AAL Joint Programme

D1.4 Human-centred design in WeCare

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Abstract: The WeCare project followed a human-centred design (HCD) (ISO 1999) approach. With the term HCD we refer both to user involvement and to co-design. User involvement was promoted by organizing research, design and evalution in close cooperation with older people, e.g. by involving them in interviews, workshops and user trials. Co-design was promoted by organizing the project as an multidisciplinary and iterative process in which project-team members with different backgrounds cooperated. HCD offers diverse potential benefits for idea generation and service development, for project management and for the participating organization(s), and longer-term benefits. In this report we studied the effects of HCD on idea generation and service development. Furthermore, we studied project-team members perceptions of the benefits, risks and costs of organizing HCD. Moreover, we articulated several (tentative) recommendations for organizing HCD in such a manner that the benefits of HCD are actually realized.

Target audience: People that are interested in organizing human-centred design (*user involvement* and *co-design*) and in cooperating with older people in technology development.

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Editor: Marc Steen, TNO

Workpackage leader: Nacho Madrid, I2BC

Project co-ordinator: Sharon Prins TNO

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List of authors

Marc Steen (TNO) (Ed.)

Carlijn Broekman (TNO)

Marja Harjumaa (VTT)

Minna Isomursu (VTT)

Matias Itkonen (Caritas)

Nacho Madrid (formerly I2BC)

Victor Hernandez (ASSDA)

Fernando Rodriguez (ASSDA)

Claire Reilly (formerly Skytek)

Gillian Reynolds (Skytech)

Sarah Bourke (Skytech)

Marry van Baalen (ANBO)

Jannie Roemeling (ANBO)

Marlou Min (ANBO)

Table of contents

Executive Summary

The WeCare project followed a human-centred design (HCD) (ISO 1999) approach. With the term HCD we refer both to user involvement and to co-design. User involvement was promoted by organizing research, design and evalution in close cooperation with older people, e.g. by involving them in interviews, workshops and user trials. Co-design was promoted by organizing the project as an multidisciplinary and iterative process in which project-team members with different backgrounds cooperated. HCD offers diverse potential benefits, ranging from benefits for idea generation and service development, to benefits for project management and the participating organization(s), to longer-term benefits.

In this report we studied the effects of HCD on idea generation and service development by reflecting on the process and outcomes of the HCD process. We found that HCD can be especially helpful and have added value for understanding users' contexts, needs and preferencds, as a basis for joint idea generation; steering service development, e.g. by grounding decisions to steer the project in another direction; prioritizing and choosing between different functionalities; choosing between further developing user interface design solutions; further improving functionalities and user interface solutions; and (last but not least) evaluating the practical added value of the services developed in people's daily lives, by organizing user trials or pilots.

Furthermore, we studied project-team members perceptions of the benefits, risks and costs of organizing HCD by organizing a survey amongst project-team members. A majority of project-team members experienced the benefits of HCD for idea generation and service development, many experienced the benefits for participating organization(s) and expected benefits for the longer term. They had mixed ideas on the benefits of HCD for project management (advantageous for quality of decision making, disadvantageous for speed of decision making). Overall, many found the costs and risks acceptable and a majority would organize HCD again in the future.

Moreover, we articulated several (tentative) recommendations for organizing HCD in such a manner that the benefits of HCD are actually realized:

- Organize HCD as an iterative process and to use HCD to promote multidisciplinary teamwork
- Consider the full range of HCD methods and to combine them productively
- See each interaction with users as a chance to develop knowledge and to steer the project.

In addition, we discuss the difference between the HCD processes in the four different countries (Finland, Spain, Ireland, The Netherlands), in order to adopt to the different contexts and user groups in the different countries. The HCD processes have been organized appropriately and differently in the different countries and have resulted in different, relevant and easy-to-use services. The services that were developed optimally match the different contexts (e.g. iOrganization, iVillage) and the needs and preferences of the different types of older people (e.g. frail clients of care services or indempendently living farmers).

We also discuss the added value of involvinig not only primary users (older people) but also of people who represent users and can speak on their behalf, and the legitimacy of starting a project with an idea for a product or service, as long as the project-team members have an open attitude towards users and their experiences during the HCD process.

1. Introduction

From the start of the *WeCare* project, project-team members have followed a human-centred design (HCD) approach. HCD can be characterized by four principles (ISO 1999):

- Actively involving users, to better understand their experiences, needs and preferences
- Finding an appropriate allocation of functions between users and technology (agency)
- Organizing productive iterations of research, design and evaluation
- Organizing multi-disciplinary teamwork throughout the project.

With the term *HCD* we refer to two types of cooperation: we refer both the *involving of (potential) users* in research and design activities, and to the organizing of a multi-disciplinary *co-design process* between project-team members with diverse backgrounds. Project-team members have cooperated closely with older people and with each other throughout the project, in an iterative process of idea generation and service development.

HCD is increasingly popular because it is believed to help design services which better match users' needs and preferences. In an earlier study, based on literature and on three cases, a list of potential benefits of HCD was identified (Steen et al., 2011; cf. Alam 2002, Kujala 2003), ranging from benefits for idea generation and service development, to benefits for project management and for the participating organization(s), to longer-term benefits:

- Benefits for idea generation:
  - to generate other/alternative ideas, based on users' or customers' input, e.g., ideas with high 'originality'
  - to generate better ideas, based on users' or customers' input, e.g., ideas with high 'user value'
  - to understand users' needs and preferences, e.g., their daily live experiences
  - to improve the process of idea generation, e.g., by bringing together (potential) users and project-team members.
- Benefits for service development:
  - to improve the service definition, e.g., by formulating more precise user requirements
  - to develop better services from users' perspective, e.g., services that better match users' needs
  - to develop more differentiated services, e.g., services that are more appropriate for a specific target group
  - to develop services with higher quality, e.g., services with better usability
  - to develop better services from project perspective, e.g., services with less shortcomings or failures.
- Benefits for project management:
  - to improve the quality of decision making, e.g., because input from users can be taken into account
  - to improve the speed of decision making, e.g., because input from users can be taken into account early-on

  - to lower the development costs, e.g., because input from users helps to improve the development process
  - to reduce the development lead-time, e.g., because input from users helps to improve the development process
  - to organize continuous improvements, e.g., by organizing iterative cycles of research, design and evaluation together with users.
- Benefits for participating organization(s):
  - to improve innovation and creativity within the organization(s) that are involved
  - to improve the focus on users within the organization(s) that are involved
  - to improve cooperation within the organization(s) that are involved, e.g., better cooperation across disciplines
  - to improve innovation capabilities, e.g., increased capabilities to organize workshops or interviews with users
  - to generate enthusiasm for innovation or creativity within the organization(s) that are involved.
- Benefits for the longer term:
  - to improve relations between the organization(s) involved and users or customers
  - to improve relations between the organization(s) involved and the general public
  - to make innovations more successful, e.g., in terms of increased sales or increased market share
  - to improve the satisfaction of customers or users
  - to improve the loyalty of customers or users
  - to educate, to instruct or to train customers or users

However, organizing HCD also poses several challenges (Steen 2011; Steen 2012): it requires cooperation between diverse people and it requires the combination and integration of different people's knowledge or ideas. In the case of WeCare, it is, e.g., a recurring challenge for project-team members to combine their own ideas for the online social networking service that they are developing with older people's ideas regarding the service in relation to their daily life.

One specific challenge in the WeCare project, regarding user involvement, was the cooperation with *older people* and their characteristics (Isomursu and Harjumaa, 2011; Eisma et al, 2004). Eisma et al. (2004) discussed their experiences in involving older people during ICT development and advocated carefully organizing interactions with them. In particular, they stress importance of explaining clearly the purpose of the interactions and what roles are expected from them, using understandable terms and concrete prototypes, focusing on the expected usefulness of the product or service which is being developed, and paying attention to the social nature of meetings and interactions.

Another specific challenge in the WeCare project, regarding co-design, was the organization of collaboration between academic and industrial partners involved in the project (Isomursu and Harjumaa 2011). Newel et al. (2006), reflected on the same project as Eisma et al. (2004) reflected on, discussed the challenges they faced in persuading the industrial partners to work together with the older people. Newel et al. (2006) emphasized that time and patience were needed when designing in cooperation with older people, and that one needs to understand the difficulties which older people can have when using computers.

Below, we reflect on the process of HCD (with which we refer both to user involvement and to co-design) in the WeCare project, in order to address three research questions:

1. *What are the effects of organizing HCD on idea generation and service development?* This question is concerned with the immediate benefits of HCD for idea generation and service development processes, and with the effects of HCD on the services that are developed—with the effects of HCD on the project's outcomes.
2. *How do project-team members' perceive the diverse benefits of HCD, how do they evaluate the costs and risks of HCD, and what are their intentions to organize HCD in the future?* This question is concerned with project-team members' perception of the different types of benefits of HCD and with their overall evaluation of costs and risks, and their intentions to organize HCD in the future.

In order to address these research questions, we will discuss the following:

- Chapter 2: Human-centred design *methods* that we applied in the WeCare project
- Chapter 3: Human-centred design *activities* that were conducted in the different countries: Finland, Spain, Ireland and The Netherlands (to address research question 1)
- Chapter 4: A survey amongst project-team memebers to study their perceptions of the benefits, costs and risks of human-centred design (to address research question 2)
- Chapter 5: Conclusions (to summarize the results from Chapters 4 and 5, and to address research question 3)

Please note that this report focuses on the process of idea generation and service development up till the moment that the user trial started in the four countries (Finland, Spain, Ireland and The Netherlands). Details on the process of user involvement and co-design can be found in the prior deliverables:

- D1.1 Plans for user involvement and co-design, which contains both generic and specific plans
- D1.2 User models, use cases and scenarios, based on preliminary findings from user studies
- D1.3 User requirements, based on various HCD activities, specific for each country.

Furthermore, details reagerding application development can be found elsewhere:

- D2.1 Technical specification of WeCare 2.0 Service
- D2.2 First release of WeCare 2.0 Service
- D2.3 First release of trial environment
- D2.4 Final release of WeCare 2.0 Service

Moreover, details on the various user trials in the different countries can also be found elsewhere:

- D3.1 Plans for trials
- D3.2 Findings from each trial (Spain, Finland, Ireland, The Netherlands)
- D3.3 Report on all trials

2. Human-centred design methods

The key goal of the WeCare project is to develop and evaluate online social networking services that would help older people to stay in touch with others. It aims to promote social communication and participation,—and to prevent them from becoming lonely. In preventing older people from becoming lonely, the WeCare sevice aims to improve older people's well-being.

Aiming to develop an online networking service that fits in the end-users livestyles and meets their whises, users were closely involved in the development process. Because the goal was to design both a service and a product, it was also necessary to involve users in the design and development process to make the product more usable by focusing on the use of the system and applying human factors, ergonomics and usability knowledge and techniques (SFS 2010). In order to profit optimal from the end-users' knowledge, the older people, and people who are closely related to the older people are treated as 'experts of their experience' (Sleeswijk-Visser et al 2005), i.e. they are involved in the project on the basis of being experts on their own daily life experiences and their knowledge about their practical needs and preferences. Project-team members aimed to develop the WeCare services together with them, rather than for them. Because some of the potential end-users could not participate in the HCD activities themselves, due to their physical challenges, their nurses were invited to represent them, in order to represent their user requirements too.

Alam (2002) discussed different *intensities* of user involvement: 1. Passive acquisition of input; 2. Information and feedback on specific issues; 3. Extensive consultation with users; and 4. Representation. In WeCare, we have focused on Information and feedback and Extensive consultation (e.g. in interviews about their daily lives, needs and prefernces), (e.g. in interviews with) and on Representation (e.g. in workhosps where older people participated in idea generation and development). Moreover, Alam (2002) discussed different *modes* of user involvement: 1. Face-to-face interviews; 2. User visit and meetings; 3. Brainstorming; 4. Users' observation and feedback; 5. Phone, faxes, and e-mails. Producers informed; and 6. Focus group discussions. In the WeCare project, many of the interactions between project-team members and older people were face-to-face, e.g. in interviews, user visits and various meetings, workshops and focus groups. During the trials there were also interactions via phone or email.

A way of organizing user involvement was proposed by Alam (2002). Based on a literature review, he discussed user involvement activities in different stages of a development process: strategic planning, idea generation, idea screening, business analysis, formation of the cross-functional team, service and process design, personnel training, service testing and pilot run, test marketing and commercialization. In the case of WeCare, the strategic planning and the cross-functional group formation were done before the actual project started. We have applied user involvement methods in idea generation, idea screening, service design, service testing and user trials. For Business analysis several organizations who might be interested in exploiting the service were contacted during the development process. The AAL event offered a good platform to meet these organisations.

In each of the four participating countries, an organization that represents older people participates in the project consortium:

- Finland: Caritas Foundation, a provider of care services

- Spain: FASS, which later merged into ASSDA, a provider of care services
- Ireland: Irish Farmers Association
- The Netherlands: ANBO, an older people's organization and HWW, a care provider

Throughout the project, different HCD activities were planned:

- Interviews: The interviews helped in gaining more understanding of older people's daily lives, and their needs and preferences, e.g. What do they do during a common day? What do people miss in their lives? How would they like to communicate with others? What are their technological skills and capabilities? The interviews were the main input for the persona's and scenario's which were conducted. These were subsequently used as input for the design and development process. Moreover, the interviews were used to evaluate ideas and prototypes in close cooperation between technology developers, case service providers, researchers and older people.
- Workshops: Workshops were organized to evaluate ideas and to articulate user requirements and specifications. In some workhops creative techniques were used, such as brainstorming or joint sketching and drawing of user interfaces. Workhops allow different people to interact with each other, to react to other people's idea's, and jointly develop new ideas. Sometimes workshops are referred to as 'focus group'; a focus group is then a workshop with a specific focus for the discussion, e.g. the user interface that is being developed.
- Trials: Trials were organized in order to evaluate, and to modify or further develop the services that were developed in the project. In these trials, the services were actually used by older people in their daily life contexts for a relatively long period of time.
- Questionnaires: Questionnaires were organized at the start ('0-measurement') and at the end of each user trial. The goals of these questionnaire studies were multiple: to study how older people used the services; and to evaluate the services and the added value of these services in their daily lives. More specifically, there were questions that aimed to evaluate in what ways and to what extent these services had actually contributed to older people's well-being.

The goal of the HCD activities is twofold: 1) The activities aim to better understand older people, and the people around them, their daily lives, their needs and preferences. The insights gained from these interactions with older people are meant to inform and inspire idea generation and service development. 2) The activities are planned in order to design with the end-user, not for the end user. Hence, the activities led to actual user requirements and specifications for the online social networking services that were being developed in the project.

The different HCD activities can be compared to eachother, based on two axis: 1) personal contex versus lab context and 2) qualitative versus quantitative method. Hence, one can plot the methods in a matrix.

- In this matrix, the y-axis maps methods based on context, ranging from 'in the field' contexts (research has no control on the environment) to 'in the lab' contexts (researcher has all control on the environment). This disticitoin is relevant in HCD, because the participant is likely to behave differently based on whether he/she is in his/her own environment, compared to when he/she is in a lab-enviroment. Participants are likely to be better able to stay closely to their own preferences when they are in their own environment, whereas they are expected to be better able to give a more general opinion when they are in a lab environment. The advantage of the

personal environment, is that the researcher will is better able to find out whether a service, or requirements of the service really suits in someones live when the HCD-participant is in his/her personal environment. On the other hand, generalizability to a certain extend is necessary, because the service is to be developed for more people than only the HCD-participants. Hence, results of the HCD process will be most fruitfull when you vary between personal and lab context.

- The x-axis maps methods based orientation, ranging from *design-oriented methods* (often qualitative), methods, such as interviews or workshops for generating ideas, to *evaluation-oriented* methods (often quantitative), such as user trials, questionnaires or workshops for evaluating ideas. Again, both ends of the continuum have there advantages. Qualitative methods provide detailed information, but are time consuming, and it is not realistic to reach a large number of people, wich can be done more easily with quantitative methods. Hence, both ends of the continuum are relevant and should be represented in the methods applied in de HCD process. However, were-as for context variety on during the process is optimal, for generalizability, best results will be gained once you start from more qualitative methods, and during the process evolve towards more quantitiative methods, with sometimes a qualitative check.

Hounering the HCD priniciples, the methods applied in the design process should start upper –left in the matrix: personal context, qualitative method, and end upper-right, personal context, quantitative method. During the process methods offering a lab-context should be applied.

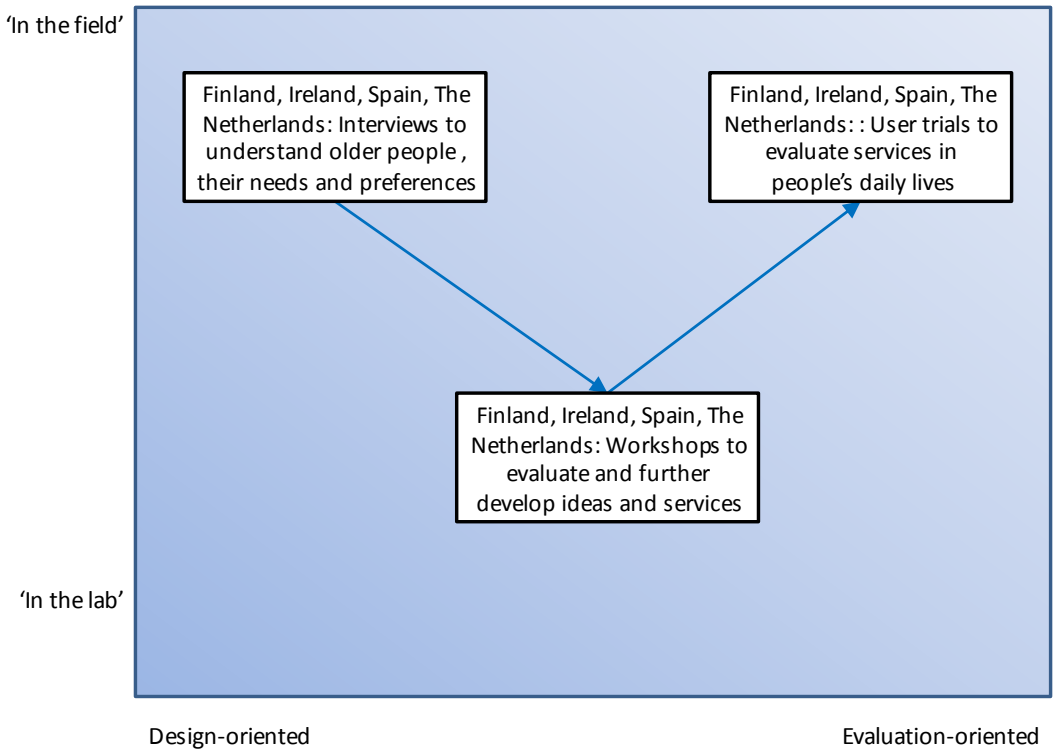

Figure 1. Different human-centred design methods in the WeCare project

The HCD activities were different in the four countries, mainly because of the different context and user groups in the different countries:

- In Finland, the HCD process was carried out by Caritas Foundation, in close collaboration with technology provider Videra and research organization VTT. The Finnish WeCare service is aimed to be used by people who have one or more handicaps. Hence, some potential end-users were represented bt nurses represented the potential users who were not able to join the HCD process themselves. Most of the HCD participants are not able to use a regular computer on their own, due to their physical challenges.
- In Spain, the HCD process was carried out by ASSDA (formerly FASS), in close cooperation with research organization I2BC. Users who participated in the HCD process were clients of the services of ASSDA. They were aged 60 years and older. Most of the participants of the HCD process had phone-contact with ASSDA on a frequent base, also to have a social chat.The participants had no or minor experience with computers.
- In Ireland, the HCD process was carried out by technology provider Skytek, in close cooperation with the Irish Farmers Association. Users who participated in the HCD process are older farmers, aged 60 and older. They live in a rural area. The participants had no or minor experience with computers.
- In The Netherlands, HCD activities were carried out by older people's organization ANBO, with HWW, researchers from TNO and developers from Sharecare/Simac and Ericsson. Users who participated in the HCD process were above 60 years old, and did not use computers frequently in their daily lives.

The HCD processes were organized as iterative processes. This way, insights in the end-user can be development step-wise,and ideas can be tried out and evaluated during the process. Such an iterative process is the opposite of a 'waterfall' process in which one proceeds from A to B in a linear fashion, without evaluating ideas decisions during the development proces. HCD is organized iteratively, so that interactions with users can help to adjust, modify or change the course of the project, in order to better match users' needs and preferences.

3. Results of human-centred design activities

During the WeCare project effort was invested in organizing a HCD process, because several prior studies show many advantages of HCD (Alam, 2002; Steen, 2011). These studies however based their findings on literature. Hence, we will test those believed advantages using the findings of the WeCare project.

The first research question—*What are the effects of organizing HCD on idea generation and service development?*—is concerned with the immediate benefits of HCD for idea generation and service development processes, and with the effects of HCD on the services that are developed.

3.1 Initial ideas

The initial ideas and goals of the WeCare service were the following:

- To help people to engage in social networks, both offline and online, and to establish new social contacts (social networking)
- To help people to improve the quality of their social relationships, for example, in terms of richness, deepness, diversity and feeling connected (social bonding)
- To help people to be(come) more active in organizing activities, e.g. based on shared interests, hobbies or sports, e.g. in their neighbourhoods (social cohesion)
- To help people to coordinate care and related activities amongst family members, friends, neighbours and informal and/or formal carers (informal care)

In order to find out how the WeCare project profited from the HCD approach, we will first describe the initial ideas for the services to be developed, as they were documented in the project proposal.

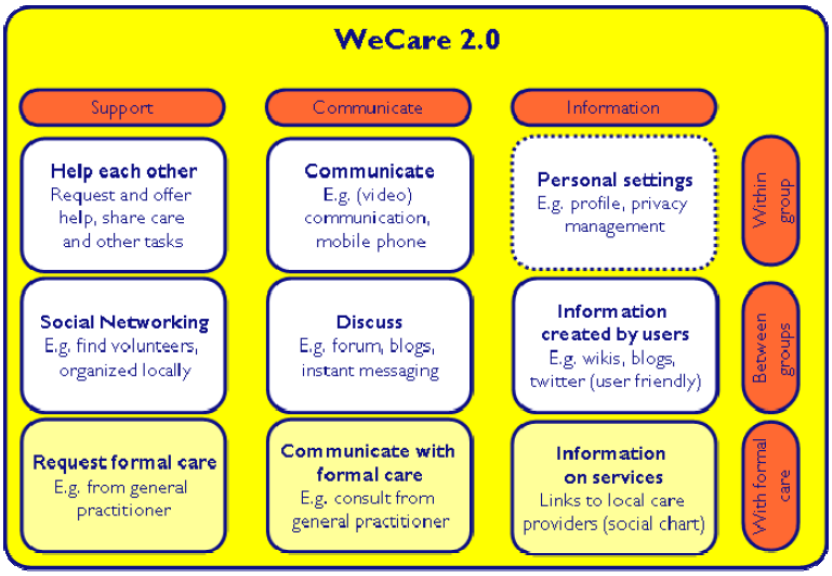

Figure 2. Initial idea for different functions and user groups in the WeCare service (from project proposal)

The initial idea was to develop one service with different modules, so that different services could be developed, by 'mix and match' and modification, for the four participating countries to match the different contexts in the different countries. See Figure 2.

The idea was that the services would allow people to create their own 'closed' groups:

- A small 'closed' group, e.g. the five to fifteen people around one or two older people, e.g. family members, friend and close neighbours—to offer a sense of safety and privacy.
- A larger, more 'open' group, e.g. the people in one neighbourhood or within one village, to promote communicaton and cooperation between different 'closed' groups.
- Also links to professional care, e.g. to request help from formal care, or to communicate or exchange information with formal carers.

In addition, the idea was to provide different functionalities or tools for these groups:

- Support: user-friendly tools to coordinate requests and offerings of help, and tools to coordinate the sharing of care and other tasks, and (for a broader group) social networking tools.
- Communication: user-friendly tools to communicate (real-time, e.g. via video communication) and to disucss (asynchrounous, e.g. via forums, blogs or messaging).
- Information: user-friendly tools for creating and editing information (user generated content), e.g. to exchange information between different 'closed' groups

The idea was that such a set-up would provide clarity to the users about the different functionalities, and about the different levels of access and privacy. Please note that Figure 2 is a conceptual schematization, and that a user interface will look very different from this first drawing.

Furthermore, the idea was to distighuish between two ways of implementing and marking such a service:

- As part of a care services of one care provider organization ('iOrganization'), this was the case in Finland (as part of the Caritas housing and care services) and Spain (as part of the FASS/ASSDA telecare services)
- As a more general service for people who live in in one area or for people that subscribe to a general service ('iVillage'), this was the case in Ireland (associated to Irish Farmer Association) and The Netherlands (associated with ANBO organization for older people).

Moreover, the initial idea was to build the services by re-using, as much as possible, technologies, components and applications that were built earlier by the various project partners:

- ShareCare/Simac's Care Site and Neighbourhood Site
- Skytek's social networking application MMWeb 2.0
- And Videra's Video Communication System

ShareCare/Simac's Care Site allows people to share and organize care and other tasks within a 'closed' group—see Figure 3 (left). ShareCare/Simac's Neighbourhood Site allows people within one neighbourhood to create and maintain social networks in which people can communicate with

each other and organize and coordinate all sorts of activities—see Figure 3 (right). For both services, special care has been given to the websites's usability and aesthetics. The goal has been to put usage, central stage—not technology.

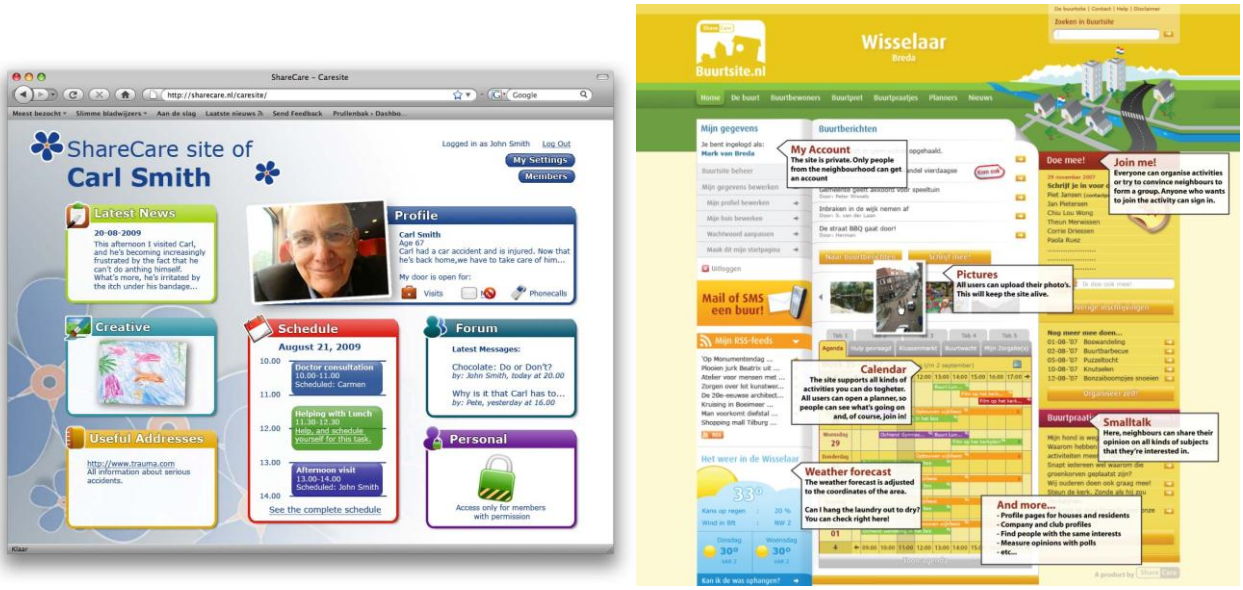

Figure 3. Screenshots of ShareCare/Simac's 'Care Site' (left) and 'Neighbourhood Site' (right)

Videra's Videra Care TV service is a two-way video link that allows both sender and receiver to see and hear each other simultaneously via high-quality video communication, and in an easy to use manner. The objective is to help older people to feel more secure, to have a higher quality of life, and to allow them to live independently in their own homes for as long as possible.

Skytek's integrated social networking application, MMWeb 2.0, uses the latest Web 2.0 technologies. It provides access to applications such as blogs, forums, wiki's, calendars, news, chat, content management etc. These applications are fully integrated and can be modified to fit the needs and preferences of specific groups of users, e.g. older people. See Figure 4.

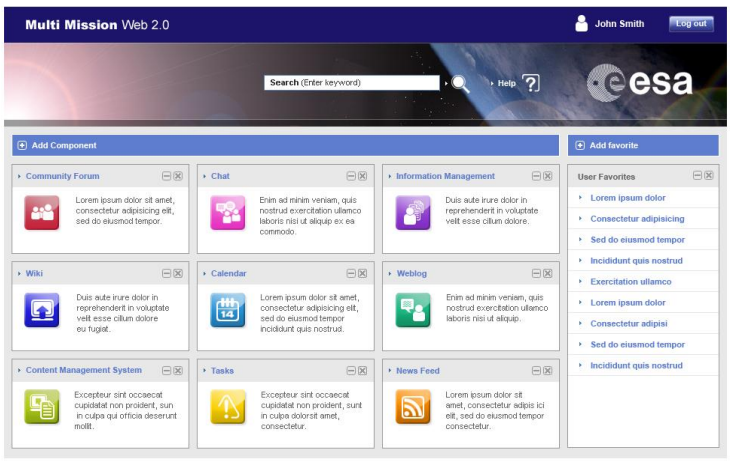

Figure 4. Screenshot of Skytek's MMWeb 2.0 social networking services

In order to be able to assess the effects of organizing HCD on idea generation and service development, we will discuss—in the next sections—the processes of HCD in the four countries (Finland, Spain, Ireland and The Netherlands). For each country we will discuss:

- Starting points, e.g. the context of the project, the actors involved, and initial ideas for the service and underlying technology
- Activities and effects, i.e. HCD (user involvement/co-design) activities, with a focus on the effects on idea generation and service development

Taken together, these disscussions allow us to conduct a cross-case analysis (Yin 1994) and to better understand the effects of organizing HCD on idea generation and service development.

3.2 Finland

In Finland the team members followed an iterative process in which interviews and workshops were organized by Caritas and VTT. Care personnel at Caritas were actively involved, also as a way to represent those older people that are unable to effectively participate in interviews or workhops.

The Finnish pilot was organised in co-operation with end-user organisation Caritas Foundation, technology provider Videra and research organisation VTT. The study aimed at designing both a service and a product, and thus, the users were involved in the process in several phases.

Context and starting points

The pilot environment in Finland was provided by Caritas Foundation: a not-for-profit organization that provides assisted living and rehabilitation services. The service offerings of Caritas Foundation cover a range of services for older or disabled people. In this study, the focus was on *rehabilitation service*. Rehabilitation is seen as a core enabler for tackling problems related to loneliness and isolation, as it can address problems from physical mobility to cognitive and psychological issues. Currently, the care service concept is based purely on face-to-face meeting and other arranged activities that require physical meetings. The Caritas Foundation wishes to expand this service concept with virtual connection between the participants of the rehabilitation, their caretakers, close ones and the professional contacts provided by Caritas Foundation and other interest groups. The goal is to expand the existing service concept to better address the long-term needs of the users, and better integrate the rehabilitation service with the everyday lives of the users.

Starting point for the service development in Finland is the Videra Caring TV, which allows both the sender and the recipient to see and hear eachother simultaneously via two-way video link. The system is especially designed for older users and it can be used for communicating e.g. with health care professionals or social workers. The goal is to provide different digital services for older people with the help of this technology and to support their independent living. Videra Caring TV also allows older people to communicate with each other and to participate in diverse interactive programmes, such as exercise classes, interactive conversations, expert lectures, and other health-promoting services. Videra Caring TV allows older people to stay in touch with their children who may live far away. Family members can have Caring TV installed on, e.g. a laptop computer.

The customers of rehabilitation services are a challenging user group regarding technology design and adoption. They are usually aged, handicapped or ill people, whose abilities have been reduced and they are normally receive care from their informal carers, i.e. their family members or other intimate persons. However, sometimes they receive temporarily at the rehabilitation services. Many of them have little or no experience with computers and they may have difficulties in imagining how such a technology could help them or how they could use it themselves. It is assumed that besides the customers of rehabilitation services, also their relatives and personnel of Caritas Foundation will be using the service.

Since the project followed a HCD approach, the project-team members did not make a detailed design at the start of the project. However, they did have ideas for what the service would look like, how it would work and how it would help older people to evolve their social lives. The service and its functionalities evolved in an iterative process of design, evaluation and development.

Activities and findings

The personnel and customers of the Caritas Foundation have been in a strategic position in the design, and personnel of technology provider and researchers have provided their experience and knowledge in addition aiming to realise all requirements put by the participants. Requirements were formulated through an extensive series of interviews and workshops. The activities, the findings and their effects on idea generation and service development are presented in Table 1.

Table 1. Human-centred design in Finland

	Activities	Findings
2010		
May	Meeting #1 26/5/2010: Involvement of end-user organisation's personnel A design workshop. Two researchers and a nurse constructively participated in designing the future technology aiming at exploring and identifying user-needs and writing persona- and scenario descriptions.	Respital care unit as use context; e.g. length of care period, current communication possibilities, current service offering (activities) Users' (customer of respital care) characteristics, e.g. age, gender, limitations with functional capacity Users' (customer of respital care) life situation; e.g. expectations, needs, wishes, concerns in life
	Interview #1 28/5/2010 An interview. A researcher interviewed an executive director (and a coordinator of peer support) of Association of informal carers in Oulu area aiming at exploring the challenges and difficulties that informal carers face in their every day life.	Informal care as use context; e.g. what is the current status of the informal care in our area, how it is organised, how it is funded, how much there are informal carers, what are their rights and obligations Users' (informal carer) characteristics, e.g. age, gender, limitations with functional capacity Users' (informal carer) life situation; e.g. expectations, needs, wishes, concerns in life
June	Meeting #2 11/6/2010: Involvement of end-user organisation's personnel and service provider A design workshop. Two researchers, a nurse, and a representative of the service provider with a technical background aiming at exploring the possibilities of the technology for specified user group.	Technology in practice; what are the possibilities and limitations, how the user profiles and accounts will be created User group in practice; e.g. who could be potential users, how they are able to use the device, for what purposes they would use the device How the relatives and friends will be using the technology Which functionalities would be useful If there will be a phone book –functionality, it should inform about the availability of people
July	Meeting #3 22/7/2010: Involvement of end-user organisation's personnel and service provider A design workshop. A researcher, a nurse,	Technology adoption at the respital care unit; who will be the main user, when the user training will be arranged, where the technology will be placed (units, rooms)

	and two representative of the service provider with a technical background aiming at exploring the possibilities of the technology for specified user group in more detail.	Set of functionalities was decided: 1) possibility to call informal carer or relative, 2) possibility to call for other project participants via phone book and 3) a possibility to follow broadcasts (after the basic use has been adopted). There is no need to turn off the system from the UI or see Caritas Foundation's weekly program from the system. Broadcasts will be send also to other Caritas Foundation's units Communication with other people should be preferred instead of informal carer
August	Interview #2 24/8/2010 An interview of a nurse working in a temporary care unit at Caritas Foundation. The interview began with pre-defined questions concerning nurse's work and continued as an informal discussion between two researchers and the nurse concerning the characteristics of the potential user group, their limitations for using technology, challenges and positive things in life, social relationships and attitudes toward technology. An initial plan of the UI layout was presented as well as the concept of the service and it was jointly evaluated. Interview #3 26/8/2010 An interview of a nurse, similar to interview #2	Users' (nurse) characteristics; e.g. age, gender, work description Users' (nurse) attitudes toward customers and technology Users' (customer of respital care) characteristics, e.g. age, gender, limitations with functional capacity Users' (customer of respital care) life situation; e.g. expectations, needs, wishes, concerns in life Development ideas Need for the service
Septem-ber	Interview #4 7/9/2010 An interview of an elderly customer of temporary care unit at Caritas Foundation. He had different kind of limitations regarding his physical capacity. The interview began with pre-defined questions concerning customer's daily tasks and continued as an informal discussion between the researcher and the customer concerning service network, attitudes toward temporary care, his functional capacity, challenges and positive things in life, social relationships and attitudes toward technology. An initial plan of the UI layout was presented as well as the concept of the service and it was jointly evaluated. Interview #5 7/9/2010 An interview of a younger customer of	Users' (customer of respital care) characteristics, e.g. age, gender, limitations with functional capacity Users' (customer of respital care) life situation; e.g. expectations, needs, wishes, concerns in life Development ideas Need for the service

	temporary care unit at Caritas Foundation. He had an illness which limits his mental and social capacity. The interview was similar to interview #4.	
October	Meeting #4 5/10/2010: Involvement of end-user organisation's personnel and service provider A design workshop. Researchers, personnel of Caritas Foundation and representatives of the service provider designed the service together.	There is no need for phone book In the future, it would be useful to have a web-service for providing peer support Caritas Foundation will create content for the WeCare service; occupational therapy, physiotherapy and music events
Novem-ber	Meeting #5 10/11/2010 and Meeting #6 25/11/2010: Involvement of end-user organisation's personnel and service provider A design workshop. Researchers, personnel of Caritas Foundation and representative of the service provider designed the service together.	Technology is in place (no broadcast unit yet) Planning activities related to technology adoption; how the personnel will be trained and how the customers and their relatives will be informed about the service, how the service use will begin, how the user profiles are managed
2011		
January	Meeting #7 13/1/2011: Researcher and occupational therapist designed how the data collection could be integrated into the processes of respital care (not user involvement).	
February	Meeting #8 9/2/2011: Involvement of end-user organisation's personnel and service provider A workshop related to technology adoption. Researchers, personnel of Caritas Foundation and representative of the service provider discussed about the service setup.	Respital care as use context is to challenging for the service adoption: the users have a difficult life situation, little computer experience, limited functional capacity, they are being cared only a relatively short time, and the nurses are busy and don't know how to "sell" the idea of using the new service. It is necessary to change the service setting: a group of home users will be recruited. The video communication possibility is not attractive enough, it is necessary to install the broadcast unit right away.
	User study #1: 2- 3/2011: Involvement of end-users A group of end-users (3 older adults and 3 nurses) were recruited to interviews and demonstration of the device (also the usability was studied).	When the phone book is almost empty, the user interface logic should be improved. Users should get feedback of their actions in a coherent way.
	User study #2: 2/2011-1/2012	Field trial, detailed findings in D3.2. Findings from each trial.
June	Meeting #9 8/6/2011 Involvement of end-user organisation's personnel and service provider A design workshop. Researchers,	There is a need to personalize the user interface per customer (e.g. to change the place of icons and change bigger font). Users are following the broadcasts; the

	personnel of Caritas Foundation and representative of the service provider discussed about the service design and service setup.	personnel of Caritas Foundation are learning how to send broadcasts and how to guide users via video connection.
August	Meeting #10 4/8/2011: Involvement of end-user organisation's personnel A design workshop related to service offering. Researchers and personnel of Caritas Foundation discussed about the users' experiences about the service and designed how the service could be improved.	Improvement ideas to be considered: - It would be useful if other units would also create content for the service - End-users (older adults) could be encouraged to create their own content - Voluntary people could be encouraged to create their own content - Would the users benefit from Caritas Foundation's news (other WeCare modules) - How the occupational therapy could be more attractive (how to provide equipments for the people at home)
	Meeting #11 9/8/2011: involvement of end-user organisation, service provider and researchers A design workshop related to service setup in different units.	The broadcasting possibility has been adopted successfully in one unit and thus, other units will also be included in the service setup.
Septem-ber	Meeting #12 9/2011: involvement of end-users (older adults and personnel of end-user organisation) and researchers in order to gather more user requirements (from those users who are active users of the service and know the possibilities of the technology).	Current WeCare 2.0 system with a touch-screen provides access to social events and physical exercises for both informal carers and people cared for. Only one participant is not able to use the system independently because of his disabilities. Findings continue*

** Participants are quite active people in their everyday life and they have the needed skills and courage to meet new people. However, at least two users find that it is difficult to make friends at their age. One reason is the limitations with functional capacity, especially poor eyesight and problems with hearing as well as problems with speech and mental activities. Participants also feel that they would benefit from peer support. They are motivated to participate in the WeCare-activities and socialize with each others. At this moment they wish that they could continue using the system also after turn of the year when the pilot ends.*

Two participants have their own computers and they use email (#10) and Skype (#8) for communication with their relatives and friends. They commented that their spouses would not be able to use normal computers with keyboard and mouse because of their physical and cognitive disabilities.

One participant mentioned that they still have their own social networks and they are "mobile". They don't always have to communicate from home; they can go outside and meet people. There's also almost oversupply of news, so those would not probable an interesting addition to the system. Maybe Caritas-Foundation's own news (or more local news) would be more interesting (#8, #10, #21). Also medicine reminder would be good (#10).

One participant mentioned that she likes to watch the news. She also would benefit from a medicine reminder, because at the moment she uses an egg timer for that purpose. (#21)

One participant mentioned that information about local news and events would be useful and more interesting than "basic" news. They haven't had difficulties with their medicines. (#8)

One participant feels that there are already so much different activities every day and also people to talk to. However, she would need a friend, because her husband, her husband's relatives and her own relatives have all died and her old friends live far away. She has only her children. She also envies other couples in some level, because they have each others. She says that it would be good if there would be more functionalities in the system and if all her children (their contact information) would be there. She is visually impaired and she uses a reading-TV for reading medicine information and other important information. (#18)

There was intensive cooperation between project team members - both researchers and developers - and, users - both older people and nurses. In the course of the project there were five interviews and twelve meetings, and two user studies.

The basis for the service has been the Videra Carting TV video communication system, which was needed to optimally match with the existing services of Caritas Foundation.

This was done in an iterative process. In a first iteration, the one-to-one video chat feature was evaluated in the context of the respital care service. The goal was to evaluate whether video communication during respital care would alleviate the separation anxiety that was experienced sometimes by the informal carer, sometimes the person in need for care, and sometimes by both of them.

The evaluation showed that the WeCare service was very easy to use, also for the frail and older users. See Figure 5 for a screenshot and Figure 6 for an illustration of practical usage.

However, challenges were identified in integrating the service into the care processes. A second iteration extended the video communication feature of the WeCare service by broadcasting functionality. The broadcasting functionality extends Caritas Foundation's group activities by broadcasting the event through video to those users who are at home or at another facility of Caritas Foundation.

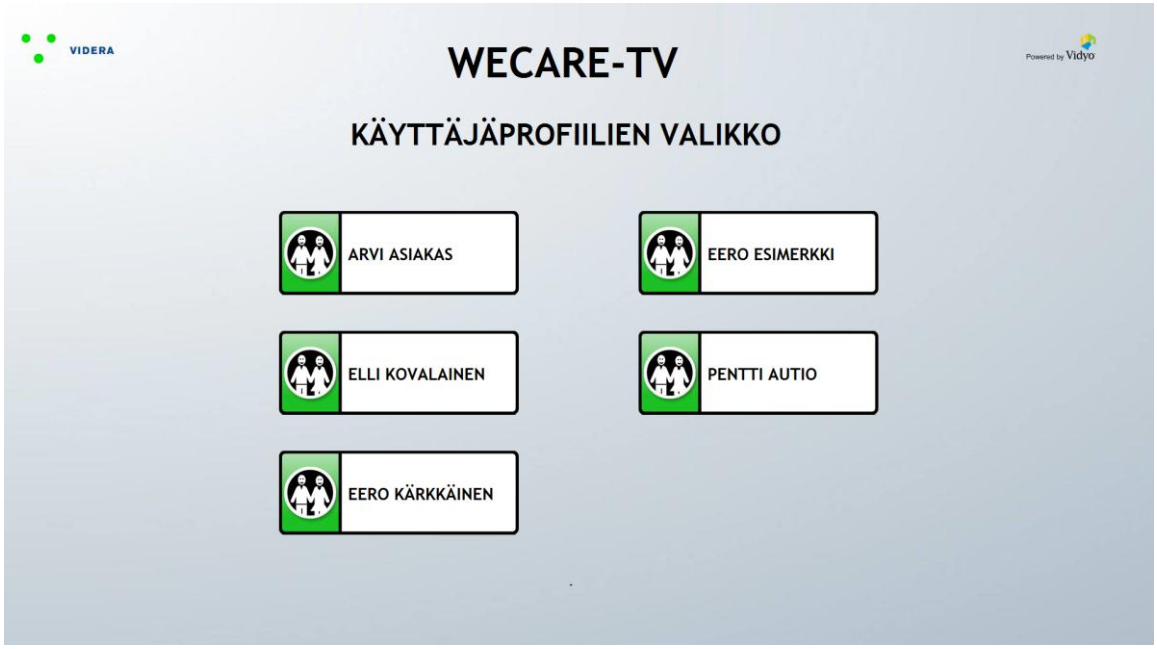

Figure 5. Screenshot of the video communication service

Figure 6. The video communication service as it is used in daily life

Findings

The HCD activities had the following effects on the process of idea generation and service development—in chronological order:

- Understanding respital care and older people, e.g. their characteristics and limitations
- Understanding the role of technology in practice, e.g., its possibilities and limitations
- List of functionalities that would be needed, e.g. to call other people and to follow broadcasts
- Understanding nurses that work in respital care, e.g., their attitudes towards technology
- Understanding of needs and ideas development, e.g. no need for phone book, need for content developed by Caritas Foundation, need for training of nurses and customers and relatives and communication with them about the service
- Change the setting: from using the service in respital care (which proved to be too challenging for service adoption) to using the service at home (with broadcasts to people's homes)
- Ideas for the user interface design, e.g. phone book and feedback, and the idea to personalize the user interface for each individual user, and other ideas, e.g. for user generated content and integration with occupational therapy

The main results of HCD and effects on idea generation and service development were the following:

- User requirements and specifications for the service, based on interactions with older people, nurses and other staff.
- The decision to focus no longer on usage in the context of respital care, but on usage in the context of people's homes.
- Knowledge about which functionalities are or are not needed, and knowledge about which user interface design solutions will or will not work.

3.3 Spain

The HCD process in Spain involved two user trials: iVillage and iOrganization. In the iVillage concept, a local community can share local information fostering social interaction amongst them. In the iOrganisation concept, the social networking service is integrated into a care services that is targeted at older people. Both concepts have been explored.

Context and starting points

The Institute of Innovation for Human Well-being (i2BC) organized an iVillage pilot in Lebrija (a medium-size town near Seville), with the support of the Town Hall and other local organisations. Traditionally, the main economic activities in Lebrija have been related to the agricultural sector and the construction sector—however, both sectors will probably not have enough capacity to support Lebrija's economy. Additionally, Lebrija is facing the consequences of a social and economic crisis, what, together with the demographic changes related to the ageing of the population, lead to an increase of the unemployment rate, as well as early retired elder adults. The end-users of the WeCare service in Lebrija will be elder adults, of ages ranging from 55 to 65 years old, with no relevant health problems. In this context, the goal of WeCare in Lebrija is to promote active ageing by improving social participation and allowing elderly people to be active members in their communities—not only passive subjects or beneficiaries, but also productive members. Prevention is also another benefit, since users can obtain more benefit from it, when they will need to be cared for later on.

The Andalusian Foundation for Social Services (FASS, which later merged into ASSDA) organized an iOrganisation pilot in Malaga and Seville. FASS/ASSDA is the provider of the Andalusian Telecare Service, a system of customized attention, providing immediate response to emergency situations or insecurity, loneliness and isolation, based on new communication technologies. This system also enables users to be reached by phone. The participants' profiles of this pilot correspond to people who are over 65 years old. They are also users of the Andalusian Telecare Service and many of them are currently suffering from dependency, loneliness and social isolation. The goals of the iOrganisation pilot are twofold: to introduce users to the world of new technologies, which will not only provide possibilities to enhance their quality of life but can also provide a means of personal fulfilment; and to test the feasibility of introducing an AAL service like WeCare in an organization like the FASS.

Activities and findings

The iVillage (Lebrija) and iOrganisation (Málaga and Seville) user trials did not only follow a relatively traditional approach of bringing users to the laboratory and asking them what they needed, but also of moving researchers to the real contexts, where they can observe the older people and these people's daily lives' contexts. In Lebrija, a two-day event was organized, including general participatory talks in which citizens discussed their social status, daily life problems and (non-technological) needs in the areas of education, health or well-being. Next, several associations and citizens were recruited to participate in the project and a collaborative atmosphere was created to discover their problems and needs. A similar session was organised by FASS, inviting some of their users for breakfast. During this session, a WeCare demo was presented and discussed, and a first group of users was recruited for the user trial.

The needs and preferences of older people were investigated by means of interviews, focus groups, direct observation of participants' daily lives, and via desk research. The information collected was used together with service requirements to articulate user requirements and to define the components to be included in the WeCare service. These requirements include information about what kind of applications they need and would like to use, in order to promote their social lives by participating in community activities and fostering the exchange of cultural experiences and hobbies. Furthermore, participants in the user trials received an initial training session, to learn the basic functionalities. During this session, some initial comments and difficulties are collected in order to improve the WeCare service in future design iterations.

The WeCare system used for the pilots in Spain (iVillage and iOrganisation) is an Internet portal that includes several components: profile management, news, events' calendar, neighbours and medical reminder. Using these different applications, people can share and comment on user-generated content, organize events, match other users with similar interests or use reminders to recall medication schedule.

The various user involvement and co-design actitivites and the findings are summed up in Table 2.

Table 2. Human-centred design in Spain

	Activities	**Findings**
2010		
March	Meeting #1: Internal meeting i2BC/FASS The aim was to discuss and put together initial service ideas.	Discussion between researchers, telecarers and project managers of both organisations resulted in a common understanding and shared vision of the WeCare service in Spain.
April	Talk #1: Presenting the WeCare project to the community of Lebrija The initial service ideas were presented to stakeholders and representative citizens in Lebrija during an Innovation-day session.	Spontaneous comments and post-talk discussion showed the interest of community stakeholder in linking the WeCare services to the existing social networks in Lebrija (e.g.labour unions, patients associations, etc.)
July	Interview sessions #1: 25 citizens in Lebrija older than 50 years were interviewed.	The user research showed the status, preferences and needs of end-users regarding ICTs use, social networks and well-being.
August	Co-design session #1: Meeting with Lebrija users and stakeholders The aim of this co-design session was to check our initial ideas on user requirements based on the results from the analysis of the interviews.	Health and active aging showed to be the main topics to be addressed by the service. Between the different components to be implemented, news, events and reminder modules were found to be most demanded, while forum and chat were less accepted.
September	Meeting #3: Internal meeting i2BC / FASS A meeting between FASS personnel and i2BC researchers in order to discussed	Using insights from user research, a set of persona and scenario description were developed in order to illustrate service use cases.

	results of user research and provide list of user requirements.	A first list of user requirements was provided focusing on the easiness of the platform and the modules (functionalities) that are included the service.
October	Meeting #4: Weekly meetings with software developers Weekly meeting were schedule from October 2010 to February 2011	A list of user requirements, together with a large list of usability, accessibility and functionality issues was constructed during these meeting. The meeting were also used to prioritize problems to solve.
November	Meeting #3: Internal meeting i2BC / FASS Analysis of persona & scenario. The goal was to extract additional user requirements based on the persona scenario descriptions.	A list of user requirements was provided to software developers and discussed in iterative weekly design sessions.
2011		
March	Co-design session #2: Meeting with 5 FASS users, and 2 telecare assistants in Málaga A first release of the WeCare 2.0 service was used during this session in order to discuss, create new ideas and produce new user requirements.	Some ideas arose on additional requirements for future improvements: - Close vs. open groups - Link between Events and Reminder modules - Reminder used as 'generic', rather than only for medicine
July	Co-design session #3: Participatory design in Lebrija After the first release of the WeCare service in Spain, an initial training session with users and participatory design workshop were organized.	Additional minor issues arose and a set of suggestion to improve the service was collected during the session.

The HCD process in Spain involved 25 interviews with citizens in Lebrija, 3 co-design sessions with FASS/ASSDA clients/users and stakeholders, 3 project-meetings and weekly meetings with software developers.The basis for the service has been the combination of components that were developed in cooperation between Ericsson, Skytek and ShareCare/Simac ,and the integration of the new service into the existing Telecare services of FASS/ASSDA. See Figure 7 and Figure 8.

Findings

The main conributions of HCD to idea generation and service development were the following:

- Prioritizing different functionalities, e.g., news, events and reminder modules were found more relevant than forum and chat
- User requirements, focusing on ease-of-use of the platform and its different functionalities.

Additional requirements for further improving some of the functionalities: e.g., ‘closed’ and ‘open’ groups, links between Events and Reminders, and Reminder used more generically (rather than only for medicines)

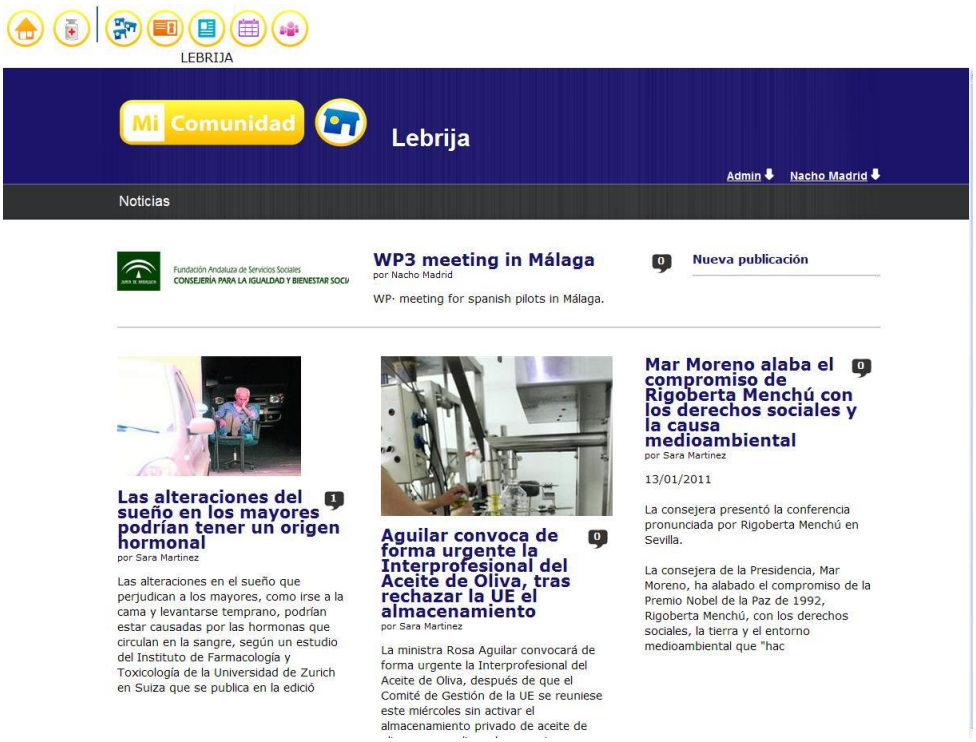

Figure 7. Screenshot of the page with news items (‘Noticias’)

Figure 8. Screenshot of the page with activities (‘Actividades’)

3.4 Ireland

Context and starting points

In Ireland the WeCare service is targeted at Irish farmers over 55 years of age in order to ascertain whether this system can help to combat loneliness and isolation in older Irish people. At present in Ireland there are 130,000 Irish farmers receiving the single farm payment. There are 65,000 farmers on the combined Early Retirement Scheme and the Rural Environmental Protection Scheme (REPS). The Irish Farmers Association has over 21,250 members aged over 65 who live in rural isolated locations all over Ireland. The IFA have a website called iFarm.ie which is actively used by the younger farming community but not by the older farming community. Furthermore, the iFarm system provides a means for the IFA to communicate with their members and for the members to request information from the IFA, but it doesn't focus on the social interaction of the members with each other or with the provision of support services such as social care.

The IFA wished to address the issue of rural isolation amongst older farmers using WeCare 2.0 in conjunction with iFarm. The IFA saw this as an opportunity to encourage older, less computer-literate farmers to use technology as a means of communication and as part of their daily activities and also as part of a larger farming community. The IFA wanted to offer WeCare 2.0 to the entire farming community, enabling farmers both young and old to develop a 'buddy system' where tips, advice and help can be exchanged. Home computers will be used to test the system in people's homes during these trials. In addition, the system was trialled on Android portable devices and on iPads. The trials were organized in Co Kilkenny and Co Louth, both of which are involved in a government initiative called 'Age Friendly Counties'. The objective of this programme is to increase the participation of older people in the social, economic and cultural life of the community, for everyone's benefit and to improve the health and well-being of older people in the county.

Activities and findings

Initially, Development Officers of the IFA in each County profiled members aged over 55 years who were active participants in the IFA and who might be interested in being participants in the project and trials. The Development Officers made a list of potential participants in each County and approached them with the idea. Once they received positive feedback, they sent the results to the customer services department in the IFA Head Office. IFA customer services then further interviewed each potential participant and asked them whether they currently use a computer or laptop, whether they have an internet connection, whether they use a mobile phone, and whether they would you like to participate in the trial. If the response to these questions was positive then the participant was invited to join a focus group, in which they viewed and evaluated the WeCare service. They were very positive about the system, especially about the social networking applications. They found it easy to use the system on an iPad and on an Android smart phone. The majority of farmers who came to the focus group decided to participate in the trials. Some farmers decided not to proceed because of hardware or internet connection issues. Ten older Irish farmers from Co Kilkenny and Co Louth made up the initial trial test group. See Table 3 for an overview.

Table 3. Human-centred design in Ireland

	Activities	Findings
2010		
April	IFA user requirements meeting Consultation with older people groups (e.g. Age action, Home instead)	Established a high level understanding of older farmer's requirements regarding the WeCare service.
May	Consultation with older people groups (e.g. Age action, Home instead)	Discussed different components to be implemented and decided news, weather and Skype most important.
July	Consultation with IFA and older people groups (e.g. Age action, Home instead)	Discussed trials and how participants would be selected.
September	User requirements meeting Focus group with IFA users	Developed a comprehensive view of the various WeCare functionalities and evaluated components during focus group with IFA members.
October	User requirements meeting	Review of WeCare functionalities and user-interface.
2011		
January	User requirements meeting Review and evalution by Skytek CEO and IFA Board	Final version of user-interface reviewed by Skytek Directors and IFA Board.

The human-centred design process in Ireland was relatively focused, and relatively fast, and was based upon a close cooperation between Skytek and the IFA. Potential users were recruited amongst farmers. They were interviewed and then invited to participate in a focus group to evaluate the WeCare service. Many of thesm participated in user trials, in which they practically used and evaluated the WeCare service. See Figure 9 and Figure 10 screenshots of the service.

Findings

HCD has helped to practically and quickly evaluate project-team members' ideas and to practically and quickly modify and improve the service.

The basis for service development has been the combination and integration of several relevant components into an easy-to-use 'portal' that offers: general communication (VoIP phone), general information (sports, news), relevant information for farmers (weather and markets), and an application for farmers (in cooperation with Agfood.ie, for payments and applications). Furthermore, the service has been made available on mobile devices and tablet computers—see Figure 10.

Figure 9. The home page, also suitable for table computers

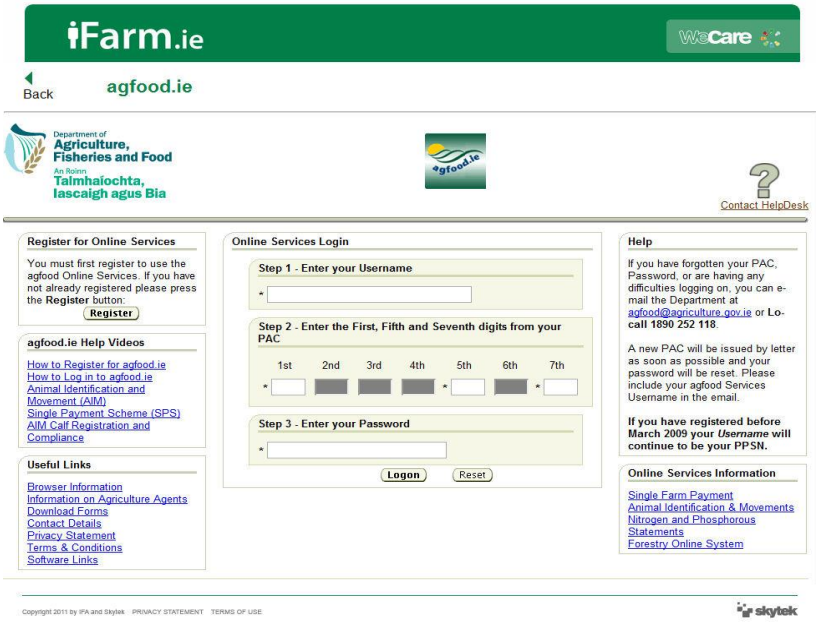

Figure 10. The iFarm application, integrated in the WeCare service

3.5 The Netherlands

Context and starting points

In the Netherlands, the WeCare service was piloted among older people living independently in their own home in Escamp, a part of the city of The Hague. Escamp consists of several neighbourhoods. The housing and population of Escamp is diverse and ranges from apartment buildings and houses built before World War II, which are typically owned by housing corporations and which house relatively many older people and relatively many people from an ethnic minority background, to modern houses and apartment buildings, which are typically owned by younger people and young families. Escamp has 113,000 inhabitants (The Hague 500,000 total). The primary user group is defined as independently living older people, and the secondary user group is defined as these older people's family members, friends and informal carers.

Activities and findings

ANBO as a user organization and TNO as a research organization interviewed 28 older people and their informal carers to better understand their situation, and their needs and wishes regarding a service like WeCare. Four of them participated in co-design sessions in which they spoke about their needs and preferences and actively contributed to the articulation of user requirements for the WeCare service. See Table 4 for an overview of HCD activities.

A group of 10 people participated in the user trial. These people were recruited and invited by a local chapter of ANBO, in close cooperation with HWW, an organization that provides formal care at people's homes. HWW was interested in experimenting with ICT services as possible supplements to their current services. In several cases, the older person was supported by their children and/or informal carers to use the WeCare service . Some older people also received formal care from HWW, in which case these formal carers were also involved in the pilot. People's experiences were evaluated during the pilot, involving both the older people themselves (primary target group) and their family members, friends and/or formal carers (secondary target group).

Table 4. Human-centred design in The Netherlands

	Activities	Findings
2010		
July	Four interviews (by phone) with expert-users. They were 'expert-users', in that they were informal carers (experts on older people's needs), have above average computer skills (experts on technology) and are active within ANBO, e.g. in helping people, both concerning social or emotional issues, and concerning technical or practical issues (experts on social networking)	Better understanding of older people's needs and preferences regarding a service like WeCare, also of issues related to informal care and supporting informal carers Input for developing personas and use cases.
November	Creative workshop with four other expert-users (see above)	Basic functionalities identified and further discussed, and basic categories of 'closed' and 'open' group identified and further discussed:

		▪ Calendar in ‘closed’ group ▪ Discussion in ‘closed’ group ▪ Calendar in ‘open’ group ▪ Discussion in ‘open’ ▪ Accessing the wider internet ▪ Contacts and contact details ▪ Management of privacy in an easy-to-use manner
December	Project-team meeting (without older people, but with project-team members as ‘user advocates’, in that they represented older people’s perspectives, based upon findings from earlier interviews and worskhops)	Review and prioritising of functions. User requirements discussed in relation to technology perspective and practical concerns.
December	Project-team meeting (with ‘user advocates’)	User requirements discussed in relation to technology perspective and practical concerns. Final version (03) of user requirements
2011		
February	Project-team meeting (with ‘user advocates’) about pilot	User requirements discussed with technology devlopers
February	Project-team meeting (with ‘user advocates’) about user interface	Recommendations for improvement of user interface design
April	Project-team meeting (with ‘user advocates’) about Dutch pilot	Improved user interface and recommendations for further improvement of user interface design
April	Project-team meeting (with ‘user advocates’) about Dutch pilot	Final version of user interface

The service development process started with project-team members’ ideas on a service that would help older people to communicate with others, in social networks, both online and ‘in real life’. These ideas were based on earlier and similar research projects. These ideas were further developed, evaluated and modified in an iterative process, in close cooperation with several older people: First, several older people (‘expert users’) were interviewed. Next several other older people (‘expert users’) participated in a creative workshop, in which we jointly further developed and modified these ideas—see Figure 11.

See also Figure 12for a screenshot of the home page and Figure 13 for a screenshot of the shared calendar, via which people can request and offer support in daily life activities.

Figure 11. Creative session with older people, in The Netherlands

Figure 12. Screenshot of the home page

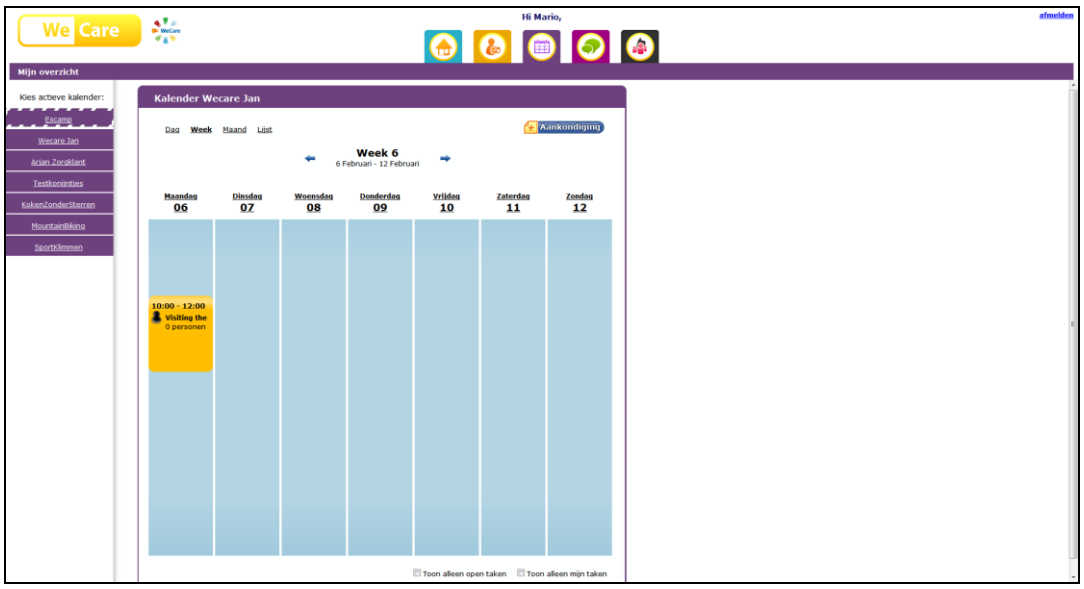

Figure 13. Screenshot of the shared calendar, to request and offer support with daily life activities

Findings

The findings from interviews and workshop were the basis for the user requirements and the user interface design, which were discussed in a series of six project-team meetings. In these meetings, the project-team members that had been involved in the interviews and creative workshop represented older people and their needs and preferences (‘user advocates’). The HCD activities were especially valuable for the usability of the service.

3.6 Discussion

It is interesting to see that the HCD process was organized differently in the different countries. These differences were anticipated because the contexts are different in the different countries:

- In Finland, the WeCare service was developed in close cooperation between care provider Caritas Foundation, technology provider Videra and research organization VTT. The service was based on a video communication system, which was integrated into existing care services, through an iterative, hands-on process in close cooperation with Caritas Foundation personell. *HCD helped to articulate user requirements and specifications for the service, to make the decision to switch focus in the context of usage (from respital care to people's homes), and to develop and fine-tune easy-to-use functionalities and user interface design solutions.*
- In Spain, the WeCare service was developed in cooperation between research organization i2BC, care service provider FASS/ASSDA and technology-oriented project-partners Ericsson, Skytek and ShareCare/Simac. Groups of citizens were interviewed, co-design sessions with FASS-ASSDA clients and stakeholders were organized, and the service was developed iteratively, through weekly meetings with software developers. The service was integrated into the current services of FASS/ASSDA. *HCD helped to prioritize different functionalities, to focus on ease-of-use of the service, and to further improve several functionalities.*
- In Ireland, the WeCare service was developed in a relatively focused and fast process through close cooperation between technology developer Skytek and users'/farmers' organization IFA. Potential users were recruited and interviewed. Several participated in a focus group and then in user trials. The basis of the service has been the combination and integration of several components into an easy-to-use 'portal'. This 'portal' has also been made available on mobile devices, such as tablet computers. *HCD helped to practically and quickly evaluate and modify project-team members' initial ideas and improve the service.*
- In The Netherlands, the service development process started with project-team members' ideas. These ideas were further developed, evaluated and modified iteratively, involving interviews and a creative workshop with older people—and a series of project-team meetings, in which older people's perspectives were represented by project-team members *HCD helped to better understand older people and their needs and preferences, to develop user requirements and user interface design solutions, and to provide input to the service development process on older people's needs and preferences on a continuous basis.*

One may note that in all cases, older people were actually involved in the process. One may also note that in all cases other people—not only older people—helped to represent older people or contributed in other ways to the service development process:

- In Finland, Caritas Foundation personell, especially nurses, represented older people that were unable to participate, and provided input for integrating WeCare into existing services.
- In Spain, people within FASS/ASSDA also had a stake and an important say in the process of service development and in integrating the service into the existing services.
- In Ireland, people from the Irish Farmer Association represented users' perspectives and contributed to the organizing of the user trials and service development.

- In The Netherlands, people from research organization TNO and user organization ANBO (who had been involved in interviews and workshops with older people), represented older people during the development of user requirements and user interface solutions.

Involvement of not only the 'users' but also of other people that represent 'users' is perfectly in line with an HCD approach. In the ISO 13407 standard for HCD (ISO 1999), it is advised to organize multi-disciplinary teamwork that includes a 'variety of skills' and 'range of personnel': users, and also, e.g., application domain specialists, systems engineers and programmers, marketer and salespersons, user interface designers, human-computer interaction specialists, trainers and support personnel.

Furthermore, one may note that in all cases there were already ideas for the service-to-be-developed and ideas to further develop systems or applications that were already available:

- In Finland, the idea was to use the Videra video communication system and to modify it so that it matches the Caritas Foundation services.
- In Spain, the idea was to choose several relevant modules from the current services of ShareCare/Simac ('Care Site' and 'Neighbourhood Site') (partly after service development process The Netherlands, chronologically)
- In Ireland, the idea was to combine and cleverly integrate several relevant components into an easy-to-use 'portal', specifically for farmers.
- In The Netherlands, the idea was to further develop and modify several relevant modules from the current services of ShareCare/Simac ('Care Site' and 'Neighbourhood Site') (so that Spain could choose from these modules, after service development in The Netherlands)

Again, there is nothing inherently good or bad with starting with an idea in HCD. The advantage of starting with an idea is that the project has more focus. A possible risk of starting with an idea is that 'users' have less influence on the idea generation process, and can 'only' contribute to service development: to the modification and further improvement of ideas into services. 'Only' is between quotes because this is indeed not a small contribution. However, this risk has been mitigated by carefully examining the initial ideas and assumptions at the start of the process, both by conducting desk research and by conducting interviews, observations and workshops with older people, in order to evaluate and validate these initial ideas and assumptions. Moreover, and probably most importantly, this risk was mitigated by fostering an open attitude amongst project-team members towards older people throughout the entire HCD process, which allowed for learning and for adopting and modifying their ideas and assumptions. E.g. the decision, in Finland, to focus the project on another context of usage, based on interactions with users.

In sum, the HCD processes have been organized appropriately and differently in the different countries and have resulted in different, relevant and easy-to-use services. The services that were developed optimally match the different contexts (e.g. iOrganization, iVillage) and the needs and preferences of the different types of older people (e.g. frail clients of care services or indempendently living farmers).

4. Benefits of human-centred design

In an earlier study, diverse potential benefits of HCD were identified (Steen et al., 2011), ranging from benefits for idea generation and service development, to benefits for project management, for the participating organization(s) and longer-term benefits.

In order to study whether these *potential* benefits of HCD were *actually* perceived by project-team members, a questionnaire was developed and project-team members were invited to fill-out this questionnaire. It contained 25 statements concerning the potential benefits of HCD, 4 statements about the costs and risks of HCD and 2 statements about intentions to organize HCD in the future (see Appendix). A large and balanced part of the population filled-out the entire questionnaire: 15 people, with an equal distribution between management, technology and application development, and user experience research roles. The results to these statements are summed up below.

A majority experienced the benefits of HCD for the generation of ideas, e.g., for a better understanding of users' needs and preferences (10 'Strongly agree' plus 4 'Agree' = 14 out of 15), and for improving the idea generation process (6 'Strongly agree' plus 8 'Agree' = 14 out of 15).

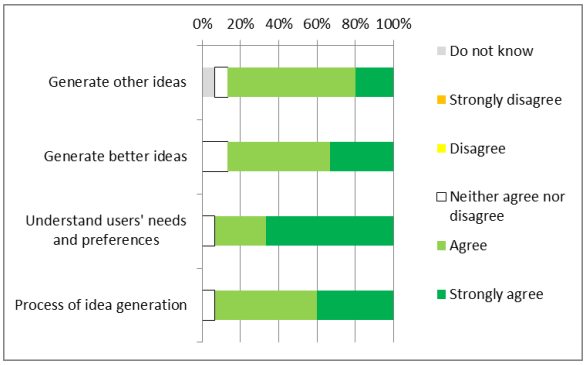

Figure 14. Benefits of HCD for idea generation

A majority also experienced the benefits of HCD for service development, e.g., for improving the service definition (7 'Strongly agree' plus 8 'Agree' = 15 out of 15), for developing better services from users' perspective (8 'Strongly agree' plus 6 'Agree' = 14 out of 15), and for developing more differentiated services (6 'Strongly agree' plus 8 'Agree' = 14 out of 15).

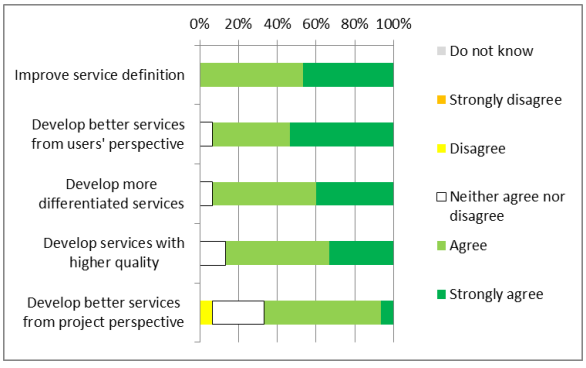

Figure 15. Benefits of HCD for service development

Many also experienced HCD's benefits for the participating organization(s), e.g., an improved focus on users (11 'Strongly agree' plus 2 'Agree' = 13 out of 15), improved relations with users or customers (8 'Strongly agree' plus 5 'Agree' = 13 out of 15), and improved cooperation (2 'Strongly agree' plus 10 'Agree' = 12 out of 15).

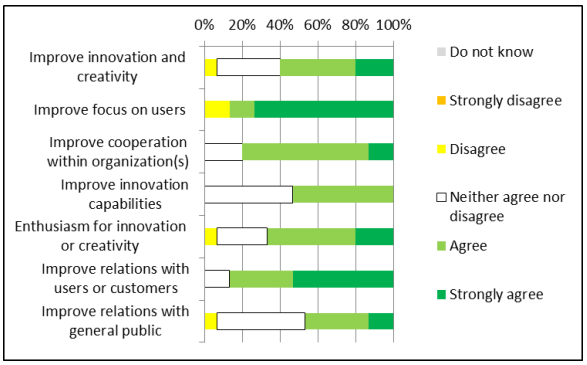

Figure 16. Benefits of HCD for participating organization(s)

Many also expect general or longer-term benefits from HCD, e.g., improving customers' or users' satisfaction (6 'Strongly agree' plus 7 'Agree' = 13 out of 15) and educating, instructing or training customers or users (3 'Strongly agree' plus 9 'Agree' = 12 out of 15).

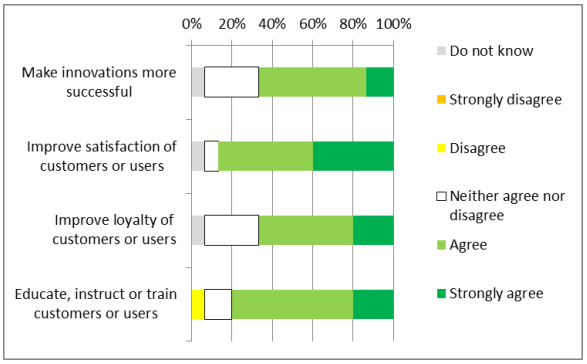

Figure 17. Benefits of HCD for longer term

Project-team members have mixed ideas on the benefits of HCD for project management. Many found that HCD had positively affected the *quality* of decision making (1 'Strongly agree' plus 11 'Agree' = 13 out of 15), whereas others found that HCD had negatively affected the *speed* of decision making (0 'Strongly agree' plus 2 'Agree'). However, many found that HCD had promoted a process of continuous improvements (4 'Strongly agree' plus 8 'Agree' = 12 out of 15).

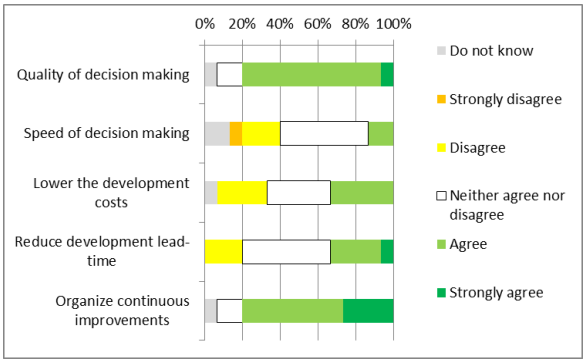

Figure 18. Benefits of HCD for project management

As an overall evaluation, many project-team members found acceptable the costs of organizing HCD, in terms of budget (5 'Strongly agree' plus 7 'Agree' = 12 out of 15) and in terms of lead-time (4 'Strongly agree' plus 7 'Agree' = 11 out of 15) acceptable, and many found acceptable the risks involved in organizing HCD, in terms of diminished control (2 'Strongly agree' plus 11 'Agree' = 13 out of 15) and in terms of increased complexity (3 'Strongly agree' plus 8 'Agree' = 11 out of 15).

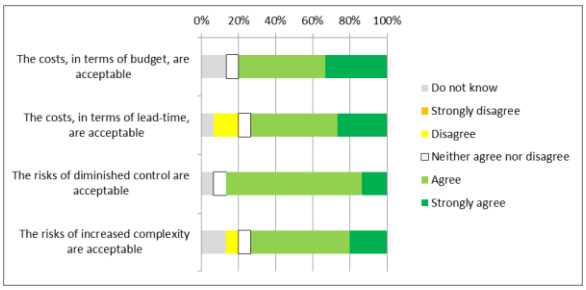

Figure 19. Evaluation of costs and risks of HCD

Finally, taking into account the beneftis, costs and risks of HCD, almost all project-team members agreed to statements about organizing HCD again (7 'Strongly agree' plus 7 'Agree' = 14 out of 15) or recommending colleagues to organize HCD (6 'Strongly agree' plus 8 'Agree' = 14 out of 15).

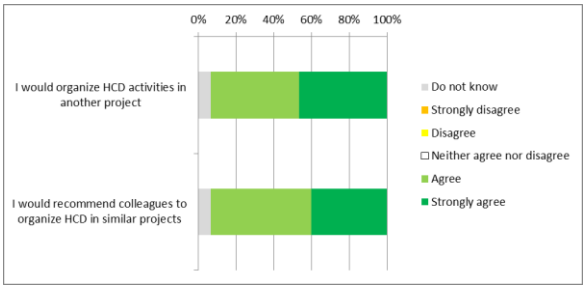

Figure 20. Intentions to organize HCD in the future

In addition, project-team members made the following remarks:

- About idea generation: 'The process of HCD also implies that the participants have to reflect on themselves and their wishes. It may not have been so clear what wishes where beforehand.'

- About service development: ‘HCD helps to increase users' motivation for the use of service(s) (The service is meaningfull for them)’’
- About project management: ‘HCD creates involvement of (representatives of) older people and their platforms, associations and strategic alliances. That creates a better and stronger support for the final product and for sustainability of the project, developed services and other products.’
- About participating organizations: ‘Involvement in HCD, in cooperation with other organizations (project partners), gives a stronger position in advocacy work and (political) policy making related to users/older people and IT related developments. ’
- Overall: ‘Co-design has to be very well monitored. Researchers carrying out these sessions have to be aware of technical feasability as well as business modeling sustainability.’

In sum, a majority of project-team members experienced the benefits of HCD for idea generation and service development, many experienced the benefits for participating organization(s) and expected benefits for the longer term. They had mixed ideas on the benefits of HCD for project management (advantageous for quality of decision making, disadvantageous for speed of decision making). Overall, many found the costs and risks acceptable and a majority would organize HCD again in the future.

5. Conclusions

We reflected on the human-centred design (HCD) activities activities that were conducted in the WeCare project, such as interviews, workhops and users trials in close cooperation with older people, and on the effects of these HCD activities on idea generation and service development, i.e. on the services that were developed. We found that HCD was especially helpful and had added value for the following purposes:

- Understanding users' contexts, needs and preferences, as a basis for joint idea generation and for screening of ideas (e.g by interviews or workhops)
- Steering service development, e.g. making the decision to focus on another context of usage, based upon knowledge about people's needs (e.g. by interviews or workhops)
- Prioritizing and choosing between different functionalities, based on knowledge about which functionalities are or are not needed by users (e.g. by interviews or workhops)
- Choosing between and further developing user interface design solutions, based on knowledge about which will or will not work for users (e.g. by interviews or workhops)
- Further detailing and improving functionalities and user interface solutions, based upon user' input and feedback (e.g. by interviews or workhops)
- Evaluating the practical added value of services that were developed in people's daily lives, specifically by organizing user trials or pilots

In addition, we studied project-team members' perceptions of the benefits of HCD, their evaluations of the costs and risks involved in organizing HCD, and their intentions to organize HCD in the future.

- We found that a majority of projet-team members had experienced the benefits of HCD for idea generation and service development, and that many had also experienced the benefits for the participating organization(s) and expect beneftis on the longer term.
- We also found that many had mixed ideas on the benefits for project management, e.g. it may positively impact the *quality* of decision making, but also negatively impact the *speed* of decision making.
- When asked to evaluate the costs and risks of organizing HCD in relation to the benefits of HCD, many found these acceptable.
- Taking the benefits and risks and costs into account, almost all project-team members had intentions to organize HCD again or to recommend other to organize HCD in the future.

6. Recommendations

Based on these findings, we can articulate several (tentative) recommendations for organizing a HCD process in such a manner that the benefits of HCD are actually realized:

6.1 Organize HCD from the start and iteratively

We recommend to organize HCD form the start of a project and throughout its iterative cycles of research, design and evaluation, in order to facilitate continuous development, evaluation and improvement of ideas, services or products. This relates to the first and third principles of HCD: organizing user involvement and iterative process. It is critical to see each interaction with (potential) users as a chance to develop knowledge about their contexts, needs and preferences, and to give 'weight' to what they say and to what you hear and see, so that users' input can actually have impact on decision making, on prioritizing and choosing between options, and on further development and improvement of the service or product. This recommendation is related to the need to foster an open attitude amongst project-team members towards (potential) users, allowing for learning and modifying ideas and assumptions.

6.2 Organize HCD as multidisciplinary teamwork

We recommend to organize HCD as multidisciplinary teamwork, e.g. involving people in technology or application development, people in user research or design roles, and people in business modelling or marketing roles (the latter was not discussed in this paper). This relates to the third and fourth principles of HCD: organizing multidisciplinary teamwork and iterative process. In the case of open innovation, which involves a number of different organizations, it is critical to organize the project—and project-team meetings more specifically—in such a manner that project-team members can cooperate effectively, preferably at the same location, but also via audio or video communication. It is also critical to invest time and effort into fostering shared understanding (Steen et al. 2012c), trust and commitment, and to develop a common 'language'.

6.3 Choose appropriate HCD methods

It is also critical to consider the full range of HCD methods: from methods 'in the field' (e.g. observations) to methods 'in the lab' (e.g. experiments), and from design-oriented methods (e.g. co-design workshops) to evaluation-oriented methods (e.g. user trials).

Based on both literature and our findings, we recommend the following order of methods (see Figure 21):

- Starting with design-oriented methods 'in the field' (e.g. observations and/or creative workshops) in order to build an understanding of (potential) users, their contexts, needs and preferences;
- Organizing several methods, both 'in the field' and 'in the lab', and both design-oriented and evaluation-oriented (e.g. interviews or workshops) in order to suit the specific purposes of specific studies in an iterative process;

- Ending with evaluation-oriented methods 'in the field' (e.g. user trials and/or questionnaires) in order to evaluate the final product as realistically as possible.

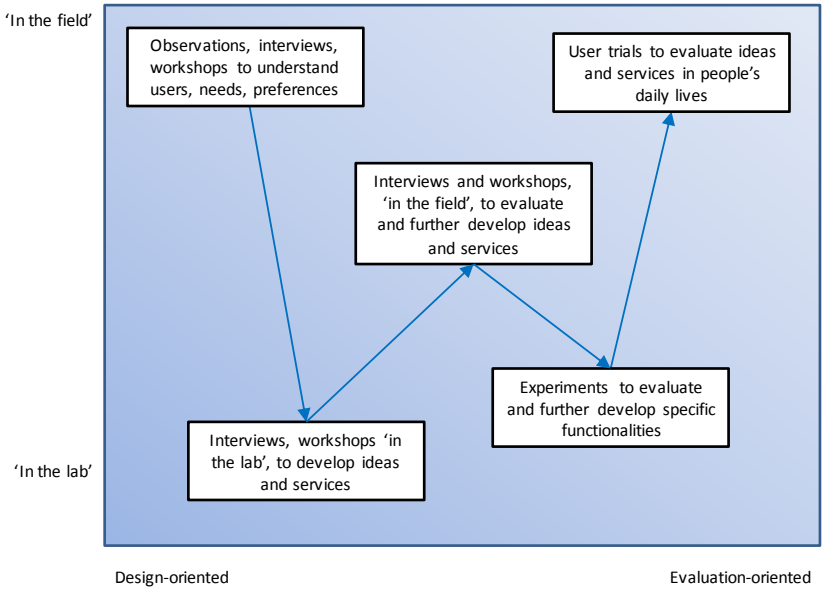

Figure 21. Tentative recommendation to organize human-centred design activities

6.4 Involve the 'right' people

Make sure that the people involved in de HCD process are also the people who are involved in the pilot, and include preferably also as many people who did not attend the HCD process in the pilot. This way, the people who joined the HCD process can evaluate on whether their ideas and user requirements were translated well into the service (or product) and people who did not participate in the HCD process can evaluate the service as an 'outsider' and potential user. There is sometimes a debate on whether one can start HCD with ideas from project-team members or with ideas from (potential) users. We believe that both options are fine, provided that ideas are discussed and evaluated by both (potential) users and project-team members as soon as possible, e.g. in a first round of creative workshops or interviews with (potential) users (ideally, 'in the field'). The advantage of starting with an idea is that the project has more focus. A possible risk of starting with an idea of project-team members is that 'users' have less influence on idea generation and can 'only' contribute to service development (modifying and improving it into a service or product. 'Only' is between quotes because this is indeed not a small contribution. This can be been mitigated by carefully examining the initial ideas and assumptions at the start of the process, both by conducting desk research and by conducting interviews, observations and workshops with (potential) users, in order to validate these initial ideas and assumptions.

There is also a debate on which people to involve as 'users' or 'customers'. In the projects studied, different groups and different people were involved. E.g. in the TA2 project, we cooperated with 'normal consumers' and with 'expert users' (enthusiast board game players), and in the WeCare project, we cooperated with 'normal older people', and with 'experts' (older people that were also active in helping other older people, e.g. with computers). Furthermore, in some cases other people acted as 'representatives' for 'primary users', e.g. in the WeCare project, nurses spoke on

behalf of older people that less able to participate effectively in interviews or workshops. In general, we propose to distinguish between three groups of users:

- Those involved in design-oriented methods (e.g. creative workshops), which can also be ‘expert users’ or ‘’representatives’ because their ability to help generate and further develop ideas is critical;
- Those involved in evaluation-oriented methods (e.g. user trials), which need to be more representative of a larger population so that the findings can be generalized;
- Those to which the service—once it is introduced—is targeted, which is a much larger group, with also people that are difficult to recruit as participants in the HCD process.

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Annex: Questionnare about human-centred design (for project-team members)

Project-team members were invited to indicate to which extent they agreed with 31 statements concerning the potential benefits of HCD, the costs and risks of HCD (Steen et al. 2011), and their intentions to organize HCD in the future, by choosing between: Strongly disagree; Disagree; Neither agree nor disagree; Agree; Strongly agree; or Do not know.
In addition, respondents were allowed to mention alternative benefits or to make remarks.

Benefits for generation of ideas:

1. HCD helps to generate other ideas, based on users' or customers' input, e.g., ideas with high 'originality'.
2. HCD helps to generate better ideas, based on users' or customers' input, e.g., ideas with high 'user value'.
3. HCD helps to understand users' needs and preferences, e.g., their daily live experiences.
4. HCD helps to improve the process of idea generation, e.g., by bringing together (potential) users and project-team members.

Benefits for developing services:

5. HCD helps to improve the service definition, e.g., by formulating more precise user requirements.
6. HCD helps to develop better services from users' perspective, e.g., services that better match users' needs.
7. HCD helps to develop more differentiated services, e.g., services that are more appropriate for a specific target group.
8. HCD helps to develop services with higher quality, e.g., services with better usability.
9. HCD helps to develop better services from project perspective, e.g., services with less shortcomings or failures.

Benefits for project management:

10. HCD helps to improve the quality of decision making, e.g., because input from users can be taken into account.
11. HCD helps to improve the speed of decision making, e.g., because input from users can be taken into account early-on.
12. HCD helps to lower the development costs, e.g., because input from users helps to improve the development process.
13. HCD helps to reduce the development lead-time, e.g., because input from users helps to improve the development process.
14. HCD helps to organize continuous improvements, e.g., by organizing iterative cycles of research, design and evaluation together with users.

Benefits for participating organization(s):

15. HCD helps to improve innovation and creativity within the organization(s) that are involved.
16. HCD helps to improve the focus on users within the organization(s) that are involved.

17. HCD helps to improve cooperation within the organization(s) that are involved, e.g., better cooperation across disciplines.
18. HCD helps to improve innovation capabilities, e.g., increased capabilities to organize workshops or interviews with users.
19. HCD helps to generate enthusiasm for innovation or creativity within the organization(s) that are involved.

General or longer-term benefits—benefits that you expect, but which you cannot yet experience because the project is not finished yet:

20. HCD helps to improve relations between the organization(s) involved and users or customers—*in the questionnaire, this item was under Benefits for the participating organization(s), but it was moved for better fit*
21. HCD helps to improve relations between the organization(s) involved and the general public—*in the questionnaire, this item was under Benefits for the participating organization(s), but it was moved for better fit*
22. HCD helps to make innovations more successful, e.g., in terms of increased sales or increased market share.
23. HCD helps to improve the satisfaction of customers or users.
24. HCD helps to improve the loyalty of customers or users.
25. HCD helps to educate, to instruct or to train customers or users

If you were to compare 'organizing HCD and having the benefits of HCD' versus 'not-organizing HCD and not-having the benefits of HCD', how would you agree with the statements below?

26. The costs, in terms of budget, of organizing HCD, e.g., organizing interviews, workshops or tests, are acceptable, when taking into account the benefits of HCD.
27. The costs, in terms of lead-time, that HCD takes, e.g., organizing interviews, workshops or tests, are acceptable, when taking into account the benefits of HCD.
28. The risks of diminished control, e.g., because of involving other people, departments or organizations, are acceptable, when taking into account the benefits of HCD.
29. The risks of increased complexity, e.g., because the interests of diverse people, departments and organizations need to be managed, are acceptable, when taking into account the benefits of HCD.

Overall evaluation:

30. I would organize HCD activities in another project, e.g., because the overall benefits outweigh the costs and risks.
31. I would recommend colleagues to organize HCD in similar projects, e.g., because the overall benefits outweigh the costs and risks.