorg en welzijn gaat helpen om…

	Totaal niet helpen			**Neutraal**			**Zeker helpen**
Mijn taken sneller af te ronden	○	○	○	○	○	○	○
Mijn productiviteit te verhogen	○	○	○	○	○	○	○
De persoon voor wie ik zorg beter te kunnen helpen	○	○	○	○	○	○	○
Mijn taak als mantelzorger te vereenvoudigen	○	○	○	○	○	○	○
Bruikbaar te zijn tijdens mijn mantelzorgwerk	○	○	○	○	○	○	○
Makkelijker zorgtaken voor een ander op te pakken	○	○	○	○	○	○	○
Meer betrokken te voelen bij zorgverlening van anderen	○	○	○	○	○	○	○
Meer zorgtaken op te pakken van onbekenden	○	○	○	○	○	○	○
Meer betrokken te voelen bij hulpvragen vanuit de buurt	○	○	○	○	○	○	○
Mijzelf op te geven als vrijwilliger, bij hulpvragen in de buurt	○	○	○	○	○	○	○

Vraag 3

In welke mate verwacht u (nu of in de toekomst) gebruik te maken van een digitaal platform voor zorg en welzijn?

Totaal onwaarschijnlijk				Neutraal				Zeer waarschijnlijk
○	○	○	○	○	○	○	○	○

Vraag 4

In welke mate denkt u een digitaal platform voor zorg en welzijn aan te raden aan vrienden/familie/collega's?

Totaal onwaarschijnlijk				Neutraal				Zeer waarschijnlijk
○	○	○	○	○	○	○	○	○

Scenario's

Scenario 2 – praktische zaken regelen

Probeer eerst de taken te voltooien die in het meest linker kolom hieronder staan beschreven. Kies daarna per taak in hoeverre dat te doen is.

	Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Taak 3: Ria heeft bericht gekregen over de levering van een hoog/laag bed. Voeg op het planbord in dat je het bed in ontvangst zal nemen.	○	○	○	○	○
Taak 4: Plan dat Frans de hond vanavond gaat uitlaten.	○	○	○	○	○
Taak 5: Houdt iedereen op de hoogte van de terugkomst van Bep via het dagboek.	○	○	○	○	○
Taak 6: Zoek en noteer hoe de WMO-adviseur van Bep heet. Naam	○	○	○	○	○
Taak 7: Zet op het planbord dat Anton een boodschappenservice regelt en wanneer	○	○	○	○	○

Overige opmerkingen:

Scenario 3C – producten en diensten organiseren

Let op: Voltooi de volgende taken door <u>alleen</u> gebruik te maken van de "Hulpchat Ann". De chatfunctie vindt u links bovenaan de website (tweede tab).

Probeer eerst de taken te voltooien die in het meest linker kolom hieronder staan beschreven. Kies daarna per taak in hoeverre dat te doen is.

	Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Taak 8: Gebruik hulpchat Ann. Zoek en noteer hieronder een dienstverlener die Bep kan voorzien van boodschappen. Dienstverlener:	○	○	○	○	○
Taak 9: Gebruik hulpchat Ann. Zoek en noteer hieronder een zorgverlener die met Bep wil wandelen Zorgverlener:	○	○	○	○	○

Overige opmerkingen:

Scenario 4C – informatie opzoeken op het Zo-Dichtbij platform

Let op: Voltooi de volgende taken door <u>alleen</u> gebruik te maken van de "Hulpchat Ann".

De chatfunctie vindt u links bovenaan de website (tweede tab)

Probeer eerst de taken te voltooien die in het meest linker kolom hieronder staan beschreven. Kies daarna per taak hoe makkelijk/moeilijk de taak was om te voltooien.

	Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Taak 10: Bep houdt van zwemmen. Gebruik hulpchat Ann. Vind en noteer waar ze kan gaan zwemmen als ze gerevalideerd is. organisatienaam	○	○	○	○	○
Taak 11: Gebruik hulpchat Ann. Zoek achtergrondinformatie over "valpreventie bij ouderen" en noteer de website hieronder. website	○	○	○	○	○

Overige opmerkingen:

Deel 3

Vraag 1
Ik verwacht dat een digitaal platform, mij of degene voor wie ik zorg, gaat helpen om….

	Totaal niet helpen			**Neutraal**			**Zeker helpen**
Sociaal betrokken te blijven	○	○	○	○	○	○	○
Extra comfort in huis toe te voegen	○	○	○	○	○	○	○
Interactie te hebben met anderen	○	○	○	○	○	○	○
Mezelf of anderen te ontzorgen	○	○	○	○	○	○	○
Dag invulling te vinden	○	○	○	○	○	○	○
Informatie over zorg en welzijn vinden	○	○	○	○	○	○	○
Lokaal vraag en aanbod te filteren	○	○	○	○	○	○	○
Anderen eenvoudiger te kunnen helpen	○	○	○	○	○	○	○
Zorgplan te delen met mijn naasten	○	○	○	○	○	○	○
Comfortabel te kunnen wonen	○	○	○	○	○	○	○
Niet te hoeven verhuizen	○	○	○	○	○	○	○
Thuis oud te kunnen worden	○	○	○	○	○	○	○
Zo lang mogelijk zelfstandig te blijven	○	○	○	○	○	○	○
Mijn naasten te kunnen monitoren	○	○	○	○	○	○	○
Zo veel mogelijk volledig onafhankelijk te zijn	○	○	○	○	○	○	○

Anders: _____

Vraag 2
Als mijn hulp voor een ander wordt verwacht, dan denk ik dat een digitaal platform voor zorg en welzijn gaat helpen om…

	Totaal niet helpen			**Neutraal**			**Zeker helpen**
Mijn taken sneller af te ronden	○	○	○	○	○	○	○
Mijn productiviteit te verhogen	○	○	○	○	○	○	○
De persoon voor wie ik zorg beter te kunnen helpen	○	○	○	○	○	○	○
Mijn taak als mantelzorger te vereenvoudigen	○	○	○	○	○	○	○
Bruikbaar te zijn tijdens mijn mantelzorgwerk	○	○	○	○	○	○	○
Makkelijker zorgtaken voor een ander op te pakken	○	○	○	○	○	○	○
Meer betrokken te voelen bij zorgverlening van anderen	○	○	○	○	○	○	○
Meer zorgtaken op te pakken van onbekenden	○	○	○	○	○	○	○
Meer betrokken te voelen bij hulpvragen vanuit de buurt	○	○	○	○	○	○	○
Mijzelf op te geven als vrijwilliger, bij hulpvragen in de buurt	○	○	○	○	○	○	○

Vraag 3

In welke mate verwacht u (nu of in de toekomst) gebruik te maken van een digitaal platform voor zorg en welzijn?

Totaal onwaarschijnlijk				Neutraal			Zeer waarschijnlijk	
○	○	○	○	○	○	○	○	○

Vraag 4

In welke mate denkt u een digitaal platform voor zorg en welzijn aan te raden aan vrienden/familie/collega's?

Totaal onwaarschijnlijk				Neutraal			Zeer waarschijnlijk	
○	○	○	○	○	○	○	○	○

Algemeen

Voordat u de volgende vragen beantwoord, mag u kort op het platform browsen.

Vraag 6 – Kunt u kort beschrijven wat u miste op Zo-Dichtbij

Vraag 7 – Kunt u kort beschrijven wat u handig vond op Zo-Dichtbij

Vraag 8 – Kunt u kort beschrijven wat u van hulpchat Ann vond?

Vraag 9 – In hoeverre bent u het eens met de volgende stellingen?

	Zeer oneens			**Neutraal**			**Zeer eens**
De test voor het platform Zo-Dichtbij was goed georganiseerd.	○	○	○	○	○	○	○
De test had een duidelijke opbouw.	○	○	○	○	○	○	○
Ik begreep wiens rol ik had tijdens de sessie.	○	○	○	○	○	○	○
De instructies waren duidelijk genoeg om mijn taken te vervullen.	○	○	○	○	○	○	○
Ik heb aan het begin genoeg informatie ontvangen om alle taken te vervullen.	○	○	○	○	○	○	○
De observanten tijdens de sessie hebben mijn gedrag beïnvloed tijdens de sessie.	○	○	○	○	○	○	○
De scenario's kwamen overeen met hoe ik het platform zelf zou gebruiken.	○	○	○	○	○	○	○
De scenario's hebben mij een duidelijk beeld gegeven van Zo-Dichtbij	○	○	○	○	○	○	○
Deelnemen aan de sessie heeft mij doen nadenken over comfortabel thuis wonen	○	○	○	○	○	○	○
Deelnemen aan de sessie heeft mij gerustgesteld over comfortabel thuis wonen	○	○	○	○	○	○	○
Deelnemen aan de sessie was een interessante ervaring.	○	○	○	○	○	○	○

Vraag 10
Als u geïnteresseerd bent in de resultaten van het onderzoek wilt u dan hieronder uw email-adres invullen?

_____

Appendix D

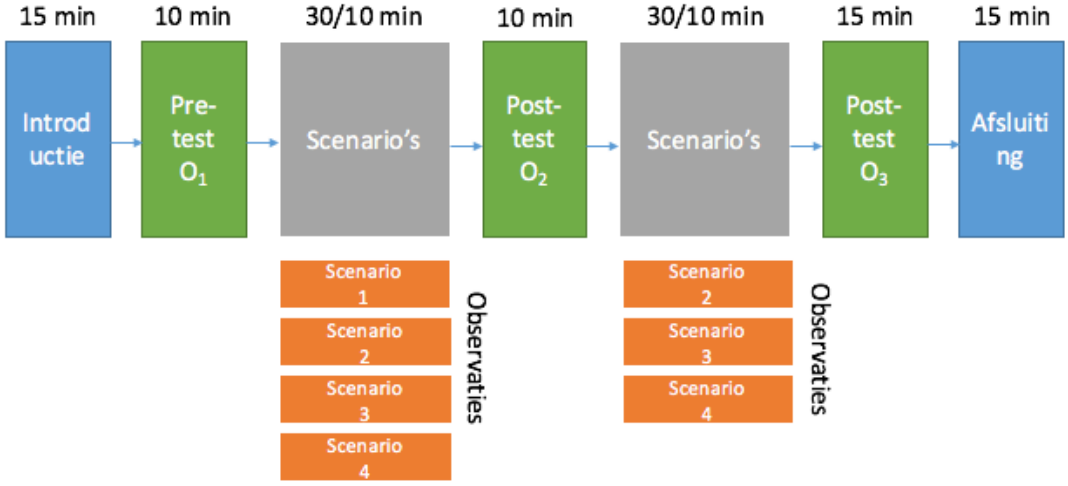
Observatie instructies

Allereerst, heel erg bedankt voor uw hulp met observeren tijden het experiment.

Dit experiment is onderdeel van mijn Master Thesis onderzoek. Op woensdag 11 mei 2016 staan drie experimentele sessies gepland. Tijdens deze sessies zullen mantelzorgers (of interesse voor mantelzorg) tussen de 50 en 75 jaar een digitaal platform voor zorg en welzijn evalueren als onderdeel van mijn onderzoek. De planning van de experimenten staan in de tabel hieronder weergegeven.

Beschrijving	**Datum**	**Tijd**	**Deelnemers**
Experiment #1	11 mei 2016	12.30-14.30	6-15 mantelzorgers
Experiment #2	11 mei 2016	15.00-17.00	6-15 mantelzorgers
Experiment #3	11 mei 2016	19.00-21.00	6-15 mantelzorgers

De deelnemers zullen verdeeld worden in twee experimentele groepen. De ene groep zal fungeren als een controlegroep. Het doel van het experiment is om te bepalen in hoeverre een digitaal platform voor zorg en welzijn ouderen kan ondersteunen in het langer comfortabel thuis wonen. Om het doel te behalen zullen drie meetinstrumenten ingezet worden: enquêtes (pre-test, post-test), tijdmetingen en observaties (zie Figuur 1).



Figuur 1- Experiment organisatie

De tijdsmetingen zijn bedoeld om te meten hoe lang het duurt om een scenario af te ronden en of er verschillen zijn tussen de twee groepen. Met de observaties kan inzicht verkregen worden over hoe deelnemers te taken (het digitaal platform) ervaren. Bovendien kan er ook gemeten worden of het gedrag van de verschillende experimentele groepen verschilt van elkaar.

Neem voor het experiment een telefoon en/of horloge mee om tijd mee te kunnen bijhouden.

Ieder observant zal van tevoren een aantal deelnemers toegewezen krijgen om te observeren. De locaties van de deelnemers in de computerzaal zullen inzichtelijk gemaakt worden aan de hand van een plattegrond. Ieder observant zal 5/6 deelnemers toegewezen krijgen om te observeren.

De deelnemers weten dat ze worden geobserveerd, het is dus prima om ook mee te kijken op de computerschermen. De scenario's zullen ook een kleur meekrijgen, zo is het eenvoudig te zien met welke scenario de deelnemer bezig is. Dit is uiteraard handig om observaties te kunnen documenteren.

Het is belangrijk dat er verder geen interactie plaatsvindt tussen de observanten en de deelnemers, zoals praten en vragen stellen. Zodra een deelnemer een vraag heeft, noteer de deelnemer en de vraag als deel van de observatie. De vraag zal vervolgens door de leiding worden beantwoord. Andere observaties specifiek per deelnemer kunnen ook per deelnemer genoteerd worden.

Indien er vragen en/of opmerkingen zijn, dan hoor ik die graag.

Alvast velen dank voor uw hulp, het wordt enorm gewaardeerd!

Met vriendelijke groet,

Edwin van den Houdt

Observatie checklist

Datum: 11 mei 2016
Sessie: ○ *Experiment 1 (12:30)* | ○ *Experiment 2 (15:00)* | ○ *Experiment 3 (19:00)*
Observatie groep: ● Groep (01-20) starten zonder chat
Hoeveelheid deelnemers geobserveerd: …….

Observaties per scenario

- **Introductie**
- **Pre-test O_1**
- **Start scenario's - deel 1**

		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario 1 *Inloggen*	**1a.** In hoeverre vonden deelnemers het moeilijk of makkelijk om in te loggen op het platform Zo-Dichtbij?	○	○	○	○	○
	1b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om in te loggen.					
	1c. Wat viel op tijdens het uitvoeren van het scenario? Waar liepen deelnemers tegenop?					

		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario 2 *Praktische zaken regelen*	**2a.** In hoeverre vonden deelnemers het moeilijk of makkelijk om praktische zaken te regelen op het platform Zo-Dichtbij?	○	○	○	○	○
	2b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om praktische zaken te regelen.					
	2c. Wat viel op tijdens het uitvoeren van het scenario? Waar liepen deelnemers tegenop?					

		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario 3 *Producten en diensten organiseren*	**3a.** In hoeverre vonden deelnemers het moeilijk of makkelijk om producten en diensten te organiseren op het platform Zo-Dichtbij?	○	○	○	○	○
	3b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om producten en diensten te organiseren.					
	3c. Wat viel op tijdens het uitvoeren van het scenario? Waar liepen deelnemers tegenop?					

		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario 4 *Informatie opzoeken*	**4a.** In hoeverre vonden deelnemers het moeilijk of makkelijk om informatie op te zoeken op het platform Zo-Dichtbij?	○	○	○	○	○
	4b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om informatie op te zoeken.					
	4c. Wat viel op tijdens het uitvoeren van het scenario? Waar liepen deelnemers tegenop?					

- **Post-test O_2**
- **Start scenario's - deel 2 Alleen Chat**

DEEL2 ALLEEN CHAT		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario 2 *Praktische zaken regelen*	**2a.** In hoeverre vonden deelnemers het moeilijk of makkelijk om praktische zaken te regelen op het platform Zo-Dichtbij?	○	○	○	○	○
	2b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om praktische zaken te regelen.					
	2c. Wat viel op tijdens het uitvoeren van het scenario? Waar liepen deelnemers tegenop?					

DEEL2 ALLEEN CHAT		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario 3 *Producten en diensten organiseren*	**3a.** In hoeverre vonden deelnemers het moeilijk of makkelijk om producten en diensten te organiseren op het platform Zo-Dichtbij?	○	○	○	○	○
	3b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om producten en diensten te organiseren.					
	3c. Wat viel op tijdens het uitvoeren van het scenario? Waar liepen deelnemers tegenop?					

DEEL2 ALLEEN CHAT		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario 4 *Informatie opzoeken*	**4a.** In hoeverre vonden deelnemers het moeilijk of makkelijk om informatie te vinden op het platform Zo-Dichtbij?	○	○	○	○	○
	4b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om informatie te vinden.					
	4c. Wat viel op tijdens het uitvoeren van het scenario? Waar liepen deelnemers tegenop?					

- **Post-test O_3**
- **Afsluiting**

Algemene observaties van de scenario's

		Heel moeilijk	Moeilijk	Niet moeilijk of makkelijk	Makkelijk	Heel makkelijk
Scenario's in het algemeen	**1a.** In z'n algemeenheid, in hoeverre vonden deelnemers het moeilijk of makkelijk om de scenario's te doorlopen?	○	○	○	○	○
	2b. Geef kort aan waarom u denkt dat de deelnemers het moeilijk of makkelijk vonden om te scenario's te doorlopen.					
	3b. In het algemeen. Wat viel op tijdens het uitvoeren van de scenario's? Waar liepen deelnemers tegenop? Wat ging er goed?					