
Benefits of human-centred design in open innovation projects

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Please note that this is a draft paper. Several sections need to be discussed and checked with key project-team members. Figures also need to be improved. And the total number of words needs to be reduced.

Abstract: Human-centred design (HCD) is a form of open innovation in which researchers and designers cooperate with (potential) users or customers, e.g. in co-design workshops, interviews, user tests and trials. Based on a case study of two open innovation projects in which HCD activities were organized (TA2 and WeCare), and a survey amongst team members of these projects, we furthered our understanding of the practical benefits, costs and risks of organizing HCD in such projects. We found benefits for idea generation and service development, and also benefits for project management, for the participating organization(s) and for the longer term. We also provide several tentative recommendations for managers and team members of such projects to organize HCD effectively, so that they can practically realize these benefits and develop products or services that match people's needs and preferences..

Keywords: Benefits; Human-centred design; Innovation management.

1 Introduction

In the open innovation literature there is discussion concerning the various ways in which innovation processes can be opened-up practically (Enkel et al. 2009; Gassmann et al. 2010; Huizingh 2010). Open innovation is often approached by trial and error and: 'What is missing is a decent cookbook, an integrated framework that helps managers to decide when and how to deploy which open innovation practices' (Huizingh 2010).

With this paper, we aim to further our understanding of one particular way to open-up the innovation process: by organizing human-centred design (HCD) (Steen 2006). With this paper, we aim to better understand the practical benefits of HCD and to articulate tentative recommendations for organizing HCD effectively. Our focus is on service

design in the context of ICT development and open innovation. Hence, we do not aim to provide a comprehensive ‘cookbook’. Rather, we aim to try-out one particular recipe.

HCD can be characterized using four principles (ISO 1999): 1) Involving (potential) users in research, design and evaluation, in order to better understand their experiences, needs and preferences; 2) Finding an appropriate allocation of functions between users and technology; 3) Organizing productive iterations of research, design and evaluation; and 4) Organizing multi-disciplinary teamwork throughout the project. We use the term *HCD* to refer to diverse types of cooperation of researchers and designers with (potential) users and customers in innovation processes, e.g., in research, design and evaluation activities, with the goal to jointly develop innovations that better match people’s needs and preferences. HCD then includes a range of methods, e.g., workshops, interviews, user tests or user trials, and a range of approaches, e.g., participatory design, contextual design or empathic design (Steen 2011). Please note that the terms *HCD* and *co-design* (Sanders and Stappers 2008) are sometimes used synonymously; both refer to the involvement of users and to the cooperation between disciplines in innovation projects.

HCD is especially relevant and valuable in technology-oriented projects because it brings users’ perspectives—and, indeed, users themselves—into the innovation process (Steen 2012). HCD can help to solve a key problem in innovation, namely the problem that many projects suffer from ‘insufficient market input, a failure to build in the voice of the customer, and a lack of understanding of the market place’ (Cooper 1999). A lack of adequate understanding of users and their needs and preferences is a key factor in the failure of innovations (Van der Panne et al. 2003). HCD can promote cooperation between researchers, designers, users and customers. Regarding the design of ICT products and services, Nielsen observed that: ‘It is amazing how much time is wasted on certain development projects by arguing over what users might be like or what they may want to do. Instead of discussing such issues in a vacuum, it is much better (and actually less time-consuming) to get hard facts from the users themselves’ (Nielsen 1993).

There are studies of user or customer involvement in product or service development (e.g. Alam 2002; Edvardsson et al. 2006; Hoyer et al. 2010; Kujala 2003; Kristensson and Magnusson 2010; Magnusson et al. 2003; Rohrer 2005; Roser and Samson 2009), but relatively little is known about project-team members’ practical expectations or experiences of the practical benefits of HCD. Rarely do project-team members articulate precisely which benefits they aim for by organizing HCD or do they evaluate precisely whether these benefits are actually realized. They often choose to organize HCD because of positive experiences with HCD in earlier projects.

Based on a literature review (Steen et al. 2011) (cf. references mentioned previously) several types of *potential benefits* of HCD were identified: benefits for idea generation (BI), benefits for service development (BS), benefits for project management (BM), benefits for the participating organization(s) (BO), and general, longer-term benefits (BL). These benefits will be further discussed below.

2 Research question and approach

In the remainder of this paper, we address the following two research questions:

1. *How does the organizing HCD influence idea generation and service development?*

This question is concerned with the immediate benefits of HCD for idea generation and service development processes, e.g., with its influence on the project’s outcomes.

2. *How do project-team members' perceive the five (potential) benefits, and the costs and risks of HCD?* This question is concerned with project-team members' experiences and expectations regarding the benefits of HCD for idea generation (BI), for service development (BS), for project management (BM), the participating organization(s) (BO) and for the longer term (BL), their perceptions of the costs and risks of organizing HCD, and their intentions to organize HCD in the future.

In this paper, we focus on the development and evaluation of innovative ICT services in research-oriented, open innovation projects. We conducted case studies (Yin 1994) of two research projects: TA2 (www.ta2-project.eu) and WeCare (www.wecare-project.eu).

Both projects are examples of human-centred design since project-team members cooperated with groups of (potential) users in an iterative process of research, design and evaluation—a process in which project-team members and (potential) users jointly explored the problem-to-be-solved, and jointly evaluated a range of possible solutions. Such an iterative process allows for trying-out and learning, e.g., by organizing co-design sessions with users or field trials with users. Furthermore, both projects are examples of open innovation since they involved cooperation between diverse organizations: 13 in TA2 and 10 in WeCare, ranging from large international companies to small-medium enterprises and from universities to research institutes. Moreover, both projects were organized as multidisciplinary teamwork, involving people with different backgrounds, such as user research or design, or technology or application development.

In addition, the projects are similar on a content level: both aim to better understand the ways in which ICT services—e.g., video communication, online gaming and social networking—can foster social communication amongst groups of people, promote social relationships and help people to improve their well-being. Moreover, the two projects match the ‘trend towards more iterative and interactive probe-and-learn processes’, which ‘support early interaction with customers, suppliers and R&D partners’, and the trends ‘from standalone to alliances’ and ‘from products to services’ (Gassmann et al. 2010).

The authors were involved in these two projects (Steen and Aarts in TA2, and Steen and Broekman in WeCare) and conducted informal participant observation (Easterby-Smith et al., 2002: pp. 110-114), e.g., during project-team meetings, and informal interviews with key project-team members (*partly to be done*). This insider perspective is needed to study the complex phenomenon which we are interested in: cooperation between 30 (TA2) or 20 (WeCare) people in a creative process over a course of 3 (WeCare) or 4 (TA2) years. Like Huizingh (2010), we believe that a case study is a valid approach for practice-oriented research into real world phenomena. Moreover, scholars in organization studies advocate generating knowledge based on participation in actual practices (Jarzabkowski et al., 2010). Our focus on projects' practices is similar to recent studies in Deutsche Telekom (Rohrbeck et al. 2009) and Vodafone (Stier et al. 2010).

In the next two sections, we further discuss our two research questions and findings.

3 Effects of human-centred design on idea generation and service development

The first question—concerning the effects of organizing HCD on idea generation and service development—was addressed by reflecting on the HCD activities in the TA2 and WeCare projects, with a focus on the effects of these HCD activities on the services that

were developed in the projects. In our analysis, we draw from two project reports (Steen et al. 2012a; Steen et al. 2012b).

First, we would like to propose that various HCD activities can be plotted into a continuum that is formed by drawing two axes:

A vertical axis that contrasts methods '*in the field*' and methods '*in the lab*' (cf. Muller 2002; Koskinen et al. 2011). On the one hand are methods that are conducted '*in the field*', such as interviews in people's homes about their daily lives, their needs and preferences, or observations in people's daily life or work contexts. Such methods offer the advantage of relatively high *realism* (and lower *control*). On the other hand are methods that are conducted '*in the lab*', such as controlled experiments or tests with prototypes, which offer the advantage of relatively high control (and lower realism). This distinction is relevant because participants are likely to behave differently in different situations. It matters whether they are in their own environment and speak about their own lives—as 'experts of their experiences' (Sleeswijk Visser et al. 2005)—or whether they are in an environment controlled by researchers or designers and e.g. discuss concepts or evaluate prototypes put forward by project-team members. Both types of methods, however, are needed in HCD.

A horizontal axis that contrasts *design-oriented* methods and *evaluation-oriented* methods. On the one hand are design oriented methods such as creative workshops, which aim to generate ideas. Such methods are often qualitative and typically provide the opportunity to involve a limited number of people in-depth studies. On the other hand are evaluation-oriented methods such as user trials or questionnaires, which aim to evaluate ideas. Such methods are often quantitative and typically provide the opportunity to study specific topics with a relatively larger number of people. This distinction is relevant because design-oriented and evaluation-oriented methods deal differently with validity, reliability and generalizability. In evaluation-oriented or quantitative studies, validity refers to how closely the measures correspond with reality, reliability refers to whether the measures yield the same results on other occasions, and generalizability refers to whether the study confirms or contradicts existing findings, whereas in design-oriented, qualitative studies, validity refers to whether access is gained to the experiences of the people studied, reliability refers to transparency in the process of making sense from the data, and generalizability refers to whether concepts from one study are relevant to other settings (Easterby-Smith et al. 2002, p. 53). Both types of methods are needed in HCD.

3.1 The TA2 project

The overall goal of the TA2 project has been to better understand the ways in which ICT can improve social communication amongst groups of people that are separated in time and space. TA2 stands for *Together Anywhere, Together Anytime*. More concretely, the goal has been to develop and evaluate a range of innovative communication, multimedia and gaming demonstrators that aim to support social interactions between groups of people that already have 'strong ties', such as family and friends. With the TA2 applications, it would be easier for family and friends to keep in touch when they are apart and to share moments of laughter and fun as well as moments of sadness and sorrow. The following demonstrators were developed and evaluated, in close cooperation with (potential) users and other stakeholders:

- Family Game, an online application for gameplay and video communication (synchronous), which aims to bring the experience of playing a board game to people when they are separated spatially.
- MyVideos, a system that allows people to share and combine pieces of video footage shot by different people at a shared event, e.g. a school concert, and to create and share (synchronously) personalised video narratives based on these pieces of footage.
- Sixth Age, an application that connects older people with others, e.g. family members that live further away, through a combination of gameplay and communication. Initially, this application focused on cross-generational gameplay, e.g. by playing Pairs with grandchildren, and was later merged with Child's Play.
- Child's Play, an application that helps younger people to jointly practise creative activities, e.g. dancing, when separated spatially. This application was later combined with Sixth Age into a Storytelling application for cross-generational (synchronous) communication by sharing bedtime stories between locations.
- Connected Lobby, a kind of portal to the other applications that helps people in different locations—and maybe in different time zones—to coordinate and initiate social communication and interaction via the abovementioned applications on a TV.
- In addition, several enabling technologies were developed: High Quality Audio Communication and Video Orchestration. These are not discussed here.

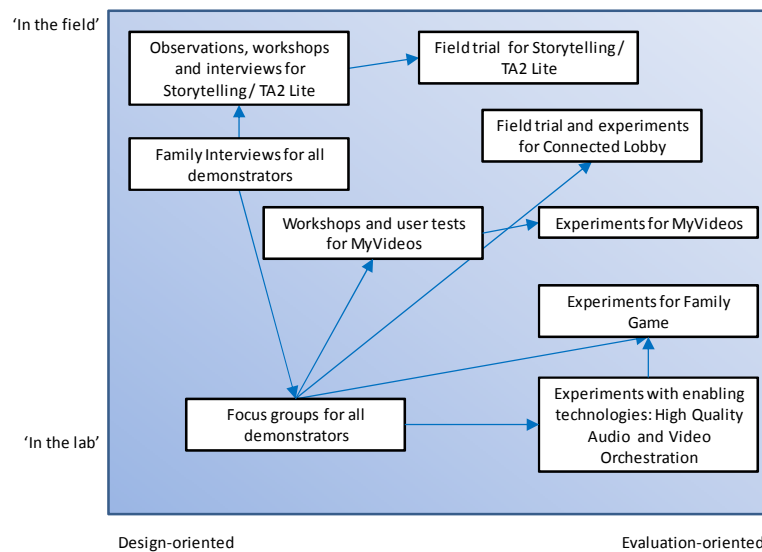


Figure 1. Human-centred design activities in TA2

First, a series of Family Interviews were conducted (late 2008 and early 2009, in the UK, Sweden, Germany and The Netherlands), in people's homes, which aimed to better understand people's current practices, needs and preferences, to discuss these in relation to the project's key theme of *togetherness* by discussing the initial ideas for developing a range of demonstrators. Next, a series of workshops ('focus groups') were conducted with people from different target groups for each of the five demonstrators (2009, for

Family Game, MyVideos, Sixth Age, Child's Play and Connected Lobby). These workshops were conducted relatively early-on in the project, using storyboards and sketches to present and discuss the demonstrators—rather than waiting with such evaluations by users until working prototypes were ready. We focused both on people's experiences, needs and preferences, and on the further development and improvement of the demonstrators. Finally, a range of experiments and user trials were conducted (2010, 2011 and 2012). See Figure 1 and Table 1.

- For Family Game, users tests were conducted with the initial set-up (2010), resulting in input for developing a 2.0-version with reduced complexity, targeting a broader target group, and to add mini-games, for tactile and embodied gameplay. Next, laboratory experiments were conducted (2012) to study people's experiences when playing Family Game in comparison to playing a board game. *HCD helped to develop the idea to use a (horizontal) table for the game play and a (vertical) screen for video communication, and the idea to use tactile or embodied game elements (mini-games).*
- For MyVideos, a group of parents of children from a high school in The Netherlands has been actively participating in a participatory design process from the start: first in interviews and workshops (2009-2010), then recording videos of a school concert with their children and evaluating a first prototype in user tests (2010), and finally in a workshops to discuss options for further development (2011). Another group of parents in the UK contributed to the evaluation of a second prototype, by making recordings of another school concert (2011) and participating in lab experiments to evaluate this second prototype (2012). *HCD helped to bring users' perspectives into the project, and to choose between alternative ideas for further development, (prioritizing the Visual Vault and Interactive Narratives functionalities).*
- Storytelling/TA2 Lite was developed based on findings from ethnography-inspired fieldwork (2009-2010) into the needs of older people to communicate and interact socially with their family members, which lead to the idea to support cross-generational shared activities and communication—and to combine Sixth Age and Child's Play into Storytelling/TA2 Lite (TA2 Lite refers to the development of a 'light' version of the TA2 system, which could be used in a longitudinal user trial in people's homes). User trials were conducted in 10 households (2011), involving over 30 people over the course of several months. *HCD helped to understand the interplay between technology development and social science, resulting—more specifically—in the idea for a second camera, in addition to the camera which is fixed to the TV set, which people asked for, in order to move around more flexibly.*
- For Connected Lobby, several experiments and user trials were organized. The experiments focused on the feasibility of using light for presence notifications (2010) and on ways to automate the process of coordinate and initiate a synchronous communication (2012). The user trials focused on the acceptance of a TV set for group-to-group video-communication in the living room and on sharing personal information, such as status updates and presence notifications with family or close friends (2011). *HCD helped to develop and evaluate ideas for balancing awareness and privacy, to develop the 'smart awareness assistant', and to develop and evaluate ideas to use light for presence notifications, and to use the TV for group-to-group communication.*

Table 1. Human-centred design activities in TA2

| | <i>Family Game</i> | <i>MyVideos</i> | <i>Sixth Age</i> | <i>Child's Play</i> | <i>Connected Lobby</i> |
|-------------------------|---|---|--|--|--|
| <i>HCD in 2008-2009</i> | Family interviews for all five demonstrators (UK, Sweden, Germany, The Netherlands) | | | | |
| <i>HCD in 2009</i> | Workshops (NL) | Workshops (UK and NL) | Observations, workshops, interviews (Sweden) | Workshops (NL) | Workshops (NL), user trials |
| <i>Effects</i> | Input for developing Family Game 2.0 (Space Alert) | Input for developing MyVideos 2.0 | Develop Pairs | Terminate Jump Style Start Music Tuition (not discussed here) | Develop 'smart awareness assistant' New user interface |
| <i>HCD in 2010</i> | User tests with initial set-up | User Tests (NL) Workshop (NL, Feb'11) | Observations, workshops, interviews | | Field trials, interviews |
| <i>Effects</i> | Develop Family Game 2.0, reduced complexity, broader target group, with mini-games | Develop MyVideos 2.0 (Visual Vault, Interactive Narratives, Director's Cut) | Develop Storytelling/TA2 Lite and Storytelling (combining Sixth Age and Child's Play) | | New user interface Improved user requirements |
| <i>HCD in 2011-2012</i> | Lab experiments | Lab experiments (UK) | User trials in people's homes ('in situ', longitudinal) | | User trials in people's homes, experiments |
| <i>Effects</i> | Understanding of people's experiences with Family Game and its added value | Understanding of people's experiences with MyVideos and its added value | Understanding of social communication and shared activities in relation to TA2 Lite Ideas for further development of TA2 Lite | | Understanding of people's experiences with Connected Lobby and its added value |

3.1 The WeCare project

The overall goal of the WeCare project has been to help older people to participate in social networks, both online and 'face-to-face', in order to improve older people's subjective social wellbeing. More concretely, the goal has been to develop and evaluate a series of online social networking services, targeted at older people and people in their 'face-to-face' social networks, e.g. their family members and friends.

The idea has been to facilitate participation of older people in social networks and social activities, to improve their social relationships, and to help people to coordinate

informal care and support amongst family members, friends and neighbours. The initial idea was to develop services would allow people to create small ‘closed’ groups, e.g. with 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, and to participate in larger, more ‘open’ group, e.g. the people in one neighbourhood or within one village, to promote communication and cooperation between different ‘closed’ groups. In addition, the idea was to provide a combination of user-friendly tools: for coordinating requests and offerings of help and coordinating the sharing of care and other tasks, for communication, e.g. video communication (synchronous) and forums and other types of user generated content (asynchronous). Furthermore, the idea has been to distinguish between two ways of implementing and marking such a service: as part of a care services of one care provider organization (‘iOrganization’ , in Finland and in Spain), or as a more general service for people living in one geographical area or related to a more general service (‘iVillage’, in Ireland and in The Netherlands). 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.

The project involved project partners from four countries—Finland, Spain, Ireland, the Netherlands—and HCD activities were organized in these four countries. 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.

Based partly on the original project plan and based partly on the findings from early interviews with older people—to better understand their daily lives, needs and preferences—the decision was made to develop four (slightly) different applications for each of the four countries, each adapted to the specific target group and context. See Figure 2 and Table 2.

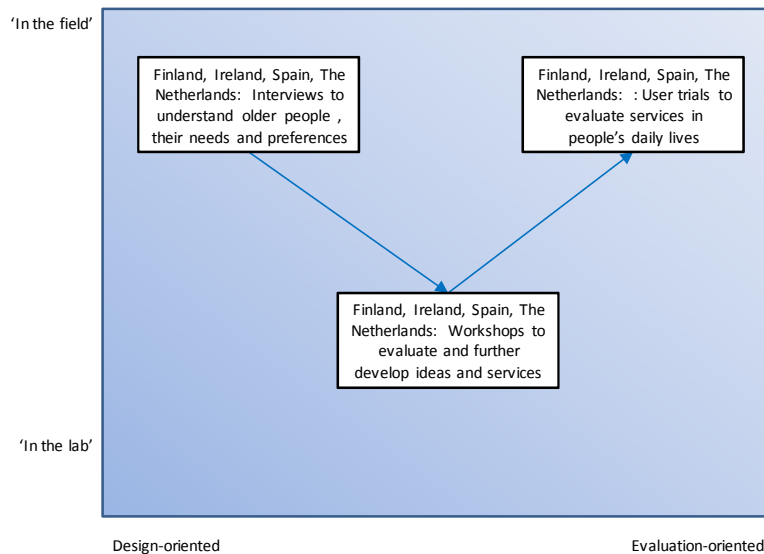


Figure 2. Human-centred design activities in WeCare (simplified)

- In Finland the team members followed an iterative process, mainly involving interviews and workshops. The service was developed in close cooperation between a care service provider, e.g. nursing homes for older people, a technology provider and a research organization. The WeCare service was based on a video communication system, which was integrated into an existing care services, through an iterative, hands-on process in close cooperation with older people, their relatives and also the care provider's nurses. When the older people were less able to participate in interviews or workshops, these nurses represented the older people. *HCD helped to articulate user requirements and specifications for the service, to make the decision to switch focus in the context of usage (from respite 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 a research organization, a care service provider and three technology-oriented project-partners. The Spanish WeCare service was based on a 'pick and mix' approach; it selectively combined functionalities that were developed for the Dutch WeCare service (see below). The HCD process involved two user trials: iVillage, in which a social networking service supports a local community to share locally relevant information, fostering social interaction amongst them; and iOrganisation, in which a social networking service is integrated into a care services targeted at older people. Groups of citizens were interviewed, co-design sessions with the service provider's clients and stakeholders were organized, and the service was developed iteratively, through weekly meetings with software developers. The service was integrated into the current care provider's services. *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 a technology developer and a farmers' organization. The service was based on the original idea to combine and integrate several relevant components into an easy-to-use 'portal': general communication (VoIP), information (sports, news), specific information (weather and commodities markets), and an application for farmers (payments and applications). The service was also made available on mobile devices and tablet computers. Potential users were recruited, interviewed in their homes, and invited for a workshop in the office, to evaluate the service. Many of them subsequently participated in user trials, in which they practically used and evaluated the service in their daily lives for a number of weeks. *HCD helped to practically and quickly evaluate project-team members' initial ideas and to modify and improve the service.*
- In the Netherlands, service development started with project-team members' ideas on a WeCare service that would help older people to communicate with others, in social networks, both online and 'in real life'—based on earlier 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 (again 'expert users') participated in a creative workshop in which ideas were further developed and modified. The findings from interviews and workshop were the basis for user requirements and user interface design. These were discussed in subsequent project-team meetings, in which those project-team members that had been involved in interviews and workshop represented older people and their needs and preferences, as 'user advocates'. *HCD helped to*

better understand older people and their needs and preferences, to develop user requirements and user interface, and to provide input for further development.

Table 2. Human-centred design activities in WeCare

| | <i>Finland</i> | <i>Spain</i> | <i>Ireland</i> | <i>The Netherlands</i> |
|--------------------|--|---|--|--|
| <i>HCD in 2010</i> | Workshop and interviews, also with nurses | Co-design workshop (#1), interviews and project meetings | Interviews ('in the field'), workshop ('in the lab') and user trial | Interviews and co-design workshop with older people |
| <i>Effects</i> | Understanding of respite care, older people's needs, and nurses' practices Ideas for user trial Change of usage context: to people's homes | Idea to relate the service to existing networks Prioritizing of functionalities User requirements | Evaluate and modify project-team members initial ideas and improve the service | Understanding of older people's needs and preferences Input for functionalities and user requirements |
| <i>HCD in 2011</i> | User trial | Co-design workshops (#2, #3) | User requirements meeting | Project-team meetings (with 'user advocates') |
| <i>Effects</i> | Improved user requirements. Ideas for content creation. Improvement of user interface. | Additional user requirements and ideas for future improvements. | Further improvement of the service. | Improved user requirements and user interface. |

4 Benefits of human-centred design perceived by project-team members

The second question—concerning project-team members' perceptions of the various benefits of HD, their evaluation of costs and risks, and their intentions to organize HCD in the future—was addressed by conducting a survey amongst the project-team members. Figure 3 presents the conceptual model that we used for our analysis.

We are interested in the relationship between project-team members' Involvement, Role and Project (A), their perceptions of the Benefits of HCD (B) and their Evaluation of costs and risks and their Intentions to organize HCD in the future (C). The arrows represent possible relationships. We would expect that people that experience or expect greater benefits or HCD will evaluate the costs and risks as acceptable and will have intentions to organize HCD in the future (arrow 3). Furthermore, we are interested in the effects of Involvement, Role and Project on Benefits perceived (arrow 1) and on Evaluation of costs and risks and Intentions to organize HCD in the future (arrow 2).

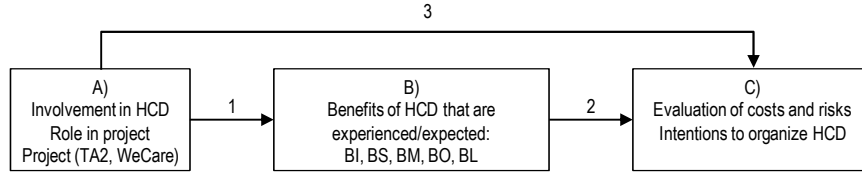


Figure 3. Conceptual model

The survey contained three sections: an introduction, in which they indicated their involvement in various HCD activities in their project; statements about potential benefits of HCD (based on Steen et al. 2011); and statements to assess their evaluation of the costs and risks of HCD and their intentions to organize HCD in the future (see Appendix for details). These three sections were further divided as follows:

- Involvement in HCD activities: project-team members responded to questions about their involvement in various HCD activities was typified as relatively low, medium or relatively high involvement (0,1,2).
- Role in project: project-team members' roles were typified (by one of the authors) according to these four categories: Management or coordination; Application development; Technology development; or User research or design.
- Project: for each project-team member, the project he or she worked in was known (TA2 or WeCare)
- Benefits of HCD: project-team members indicated their (dis)agreement to a series of 25 statements about potential benefits of HCD (on a 5-point scale), in order to indicate whether they experienced or expected specific benefits of HCD; these benefits were presented in five clusters:
 - Benefits for idea generation (BI)
 - Benefits for service development (BS)
 - Benefits for project management (BM)
 - Benefits for participating organization(s) (BO)
 - Benefits on longer term (BL)
- Evaluation of costs and risks: project-team members indicated their (dis)agreement to a four statements to evaluate whether they found the costs and risks that are involved in organizing HCD acceptable, taking all the benefits into account.
- Intentions to organize HCD: project-team members indicated their (dis)agreement with a two statements about their intentions to organize HCD in the future or to recommend others to organize HCD in other projects.

The questionnaire was filled-out by a representative sample: 37 project-team members (21 from the TA2 project-team, with approx. 30 people; and 16 from the WeCare project-team, with approx. 20 people). In the section below (*Descriptive findings*), we present characteristics of project team members and their perceived benefits of HCD. In the next section (*Relational findings*), we present the relationships found between project-team members' characteristics, Benefits perceived and Evaluation of costs and risks.

4.1 Descriptive findings

In this section we examine the findings for the items measuring Benefits perceived, Evaluation of costs and risks, and Intentions to organize HCD in the future. After that, we present descriptive statistics on characteristics of project-team members as well.

Most project-team members agreed to statements about having experienced the benefits of HCD for *idea generation*, e.g., for better understanding users' needs and preferences (25 strongly agree; 11 agree), for generating alternative ideas (9 strongly agree; 22 agree) and better ideas (15 strongly agree; 14 agree), and for improving the process of idea generation (13 strongly agree; 18 agree). See Figure 4.

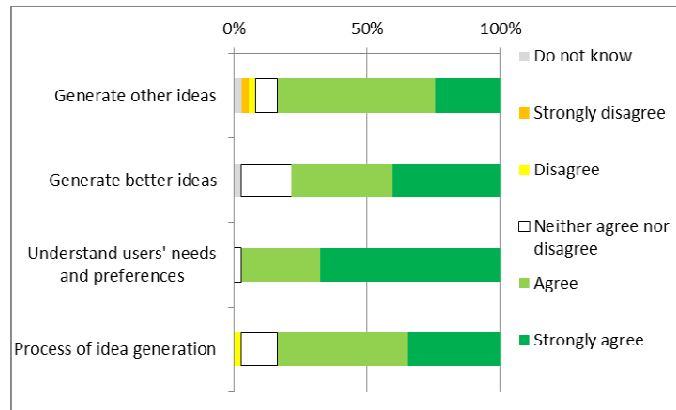


Figure 4. Benefits of HCD for idea generation (BI)

Many also agreed to statements about benefits of HCD for *service development*, e.g., for improving the service definition (13 strongly agree; 23 agree), for developing better services from users' perspective (17 strongly agree; 16 agree), more differentiated services (13 strongly agree; 15 agree) and services with higher quality (13 strongly agree; 17 agree). See Figure 5.

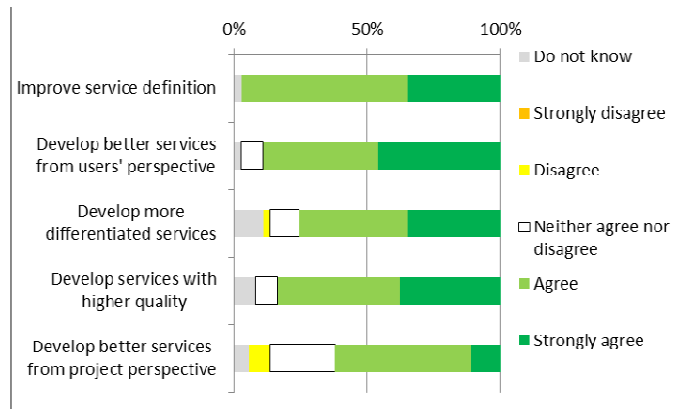


Figure 5. Benefits of HCD for service development (BS)

Furthermore, project-team members did not uniformly agree or disagree on the benefits of HCD for project management. E.g., many agreed that HCD had improved the *quality*

of decision making (4 strongly agree; 24 agree; 4 neither agree nor disagree; 4 disagree; 1 do not know), but only few agreed that HCD had improved the *speed* of decision making (2 strongly agree; 4; agree; 14 neither agree nor disagree; 11 disagree; 3 strongly disagree; 3 do not know). Relatively few found that HCD had helped to lower the development costs (2 strongly agree; 10 agree; 11 neither agree nor disagree; 11 disagree; 3 do not know) or to reduce development lead-time (3 strongly agree; 5 agree; 18 neither agree nor disagree; 8 disagree; 1 strongly disagree; 2 do not know). However, many agreed that HCD helps to organize continuous improvements, e.g., by organizing iterative cycles of research, design and evaluation together with users (8 strongly agree; 21 agree; 5 neither agree nor disagree; 2 disagree; 1 do not know). See Figure 6.

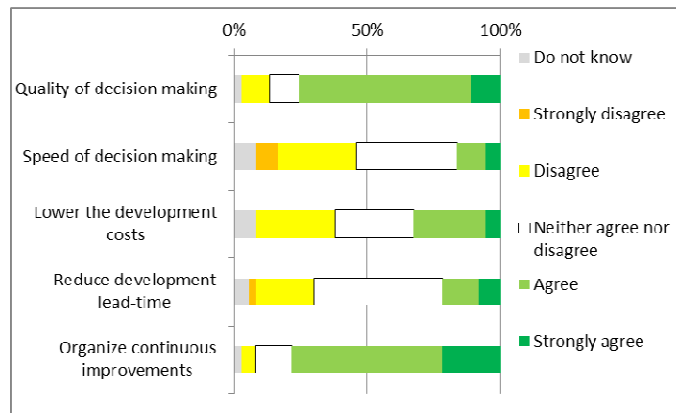


Figure 6. Benefits of HCD for project management (BM)

Many project-team members agreed to statements about the benefits of HCD for the participating organization(s), e.g., an improved focus on users (11 strongly agree; 14 Agree), improved cooperation within the organization(s) (6 strongly agree; 18 agree), positive effects on innovation capabilities (3 strongly agree; 18 agree), innovation and creativity (11 strongly agree; 14 agree), and enthusiasm for innovation and creativity (6 strongly agree; 19 agree). See Figure 7.

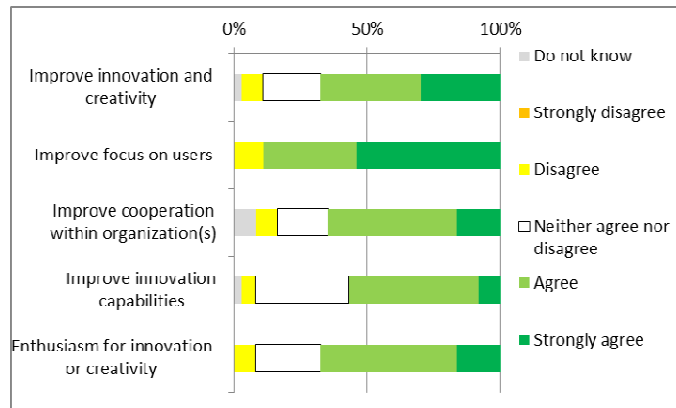


Figure 7. Benefits of HCD for the participating organization(s) (BO)

In addition, many agreed to statements about expecting benefits of HCD in the future, e.g., after the project, e.g., improved relations with customers or users (14 strongly agree; 13 agree), improved satisfaction of customers or users (12 strongly agree; 17 agree). See Figure 8.

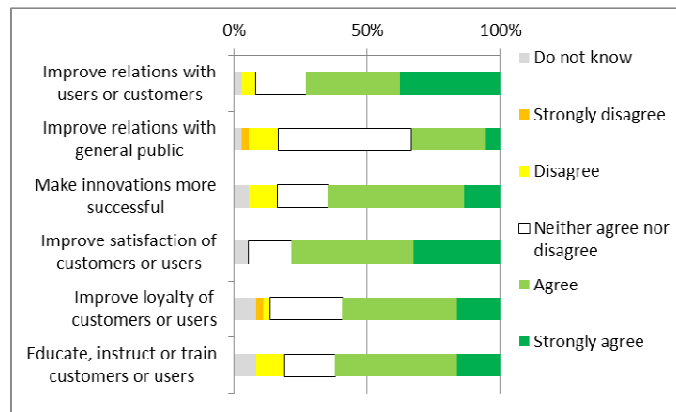


Figure 8. Benefits of HCD on longer term (BL)

Taking these benefits into account, project-team members were asked to evaluate the costs and risks associated to organizing HCD. Many found the costs acceptable, in terms of budget (10 strongly agree; 19 agree) and lead-time (8 strongly agree; 18 agree) and many found the risks acceptable, in terms of diminished control (6 strongly agree; 20 agree) and increased complexity (7 strongly agree; 20 agree). See Figure 9.

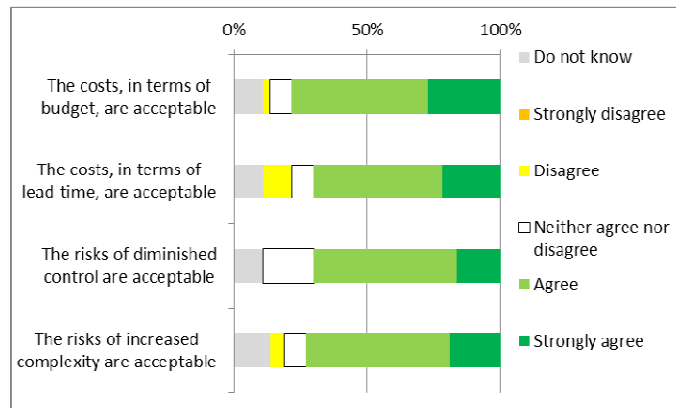


Figure 9. Evaluation of costs and risks associated with HCD

A majority of project-team members—taking these benefits, and the costs and risks into account—agreed with the statement ‘I would organize HCD activities in another project’ (17 strongly agree; 16 agree) or ‘I would recommend colleagues to organize HCD in similar projects’ (16 strongly agree; 16 agree). See Figure 10.

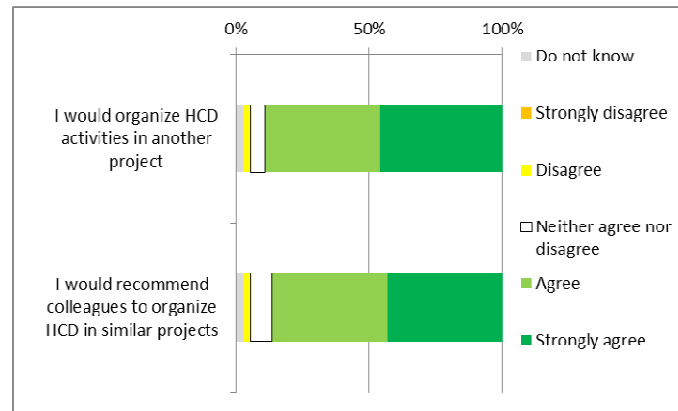


Figure 10. Intentions to organize HCD in the future

4.2 Relational findings

Before examining the relationships, we created clusters for the items that measure specific benefits, and transformed these clusters into scales. Scales represent average scores ranging from 0 ('strongly disagree') to 4 ('strongly agree'). To be included in the analysis project members were allowed to have only one missing score (e.g. 'I don't know') on an item belonging to one specific benefit. The same goes for the Evaluation of costs and risks and Intentions to organize HCD in the future.

The internal consistency of these scales was examined by calculating the Cronbach's Alpha for each Benefit. All Cronbach's Alpha were sufficiently high for all benefits. Results are displayed in Table 3. Only Benefits for idea generation (BI) scored relatively low. This may be due to the conceptual spread of items: some measure idea generation within existing lines of thinking, whereas others measure out-of-the-box idea generation. In particular the 'Generate other ideas' item makes the Chronbach's Alpha drop from .654 to .456. Nevertheless, we included this item in the analysis because it provides a more encompassing scale to measure BI. Furthermore, the relatively high Chronbach's Alpha for Intentions to organize HCD in the future indicates redundancy of either one of the two items ('I would organize HCD activities in another project', 'I would recommend colleagues to organize HCD in similar projects').

Table 3. Cronbach's alpha's of scales for Benefits, Evaluation of costs and risks, and Intentions to organize HCD in the future

| | N of items | Alpha |
|---|------------|-------|
| Benefits for idea generation (BI) | 4 | .456 |
| Benefits for service development (BS) | 5 | .636 |
| Benefits for project management (BM) | 5 | .841 |
| Benefits for participating organization(s) (BO) | 5 | .746 |
| Benefits on longer term (expected) (BL) | 6 | .815 |
| Evaluation of costs and risks | 4 | .813 |
| Intentions to organize HCD in the future | 2 | .946 |

Table 4 presents several descriptive statistics. On average, the Involvement in HCD activities of respondents was 1.28, which is slightly above medium Involvement

(assigned value 1). Overall the agreement on Benefits was relatively high, averaging around 3 meaning agreement on the perceived benefits. Intentions to organize HCD in the future was transformed into a binominal variable due to heavy negative skewness (89 percent of the project members would recommend organizing HCD in the future). Of the 37 respondents, 21 (57%) worked in the TA2 project and 16 (43%) in the WeCare project.

Furthermore, as Table 5 shows, respondents evenly represented the four Roles in project: 5 (14%) had Management or coordination roles; 10 (27%) had application development roles; 7 (19%) had technology development roles; and 15 (40%) had User research or design roles.

Table 4. Descriptive statistics

| | N | Range | Mean | St. Dev. |
|---|----|-------|------|----------|
| Involvement in HCD activities (low, medium, high) | 37 | 0 – 2 | 1.28 | .78 |
| Project (WeCare/TA2) | 37 | 0/1 | .57 | .50 |
| Benefits for idea generation (BI) | 37 | 0 – 4 | 3.27 | .45 |
| Benefits for service development (BS) | 35 | 0 – 4 | 3.20 | .42 |
| Benefits for project management (BM) | 34 | 0 – 4 | 2.31 | .69 |
| Benefits for participating organization(s) (BO) | 35 | 0 – 4 | 2.92 | .63 |
| Benefits on longer term (expected) (BL) | 34 | 0 – 4 | 2.77 | .63 |
| Evaluation of costs and risks of HCD | 33 | 0 – 4 | 3.01 | .62 |
| Intentions to organize HCD in the future** | 36 | 0/1 | .89 | .32 |
| N (listwise) | 30 | | | |

*= 0: Strongly disagree, 4: Strongly agree.

**= 0: Strongly disagree-Neutral, 1: Agree-Strongly agree.

Table 5. Frequency of Role in project

| | Frequency | % |
|----------------------------|-----------|----|
| Management or coordination | 5 | 14 |
| Application development | 10 | 27 |
| Technology development | 7 | 19 |
| User research or design | 15 | 40 |
| N | 37 | |

First, we examined the relationships between Involvement, Benefits perceived (BI, BS, BM, BO, BL), Evaluation of costs and risks and Intentions to organize HCD in the future.

Table 6 shows that higher Involvement in HCD is positively and significantly related to perception of Benefits for idea generation (BI) (indicated in blue). Apparently, people that were more involved in HCD did experience Benefits for idea generation to a higher extent. Although no other significant relations were found, some relations are relative substantial, like Benefits for project management and the evaluation of costs and risks.

Table 6 also shows that all perceived HCD benefits (BI, BS, BM, BO, BL) are positively and significantly correlated with Evaluation of costs and risks, and with Intentions to organize HCD in the future (indicated in green). This sounds reasonable: if one perceives benefits of HCD, one is likely to find the costs and risks of HCD as acceptable and to intend to organize HCD in the future. See Figure 11.

Table 6. Correlations between Involvement in HCD, Benefits perceived, Evaluation of costs and risks of HCD and Intentions to organize HCD in the future

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|-------|--------|--------|--------|--------|--------|--------|
| 1. Involvement in HCD activities (low, medium, high) | - | | | | | | |
| 2. Benefits for idea generation (BI) | .415* | - | | | | | |
| 3. Benefits for service development (BS) | .232 | .749** | - | | | | |
| 4. Benefits for project management (BM) | .296 | .546** | .601** | - | | | |
| 5. Benefits for participating organization(s) (BO) | -.019 | .546** | .741** | .638** | - | | |
| 6. Benefits on longer term (expected) (BL) | .144 | .620** | .713** | .655** | .702** | - | |
| 7. Evaluation of costs and risks of HCD | .265 | .644** | .579** | .619** | .424* | .605** | - |
| 8. Intentions to organize HCD in the future** | .271 | .499** | .343* | .546** | .435* | .550** | .729** |

* = sign. $p < .05$ (two-tailed)

** = sign. $p < .01$ (two-tailed)

Next, we examined the relation between project-team members' characteristics and perceived Benefits (BI, BS, BM, BO, BL). Results are shown in Table 7. Due to the relatively small data set a type II error is more likely to be made as it is quite difficult to find significant effects due to a lack of power (i.e. failing to reject a false null hypothesis – H_0 : no effect). However, substantial relationships can also provide relevant insights.

We found that higher Involvement in HCD activities results in higher perceived Benefits (in blue) for idea generation (significant), for service development, for project management and for the longer term (cf. correlations in Table 6). Though only the former is significantly positive.

Furthermore, we found several effects of Role in project (in green), when comparing Management or coordination, Application development and Technology development roles relative to User research and roles. (User research or design roles were taken as a reference category based on relative size for model stability reasons: 40% of the project members had User research or design roles.)

- People in Management or coordination roles perceived relatively higher Benefits for participating organizations (.404) and Benefits for the longer term (.295), compared to people in User research or design roles.
- People in Application development roles perceived relatively less Benefits of HCD, especially of Benefits for idea generation (-.243), service development (-.232) and project management (-.306), compared to people in User research or design roles.
- People in Technology development roles perceived relatively less Benefits for idea generation (-.151), Service development (-.012) and Project management (-.103), but relatively more Benefits for the participating organization(s) (.173) and Benefits on longer term (.206), compared to people in User research or design roles.

In addition, we found that people in TA2 perceived relatively fewer Benefits of HCD than people in WeCare (in red), significantly for longer term benefits. This difference

may be due to the projects' different contexts and characters: TA2 (in FP7 programme) focuses on technology research, whereas WeCare (in AAL programme) focuses on service development, where HCD is likely to be more beneficial for the latter.

In sum, we found a significant positive relationship between Involvement in HCD and perceived Benefits of HCD for idea generation. A significant difference was also found for the Benefits for longer term between the WeCare and TA2 projects. It was also found that the perceptions of benefits vary between project roles; e.g. people in Management or coordination roles were relatively positive about organizational and longer term benefits. See Figure 11.

Table 7. Regression of Benefits on Involvement, Role and Project

| | Benefits for idea generation (BI) | Benefits for service developmen t (BS) | Benefits for project managemen t (BM) | Benefits for participating organization (s) (BO) | Benefits on longer term (expected) (BL) |
|-------------------------------------|--|---|--|---|--|
| | B | B | B | B | B |
| Constant | 3.214*** | 3.155*** | 2.359*** | 2.843*** | 2.872*** |
| Involvement in HCD activities | .191* | .135 | .210 | .073 | .164 |
| Role in project | | | | | |
| Management or coordination roles | -.192 | .019 | -.217 | .404 | .295 |
| Application development roles | -.243 | -.232 | -.306 | -.065 | -.210 |
| Technology development roles | -.151 | -.012 | -.103 | .173 | .206 |
| User research or design roles | (ref.) | (ref.) | (ref.) | (ref.) | (ref.) |
| Project (TA2) | -.125 | -.137 | -.318 | -.175 | -.554** |
| R ² | .125 | .142 | .180 | .061 | .255 |
| N | 36 | 34 | 33 | 34 | 33 |

* = sign. $p < .10$ (two-tailed)

** = sign. $p < .05$ (two-tailed)

*** = sign. $p < .01$ (two-tailed)

Finally, we examined the influences of Involvement, Role, Project and Benefits perceived on the Evaluation of costs and risks of HCD. Due to a lack of variation in Intentions to organize HCD, which approximates a constant, logistic regression analyses could not be performed for Intention (see Table 4).

First, effects of Involvement, Role and Project on Evaluation of costs and risks were examined—see Model 1 in Table 8. Higher Involvement slightly increases the Evaluation of costs risks as acceptable (.092). Relative to project-team members in User research or design roles (reference category), people in other roles evaluated the costs and risks of HCD as slightly less acceptable, with people in Technology application roles scoring significantly lower (-.492, -.468*, -.473). Please note that a majority of project-team members evaluated the costs and risks of HCD as acceptable (see Figure 9 and Table 4).

Second, we examined the effects of Benefits perceived on Evaluation of costs and risks—see Model 2 in Table 8. Due to the small sample size, and therefore limited

degrees of freedom, we used a stepwise regression method to include the most sizable and significant effects only. We found that Benefits for idea generation (BI .559**) and for project management (BM .396***) positively influenced the Evaluation of costs and risks.

Third, we examined the effects of Involvement, Role, Project and Benefits perceived on the Evaluation of costs and risks simultaneously—see Model 3 in Table 8. We found that the perception of Benefits for idea generation (BI) and project management (BM) positively influenced the Evaluation of costs and risks. We also found that people in User research or design roles (reference category) evaluated the costs and risks of HCD more positively, compared to people in other project roles. Almost all project-team members agreed to statements about intentions to organize HCD in the future, irrespective of their Involvement, Role or Project, and their perceptions of Benefits (Table 4). Consequently, as this is almost a constant, no logistic regression analyses found any effect.

Moreover, when the effects of Benefits on Evaluation of costs and risks are taken into account, the degree of Involvement in HCD activities has a negative effect on the Evaluation of costs and risks of HCD (-.153). The latter may be explained as follows: if project-team members are involved more in HCD, they may evaluate the costs and benefits less favourably. However, this negative effect is more than compensated by the perceived benefits; as shown in Table 7, more involvement leads to a higher perception of HCD benefits.

In sum, we found positive significant effects of Benefits for idea generation (BI) and project management (BM) on Evaluation of costs risks. See Figure 11. Differences in Evaluations of costs and risks between people in User research or design roles and other project roles are noteworthy.

Table 8. Regression of Evaluation of cost and risks on Involvement, Role and Project

| | Model 1 | Model 2 | Model 3 |
|---|----------|---------|---------|
| Constant | 3.156*** | .284 | .512 |
| Involvement in HCD activities (I) | .092 | - | -.153 |
| Role in project (R) | | | |
| Management or coordination roles | -.492 | - | -.397 |
| Application development roles | -.468* | - | -.290 |
| Technology development roles | -.473 | - | -.463 |
| User research or design roles | (ref.) | | (ref.) |
| Project (TA2) | -.008 | - | .067 |
| Benefits for idea generation (BI) | | .559** | .664*** |
| Benefits for service development (BS) | | - | - |
| Benefits for project management (BM) | | .396*** | .308** |
| Benefits for participating organization(s) (BO) | | - | - |
| Benefits on longer term (expected) (BL) | | - | - |
| R ² | .193 | .573 | .639 |
| N | 32 | 29 | 30 |

*= sign. p<.10 (two-tailed)

** = sign. p<.05 (two-tailed)

***= sign. p<.01 (two-tailed)

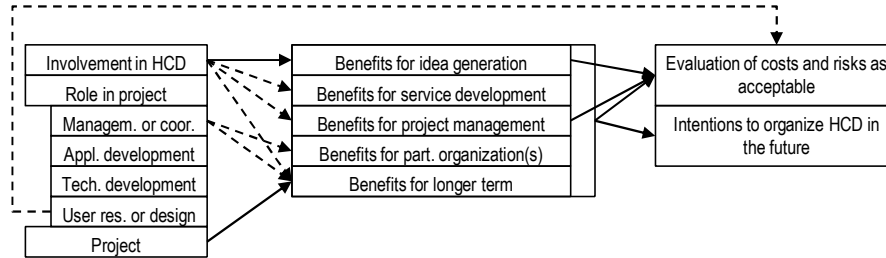


Figure 11. Conceptual model and relations found (drawn lines indicate significant relationships; dotted lines indicate substantive relationships)

5 Conclusions and implications

We aimed to further our understanding of human-centred design (HCD) as a way to open-up the innovation process. HCD refers to diverse ways to organize cooperation of researchers and designers with (potential) users and customers e.g., in workshops, interviews, user tests or user trials. HCD refers both to involving users and customers in research, design and evaluation, and to organizing multidisciplinary teamwork and an iterative process of research, design and evaluation.

We reflected on HCD activities in two projects (TA2 and WeCare) to further our understanding of the immediate benefits of HCD for idea generation and service development. We found that HCD has helped to develop specific ideas, based on the ideas and input of (potential) users, such as the idea to use a (horizontal) table for the game play and a (vertical) screen for video communication, and the idea to use tactile or embodied game elements (mini-games) (TA2 Family Game) or the idea to use a second camera in response to people asking for it (TA2 Storytelling/TA2 Lite) and to prioritize and choose between alternative ideas for further development (TA2 MyVideos) or to evaluate and further develop different interaction design solutions (TA2 Connected Lobby). HCD has also helped to evaluate project-team members initial ideas and to articulate user requirements and specifications (WeCare Finland, Ireland, The Netherlands), to make strategic decisions, e.g. to switch the focus in the context of usage (WeCare Finland), to prioritize and choose between different functionalities (WeCare Spain) and to further develop and improve service functionalities and user interface in an iterative process (WeCare Finland, Spain, Ireland, The Netherlands). Overall, HCD has helped to better understand (potential) users, and their contexts, and to develop services that better match their needs and preferences.

In addition, we conducted a survey amongst members of these projects (TA2 and WeCare, n=37) to study project-team members' perceptions of the benefits of HCD; not only the immediate benefits for idea generation and service development, but also broader benefits for project management, for the participating organization(s) and for the longer-term. A majority of project-team members had experienced the benefits of HCD for idea generation and service development. Many had 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, e.g. they found that HCD can improve the quality of decision making, but can also slow down decision making. Overall, taking into account the various benefits of HCD, many found the costs and risks involved in organizing HCD acceptable, and a majority would organize HCD again in the future or would recommend others to organize HCD.

Based on these findings, we propose the following tentative recommendations for organizing HCD:

We recommend to organize HCD from the start of a project and to organize 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.

Furthermore, 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, trust and commitment, and to develop a common ‘language’.

Moreover, we recommend to consider a range of HCD methods and to choose appropriate 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 theory and our findings, we would recommend the following order of methods—see Figure 12 for a fictional, illustrative example:

- 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.

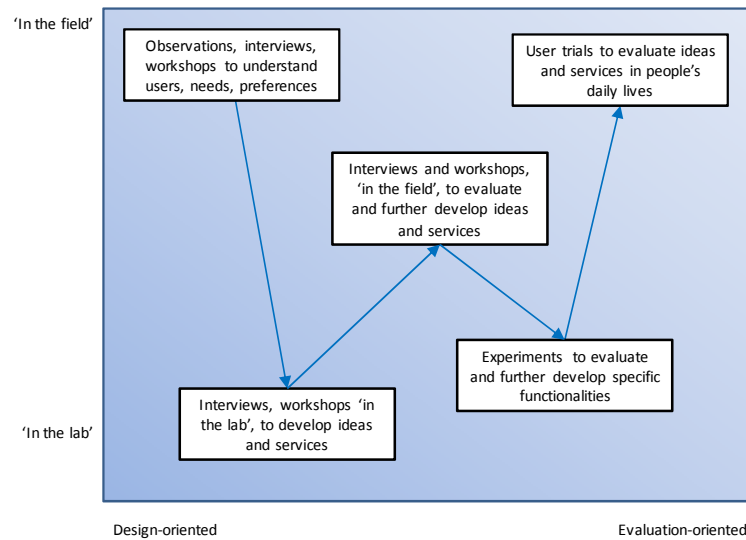


Figure 12. Tentative recommendation to organize human-centred design activities

There have been debates on whether one can start HCD with ideas from project-team members or that one should start with ideas from (potential) users. We believe that both options are fine, provided that ideas are discussed between project-team members and (potential) users as soon as possible—e.g. in a first round of creative workshops or interviews in which project-team members interact with (potential) users ‘in the field’. The advantage of starting with an idea is that the project has more focus. A possible risk of starting with the project-team’s idea is that ‘users’ have less influence on idea generation and can ‘only’ contribute to service development, in modifying and improving it into a service or product. ‘Only’ is between quotes because this can be a major contribution. This can be 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.

In addition, there have been debates on which people to involve as ‘users’. In the projects studied, different groups and different people were involved. E.g. in the TA2 project, we cooperated also 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.

Overall, it is critical that both project manager and project-team members are aware of the potential benefits of HCD and of ways to organize HCD effectively. With this paper, we aim to contribute to developing such awareness, and to help people to organize HCD in such ways that the potential benefits are indeed realized, so that project-team members can productively cooperate with each other and with users or customers, and can jointly develop products or services that match people's needs and preferences.

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Annex: Benefits of human-centred design questionnaire

People 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 later 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 later 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.