

Action Design Research for Social Innovation: Lessons from Designing a Health and Wellbeing Platform

Completed Research Paper

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Abstract

IT artifacts play an important role in solving societal problems and realizing social innovations. Existing practice-inspired design science research (DSR) approaches, such as Action Design Research (ADR), do not consider social innovation as an explicit starting point for design iterations. In this paper, we explore how social innovation as a starting point affects the ADR approach. By reflecting on a three-year long ADR project in the domain of health and wellbeing, we suggest four principles to extend the ADR approach: (1) Translate a societal problem into practical problems on a stakeholder-level; (2) Reciprocal shaping between social practices and the IT artifact; (3) Involve citizens early and throughout the project; and (4) Balance political, economic and societal values for evaluating ADR results.

Keywords: Action Design Research, Design Science, Social innovation, E-health

Introduction

IT artifacts have the potential to solve societal problems. For instance, in healthcare, monitoring and communication systems support elderly people to live longer at home independently, in order to reduce healthcare expenditures and improve quality of life (Nikayin et al. 2013). Electronic patient records enable sharing of information between medical professionals, in order to realize integrated care provisioning (Barr et al. 2003). In these instances, IT artifact development is driven by a desire to realize social innovations, i.e. purposeful changes of social practices to solve societal problems (Cajaiba-Santana 2014).

How practical problems inspire IT artifact development is a core concern in Action Design Research (ADR) (Sein et al. 2011). As Iivari (2015) explains, ADR differs from other Design Science Research (DSR) approaches in Information Systems (IS) because of its starting point. While other DSR approaches typically start from a theoretical design problem, ADR takes the practical stakeholder setting as a starting point. Sein et al (2011) suggest two specific starting points of ADR: a technological innovation or an organizational opportunity. As far as we are aware, social innovation is not considered a starting point in ADR.

Social innovation as a starting point has important implications for structuring ADR projects. Social innovation implies that relationships and transactions between organizations and individuals are to be redefined (Marcy and Mumford 2007). Therefore, the ADR researcher faces much uncertainty in the initial phase as to which stakeholders are relevant to involve. In fact, stakeholders, clients and their objectives are not external conditions to the ADR project but an integral part of the design space.

In this paper, we explore if and how the ADR approach should be adapted for projects driven by social innovation. We define social innovation as creating new legitimated social practices aimed at social change (Cajaiba-Santana 2014). We analyze a case in which we applied ADR for developing an IT artifact for social innovation in the domain of health and wellbeing. Health and wellbeing is especially appropriate since political motives of reducing healthcare expenditures and improving quality of life for elderly people are driving social innovations. In our case, we take the desire for social innovation in health and wellbeing as a starting point. Based on extensive empirical research, we suggest an IT artifact (i.e., a matchmaking platform) to change the social practices of care provisioning in municipalities. Next, we set up a Living Lab with stakeholders to build, implement and evaluate the IT artifact. Our three-year research project covers multiple design iterations and empirical evaluation steps.

This paper is structured as follows. First, we provide a background on social innovation and ADR. We then explain our research setting of health and wellbeing in the Netherlands. Next, we describe how we designed, implemented and evaluated our service platform for health and wellbeing within a Living Lab setting. After that, we reflect on our design case in order to elicit principles for extending the ADR approach for social innovation purposes. Finally, we conclude the paper by discussing limitations and future work.

Background

Social innovation

Although the interest in social innovations is growing, no commonly accepted definition is available. In one of the earliest publications, Zapf (1989) referred to social innovation as changes in social practices to solve societal problems. Such social practices include organizational forms, regulations and lifestyles. Based on an extensive literature review, Cajaiba-Santana (2014) adds that social innovation should be purposeful, and that new social practices should be legitimated. We argue here that social innovations have specific characteristics that affect design science researchers in at least three ways.

First, the objective of social innovation has implications on what evaluation criteria should be considered (Rammert 2010). As social innovations aim at solving social issues, they are often considered to benefit the society as a whole (Caulier-Grice et al. 2012). While commercial viability could be a condition for realizing social innovation, the main evaluation criteria should focus on social issues (Dawson and Daniel 2010). At the same time, what social change is 'desirable' depends on political, economic and social values that stakeholders hold.

Second, the object of social innovation has implications on what design choices should be made. Social innovation entails new configurations of social practice to solve problems (Howaldt and Schwarz 2010). As such, the object of social innovation involves relationships between people and institutions to achieve their social goals (Marcy and Mumford 2007). While other forms of innovation may also produce social change as a by-product, social innovation is different as social change is the main object that is being pursued (Cajaiba-Santana 2014).

Third, the process of social innovation has implications on the role of the design researcher. Although social innovation is also achieved by collectives of individuals (Cajaiba-Santana 2014), it is often claimed that influential individual people initiate and drive social change (Mulgan 2006). The concept of social entrepreneurship has been introduced as "the creation of viable socioeconomic structures, relations, institutions, organizations and practices that yield and sustain social benefits" (Fowler, 2000, p. 649). As such, an individual person is often driving the social innovation process.

To summarize, the specific characteristics of social innovation affect how to approach a design project. Evaluation criteria should not be specified on the individual or organizational level but on the level of society, and should focus on political, economic and social values. The object of design includes institutional and social configurations, which are thus no longer external conditions to the design project. Finally, as social innovations are often driven by an individual person, the role of the design researcher becomes the center rather than being member of a design team.

The interplay of social and technical materiality

The interaction between IT artifacts and social entities is a topic in various streams of literature in IS. Producing IT artifacts for solving relevant solutions to practical problems is at the heart of DSR in IS (Hevner et al. 2004). Recent debate in IS literature stipulates the importance of social elements in discussing IT artifacts. For instance, Goldkuhl (2013) argues that the IT artifact should be conceptualized broadly and include social elements. Silver & Markus (2013) introduce the concept of a sociotechnical artifact, with equal attention to technical and social elements, and argue to take into account the consequences of those artifacts, such as health or social inclusion. Lee, Thomas, & Baskerville (2015) argue that artifacts should be composed of technology artifacts (e.g., hardware), information artifacts (e.g., message) and social artifacts (e.g., charitable act). Recent literature on sociomateriality also stipulates interplay between material characteristics of IT artifacts and the social dimensions of organizations. For instance, Leonardi (2011) finds that the use of technology results from imbrication between organizational routines and technical materiality.

However, we argue that our focus on social innovation adds a layer of complexity to the imbrication between technical and social materiality. Since there is no focal organization to begin with, but rather an abstract societal problem, the organizational routines are not given. The interplay or reciprocal shaping between social and technical materiality thus has far greater degrees of freedom as in organization-dominant ADR. Designers therefore need to explore how the social problem is perceived by stakeholders, specify a problem owner and obtain commitment from stakeholders.

Action Design Research

DSR projects can have highly diverse starting points (Peppers et al. 2007). A design effort may start by observing a class of problems (Kuechler and Vaishnavi 2008) or a first hunch on how to solve a problem (Verschuren and Hartog 2005). Iivari (2015) suggests a more fundamental basis for diversity in starting points arguing that two main strategies can be discerned. In the first strategy, a researcher constructs an IT artifact as a general solution concept to address a class of problems, while in the second strategy the researcher creates a concrete IT artifact in a specific context. The most prominent instantiation of the second type is ADR (Sein et al. 2011).

ADR takes a practical setting as a starting point for a design effort and assumes that building, intervention and evaluation of an IT artifact cannot be isolated in separate phases but occur in concert (Sein et al. 2011). The ADR method thus contains four stages: 1) Problem Formulation, 2) Building, Intervention and Evaluation (BIE), 3) Reflection and Learning, and 4) Formalization of Learning. We argue that ADR is appropriate for social innovation for a number of reasons. Similarly as social innovation, ADR is driven by practical problems rather than general solutions for a class of problems. Social innovation objectives of effectuating social change fit the interventionist nature of ADR. The object of changing social practices fits the idea of the ensemble artifact in ADR, which should contain both the IT artifact itself and the work context in which it is to be used. The importance of individual people driving social innovation fits the explicit attention in ADR for the role of design researchers in design teams.

Sein et al (2011) suggest two different starting points for ADR projects: an organizational problem (i.e., Organization-Dominant Demand BIE) and a technological opportunity (i.e., IT-Dominant Demand BIE). As such, the desire to solve a societal problem beyond the scope of an individual organization is not considered an explicit starting point.

We argue that the desire for social innovation presents a significantly different starting point. First, the objective of realizing social change implies that outcomes should be evaluated on the societal level of analysis. Second, the object of social practice implies that stakeholders, clients and their objectives, interactions and practices are not conditional to the design effort but the object of design. Third, the role of the social entrepreneur implies that the ADR researcher has a highly influential role in initiating change and motivating organizations and individuals for interventions. As such, entrepreneurial traits of the researcher, like the ability to motivate, influence and network, are decisive for the design process. In the remainder of the paper, we explore how characteristics of social innovation affect the ADR approach.

Table 1. Seven principles for ADR by Sein et al (2011)

Stage	Principles
Stage 1: Problem formulation	Principle 1: Practice Inspired Research
	Principle 2: Theory Ingrained IT artifact
Stage 2: Building, Intervention and Evaluation	Principle 3: Reciprocal Shaping
	Principle 4: Mutually Influential Roles
	Principle 5: Authentic and Concurrent Evaluation
Stage 3: Reflection and Learning (entered throughout the whole research process)	Principle 6: Guided Emergence
Stage 4: Formalization of Learning	Principle 7: Generalized Outcomes

Since the breakthrough of the Sein paper (2011) several studies used the ADR methodology, either to review or compare the design science method (Purao, Henfridsson, Rossi & Sein 2013; Maccani, Donnellan & Helfert 2015) or to apply the method in practice. Those studies with a practical focus, take the organization dominant stream (Mullarkey, Hevner, & Collins 2013, Rothengatter 2012) or an educational perspective (Rogerson & Scott 2014; Marjanovic 2016; Lee, Hillegersberg & Kumar 2015) into account. The scarce literature about ADR applied in the healthcare domain are related to social media engagement (Spagnoletti, Resca & Sæbø 2015), digital wellbeing of young elderly (Carlsson & Walden 2015) and IT value creation (Sherer 2014), but they merely touch upon parts of the ADR method, or are still work in progress. Within the completed ADR studies only a few gave explicitly rise to new or redefined design principles (Mustafa & Sjöström 2013; Marjanovic 2016, Spagnoletti, Resca & Sæbø 2015) and none of the studies has social innovation as a starting point and involved end-users from the start of the project.

Research setting

We analyze an ADR project in the domain of health and wellbeing. Health and wellbeing is appropriate for our purposes, as demographic and economic pressures increasingly require social innovations. Worldwide, aging populations create challenges for sustaining healthcare and elderly care financially (Colombo et al. 2011; Schut and van den Berg 2010). One policy strategy to harness healthcare expenditures is to support elderly people to live longer at home independently, rather than having them move to elderly care homes. IT artifacts that support independent living for elderly people include medical applications (e.g., remote diagnosis, telemedicine), care applications (e.g., fall detection, medication dispensers) and safety applications (e.g., alarm systems, monitoring systems). However, to realize the impact of these IT innovations, the social practices in which elderly care is being organized need to be changed.

Our project is situated in the Netherlands. The dominant policy strategy for the Dutch government is to integrate health and social care to support elderly people in their local community (Schut et al. 2013). The underlying assumptions are that elderly people prefer to live longer at home independently and that doing so is less costly than institutionalized care. From 2015 onwards, care delivery to elderly living at home has been shifted from the national government to local municipalities. The national government does not prescribe how municipalities should support elderly people and provides non-earmarked budgets, which are drastically lower than in the situation before 2015. This implies that municipalities have much freedom on how they support elderly living at home, and have strong incentives to do so in cost-effective manners (Da Roit 2012). As a result, most Dutch municipalities are actively looking for new ways of organizing care for elderly at home. Such new ways of organizing care delivery fit our definition of social innovation as new social practices are intentionally pursued to solve societal problems.

While the social innovation that drives our design effort was clear, as outlined above, other conditions were not yet specified. At the start of the ADR project, no government or business stakeholders were involved, nor was it clear which technological building blocks the IT artifact should comprise.

The ADR project took place over the period 2013-2016. The principal author, who led the ADR project, kept an observation log on a daily basis, amounting to 1000 memos, which contains all decision steps and preliminary outcomes (Alaszewski 2008). The case description is based on analysis of the logbook. See Table 2 for an excerpt of the decision steps derived from the logbook generated in the first year of the project.

Table 2. Decision steps derived from daily logbook (highlights from 2013 - 2014)

Date	Decision step	Preliminary outcome
2013/02/04	Maintain a logbook to track iterative design steps of the research project	Logbook (1000 notes)
2013/03/13	Involve end-users from the start of the research project (establish an expert team, and conduct explorative interviews)	Elderly and informal caretakers involved (i.e., end-users) in Living Lab setting
2013/04/17	Approach a small municipality (Midden-Delfland) for piloting the IT artifact	Several discussions with Mayor/Alderman and project leader including two pitches for the project team to get the municipality on board
2013/06/13	Elaborate on multi-sidedness platform (providers/end-users and government)	Engaged core users of the platform
2013/07/13	Elaborate on benefits for involvement public/private stakeholders in the project (small businesses/multinationals)	Living Lab setting (academia, government, firms and end-users)
2013/09/06	Involve patient bond in the platform (one of the mayor players related to healthcare databases)	Provider of information on the platform (i.e., zorgkaart)
2013/09/18	Approach a second municipality (Delft) for piloting the IT artifact, as back-up for the first one.	Separate discussions with two Alderman and project leader of Social Care Act
2013/10/28	Pitch project to municipality Midden-Delfland	Municipality Midden-Delfland rejects participation because the alderman foresees no problems caused by aging population in this district
2014/02/18	Pitch project to governmental foundation	Governmental foundation becomes partner in ADR project
2014/03/18	Second discussion round for pilot with municipality Delft (Alderman and project team)	Municipality Delft postpones decision to participate in the ADR project due to lack of available personnel
2014/06/24	Pitch project to multinational company	Multinational becomes partner in ADR project
2014/07/13	Establish a foundation for scaling up	Foundation Zo-Dichtbij established
2014/07/20	Third discussion round for pilot with municipality Delft (Alderman and interim project leader)	Municipality Delft rejects participation due to lack of budget and time in care transition phase
2014/07/26	Explore municipality of Rotterdam as back up for Delft	First round of discussions with innovation manager
2014/11/20	Pitch project to municipality Rotterdam	Municipality Rotterdam agrees to participate in ADR project

Artifact description

During our longitudinal study we attempt to solve a societal problem by building a concrete artifact (i.e., service platform for Health and Wellbeing) in a specific context (i.e., aging-in-place) and distills prescriptive knowledge (i.e., about applying ADR for a societal problem) to be packaged into a general solution concept (i.e., social innovation) to address a class of problems (i.e., matchmaking platform for social issues that matter). In our ADR case the artifact is still emerging from design, use and on-going refinement (i.e., from low-fidelity prototypes until a Minimal Viable Product) in context. Therefore we envision as a future research topic that the Minimal Viable Product will emerge into an implemented service platform in practice. See for a screenshot of the artifact Figure 1.

The screenshot shows the homepage of the 'Zo-Dichtbij' care plan. At the top, there is a navigation bar with the logo 'ZO-dichtbij', 'Zorgplan', 'Hulp chat', 'Berichten', 'Help', 'Uw Profiel', and 'Uitloggen'. The main content area is divided into three sections:

- Planbord (Tasks):** A table with columns 'Taakbeschrijving', 'Datum', and 'Voltooid'. It lists three tasks:

Taakbeschrijving	Datum	Voltooid
12.00 - Lizet gaat mee naar het WMO loket	09 mei 2016	<input type="checkbox"/>
** Anton ** fysio therapeut uitzoeken	11 mei 2016	<input type="checkbox"/>
** Ria ** hoog/laag bed regelen	14 mei 2016	<input type="checkbox"/>
- Activiteiten (Activities):** A table with columns 'Activiteiten beschrijving', 'Datum', and 'Voltooid'. It lists two activities:

Activiteiten beschrijving	Datum	Voltooid
15.00 - Neef Harry komt op bezoek bij ma	09 mei 2016	<input type="checkbox"/>
15.00 - kaarten pa	13 jul. 2016	<input type="checkbox"/>
- Dagboek berichten (Journal messages):** A list of messages from 'Wally Keyzer' dated 08 mei 2016 and 07 mei 2016. The messages describe visits to the WMO-loket and reports on sleep and well-being.

On the left side, there is a user profile for 'Bep van Leeuwen' (born 12 april 1936) and a vertical menu with buttons for HOME, PLANBORD, ACTIVITEITEN, DAGBOEK, GEZONDHEID, CONTACTEN, PRODUCTEN & DIENSTEN, HELP, and UITLOGGEN.

Figure 1: Care plan homepage of the IT artifact called Zo-Dichtbij (in Dutch).

The IT artifact as instantiated combines features of information provisioning between elderly and caretakers and matchmaking between elderly and care providers. Information provisioning and matchmaking are not novel features for platforms, although they have not been applied in our domain yet. As such, the research represents a case of exaptation (Gregor & Hevner, 2013).

Practically, the proposed online platform can be seen as a groundbreaking concept for the smart living domain in the Netherlands, because there are currently no platforms that offer: 1) matchmaking between providers of smart living products and services and potential end-users 2) finding local activities 3)

connecting with other people (e.g., family, caretakers) 4) information about aging-in-place and, 5) integration of successful, existing platforms in the Health and Wellbeing domain.

On the homepage users are able to add tasks to the planning board and activities to the activity list, as well as adding diary entries. On the left side the distinct green sidebar provides oversight for the users when browsing the platform. In the top-navigation users are able to switch between the care plan and the help chat. Thereby, links to their personal messages and profile are provided. Adding tasks, activities and diary entries have been fully implemented. Users are actually able to use that functionality.

The left menu of the home page provides a list of main features like: 1) planning board, 2) activities, 3) diary, 4) health, 5) contacts, and 6) products and services.

In addition, there are also help features that contain general information about Zo-Dichtbij and Frequently Asked Questions (FAQ).

Case description

In this section, we describe the design process of our ADR project. We structure our case description following the seven principles for ADR by Sein et al (2011).

Problem Formulation

In the Problem Formulation stage, the problem is formulated as perceived by the researchers.

Principle 1: Practice-inspired research

In our case, the practical problem is not so much an organizational problem but the societal challenge of an aging population, and its associated health costs. Growing social needs, together with budgetary constraints, call for innovative solutions. In the context of limited resources, especially social innovations offer opportunities to provide solutions to pressing social demands, while making better use of available resources.

To identify and conceptualize the research opportunity, we conducted interviews with stakeholders in the smart living and health and wellbeing domain. Interviews were conducted in two rounds.

A first round of eleven interviews focused on distilling the practical problem. We conducted open-ended interviews on issues of existing health and wellbeing offerings, end-user adoption, technology issues, business models, inter-organizational collaboration and knowledge sharing. Interviewees were installer companies, opinion leaders and manufacturers. Although we are aware that other companies in the smart living industry play a role as well (i.e., energy companies, healthcare providers and telecom operators), in the Netherlands the installer is one of the few who has a regular contact with end-users about independent living at home.

Main finding of the first set of interviews was that end-users lack awareness of what solutions are available and how these solutions could fulfill their needs (Keijzer-Broers, de Reuver 2016 accepted). The highly fragmented market makes it difficult to find appropriate services, and the predominantly technological focus of service providers hinders them to understand how services fit end-user needs. For example, people in need of healthcare services go through different stages during the progression of their disease or impairment. For this reason, their need for healthcare interventions at home changes over time and end-users are often unaware as to what services they could use at a certain point in time. Meanwhile, we discovered that service providers had problems to reach end-users and to market and promote their products and services. According to the interviewees, a solution was required to address this mismatch between demand and supply.

Considering reduced care budgets, personal advice to elderly people on which care solutions to adopt is not feasible for municipalities. Therefore, we decided to focus our ADR project on designing a service platform that conducts matchmaking between elderly people and service providers in the domain of health and wellbeing. The aim of the artifact is to create awareness among elderly people about what services and technologies can help them while aging at home, but also to assist in matchmaking between their (latent) needs and (yet unknown) services. Ultimately, such a platform should enable end-users to

enhance self-management (i.e., independency) by the provision of relevant information and support in matchmaking between different stakeholder groups (i.e., citizens, providers and government). Eventually the platform has to enhance the quality of life of citizens. While our design effort thus has an explicit IT artifact (i.e. a matchmaking platform), the starting point is a social innovation (i.e. new way of matchmaking between elderly people and service providers).

In a second round of interviews, we focused on identifying potential solutions to the practical problem. We arranged this second round of semi-structured interviews with various stakeholders, ranging from care providers, end-users and local governments until potential funding partners and research partners. The objective of the interviews was to explore solutions for addressing the mismatch between demand and supply, but also to gain support from potential stakeholders in solving the societal problem. Interviewees were selected from the researchers' network, because they 1) were somehow affected by the societal problem from an end-user or provider perspective, 2) could support exploring the platform idea, 3) could support to jumpstart the social innovation, and 4) could embed the topic in research or knowledge exchange related issues. Interviewees were selected from three stakeholder groups: 23 strategic level stakeholders (i.e., knowledge institutes, government and funding partners), 17 affiliate level stakeholders (i.e., service and technology providers) and 19 potential users (i.e., care providers and citizens).

Based on the second round of interviews, we elicited three main features for an online platform for health and wellbeing: 1) an online community for contact, social wellbeing and interaction with the neighborhood, driven by the need for social cohesion; and 2) a portal for bundled smart living services and solutions (business to consumer), driven by the need to centralize all information about aging-in-place and 3) an intervention instrument for the municipality (government to consumer), driven by the need of municipalities to interact with citizens about needs for services and questions about the different health care arrangements. As a main goal for the artifact, we found it should enable end-users to enhance self-management (i.e., independency) by the provision of relevant information and support in matchmaking between different stakeholder groups (i.e., citizens, providers and government).

To evaluate our first ideas about a health and wellbeing platform, and in order to develop requirements for the artifact, we conducted two rounds of focus group meetings, with a total of 28 participants. Focus groups are informal group discussions among a small group of individuals in which different views and experiences are explored through group interaction. We used the focus group method to: 1) validate the basic platform features (i.e., online community, portal and intervention instrument), 2) elicit the first functional and non-functional requirements of the platform, and 3) shape the outline of the tentative design of the platform. During the focus group meetings with researchers, end-users and practitioners we developed 13 basic requirements for the digital platform.

Principle 2: Theory-ingrained artifact

We used two main kernel theories to be ingrained in the artifact. As we found in the problem exploration, the main goal of the artifact should be to connect citizens with product and service providers. As the platform would thus have multiple user groups, we adopted multi-sided platform theory to inform our design. Multi-sided platforms are discussed in disciplines of strategic management (Gawer 2009; Hagiu 2007) and IS (Tilson et al. 2010; Tiwana et al. 2010). We used concepts from multi-sided platform literature to derive design issues for our IT artifact.

Ultimately, the platform should support elderly people to live longer at home. We therefore needed a theory to conceptualize the consequences of the platform in terms of capabilities of people to function as they want to. We adopted the capability approach (Robeyns 2005), which has recently been adapted to measure the impact of health and wellbeing initiatives on a society level (Stephens et al. 2014; Vichitvanichphong et al. 2014). As Robeyns (2005) explains, the capability approach assumes that the end of wellbeing should be conceptualized in terms of people's capabilities to function; in other words it is people's actual opportunities to take on, meaning the actions and activities that they want to engage in, and be whom they want to be. We used the concepts of the capability approach to understand the consequences of our platform for the wellbeing of elderly people.

Building, Intervention and Evaluation

In the second design stage (i.e., Building, Intervention and Evaluation - BIE), the input from the first stage (i.e., problem framing and theoretical premises) is used for designing the IT artifact.

For conducting the BIE stage we set up a so-called Living Lab of public and private partners as well as elderly people and their informal caretakers. We tried to gain commitment from partners, identified in the Problem formulation stage, developing, implementing and testing the artifact in practice. The most critical stakeholder in our setting is a municipality, since municipalities fund, organize and provide care to elderly people living at home. Participation of a municipality is thus critical for access to end-users, redefining social practices and evaluating the artifact in practice. Notably, two efforts to involve a municipality failed, and only the third effort led to the municipality of Rotterdam coming on board (see table 1). In the first two efforts, the idea for the platform and social innovation were introduced to municipality stakeholders and pitched in the board of Mayor and Alderman. The first municipality rejected to participate, as they did not see the urge to conduct social innovation or to use a platform for empowering their elderly citizens. The second municipality agreed to participate but could not commit to the project due to severe budget problems resulting from city infrastructural projects. The third municipality, one of the four largest municipalities in the Netherlands, did agree to participate.

Besides the municipality, other Living Lab participants were two small businesses that develop software for healthcare, one large IT firm that develops big data analytics systems for healthcare and other domains, and one telecom operator that has a relation with end-users. Two Foundations (government and non-profit) and representatives of the elderly and informal caretakers. None of the participants were compensated financially for their efforts nor was any external funding available. Consequently, one of the limitations throughout the project was time and money constraints within the Living Lab.

Principle 3: Reciprocal shaping

In the BIE stage, we interweaved building of the platform (i.e., prototyping) and constantly evaluated the prototypes in recursive design iterations. Practices both from researchers as well as practitioners and end-users are been taken into account in this phase.

To shape the design iteration steps, we formed three ADR teams from the Living Lab setting, that worked in parallel: 1) Development Team: specify the critical design issues of the platform, establish a project plan, and develop a first template of the platform architecture and refinement, 2) Design Team: design mock-ups and build a low-fidelity platform prototype as minimal viable product; 3) Research Team: identify problems by means of interviews, facilitate workshops and evaluate the product by usability testing. Having the end-user on-site made it possible to facilitate usability testing and allow the different teams to incorporate test results in subsequent design iterations. Meanwhile, input from potential end-users within the living lab (e.g., local government, service providers, informal caretakers and elderly) informed the research process. Throughout the BIE process the teams used different software tools like Archimate, Liferay and Invisio, but also design tools like Storyboards and InDesign, which helped developing and visualizing the IT artifact.

In total the three ADR teams conducted four BIE design iterations, with one final design iteration is work in progress, see Figure 1.

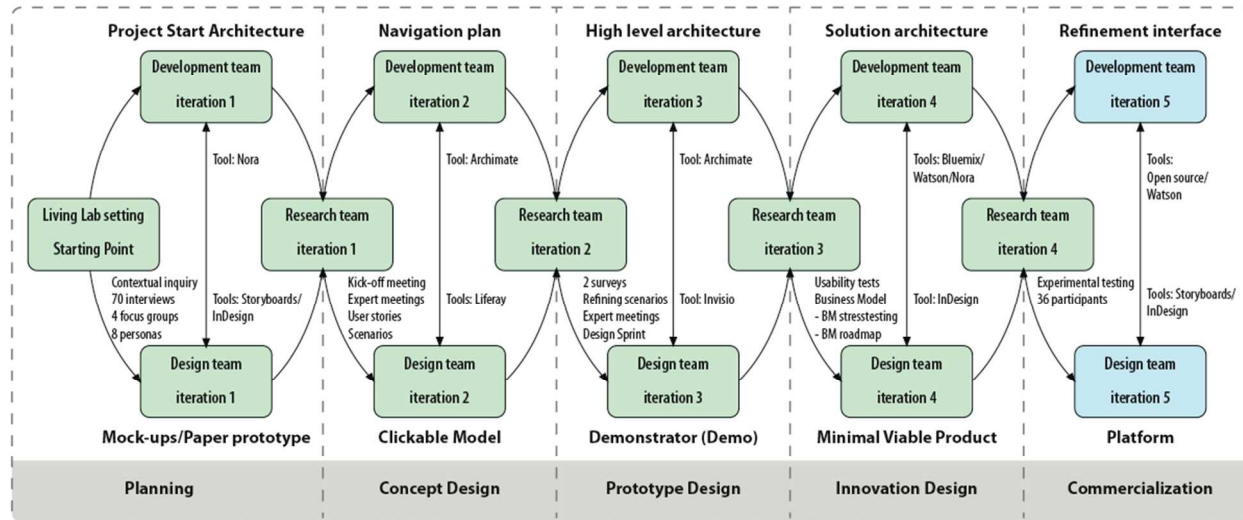


Figure 2: Overview design iterations within the BIE phase

As a starting point of the Living Lab setting previous research input (i.e., 70 interviews, contextual inquiry, results from four focus groups sessions and defined personas) (Keijzer-Broers, Nikayin, et al., 2014) was already available to inspire the three ADR research teams (i.e., Development, Design and ADR Research team) at the same time.

In the **first design iteration** (i.e., planning phase), the development team defined a project plan to guide the platform architecture, while the design team worked on the mock-ups of the platform. In the meantime the research team developed user stories and scenarios based on eight early-defined personas and refined the requirements based on interviews, focus groups and end-user survey.

In the **second design iteration** (i.e., concept design phase), the development team worked on the initial version of the platform architecture, while the design team translated the mock-ups in a clickable model (i.e., alpha version of the platform). Subsequently, the research team refined the user stories/scenarios and evaluated the clickable model in two usability tests and included two surveys among potential end-users. Based on the main features, the alpha version of the platform evolved from a paper prototype via mock-ups into a clickable model. The alpha version captures basically three core functionalities: 1) a social environment for local activities and contacts, 2) a marketplace for smart living products and services with reviews, and 3) a health and wellbeing profile which can be extended with a personal care plan. The rationale behind adding a care plan is that people themselves can be the center of action-taking related to health and wellbeing, such as measuring, tracking, experimenting and engaging in interventions, treatments and activities.

In the **third design iteration** (i.e., prototype design phase), the development and design team respectively refined the architecture and the clickable model and, subsequently, representatives of each ADR team were included in a three day design sprint workshop. As an output of the workshop, the design team delivered a demo of the platform (Keijzer-Broers, Florez Atehortua & De Reuver, 2016). The demo is subsequently used for a usability test with elderly end-users, informal caretakers, service providers and representatives from the local government. In parallel the research team arranged two business model workshops to be prepared for up scaling of the platform initiative.

The outcomes of the third design iteration are being used for the **fourth design iteration** (i.e., design innovation phase), where the teams focused on the development of the Minimal Viable Product (i.e., interface) and the Solution Architecture of the platform.

In the end the beta version evolved from a demo into a minimum viable product, which is implemented and evaluated in a real-life setting.

The **fifth design iteration** (i.e., commercialization phase) noted in blue is work in progress and is part of the future research agenda within the Living Lab setting.

Principle 4: Mutually influential roles

Mutual learning between the Living Lab partners was crucial. In different workshops with the Living Lab partners, ranging from design and architecture until business modeling, the ‘open mind’ of the participants supported the process of mutual learning.

Principle 5: authentic and concurrent evaluation

Evaluation in ADR is not a separate stage of the research process that follows after building the artifact, but is interwoven with ongoing evaluation steps. As evaluation steps already executed in the Formulation phase (i.e., focus groups) we followed this path in the BIE phase as well. Next to formative evaluation like usability tests among elderly people and informal caretakers, we also used summative evaluations like two surveys for evaluating the paper prototype.

Reflection and Learning

In the third design stage (i.e., Reflection and Learning) we move from building a solution for a particular case to applying that learning to a broader class of problems. Conscious and constant reflection, on the problem, the kernel theories and the evolving artifact are necessary to generate knowledge. Principle 6 (i.e., guided emergence) combines analysis of intervention results with an ongoing evaluation and is a combination of principle 1 to 5.

Principle 6: Guided emergence

Based on a logbook with 1000 memos, which incorporates decision steps related to the ADR process, the ADR researcher could constantly reflect on the process. Subsequently, regular discussions with an expert team outside of the Living Lab could mirror these reflections.

Formalization of Learning

In the fourth stage (i.e., Formalization of Learning) we aim to formalize the learning by developing general solution concepts for a class of field problems.

Principle 7: Generalized outcomes

Due to the situated nature of the ADR project, outcomes generalization is a challenge. Although this phase in our project is still work in progress, we strive to generalize outcomes on three levels: 1) generalization of the problem instance, 2) generalization of the solution instance, and 3) derivation of design principles from the design research outcomes.

Table 3 summarizes how the seven principles relate to our case.

Table 3. Application of ADR design principles (Sein et al 2011) to our case.

Stages and principles	IT artifact
Stage 1: Problem formulation	
Principle 1: Practice Inspired Research	Research was driven by the need for support of citizens related to aging-in-place
Principle 2: Theory Ingrained IT artifact	Recognition: Shortcomings of available digital service platforms to support people age-in-place
	The kernel theories used were Platform Theory and Capability Approach, embedded in a Social Innovation context

Stage 2: Building, Intervention and Evaluation		
Principle 3: Reciprocal Shaping	Recursive cycles (i.e., design iterations) to shape the Living Lab environment	Alpha Version: The service platform (i.e., Zo-Dichtbij) conceived as a design idea evolved from a paper prototype via mock-ups into a clickable model.
Principle 4: Mutually Influential Roles	The Action Design Researcher who was in the lead (social entrepreneur and PhD researcher) included end-users, practitioners and researchers in the Living Lab in order to include technical, theoretical and practical perspectives.	
Principle 5: Authentic and Concurrent Evaluation	The prototypes of the platform (i.e., paper, mock-ups, clickable model and demo) were evaluated internally (i.e., within the Living Lab) as well externally (i.e., elderly end-users and (in)formal caretakers).	
Stage 3: Reflection and Learning (entered throughout the whole research process)		
Principle 6: Guided Emergence	The ensemble nature of Zo-Dichtbij was recognized. Furthermore, design elements for the platform were derived and mirrored with an Expert Team. The logbook of the Action Design Researcher is used to reflect on the process.	Emerging Version and Realization: New design elements for Zo-Dichtbij based on results emerging from the Formulation and the BIE stage.
Stage 4: Formalization of Learning		
Principle 7: Generalized Outcomes	A set of design principles for ADR were articulated positioning Zo-Dichtbij as an instance for similar settings (i.e., Living Lab) See section 12.7	Ensemble Version: An ensemble embodying the design principles and a guideline for researchers to apply ADR in practice.

Discussion

In this section, we reflect on the design process of our case, in order to elicit principles for extending the ADR approach to social innovation. Principles are derived from analyzing the logbook data collected throughout the project. See Table 5 in Appendix for an illustration.

From a societal problem towards a stakeholder problem

In our case we started from a rough idea about the societal problems at hand, i.e. growing expenditures in elderly care, decentralization of elderly care to municipalities, and the trend of having elderly people live longer independently at home. Before initiating the BIE cycles, we had to translate the societal problem into a practical problem of one or more specific stakeholders. We did so by conducting two extensive rounds of interviews with potential stakeholders. These interviews were not only instrumental for understanding the societal problem and solutions, but also for identifying and motivating stakeholders to become involved in our BIE cycles. Identifying and gaining commitment from stakeholders took much effort, especially since two municipalities rejected to participate in advanced stages of preparation. Moreover, as there was no specific practical problem at the start of the ADR project, the researcher had to drive the process of identifying and motivating stakeholders to become and stay involved. Besides research skills, this also required entrepreneurial activities of safeguarding interests of the stakeholders, setting up gentlemen agreements and setting up a foundation to ensure long-term sustainability of the project.

Our case example shows the challenges of moving from a societal problem towards a specific stakeholder-level problem that can be addressed in BIE cycles. The ADR researcher needs to understand the societal problem, the affected stakeholders and their social practices, but also needs to identify, involve and motivate stakeholders.

Reciprocal shaping between social practice and IT artifact

Our different BIE cycles led to increased understanding of how the IT artifact and social changes were affecting each other. Our conceptualization of a matchmaking platform between elderly people and service providers (i.e. the IT artifact) made the municipality aware that their front-office should give more comprehensive and tailored advice to their elderly citizens on what care products and services to adopt for their specific situation (i.e. a new social practice). While discussing the IT artifact, the municipality also became aware that they might save costs if the platform would answer easy-to-solve questions from citizens. When exploring the idea of advice to citizens more, the municipality realized that elderly people should also interact with each other on what care solutions are available. The municipality thus realized they should not only provide advice but also facilitate interaction between elderly people (i.e. a new social practice), based on which we decided to add peer-to-peer communication features to our matchmaking platform (i.e. the IT artifact). The platform log data functionality (i.e. the IT artifact) also raised ideas on how to use segmentation in delivering care services and advice by the municipality (i.e. a planned new social practice).

While developing our IT artifact, we found that a matchmaking platform would affect family members of elderly people as well, who often provide informal care. We found that a main challenge for informal caretakers is to stay up-to-date on what care is provided to their relatives. Therefore, we added a care plan feature to our matchmaking platform (i.e. the IT artifact), which provides a single point where informal caretakers can find and exchange care information on the status and care received by their relatives. Discussions with informal caretakers showed they especially value how these remote communication opportunities help them to stay on a distance but still take care of their family members, and share information with other informal caretakers and medical professionals (i.e. new social practice).

These examples show how our BIE cycles iterated between shaping the IT artifact and the affected social practices. New features of the IT artifact led to ideas on how to improve social practices of the stakeholders involved, and vice versa. We found there is no one-way relation from social practice to IT artifact, but rather that they reciprocally influence each other.

Citizen involvement

In our case, the new social practices and IT artifact affect citizens in various ways. Elderly people are affected as they shift from a passive role receiving advice on care products and services into an active role of finding information themselves. But also family members that provide informal care are affected as they will, in practice, often use the matchmaking platform on behalf of the elderly person. Especially the sandwich generation of young elderly between 55 and 75 are affected, as they will use the platform to find care for themselves as well as their parents. We involved citizens already in the Problem Formulation stage to ensure coming up with acceptable solutions. We used representatives of elderly bonds to inform our design choices but also to gain credibility among prospective users. We used tools like personas, user stories and user scenarios to actively remind the designers continuously of how their choices affect the social practices of citizens. We used methods of focus groups, surveys, interviews and usability tests to inform and evaluate our artifact development.

While involvement of end-users in design processes is certainly not a new idea, the examples we gave from our case illustrate how citizen involvement is helpful even before any alpha or beta versions are produced. Social innovations often affect the social practices of citizens in profound ways. The ADR researcher should elicit and continuously consider, how the social practices of citizens are affected by the artifact.

Social, economic and political values

In our case, we encountered different political, economic and social values to justify the social change created by our platform. Facilitating elderly people to live longer at home is often justified by argumentation that doing so contributes to their quality of life and wellbeing. Transferring elderly care from professional providers to family members, as the care plan in our artifact facilitates, is often justified by the idealistic vision of 'participatory society', where citizens take care of each other rather than relying on the state. Decentralization of care to municipalities, which our platform helps to organize, is justified by the idea that reduced overhead leads to more intimate relationships between care providers and elderly people. At the same time, all three of these social changes are also clearly policy strategies for reducing healthcare expenditures. During the decentralization of care to municipalities, elderly care budgets were reduced with more than 50%. Critics have argued that independent living, informal care and decentralization are not so much used to benefit elderly people, but are frames to justify harsh budget cuts. Therefore, rather than sticking with the political justifications, we explicitly considered the citizen perspective in evaluating the consequences of our designed platform. We used the capability approach to evaluate how the platform contributes to the ability of elderly people to live their life how they want to, in ways that are meaningful for them. By doing so, we broadened our evaluation criteria beyond the economic and business criteria of municipalities and providers, to include the effects of the artifact on citizens.

We argue, here, that the ADR researcher should be well aware of the different political, economic and social values that play a role in the social innovation. What is called a social innovation by one stakeholder, may be considered a harsh budget cut by others, as we found in our health and wellbeing case. What is considered a beneficial social change by one political stream may be considered a regrettable step towards individualization and reduced solidarity between citizens. Evaluation criteria for the artifact are thus value-laden and ADR researchers aiming for social innovation should make explicit and balance these different values.

In summary, we suggest four new principles that extend the ADR approach to social innovation, see Table 4.

Table 4. New principles for ADR for social innovation

Principle	Explanation
Principle A: Translate a societal problem into a practical problem on a stakeholder-level	As the starting point is a social innovation, the ADR researcher first needs to come to a practical stakeholder problem. This is both a research issue (i.e. understanding the societal problem, affected stakeholders and their social practices) and an action issue (i.e. identify, involve and motivate stakeholders).
Principle B: Reciprocal shaping between social practice and IT artifact	Ideas on new IT artifacts and changed social practices do not evolve independently but influence each other. To solve social problems, the ADR researcher thus needs to allow for reciprocal shaping between social practices and IT artifact.
Principle C: Involve citizens early and continuously in the ADR project	Social innovations affect practices of citizens in profound ways. User involvement goes beyond ensuring adoption or fulfilling user needs. To understand the social problem and allow reciprocal shaping between social practice and IT artifact, the ADR researcher should involve citizens early and continuously.
Principle D: Balance political, economic and social values for evaluating ADR results	Social innovations and desired social change are value-laden. Social innovations are often used for reframing of political or economic agendas. ADR researchers should be aware and balance the different values at play.

Conclusion

In this paper, we explored how to adapt the ADR method for projects that are inspired by social innovation. We suggest that social-innovation inspired ADR should (1) translate a societal problem into a practical problem on stakeholder-level; (2) allow reciprocal shaping between the changes to social practices and the IT artifact; (3) involve citizens that are affected by the social innovation from the very start of the ADR process; (4) be aware of and balance political, economic and social values in evaluating ADR results.

A limitation of our paper is that our principles are grounded in one case of social innovation inspired ADR, conducted by ourselves. While our analysis is grounded in over 1000 diary notes, the personal involvement of the authors in the ADR project could be a source for bias. Our finding that the entrepreneurial orientation of the ADR researcher plays a major role in moving from a societal problem to a stakeholder-level problem, represents also a limitation to generalizability. Another limitation is that our case is bound to the health and wellbeing domain. While this domain is especially appropriate since social innovations driven by ICT are prominent, and the mix of political, economic and social values is highly complex, further studies in other domains should be done to test our new principles.

Given that societal challenges in areas like healthcare, sustainability and safety increasingly require ICT solutions, we expect that social innovations will become increasingly important for IS design researchers. The ability to solve social problems will add to the legitimacy of IS research towards other disciplines and society at large. We hope this paper paves the way for further research that applies ADR to realizing social innovations. We suggest that taking into account our four elicited principles will affect IS researchers. Taking into account the principles will help to create IT artifacts that contribute to solving societal challenges.

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Appendix

Table 5. Fragments from logbook related to new and refined design principles

Date	Researcher activity	Main findings	Formalization of learning
Feb 2013	Conduct explorative interviews with elderly and informal caretakers	End-users are skeptical: they fear yet another technology will be developed without consulting target group	<u>Principle:</u> Translate a societal problem into a practical problem on a stakeholder-level
Apr 2013	Desk research on societal problems of aging population; Follow-up interviews with stakeholders in healthcare and potential end-users	Artifact should enable social intervention for participation in healthcare, 'bringing back users in the driver seat'	Start with a social problem with potentially large impact, i.e. the transition in care provisioning from national to local government and the idea of harnessing healthcare expenditures by having people live longer independently at home.
May 2015	Establish an Expert Team composed of four people that represent end-users familiar with healthcare domain. Expert Team will mirror the ADR researcher and translate the decision steps that were made in a logbook	Expert Team minimized research bias from ADR researcher	<u>Principle:</u> Involve citizens early and continuously in the ADR project Social innovations often affect the social practices of citizens in profound ways. The ADR researcher should elicit and continuously consider how the IT artifact affects the social practices of citizens. Therefore involvement of end-users from day one of the project is recommended, even before any alpha or beta versions are produced.
Jul 2015	Develop a stakeholder map that visualizes the multiple user groups of the health and wellbeing platform	End-users should not be treated as homogeneous group but fulfill different and partly overlapping roles: elderly people and informal caretakers	To involve end-users from start to finish helps to get the study objectives and methods right
Jul 2015	Conduct focus groups with stakeholders and end-users	Insight in what should be core functionalities of a health and wellbeing platform to support people age-in-place from an end-user/stakeholder perspective	
Sep 2015	Involve elderly bonds (Unie-KBO, ANBO, PCOB) and the patient bond (NPCF) in ideation of the artifact	Insight in the wish-list of branch associations regarding a social innovation to support people aging-in-place	
	Desk research on project cooperation involving stakeholders from different disciplines	Insight in how to gain long-term commitment from stakeholders to become involved in practice-oriented research	<u>Principle:</u> Reciprocal shaping between social practice and IT artifact Design cycles iterated between shaping the IT

Jul 2014	Set up a Living Lab for the Building, Intervention and Evaluation phase of the ADR framework. Give participants an equal vote in decision making. Involvement from enterprises, university, public organizations and end-users.	The designed artifact emerges from interaction in the Living Lab, and results from trial and error: from having the idea, to testing, learning, failing, re-envisioning until getting to a (minimal) viable product	artifact and the affected social practices. New features of the IT artifact led to ideas on how to improve social practices of the stakeholders involved, and vice versa.
Sep 2014	Use different design tools to support the decision-making process of the platform: personas, user stories, vision documents, task scenarios.	In-depth understanding and refinement of whom the platform is and consequently not is being designed for	
Apr 2013	Quantitative (end-user surveys) and qualitative research (interviews, focus groups, workshops) for formative evaluations of the artifact	Formative evaluation of the artifact. Identification of knowledge gaps	
Dec 2014	Use participatory observation and keep a logbook (>1100 notes) and involve research assistants, to build a chain of evidence to reduce the researcher's bias	ADR researcher is part of the study but at the same time observe as an outsider The paradigm shift in the healthcare domain requires not only an attitude and involvement of citizens, but also from public and private parties, in order to improve the response to new social demands.	<u>Principle:</u> Balance political, economic and social values for evaluating ADR results The ADR researcher should be well aware of the different political, economic and social values that play a role in the social innovation. Evaluation criteria for the IT artifact are thus value-laden and ADR researchers aiming for social innovation should make this explicit and balance these different values.
Jul 2014	Use the Capability Approach to evaluate how the platform contributes to the ability of elderly people to age-in-place	Empirical basis for the Capability Approach to evaluate the impact of IT artifacts as an alternative framework in adoption research	
Apr 2013	Use Iivari's (2015) second design science research strategy to frame the research	Solve a societal problem by building a concrete artifact in a specific context and distil prescriptive knowledge to be packaged into a general solution concept to address a class of problems	