

Benefits of organizing human-centred design in open innovation projects

Marc Steen and Olav Aarts, submitted to *International Journal of Innovation Management*

Human-centred design (HCD) is a form of open innovation in which researchers and designers cooperate with users or customers, in order to develop products and services that match people's needs and preferences. In the literature, the following benefits of HCD are identified: for idea generation, for service development, for project management, for the participating organizations, and for the longer term. We studied HCD activities in two open innovation projects and conducted a survey among their team members, in order to better understand the *practical* benefits of HCD. The benefits for idea generation and service development were manifest in our study of these projects. Project-team members also perceived these benefits, and also the benefits for the participating organizations and for the longer term. Moreover, they found the costs and risks of organizing HCD acceptable and had intentions to organize HCD in future projects. The paper closes with recommendations for organizing HCD effectively, so that its potential benefits are actualized.

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

Introduction

There is a discussion in the open innovation literature concerning the diverse practical ways in which innovation processes can be opened-up effectively (Enkel et al., 2009; Gassmann et al., 2010; Huizingh, 2010; Giannopoulou et al., 2011; Lichtentaler 2011). Open innovation is often approached by trial and error; '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).

This paper's purpose is to better understand one particular way of opening-up the innovation process, that is, by organizing human-centred design (HCD) (ISO, 1999). This approach of involving (potential) users or customers in innovation projects has been identified as an interesting and relevant aspect of open innovation (Enkel et al., 2009; Gassmann, 2006; Gassmann et al., 2010; Lichtentaler 2011; Öberg, 2010) and has received some attention (Buur and Matthews, 2008; Janssen and Dankbaar, 2008; Pals et al. 2008; Jespersen 2010; Öberg, 2010; Greer and Lei, 2012). However, relatively little is known about the practical benefits of HCD and about organizing HCD effectively. Greer and Lei (2012) proposed, for example, that 'more research into the detailed operational aspects' of collaborating with users or customers is needed.

This paper's focus is relatively narrow; below, we study two research-driven innovation projects in which several demonstrators or prototypes of innovative internet services were developed and

evaluated. Rather than aiming to provide a comprehensive ‘cookbook’, we aim to study one particular recipe, that is, for organizing HCD.

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. HCD aims to promote cooperation with users or customers during research, design and evaluation activities, with the goal to jointly develop innovations that better match people’s needs and preferences. We use the term ‘HCD’ to refer a range of methods, e.g., co-design workshops, interviews, user tests or user trials, and approaches, e.g., participatory design, contextual design or empathic design (Author, 2011). Please note that the terms ‘HCD’ and ‘co-design’ (Sanders & Stappers, 2008; Author, 2013) are sometimes used synonymously; both refer to cooperation with users or customers, and to cooperation between people with different backgrounds, 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 (Author, 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, Van Beers, & Kleinknecht, 2003). 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, Gustafsson, Kristensson et al., 2006; Hoyer et al., 2010; Kujala, 2003; Kristensson & Magnusson, 2010; Magnusson et al., 2003; Rohrer, 2005; Roser & Samson, 2009). However, relatively little is known about project managers’ or project team members’ practical experiences or perceptions of the benefits of HCD. Rarely do they articulate specifically which benefits they aim for by organizing HCD or do they evaluate precisely whether these benefits were realized.

Benefits of human-centred design

Based on a literature review (e.g. Alam, 2002; Edvardsson, Gustafsson, Kristensson et al., 2006; Hoyer et al., 2010; Kujala, 2003; Kristensson & Magnusson, 2010; Magnusson et al., 2003; Rohrer, 2005; Roser & Samson, 2009—summarized in Author et al., 2011) different types of *potential*

benefits of HCD were identified, which range from immediate benefits for idea generation and service development, to more general benefits for project management, for the participating organization(s), to benefits for the longer term. See Table 1 for an overview.

Table 1: Potential benefits of human-centred design (from Author et al., 2011)

<p>Benefits for idea generation (BI):</p> <ol style="list-style-type: none"> 1. To generate other/alternative ideas, based on users' or customers' input, e.g., ideas with high 'originality' (Kristensson et al., 2002; Magnusson, 2003; Magnusson et al., 2003; Kristensson & Magnusson, 2010) 2. To generate better ideas, based on users' or customers' input, e.g., ideas with high 'user value' (Kristensson et al., 2002; Magnusson, 2003; Magnusson et al., 2003; Kristensson & Magnusson, 2010) 3. To understand users' needs and preferences, e.g., their daily live experiences (Roser & Samson, 2009; Muller, 2002; Sleeswijk Visser et al., 2005) 4. To improve the process of idea generation, e.g., by bringing together (potential) users and project-team members (Sanders, 2000 and 2002; Cottam & Leadbeater, 2004; Parker & Heapy, 2006; Muller, 2002; Roser & Samson, 2009) <p>Benefits for service development (BS):</p> <ol style="list-style-type: none"> 5. To improve the service definition, e.g., by formulating more precise user requirements (Kujala, 2003) 6. To develop better services from users' perspective, e.g., services that better match users' needs (Kujala, 2003; Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010) 7. To develop more differentiated services, e.g., services that are more appropriate for a specific target group (Alam, 2002) 8. To develop services with higher quality, e.g., services with better usability (Kujala, 2003; Roser & Samson, 2009) 9. To develop better services from project perspective, e.g., services with less shortcomings or failures (Hoyer et al., 2010) <p>Benefits for project management (BM):</p> <ol style="list-style-type: none"> 10. To improve the quality of decision making, e.g., because input from users can be taken into account (Roser & Samson, 2009) 11. To improve the speed of decision making, e.g., because input from users can be taken into account early-on (Roser & Samson, 2009) 12. To lower the development costs, e.g., because input from users helps to improve the development process (Roser & Samson, 2009) 13. To reduce the development lead-time, e.g., because input from users helps to improve the development process (Alam, 2002; Hoyer et al., 2010; Roser & Samson, 2009) 14. To organize continuous improvements, e.g., by organizing iterative cycles of research, design and evaluation together with users (Hoyer et al., 2010) <p>Benefits for the participating organization(s) (BO):</p> <ol style="list-style-type: none"> 15. To improve innovation and creativity within the organization(s) (Muller, 2002; Roser & Samson, 2009) 16. To improve the focus on users within the organization(s) (Burns, Cottam, Vanstone, & Winhall, 2006; Sleeswijk Visser et al., 2005) 17. To improve cooperation within the organization(s), e.g., better cooperation across disciplines (Burns et al., 2006; Muller, 2002)

18. **To improve innovation capabilities**, e.g., increased capabilities to organize workshops or interviews with users (Burns et al., 2006; Roser & Samson, 2009)
 19. **To generate enthusiasm for innovation or creativity** within the organization(s) (Burns et al., 2006)
- Benefits for the longer-term (BL):**
20. **To improve relations** between the organization(s) and users or customers (Alam, 2002; Hoyer et al., 2010)
 21. **To improve relations** between the organization(s) and the general public (Alam, 2002)
 22. **To make innovations more successful**, e.g., in terms of increased sales or increased market share (Alam, 2002)
 23. **To improve the satisfaction** of customers or users (Kujala, 2003; Roser & Samson, 2009)
 24. **To improve the loyalty** of customers or users (Roser & Samson, 2009)
 25. **To educate, to instruct or to train** customers or users (Alam, 2002)

Research questions and approach

We aim to deepen our understanding of the practical benefits of human-centred design (HCD) in open innovation projects. Hence, we will address the following research questions:

1. *What are the immediate benefits of organizing HCD for the process and outcomes of idea generation and service development?*
2. *To what extent do project-team members—depending on their involvement in HCD activities and their role in the project—perceive the various benefits of HCD?*
3. *How do project-team members evaluate the costs and risks of organizing HCD—given its benefits—and what are their intentions to organize HCD in future projects?*

Question 1 is addressed by studying the effects of organizing HCD on both the process and the results of idea generation and service development processes in two projects (TA2 and WeCare, see below). Questions 2 and 3 are addressed by conducting a survey among team members in these projects and analysing the results.

The answers to these research questions are relevant to project managers and project team members because they will help them to decide whether and when to organize HCD in their projects and if so, how to organize HCD (more) effectively, so that its potential benefits are actualized.

In the next section, the two projects are introduced and their HCD activities are analysed, followed by a discussion of the survey and its results. In the last two sections, we will draw conclusions and articulate tentative recommendations for organizing HCD effectively.

Case study of the TA2 and WeCare projects

In order to address research question 1 (immediate benefits of HCD for idea generation and service development), we discuss the TA2 and WeCare projects, and focus on the added value of HCD for

idea generation and service development. We conducted case studies (Yin, 1994) of two projects: TA2 and WeCare. This case study approach provided us a focus on the design, development and evaluation of several internet services in research-driven, open innovation projects. Both projects are examples of HCD since project-team members cooperated with (potential) users in an iterative process of research, design and evaluation, e.g. by organizing co-design workshops, interviews, user tests or user trials. Furthermore, both are examples of open innovation since they involved cooperation and exchange of knowledge and ideas between diverse organizations (13 in TA2, 10 in WeCare), ranging from large companies, small-medium enterprises and service providers, to universities and research institutes. Moreover, both were organized as multidisciplinary teamwork, involving people with diverse backgrounds, such as user research and design, and technology and application development.

In addition, the projects have similar aims. Both aim to better understand how internet services—e.g., video communication, online gaming and social networking—can foster social communication among groups of people, promote social networking and help people to improve their well-being. The 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 the projects and conducted informal participant observation (Easterby-Smith et al., 2002: pp. 110-114), e.g., during project meetings. This insider perspective is needed to study the complex phenomenon which we are interested in: cooperation between 30 (TA2) or 20 people (WeCare) in a creative process over a course of 4 (TA2) or 3 years (WeCare). Like Huizingh (2010), we argue that a case study is a valid approach for practice-oriented research into real world phenomena. Additionally, scholars in organization studies advocate generating knowledge based on participation in actual practices (Jarzabkowski et al., 2010).

The TA2 project

The overall goal of the TA2 project has been to better understand the ways in which ICT can improve social communication among 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’ (Granovetter, 1973), 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 applications were developed and evaluated in close cooperation with different groups of users (see Author et al. TA2 2011 for details).

The HCD process involved interviews, creative workshops and experiments. First, a series of Family Interviews were conducted (UK, Sweden, Germany and The Netherlands), in people's homes, which aimed to better understand people's current practices, needs and preferences, and to discuss these in relation to project-team members' initial ideas. Next, a series of creative workshops were conducted with different target groups for each of the five demonstrators. These workshops were conducted relatively early-on in the project, using storyboards and sketches to present and discuss the demonstrators—rather than waiting until working prototypes were ready. We focused on understanding people's experiences, needs and preferences, and articulating ideas for further development and improvement of the demonstrators. Finally, a range of experiments and user trials were conducted, in which potential users used the prototypes, either in a lab or in their own homes, in order to evaluate their added value from users' perspectives. The following demonstrators were developed and evaluated—with a summary of the added value of HCD:

- Family Game, an online application for gameplay and video communication, which aims to bring the experience of playing a board game to people when they are separated spatially. Users tests were conducted with the initial set-up, 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 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 add mini-games.*
- MyVideos, a system that allows people to share pieces of video footage shot by different people at a shared event and to combine these to create personalised video narratives. A group of parents of children from a high school participated in interviews and workshops, in recording videos of a school concert with their children and evaluating a first prototype, and in discussions of options for further development. Another group of parents from another school participated in the evaluation of a second prototype, by making recordings of another school concert and in lab experiments to evaluate this prototype. *HCD helped to bring users' perspectives—their practical experiences with similar technologies and their creative idea—into the project, and to prioritize and choose between alternative ideas for further development.*
- TA2 Lite, an application that connects older people with, for example, family members that live further away, by combining gameplay and video communication. It was developed based on findings from ethnographic fieldwork into the needs of older people to communicate and interact socially with family members. User trials were conducted in 10 households, involving over 30 people, lasting several months. *HCD helped to understand the interplay between technology and daily life, and to develop the idea for a second camera (to accompany the camera that fixed to the TV set, in order to move around flexibly).*

- Connected Lobby, an application that helps people to coordinate communication and interaction via the abovementioned applications on a TV. Experiments with users were conducted to study the feasibility of using light for presence notifications and ways to automate coordination and communication. User trials in people's homes were conducted to study the acceptance of a TV set for group-to-group video-communication, and sharing personal information, such as status updates and presence notifications. *HCD helped to develop and evaluate ideas to use light for presence notifications, to use the TV set for group-to-group communication, to balance awareness and privacy, and to develop a 'smart awareness assistant'.*

The WeCare project

The overall goal of the WeCare project was to help older people to participate in social networks, both online and face-to-face, in order to improve their wellbeing. More practically, the goal was to develop and evaluate four online social networking services (in Finland, Spain, Ireland and The Netherlands), that would facilitate older people to participate in social networks and social activities, and to help people to coordinate informal care and support among family members, friends and neighbours. These services were developed and evaluated in close cooperation with potential users (older people, the 'primary users') and others, such as family members or professional carers ('secondary users'), and were based on modifying and combining several technical components, ('pick-and-mix'), in order to match different target groups and usage contexts, in the four different countries (see Author et al. WeCare 2012 for details).

The HCD process involved interviews with older people, to better understand their daily lives, needs and preferences, creative workshops with older people, family members and professional care providers, to develop and evaluate ideas for the services, and user trials, in the four countries, in which people used the services for several weeks in their daily life contexts. In Finland and Spain, the services were developed in cooperation with care service providers and integrated into their existing services. In Ireland and The Netherlands, the services developed in cooperation with older people's associations, and were targeted at broader groups of older people. The following four services were developed and evaluated—with a summary of the added value of HCD:

- In Finland, interviews and workshops with older people and the care provider's nurses were organized during the development and evaluation of the service. A video communication system was integrated into an existing care services, through an iterative, hands-on process in close cooperation with older people, their relatives and nurses. *HCD helped to articulate user requirements and specify the service, to decide to change the context of usage (respite care), and to develop and fine-tune easy-to-use functionalities and user interface design solutions.*
- In Spain, interviews with older people and co-design workshops with the service provider's clients, stakeholders and software developers were conducted during the development of the

service. The service was evaluated in two user trials: one in which the service supported the sharing of locally relevant information, fostering social interaction; and another in which the service was integrated into an existing care service. *HCD helped to prioritize and choose between functionalities, to focus on ease-of-use, and to further improve functionalities and user interface.*

- In Ireland, the service was developed in a relatively focused and fast process through close cooperation between a technology developer and a farmers' organization. For increased ease of use, it 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 rapidly evaluate project-team members' initial ideas, to modify these ideas, and to develop the service.*
- In the Netherlands, the process started with project-team members' ideas, based on earlier projects. These ideas were further developed, evaluated and modified in an iterative process, in close cooperation with older people: several older people ('expert users') were interviewed to understand their needs and preferences; then several other older people (also 'expert users') participated in a co-design workshop in which they helped to further develop and modify ideas. The findings from these interviews and workshop were the basis for user requirements and user interface design. *HCD helped to better understand older people, their needs and preferences, to develop user requirements and user interface, and to provide input for further development.*

Findings

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 table for game play and a screen for video communication, and the idea to develop mini-games (TA2 Family Game) or the idea to add a freely moving second camera (TA2 Lite), to prioritize and choose between alternative ideas for further development (TA2 MyVideos) and to evaluate and further develop 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, for example, to switch the focus in the usage context (WeCare Finland), to prioritize and choose between 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, their contexts, and to develop services that better match their needs and preferences. See Table 2 for an overview of the benefits that were manifest in the different projects ('BI' is for Benefits for idea generation; 'BS' is for Benefits for service development).

Table 2: Benefits of human-centred design in the TA2 and WeCare projects

	TA2: Family Game	TA2: MyVideos	TA2: TA2 Lite	TA2: Connected Lobby	WeCare in Finland	WeCare in Spain	WeCare in Ireland	WeCare in The Netherlands
BI: Alternative ideas	X		X					X
BI: Better ideas	X		X					X
BI: Understand users	X	X	X	X	X	X	X	X
BI: Process of idea generation	X	X	X	X	X	X	X	X
BS: Service definition	X	X	X	X	X	X	X	X
BS: Better services, for users		X	X	X	X	X	X	X
BS: Differentiated services		X		X	X	X	X	
BS: Higher quality	X	X	X	X	X	X	X	X
BS: Better services, for project			X	X	X	X	X	X

One may notice that the benefits of ‘Understanding users’, ‘Process of idea generation’, ‘Service definition’ and ‘Higher quality’ were manifest in all cases. In addition, one may notice that benefits like ‘Alternative ideas’ and ‘Better ideas’ were manifest in cases that emphasized idea generation in cooperation with users (TA2 Family Game and TA2 Lite, and WeCare in The Netherlands), whereas benefits like ‘Better services, for users’ and ‘Differentiated services’ were manifest in cases that emphasized service development in cooperation with users (TA2 MyVideos and Connected Lobby; and WeCare in Finland, Spain and Ireland), and that the benefit ‘Better services, for the project’ was most manifest in cases which emphasized user trials in people’s daily lives (TA2 Lite, Connected Lobby, and WeCare in Finland, Spain, Ireland and The Netherlands). One may conclude that HCD was appropriated adequately in the different cases.

Discussion

There have been debates about the balance between ‘technology push’ and ‘user pull’, e.g. on whether project-team members can start with their own ideas or whether they should start by meeting users and listening to their ideas. For example, people may be unaware of their needs, unable to express these, or unwilling to share these with an interviewer (van Kleef et al., 2005), designers can become prejudiced about users’ needs when they involve them too frequently (Van der Panne et al., 2003), or paying too much attention to what users say may erode the role of the designer, whose vision and creativity are key for innovation (Hekkert & Van Dijk, 2006). We propose that both options are fine, provided that ideas are discussed between project-team members and users as soon as possible, for example in a first round of interviews or workshops. Starting with project team members’ ideas can be helpful in giving focus to the project. Conversely, it brings the risk of allowing users to have relatively less influence on idea generation and service development. This risk can be been mitigated by carefully examining the initial ideas and assumptions, by

conducting desk research, interviews, workshops and observations, in order to validate or modify these ideas and assumptions. An open attitude and mind-set and an iterative process are critical for this (Author, 2011; Author, 2012).

In addition, there have been debates on which people to involve as 'users'. In the projects studied, different groups and different people were involved, not only the targeted 'users', but also people that can speak about them or on their behalf. In the projects studied, we also cooperated with 'expert users' (board game enthusiasts in TA2; older people who were helping other older people in WeCare), and with people who acted as their 'representatives' (marketing experts in TA2; nurses in WeCare, when older people were less able to communicate).

Survey among project team members

In order to answer research questions 2 and 3 (*project-team members' perceptions of the benefits of HCD, their evaluation of the costs and risks of HCD, and their intentions to organize HCD in future projects*), a survey was conducted among the members of the TA2 and WeCare projects. The survey contained the following sections:

- A. Involvement, Role and Project: A series of questions about their involvement in HCD activities, typified (by one of the authors) as low, medium or high involvement (0,1,2). Furthermore, each respondent's role in the project was categorized (by one of the authors) as Management or coordination, Application development, Technology development, or User research or design. Finally, for all respondents, the project they worked in was known (TA2 or WeCare).
- B. Benefits of HCD: A series of 25 statements about the potential benefits of organizing HCD, in five categories: for idea generation (BI), for service development (BS), for project management (BM), for the participating organization(s) (BO), and for the longer term (BL) (based on Author et al., 2011). Respondents could indicate their (dis)agreement with these statements, on a 5-point scale.
- C. Evaluations and Intentions: A series of four statements about the costs and risks of organizing HCD, and two statements about intentions to organize HCD in the future (see Appendix), for which respondents could indicate their (dis)agreement, on a 5-point scale.

The (online) questionnaire was filled-out by a representative sample: 37 project-team members (21 from TA2, with approx. 30 people; and 16 from WeCare, with approx. 20 people).

Descriptive statistics

Most project-team members agreed to statements about having experienced the benefits of HCD for idea generation (BI), e.g., for better understanding users' needs and preferences, for generating alternative ideas, and better ideas, and for improving the process of idea generation. Many also

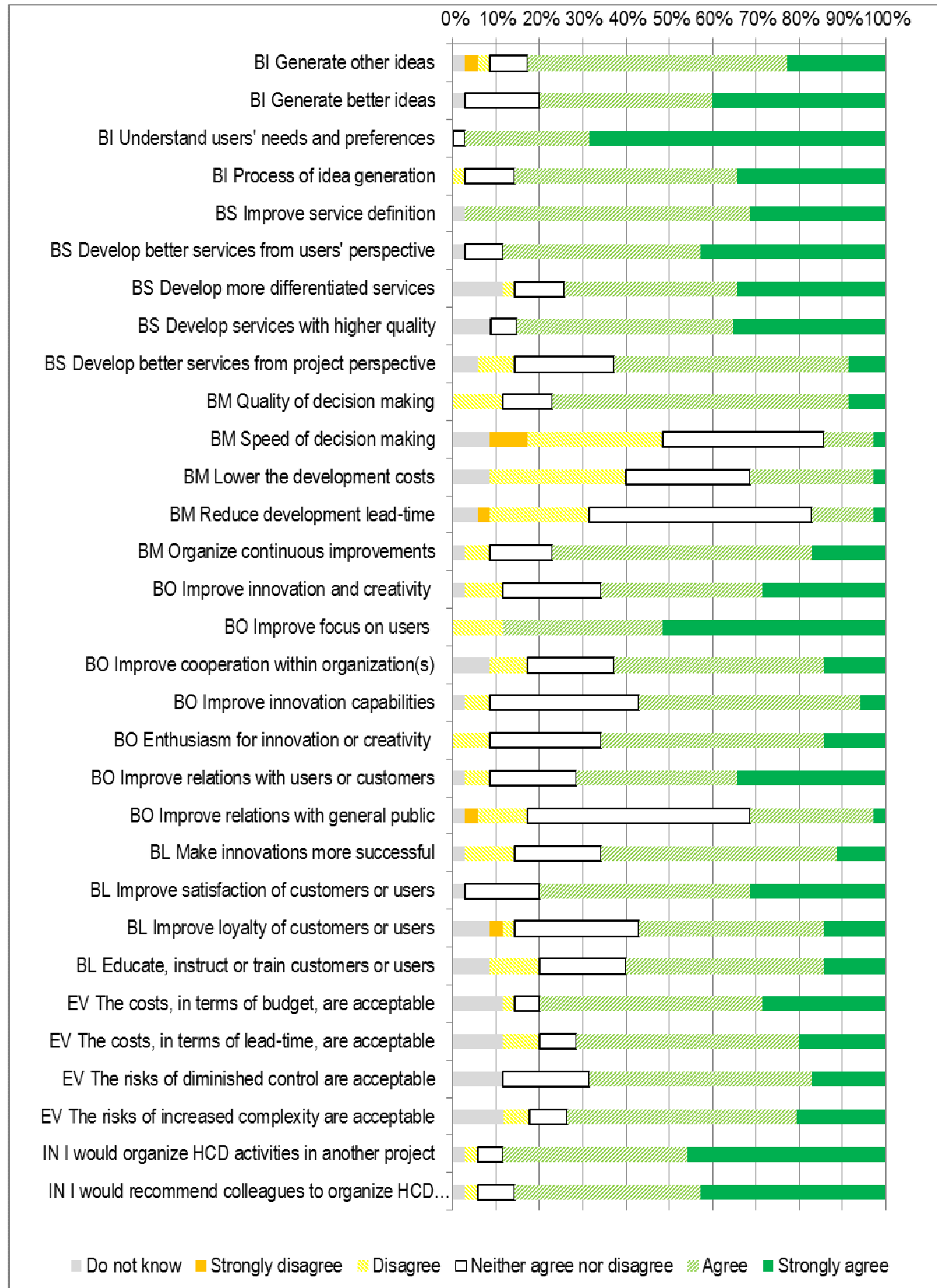
agreed to statements about benefits of HCD for service development (BS), e.g., for improving the service definition, for developing better services from users' perspective, more differentiated services, and services with higher quality.

Furthermore, project-team members did not uniformly agree or disagree on the benefits of HCD for project management (PM). E.g., many agreed that HCD had improved the quality of decision making, but only few agreed that HCD had improved the speed of decision making. Relatively few found that HCD had helped to lower the development costs or to reduce development lead-time. However, many agreed that HCD helps to organize continuous improvements, e.g., by organizing iterative cycles of research, design and evaluation together with users.

Many agreed to statements about the benefits of HCD for the participating organizations (BO), e.g., an improved focus on users, improved cooperation within the organization(s), positive effects on innovation capabilities, innovation and creativity, and enthusiasm for innovation and creativity. In addition, many agreed to statements about expecting benefits of HCD for the longer term (BL), e.g., after the project, e.g., improved relations with customers or users, and improved satisfaction of customers or users.

Taking these benefits into account, most project-team members evaluated the costs of organizing HCD (budget and lead-time) and the risks (diminished control and increased complexity), as acceptable (70%-80% agreed or strongly agreed). Finally, a vast majority of project-team members—taking the benefits, and costs and risks into account—agreed with the statement 'I would organize HCD activities in another project' (90% agreed or strongly agreed) or 'I would recommend colleagues to organize HCD in similar projects' (85% agreed or strongly agreed). See Table 3 for an overview.

Table 3. Project team members' perceptions of the benefits of organizing human-centred design, their evaluations of the costs and risks involved, and their intentions to organize human-centred design in the future (from a survey among project-team members in TA2 and WeCare)



Relational analysis

In addition, we examined the relationships between project-team members' involvement in HCD, their role in the project, the project they worked in, their perceptions of the benefits of HCD, their evaluations of the costs and risks involved, and their intentions to organize HCD in the future. We would expect that people who perceive greater benefits of HCD would evaluate the costs and risks as acceptable and would have intentions to organize HCD in future projects. Furthermore, we were interested in the effects of Involvement, Role and Project on people's perception of Benefits, Evaluation of costs and risks, and Intention to organize HCD in the future.

First, we examined the relationships between Involvement, Benefits perceived (BI, BS, BM, BO, BL), Evaluation of costs and risks, and Intentions for future projects. We found that higher involvement in HCD is positively and significantly related to the perception of benefits for idea generation (BI). Furthermore, we found that all Benefits perceived (BI, BS, BM, BO, BL) are positively and significantly correlated with each other, with Evaluation of costs and risks, and with Intentions to organize HCD in the future. 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. These findings are displayed in Table 4 in the appendix.

Next, we examined the relation between project-team members' Involvement, Role and Project and the Benefits they perceive. We found (as Table 4 already suggested) that higher involvement relates to higher perceived benefits for idea generation (significant), and for service development, for project management and for the longer term (substantial but not significant, probably due to the relatively small data set). In addition, we found that people in management or coordination roles perceived relatively higher benefits for the participating organizations (BO) and for the longer term (BL), whereas people in application development roles perceived relatively less benefits for project management (BM). Furthermore, we found that people in TA2 perceived significantly less benefits for the longer term (BL), compared to people in WeCare. The results are displayed in Table 5 of the appendix.

Finally, we examined the relations between project-team members' Involvement, Role and Project, and Benefits and Evaluation of costs and risks of HCD. We found that higher involvement in HCD corresponds with evaluating its costs and risks as acceptable, and that people in application development roles are less likely to evaluate the costs and risks as acceptable (compared to people in User research or design roles—see Appendix: Table 6, Model 1). Please bear in mind that a majority of project-team members evaluated the costs and risks of HCD as acceptable (Table 3). Furthermore, we found that perceiving benefits for idea generation (BI) and project management (BM) positively corresponded to evaluating the costs and risks of organizing HCD as acceptable (see Appendix: Table 6, Models 2 and 3).

The statistically significant and substantial relationships are illustrated in Figure 1.

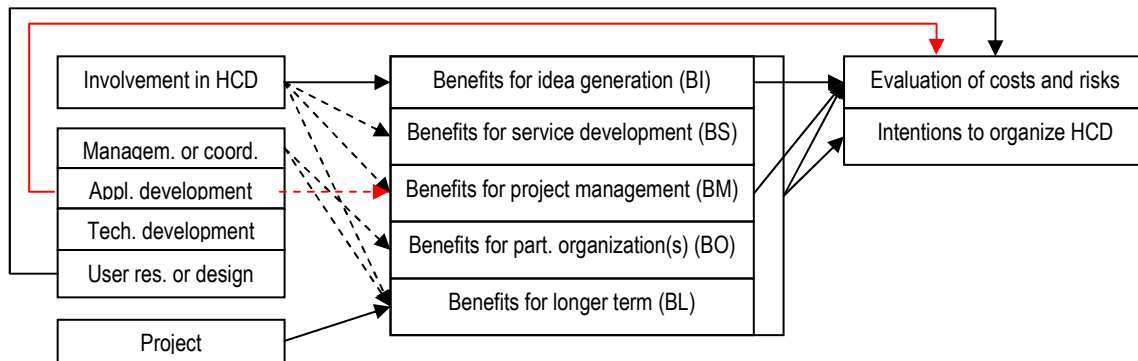


Figure 1. Relationships found (significant solid, substantial dashed; and positive black, negative red)

Discussion

Most project-team members perceived the benefits of HCD positively. This was most clear for the immediate benefits for idea generation and service development. The benefits for the participating organizations and for the longer term were also perceived by many. Interestingly, people in Management or coordination roles are relatively positive about the benefits of HCD for the organization and for the longer term. We would like to suggest that these people can advocate organizing HCD, since they see its benefits. In addition, we would like to suggest—based on the positive perceptions of the benefits of HCD for the participating organizations, in terms of improving innovation and creativity—that HCD can help to foster a climate that promotes innovation and creativity (Isaksen & Lauer 2002; Isaksen and Ekvall, 2010). Finally, the project-team members had mixed perceptions of the benefits of HCD for project management; e.g. people indicated that it slowed down the process of decision making and also that it improved the quality of decision making.

Most project-team members evaluated the costs and risks associated to organizing HCD as acceptable, and expressed their intentions to organize HCD in future projects and to recommend others to do so. All in all, the benefits of organizing HCD outweigh its costs and risks.

Personal and practical involvement in HCD activities positively affected the perception of its benefits; the more one is involved in HCD, the more one appreciates and values it. This is especially the case for people in user research or design roles; they are positive about HCD, e.g. compared to people in application development roles. The latter can have less positive perceptions of the benefits of HCD for project management and of the costs and risk of organizing HCD. Therefore, we would like to propose to pay special attention to involving people in application development roles in a positive manner in HCD activities—to see whether their perceptions can become more favourable.

We also found that people in TA2 perceived less benefits of HCD for the longer term (BL) than people in WeCare. This difference may be due to the projects' different contexts and characters: TA2

focuses on technology research, with a 3-to-5-year horizon, whereas WeCare focuses on service development, with a 1-to-2-year horizon. The questionnaire items for this category (BL) included statements about improved relations with and satisfaction and loyalty users/customers, and about increased sales or market share—statements that are likely to be more relevant to a project like WeCare, than to a project like TA2.

In order to draw more solid conclusions, more research and bigger datasets are needed.

Conclusions

Based on a case study of two projects and a survey among these projects' team members, we found that, in practice, HCD has many of the potential benefits that were identified in the literature. The most direct and immediate benefits are for idea generation and service development. From case studies of the projects' HCD process, we found clear examples of benefits of HCD for idea generation and service development. For idea generation, HCD helps to better understand potential users, their experiences, needs and preferences, and, by involving them in the project, to generate better or alternative ideas. For service development, HCD helps to develop better services, more differentiated services and services with higher quality. In the survey, we found that most project-team members also perceived these benefits.

From the survey, we found that many project-team members also perceived the more general benefits of HCD for the participating organizations, such as an improved focus on users, and for the longer term, such as improved satisfaction of users. We also found that direct and personal involvement in HCD activities, e.g. of people in user research or design roles, correlates with more positive perception of the benefits of HCD, especially of the benefits for idea generation, and also that people in management or coordination roles have relatively positive perceptions of the benefits of HCD for the organization and for the longer term.

Overall, taking into account the benefits of HCD, project-team members perceived the costs and risks involved as acceptable, and most have intentions to organize HCD in future projects. All perceived benefits of HCD are positively correlated to the evaluation of costs and risks and to intentions to organize HCD in the future. Interestingly, the benefits for idea generation and for project management significantly affected the positive evaluation of the costs and risks of organizing HCD. In order to promote HCD, one could focus on these specific benefits.

Recommendations

It is critical that project managers and project-team members are aware of the benefits of HCD and of ways to organize HCD effectively. In order to help practitioners to actualize the potential benefits of HCD, we propose the following recommendations:

- To organize HCD from 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 (cf. ISO, 1999: user involvement and iterative process). To have an open attitude and to see each interaction with potential users as a chance to learn about their experiences, needs and preferences. And to take users' input into account when making decisions, for example, when choosing between options for further development. HCD will then deliver immediate benefits for idea generation (e.g. better match users' needs) and service development (e.g. higher quality), and more general benefits for project management (e.g. decision making) and the organizations involved (e.g. focus on users, creativity).
- To organize HCD as multidisciplinary teamwork, promoting cooperation between, for example, people in technology or application development, user research or design, and business or marketing roles (the latter was not discussed in this paper) roles (cf. ISO, 1999: multidisciplinary teamwork and iterative process). In the case of open innovation, which involves close cooperation between organization, it is critical to organize the project—and, for example, project-team meetings—in such a manner that project-team members can communicate and cooperate effectively. It is critical to promote shared understanding, trust and commitment, and to develop a common language (Author et al., 2013).
- To consider a range of HCD methods and to choose appropriate methods. One can characterize HCD methods according to two axes: one axis that ranges from methods 'in the field' (e.g. observations) to methods 'in the lab' (e.g. experiments); and another axis that ranges from design-oriented methods (e.g. co-design workshops) to evaluation-oriented methods (e.g. user trials) (Author et al. 2008). In our case study, we found a pattern in the different HCD methods that were applied in the course of the projects: they typically started with design-oriented methods 'in the field', then moved to different methods to suit different purposes (both 'in the field' and 'in the lab', and both design-oriented and evaluation-oriented), and concluded with evaluation-oriented methods 'in the field'. Based on the positive contribution and results of HCD in these projects, we would like to propose the following—see Figure 2:
 - To start a project with design-oriented methods 'in the field' (e.g. observations or co-design workshops) in order to better understand potential users, their experiences, needs and preferences, and to initiate idea generation and steer development;
 - To apply different HCD methods, in order to address different questions at different moments in the project, both 'in the field' and 'in the lab', and both design-oriented and

- evaluation-oriented (e.g. interviews or workshops, experiments or user tests), and to modify these methods to suit the project's specific questions and moments;
- To conclude with evaluation-oriented methods 'in the field' (e.g. user trials, user pilots) in order to evaluate the final product as realistically as possible, and in order to see 'how things work in the real world' and in order to quantify and generalize findings.

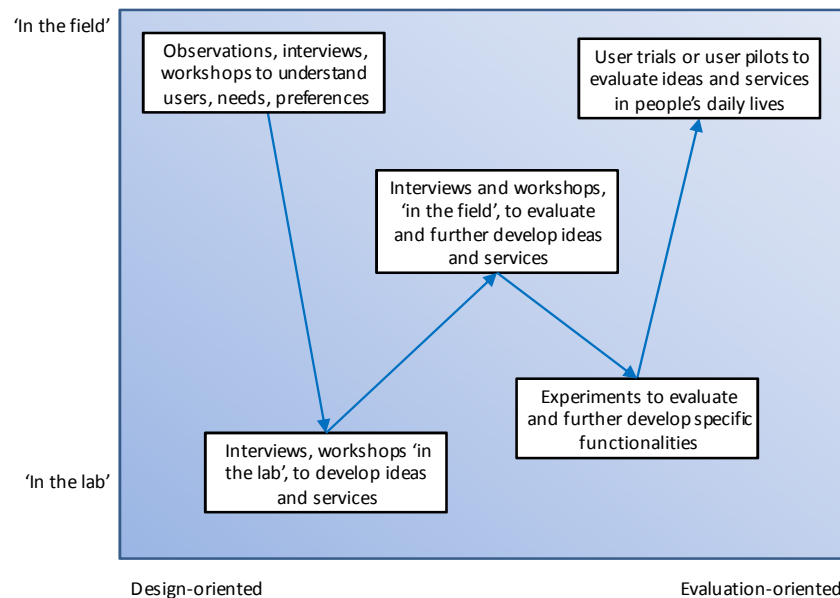


Figure 2. Fictive example of applying different human-centred design methods in the course of a project, in order to suit different purposes

Appendix: Questionnaire

Project-team members were invited to indicate their agreement with the following 31 statements, by choosing between: Strongly disagree; Disagree; Neither agree nor disagree; Agree; Strongly agree; or Do not know.

Benefits for idea generation:

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 service development:

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.

Longer-term benefits—which you expect, but which you cannot yet experience because the project is not yet finished:

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.

Appendix: Statistical analysis

Table 1. Cronbach's alpha of scales for Benefits **perceived**, Evaluation of costs and risks, and Intentions

	N of items	Cronbach's 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 2. 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 3. 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	

Table 4. Correlations between Involvement in HCD, Benefits perceived, Evaluation of costs and risks, and Intentions

	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)

Table 5. Regression of Benefits perceived on Involvement, Role in project, and Project

	Benefits perceived				
	Benefits for idea generation (BI)	Benefits for service development (BS)	Benefits for project management (BM)	Benefits for participating organization (BO)	Benefits on longer term (expected) (BL)
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)

Table 6. Regression of Evaluation of cost and risks on Involvement, Role in project, Project and Benefits perceived

	Evaluation of costs and risks		
	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)

For some project-team members, their involvement in HCD made them evaluate the costs and benefits less favourably (see Appendix: Table 6, Model 3). However, this negative effect is more than compensated by the perceived benefits: as shown in Table 5 of the appendix, more involvement leads to a higher perception of HCD benefits.

References

- Alam, I. (2002). An exploratory investigation of user involvement in new service development. *Journal of the Academy of Marketing Science*, 30(3), 250-261.
- Author (2011). About human-centred design approaches.
- Author (2012). About human-centred design and openness.
- Author (2013). About co-design processes.
- Author et al. (2008). About human-centred design methods.
- Author et al. (2011). About benefits of co-design/human-centred design.
- Author et al. (2013). About shared understanding in co-design.
- Author et al. TA2 (2011). About human-centred design process in TA2.
- Author et al. WeCare (2012). About human-centred design process in WeCare.
- Burns, C., Cottam, H., Vanstone, C., & Winhall, J. (2006). *Transformation Design*. London: Design Council.
- Buur, J. and Matthews, B. (2008). Participatory innovation. *International Journal of Innovation Management*, 12(3), 255–273.
- Cooper, R. (1999). The invisible success factors in product innovation. *Journal of Product Innovation Management*, 16(2), 115-133.
- Cottam, H. & Leadbeater, C. (2004). *Health: Co-creating services*. London: Design Council.
- Edvardsson, B., Gustafsson, A., Kristensson, P., Magnusson, P., & Matthing, J. (2006). *Involving customers in new service development*. London: Imperial College Press.
- Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation. *R&D Management*, 39(3), 311-316.
- Gassmann, O. (2006) Opening up the innovation process: Towards an agenda. *R&D Management*, 36(3), 223-228.
- Gassmann, O., Enkel, E., & Chesbrough, H. (2010). The future of open innovation. *R&D Management*, 40(3), 213-221.
- Giannopoulou, E., Yström, A., & Ollila, S. (2011). Turning open innovation into practice: Open innovation projects research through the lens of managers. *International Journal of Innovation Management*, 15(3), 505-524.
- Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, 78, 1360-1380.
- Hekkert, P. & Van Dijk, M. (2011). *Vision in design: A guidebook for innovators*. Amsterdam: BIS Publishers.
- Hoyer, W. D., Chandy, R., Dorotic, M., Krafft, M., & Singh, S. S. (2010). Consumer cocreation in new product development. *Journal of Service Research*, 13, 283-296.
- Huizingh, E. (2010). Open innovation: State of the art and future perspectives. *Technovation*, 31, 2-9.
- Isaksen and Lauer (2022), The climate for creativity and change in teams. *Creativity and Innovation Management*, 11(1), 74-86.
- Isaksen and Ekvall (2010), Managing for Innovation: The two faces of tension in creative climates. *Creativity and Innovation Management*, 19(2), 73-88.
- ISO (1999). *ISO 13407: Human-Centred Design Processes for Interactive Systems*. Geneva, Switzerland: ISO.
- Janssen, K.L. & Dankbaar, B. (2008). Proactive involvement of consumers in innovation: Selecting appropriate techniques. *International Journal of Innovation Management*, 12(3), 511–541.
- Jespersen, K.R. (2010). User-involvement and open innovation: The case of decision-maker openness. *International Journal of Innovation Management*, 14 (3), 471–489.
- Kristensson, P. & Magnusson, P. (2010). Tuning users' innovativeness during ideation. *Creativity and innovation management*, 19, 147-159.
- Kristensson, P., Magnusson, P., & Matthing, J. (2002). Users as a Hidden Resource for Creativity: Findings from an Experimental Study on User Involvement. *Creativity and Innovation Management*, 11, 4-14.
- Kujala, S. (2003). User involvement: A review of the benefits and challenges. *Behaviour and Information Technology*, 22, 1-16.

- Lichtentaler, U. (2011). Open innovation: Past research, current debates, and future directions. *Academy of Management Perspectives*, 25, 75-93.
- Magnusson, P. (2003). Benefits of involving users in service innovation. *European Journal of Innovation Management*, 6, 228-238.
- Magnusson, P., Matthing, J., & Kristensson, P. (2003). Managing user involvement in service innovation: Experiments with innovating end users. *Journal of Service Research*, 6, 111-124.
- Muller, M. J. (2002). Participatory Design: The third space in HCI. In J. Jacko & A. Sears (Eds.), *The human-computer interaction handbook* (pp. 1051-1068). Mahwah, NJ: Lawrence Erlbaum Associates.
- Nielsen, J. (1993). *Usability Engineering*. London: Academic Press.
- Öberg, C. (2010). Customer roles in innovation. *International Journal of Innovation Management*, 14(6), 989-1011.
- Pals, N., Steen, M., Langley, D., & Kort, J. (2008). Three approaches to take the user perspective into account during new product design. *International Journal of Innovation Management*, 12(3), 275-294.
- Parker, S. & Heapy, J. (2006). *The journey to the interface: How public service design can connect users to reform*. London: DEMOS.
- Rohracher, H. (2005). *User involvement in innovation processes: Strategies and limitations from a socio-technical perspective*. München, Germany and Wien, Austria: Profil Verlag.
- Rohrbeck, R., Hölzle, K., & Gemünden, H. G. (2009). Opening up for competitive advantage: How Deutsche Telekom creates an open innovation ecosystem. *R&D Management*, 39, 420-430.
- Roser, T. & Samson, A. (2009). *Co-creation: New paths to value*. London: Promise / LSE Enterprise.
- Sanders, E. B. N. (2000). Generative Tools for Co-designing. In S.A.R. Scrivener, L. J. Ball, & A. Woodcock (Eds.), *Collaborative Design: Proceedings of CoDesigning 2000* (pp. 3-12). London: Springer-Verlag.
- Sanders, E. B. N. (2002). From user-centred to participatory design approaches. In J. Frascara (Ed.), *Design and the social sciences: Making connections* (pp. 1-8). London: Taylor & Francis.
- Sanders, E. B. N. & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, 4(1), 5-18.
- Sleeswijk Visser, F., Stappers, P. J., Van der Lugt, R., & Sanders, E. B. N. (2005). Contextmapping: Experiences from practice. *CoDesign*, 1(2), 119-149.
- Stüer, C., Hüsig, S., & Biala, S. (2010). Integrating art as a trans-boundary element in a radical innovation framework. *R&D Management*, 40, 10-18.
- Van der Panne, G., Van Beers, C., & Kleinknecht, A. (2003). Success and failure of innovation: A literature review. *International Journal of Innovation Management*, 7, 309-338.
- Van Kleef, E., Van Trijp, H.C.M., & Luning, P. (2005). Consumer research in the early stages of new product development: a critical review of methods and techniques. *Food Quality and Preference*, 16, 181-201.
- Yin, R. (1994). *Case study research (2nd ed.)*. Thousand Oaks: Sage.
- Van Kleef, E., van Trijp, H. C. M., & Luning, P. (2005). Consumer research in the early stages of new product development: a critical review of methods and techniques. *Food Quality and Preference*, 16, 181-201.