Agile as Change Approach in eHealth Innovation Projects

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Abstract. Many new eHealth products have been developed, but few reach widespread adoption within healthcare organisations. Literature mentions bottlenecks for the acceptance of new technology in the healthcare industry, such as insufficient attention for change management and reluctant acceptance by intended users. In this paper, we argue that Agile software development is a valid change approach and is applicable in eHealth innovation projects. We compared Scrum with Kotter's eight step model of change (1995) and verified the theoretical findings with a case study where an innovative eHealth application was developed to support the care for persons with mental disability. We found support for our proposition that Agile practices support an emerging change process as required for the innovative nature of eHealth projects and lead to increased user acceptance. Agile practices especially facilitate co-creation and increase user self-efficacy but they do not automatically create a sense of urgency nor the management support needed to sustain the change.

1 Introduction

The healthcare sector is a challenging field for innovation, with many innovations never achieving large scale adoption (Heeks, 2006; Kaplan & Harris-Salamone, 2009). Innovative ideas are often developed as proof-of-concepts but do not lead to a lasting change within the organisations involved. With the ever increasing pressure on healthcare budgets, the growing demand for care and the shortage of available staff, there is clearly a need to improve the success ratio of these innovation projects.

Innovation projects tend to require radical changes in organizations and demand many changes of individuals in the organizations. For an innovation to succeed, a variety of factors must be addressed. Critical success factors for innovation in healthcare include technology, user acceptance, financing and legislation (Kaplan & Harris-Salamone, 2009; Broens et al., 2007). Since healthcare innovations invariably imply change for the intended user, explicit attention for managing the change is necessary.

In this paper, we focus on change management as a success factor for eHealth innovation projects. Change management covers the actions that should lead to higher organizational acceptance of the developed innovations.

The idea for this article rose while participating in an innovation project in which an expert system was developed for supporting healthcare workers caring for people with intellectual disability. An Agile software development method was chosen to develop the eHealth innovation together with intended users. While the project's goal was to develop a system, the Agile method turned out to be a strong facilitator of the change process. Prahalad and Ramaswamy (2004) have argued that the creation of customer value should involve collaboration between the innovators and prospective users in a development process that essentially becomes a process of co-creation. Our approach led to such a form of co-creation.

The goal of this paper is to show that Agile software development methods are a working change approach in eHealth innovation projects. We compare Agile practices with the change management approach of Kotter (1995) and validate the theoretical comparison through a case study.

In the remainder of this paper, we first define the concepts of this per: eHealth innovation projects and fitting change management approaches for such projects. Then we briefly describe relevant practices of Agile approaches and compare the Agile method Scrum with Kotter's eight step model of change. In Section 3 we describe our methodology and present our case and in section 4 contains the results of the validation of our comparison. In section 5 we discuss the effects of Scrum as a change approach and we finish this paper with conclusions, limitations and suggestions for further research.

2 Agile development as a change approach in eHealth Innovation projects

In this section we describe the characteristics of typical eHealth innovation projects. We then look into change management approaches for eHealth. Then we describe relevant Agile development practices and come to our proposition where we compare Kotter's (1995) model to the Agile practies as an approach for eHealth innovation projects.

2.1.   eHealth Innovation projects

Healthcare organizations face a number of challenges that force them to change: increasing pressure on budgets, a growing demand for care and an increasingly tighter job market. The healthcare sector has a number of specific complicating characteristics for innovations, such as a wide range of roles, responsibilities and disciplines, complicated legislation and regulations involved, highly disciplined professionals who are trained to follow protocol, and the costs in case of failure (LeTourneau, 2004).

As a consequence, innovation projects in eHealth typically are of transformational nature, where the technology to be implemented sometimes is new to the sector, but at least new to the organization where it is developed and implemented (Garcia & Cantalone, 2002). In most eHealth innovation projects the outcomes are not exactly known when the projects are initiated so they are of emergent nature. Usually a system software product is developed that needs to fit with the actual work practice. In recent years a number of papers have focused on the importance of end-user involvement when developing healthcare innovations (Nies & Pelayo, 2010; Scandurra, Hagglund & Koch, 2008; Teixeira, Ferreira & Santos 2012). Some have even gone so far as to call users heterogeneous engineers (Roed & Ellingsen 2011).

2.2   Change management approaches

According to Garcia and Cantalone (2002), innovations range from new to the world to new to a specific organization. All innovations usually require major changes for individuals in organizations. The implementation of new ways of working requires people to explore previously unknown ways of working and adopt these as their new day-to-day standards. Changes like these do not come easily, but need to be supported by a deliberate process of change management. Because we focus this paper on the intersection of healthcare, change management and informatics, we will use the definition of change management by Lorenzi (2003): "the process of assisting individuals and organizations in passing from an old way of doing things to a new way of doing things".

There are two main approaches in change management literature: planned and emergent change (Burnes, 2009; Palmer, Dunford & Akin 2008). Planned change approaches describe a clearly defined goal, are top-down and use strict control mechanisms such as project management. Emergent change approaches describe a bottom-up process of interaction that leads to change. Although often positioned as opposing approaches, some consider the combination of both approaches the best road to achieve organizational change. Two examples of this complementary approach are Kanter et al.'s (1992) bold strokes and long marches and Beer and Nohria 's (2000) theory E and theory O. Based on a complementary approach both Kanter et al. (1992) and Kotter (1995) developed a generic plan to facilitate emergent change. Kotter's (1995) generic plan, the eight steps (table 1), is a widely recognized approach.

Table 1: Kotter's 8-step model

Creating a climate for change
1.   Develop a sense of urgency
2.   Building a guiding team
3.   Creating a vision
Engaging and enabling the entire organisation
4.   Communicating for buy-in
5.   Empowering others to act on vision
6.   Creating short term wins
Implementing and Sustaining the Change
7.   Consolidating and producing more change
8.   Institutionalize new approaches

Organizational change requires individual change. In research on organizational change, resistance to change is seen as one of the main causes that change does not "stick" (Kotter, 1995; Kanter, Stein & Jick, 1992; Beer & Nohria, 2000). Resistance to change can be reduced by enhancing readiness for change. Holt et al. (2007) and Rafferty & Simons (2006) found that self-efficacy and management support are important factors that enhance readiness for change. Self-efficacy is facilitated by end-user involvement or co-creation, as project outcomes that are co-created better fulfil the user's needs (Prahalad & Ramaswamy, 2004). Also the opportunity to experiment with new ways of working while creating a system adds to individuals' belief in their own capacity (Rafferty & Simons, 2006).

2.3   Agile software development in eHealth

In software development, the last decade has seen the rapid rise of Agile methods. United through the formulation of the underlying values in the Agile Manifesto (Beedle et al., 2001) these methods approach the development of software projects in an iterative, interactive, and exploratory fashion. The approach is iterative in the sense that new working functionality is produced in iterations, each delivering fairly small increments. The approach is interactive in the sense that customer representatives, for example the intended users, get actively involved in evaluating the previous iteration and in planning the contents of the next iteration. The approach is also explorative, meaning that the full specification only emerges as the consequence of subsequently planned iterations.

With regard to the Agile methods in eHealth a number of papers have been written. Offenbeek (1996) proposes the applicability of interactive and iterative methods in situations with a high resistance potential, to which we categorize healthcare. Krause and de Lusignan (2010) state that, from the point of usability of clinical applications, Agile techniques are more appropriate than processes that separate developers from users, and test products against theoretical assurance models. Kitzmiller (2006) presents the Agile approach as an improvement and evolution over the traditional plan-driven approach. For a general academic overview in Agile methods we refer to Dybå and Dingsøyr (2008) ans Lee and Xia (2010). Since Agile methods are an actively developing field, there is a continuous need for more rigorous studies (Lee & Xia, 2010; Abrahamsson, Conboy & Wang, 2009).

Currently Scum is the most widely used Agile method (Version One 2010). Scrum emphasizes the project management aspects of projects where it is difficult to know the full specification of the desired end product at the beginning of the project and therefore impossible to plan everything at the start of the process. Central to the method are a number of practices, such working with a list or backlog of prioritized workitems, short cycles that lead to demonstrable products and an adaptable planning whereby a self-organising team continuously inspects and adapts its own progress (see Fig. 1). For a full description of Scrum we refer to Schwaber and Beedle (Schwaber & Beedle, 2002).
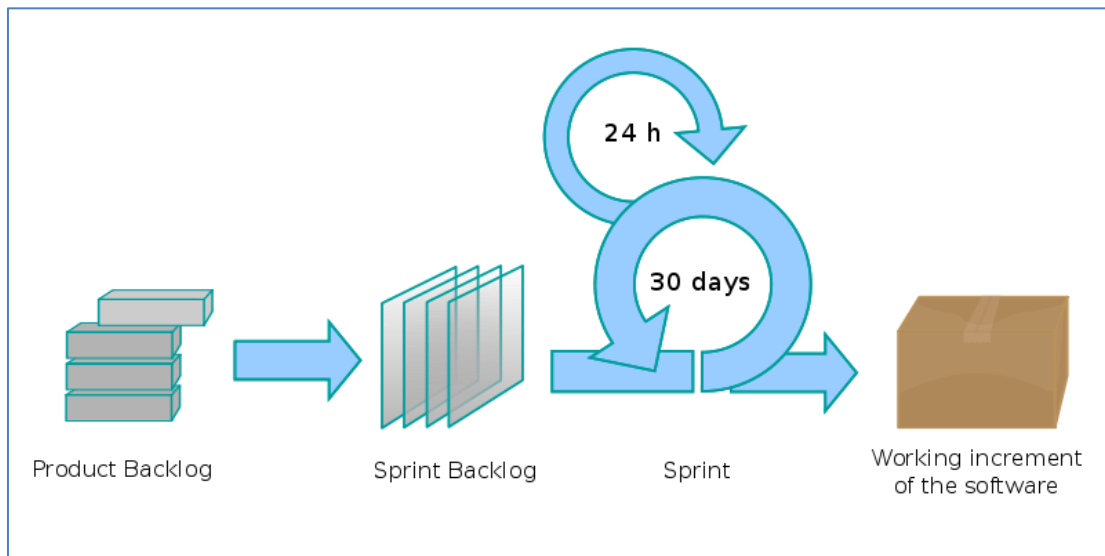
Fig. 1: Scrum process, from Lakeworks; Scrum Process; WikiMedia Commons; 9 Jan 2009; Web; 20 May 2012

2.4 Development of the proposition

Considering the previous paragraphs it is clear that approaches for eHealth innovation projects must support the innovative nature of the projects, ensure management support, increase user self-efficacy as a basis for increased user acceptance and allow for emergence (Burnes, 2004). Building on these characteristics we chose Kotter's eight steps (1995) as the change management approach for this study, because it supports emergent change and focuses on management support and organizational involvement. From a software development perspective, the Agile methods have been specifically tailored for projects that are innovative, have uncertain outcomes and require user-involvement. To operationalize Agile we chose Scrum. Scrum is one of the most widely used Agile methods in this time period and as such also the logical choice for the development approach in our case study.

In this section we compare the Scrum practices with the eight steps of Kotter's model and describe how they theoretically match, represented in the overview in table 2.

The first phase in Kotter's model (steps 1-3) aim at developing a climate for change. Scrum practices do not specifically support these. The sense of urgency, step 1, that is needed to start the actual eHealth project is not part of the Scum practices, but once a project has been started several Scrum practices support maintaining the sense of urgency. The basis of Scrum is a prioritized list, called the product backlog, and projects start with the stakeholders collaboratively translating the initial vision into finer grained items that are put into the backlog. This backlog then has to be prioritized through consensus of the stakeholders. The act of actively working on the specification of the project deliverables and prioritizing as a team, combined with the knowledge that the first results will be delivered in a short period of time, contributes to a sense of urgency. This sense of urgency is maintained by repeating sprintdemos and sprintplannings, a typical sprintlength being somewhere between two to four weeks.

Kotter's step 2 describes the need for a guiding team. In Scum, the sprintdemos and sprintplannings offer a natural opportunity for the stakeholders within the healthcare organization to meet. They can collectively witness progress, reflect on the impact of the eHealth application on their working practices, voice objections encountered in their departments, suggest improvements and adjust priorities. Formally the Product Owner has the final say, but he or she tries to achieve consensus between the stakeholders. This group of stakeholders become ambassadors of the new product and guide the necessary changes in the organization until the next sprintdemo. One aspect of the guiding team, enough organizational power, is not specifically addressed by Scrum, although the product owner is likely to be the person providing the organizational power.

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Kotter's step 3, the creation of a vision is supported in Scrum through the development and maintenance of the product backlog during the sprintplanning meetings. The product backlog essentially becomes the description of the product and allows a vision to emerge. During the springplanning, sprintgoals are formulated to summarize the results of every sprint. Finally, the emerging vision is strengthened by the practice of incremental realization through working deliverables, demonstrated at the end of each sprint.

The next phase in Kotter's model, step 4, is engaging and enabling the entire organisation. This step is about communication and that is a central principle in Agile methods. The progress that is demonstrated through a working product at the end of every sprint, has a powerful communication effect on the organisation involved. It is good practice to make the sprint demo open for a broader audience, appealing to all interested. Stakeholders can actively participate in the ongoing process of change rather than be confronted with the facts afterwards, adding to buy-in. The guiding team can also take the working deliverables and demonstrate them in their department. If the need for additional demonstration material is felt, Scrum allows for the priorities to be adapted as the need arises during the project.

Kotter's step 5 is the empowerment to act on the vision and is supported by Scrum in several ways. Part of the process is to regularly inspect which impediments are holding the project back. Having an early working version of the eHealth innovation helps in signaling these obstacles. Obstacles of a technical nature can be entered into the product backlog and prioritized be solved as quickly as needed. Obstacles of an organizational nature are typically tackled by the guiding team following a sprintdemo. The periodic nature of sprints forces the problem owners to fulfill their designated tasks quickly. The same argument holds for step 6, the creation of short term wins. Opportunities for interesting functionality or other uses of the eHealth system can be taken by the Product Owner into the adaptable planning.

How well Scrum supports Kotter's final phase, step 7 and 8 of implementing and sustaining the change depends on whether Scrum is still applied at that time or not. If Scrum is still in operation, then the above benefits are still in effect. In practice an often encountered scenario is that Steps 7 and 8 are disconnected from the development phase, sometimes due to the time needed to evaluate a pilot system or time needed to take decisions or change policy. Then the momentum for change that was gained during the Agile development phase is lost. A common issue in practice is that Agile development practices require strong discipline during execution, which work well under pressure. When the pressure is off, other priorities often intervene and the practices dilute.

Based on the above we conclude that Scrum practices to a large extent can be compared with Kotter's eight steps (1995). Strong points of the Scum practices are the development and maintenance of a sense of urgency and a climate of change once a project is underway. Scrum practices force management involvement and effectively result in co-creation of the emerging product. These practices increase user self-efficacy and management support, two important enhancers of readiness for change. Whether Scrum practices support the third phase of Kotter's eight steps (implementing and sustaining the change) will depend on the chosen project approach. If this phase is disconnected from the development phase there is a real danger that the momentum created through Scrum during the pilot project will be lost.

Table 2: Mapping of Scrum as a change approach according to Kotter's eight steps

Kotter	Supported through Scum practice
Creating a climate for change	
Develop a sense of urgency	Once the initial sense of urgency has been created and a project has been started: Periodic sprints, including sprint planning and sprintdemo's Specification and prioritisation of product backlog by stakeholders
Building a guiding team	Product owner role Sprint planning meeting Sprintdemo

Creating a vision	Initial product backlog
	Revisions of product backlog
	Sprint planning meetings
	Sprintdemo's
	Working product after every sprint
Engaging and enabling the entire organisation	
Communicating for buy-in	Working product after every sprint
	Gathering feedback during sprintdemo's
	Possibility to prioritise demonstration items
	Emphasis on visibility of progress
Empowering others to act on vision	Inspect for impediments
	Periodic sprints + Prioritisation backlog
	Working product after every sprint
Creating short term wins	Input through product owner
	Periodic sprints + Prioritisation backlog
	Working product after every sprint visualizing progress
Implementing and Sustaining the Change	
Consolidating and producing more change	When Scrum is still the project approach: Periodic sprints Prioritised product backlog
Institutionalize new approaches	n.a.

We mapped Scrum practices on Kotter's eight steps (table 2) and conclude that where Kotter describes the outcomes to be achieved with each step, Scrum practices effectively provide a working method on how to achieve the desired outcomes. The only step that is not automatically supported by Scrum is Kotter's stap 8, institutionalize the change. This stands to reason, because Scrum is a development approach and not an implementation approach. In the following section we present our case study to validate this proposition.

3 Case study: developing an Intelligent Monitoring System

In this section, we describe our case study to validate our proposition. The case is a project in which we developed an intelligent monitoring system to support the care for persons with intellectual disability living semi-autonomously. First, we describe the methods used for the case study. Then we give a brief description of the setting and scope of the project. We show how the Scrum method was used during the development of the monitoring system. Finally we present how the process and impact were perceived by a set of stakeholders, i.e. the users and the management of the healthcare institution, to indicate to which extent the Agile approach supported change management and which Agile practices were deemed to have the most impact.

3.1   Methodology

The case research methodology was chosen for this study in order to be able to collect rich descriptive data from a case available to us. The case research approach also allows the researcher to take advantage of unique features and opportunities for triangulation (Eisenhardt, 1989). The main drawback to the case approach is that the generalizability of the results is limited to propositions for future research, not to a population.

This case study can be classified as a single case design with a single unit of analysis (Yin, 2009) the unit of analysis being a development project to create a pilot eHealth system called Intelligent Monitoring System (IMS). This system was developed in the period 2010-2011 in joint cooperation between the NOVO foundation, Hanze University of Applied Science and a system integrator. The case was chosen on the basis of availability, but we believe this case to be a typical example {{80 Yin,

Robert K. 2009/f, p.49;}}, providing insight into a healthcare organization with relatively little experience in these kind of projects attempting to develop an innovative eHealth system which has impact on management, specialists and caretaking staff.

The main data was collected through focused interviews with six stakeholders from NOVO, listed in table 3 The interviewees were selected because of their involvement in the project, either as part of the projectteam or as intended users of the pilot system. The interview data were supplemented with observations and artifacts (e.g. the product backlog) collected during the development process. A case study protocol was developed including field procedures and interview guidelines and was reviewed by an independent senior researcher.

Table 3: Interviews

Interview	Job title	Part of projectteam	User of system
1	Personal coach	No	Yes
2	Personal coach	Part of the time	Yes
3	Behavioral scientist	Yes	Yes
4	Behavioral scientist	Yes	Yes
5	Manager	Yes	No
6	Manager	Yes	No

The interviews started with an introduction, including an brief explanation of Kotter's model and a refresher of the Scrum method. This was followed by open questions on the experience of the interviewee with innovation projects and their role in this project. The main part was a structured walkthrough of the eight steps of Kotter's model, each supported by a one page printout, questioning whether the interviewee experienced that particular step during the project and what causes they identified for that step occurring or not. The interviews were digitally recorded and transcribed by a third party. The collected data were stored in a secure case study database.

For the analysis the responses to the eight main questions about Kotter's steps were tabulated and then coded. Codes for Scrum practices were defined beforehand, codes for rival explanations were developed on the basis of the data.

## 3.2   The Intelligent Monitoring System (IMS)

The project concerned the care for persons suffering from mild intellectual disability (IQ 50-70). These clients are ambulatory resident and in general have some form of daytime activity such as supported work. The NOVO foundation helps the clients with their basic living conditions, such as safety, security, food and health, and also tries to promote self-reliance and personal development. As a result of their disability the clients have issues with a sense of time, duration, place, distance, risk estimation, "if-then" cause-effect, planning, taking action, continuing and finishing activities and determining errors and/or dangers. Currently, the clients are mainly supported through human intervention, in which *personal coaches* observe, identify and intervene. These personal coaches are guided in their decisions by treatment plans written by behavioural specialists.

Due to shrinking of the potential workforce in the northern region of the Netherlands, NOVO expects it will be faced with employee shortage in the future. An Intelligent Monitoring System was envisioned as a potential solution to this problem. Such a system would be able to monitor the clients' situation and take appropriate interventions where necessary. This allows the client to resolve the situation and, perhaps, over time learn how to avoid them. This would lighten the workload for personal coaches, but the main potential benefit would be the shift from reactive care to proactive care. Another benefit is that this category of clients generally prefers as little human intervention as possible. If the client can resolve a situation with the help of the monitoring system then the personal coach need not be notified.

The Intelligent Monitoring System consists of a number of components (see Fig. 2):

- Sensors in the home of the client, i.e. a bed sensor to detect whether a client is in bed or not.
- A rule-based expert system containing rules for certain situations in the home of the client. In evaluating the rules the system recognizes critical situations based on the received sensor data and determines which interventions should be applied. These interventions are typically first sent to the client and escalated to the personal coaches after a number of resends.
- Actuators in the home of the client which can perform an intervention, e.g. playing a sound clip that tells the client it is time to go to bed or a phone capable of sending text messages. Physical actuators like closing a window or shutting down a computer are technically feasible but were not used in the project.
- A user interface for behavioural specialists to define and manage the rules for the clients in the expert system. To create a Graphical User Interface that allows a healthcare professional to create generic logical rules was both a technical and a usability challenge.
- A user interface for the coaches to see issues that require their intervention.
- A reporting system with which, among others, the effectiveness of interventions over a period of time can be traced.

Fig. 2: Intelligent Monitoring System
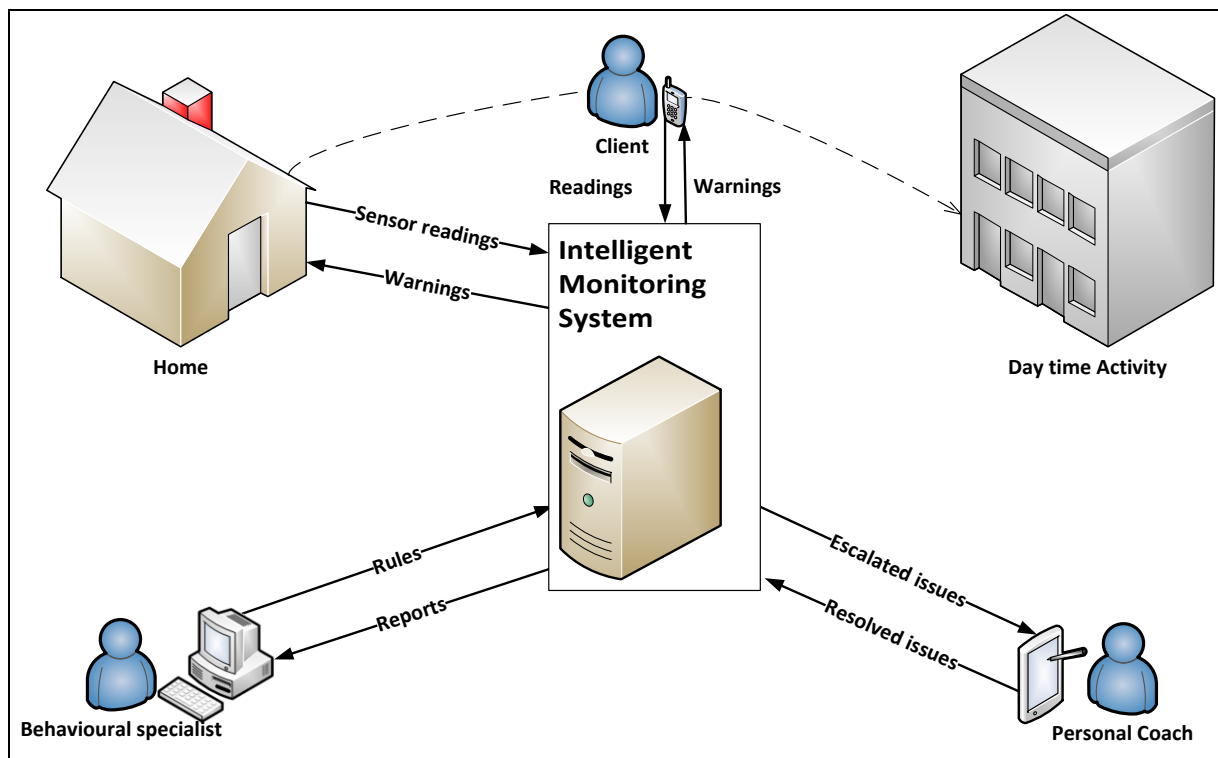
The goal of the project was to deliver a pilot system that could be tested with three clients for three scenarios. NOVO had no prior experience with developing this kind of innovative eHealth systems. The introduction of the IMS would have major consequences for all stakeholders involved, the most significant ones being:

- The behavioral specialists needs to learn how determine logical rules for clients with a certain treatment plan and to enter these in the user interface of the expert system. An example of such a rule could be "IF time>=23.00 AND isActiveInLivingRoom THEN

send(timeToGoToBedMessage)". Over time the specialists would also need to validate the effectiveness of the rules.

- The personal coach on duty needs to be able to interface with the system on a real-time basis through a computer or mobile device to see if there are issues that the client failed to resolve. If so, the coach contacts the client and helps with resolving the situation. This is an entirely different workflow than the current one in which there can be multiple days between a situation, for example the client goes to bed too late, and the symptoms, for example the supervisor complaining that the client has been late for work this week.
- The clients and their families need to get accustomed to the systems presence in their house and how to handle notifications.
- The entire process of informing clients and their families about the system, getting consent, and having third parties perform the installation of the required components turned out to be a major task for the management.

The main development work was done over a one year period, resulting in the software system demonstrable in a test environment. The transition into the houses of the clients proved challenging however, leading to disagreement with the system integrator and the testing and implementation being stalled. During the final period, Scrum was no longer applied.

3.3   The application of Scrum

When choosing a development method for this project, the main deciding factor was the novelty and innovativeness of the proposed system for all parties involved. Determining the correct requirements is a demanding task for any project, let alone for an interdisciplinary innovative project with healthcare professionals who have to alternate between their project tasks and operational crisis calls. To address the requirements elicitation under uncertainty Scrum was chosen.

The typical Scrum components were implemented in the following ways. The *Product Owner* position was taken by a behavioural specialist from NOVO, in close cooperation with a top-level manager. The *Scrum Master* role was taken by one of the authors. He was to ensure that the development process kept working and any impediments were resolved. The development *team* consisted of staff and students from the Hanze University of Applied Science. Expertise on Human Computer Interaction was added to the team.

The main product development was done in twelve *sprints* lasting three weeks each. Each sprint was given an explicit *sprint goal*. These sprint goals were planned for several sprints upfront but adapted after every sprint according to new insights. The work in the sprints was guided by the requirements which were prioritised in the *product backlog*. The main meeting at the end of every sprint was the *sprint demo*. In this meeting the developers presented their results directly to NOVO staff. Senior management and behavioural specialists were present at the earlier sprint demos, later on the personal coaches and IT-staff also joined. This demonstration would then trigger discussion about (dis)advantages of the implemented solution, possible exception scenarios and how to deal with them, implications for NOVO and their clients, and new ideas for features. Ideas and suggestions were recorded on the spot to prevent them of getting lost in the following discussion. After the demonstration and discussion the *sprint planning* for the next sprint was done. The product backlog, together with the newly generated ideas, was again prioritised. The long term sprint planning was reviewed and a decision was made concerning which backlog items were to be developed in the next sprint. Organisational actions or impediments that were identified during discussion were handled by management.

Finally, the typical Scrum practices such as *daily stand up, scrum board* and *burn down chart* were applied internally by the development team, but were not part of the interaction with NOVO.

4   Results

In this section we present the collected data and our findings. Table 4 presents the main interview data, while table 5, in the appendix contains the sprintgoals as they were envisioned beforehand and as they were realised during the project. We also describe our findings related to the first six steps of Kotter's eight steps.

Table 4: Representation of main interview data

Steps Kotter	Perceived?	Analysis – Scrum practices	Who	Quotes
1. Urgency	Y	10_APPRECIATE_OPPORTUNITIES 03_ADAPTABLE_PLANNING 02_SHORT_CYCLES 01_SMALL_ITEMS 13_LACK_OF_TIME	PC1[1] PC2 BS1 BS2 HM1 HM2 PC1 BS2 PC2 BS1 BS2 HM1 HM1 BS1 HM2	• "it becomes more tangible if you are taken along in the prcess and you get to see things, this motivates you" (PC1) • "[through the regular meetings] the project remained on the surface which meant I could stay engaged" (PC2)
2. Guiding team	Y/N	02_SHORT_CYCLES 03_ADAPTABLE_PLANNING 11_UNCLEAR_PRODUCT_OWNER 12_MISSING_STAKEHOLDERS	PC2 PC2 HM1 HM2 HM1 HM2	• "At the end [when Scrum was no longer applied] I lost sight who was leading the project." (BS1)
3. Vision	Y	02_SHORT_CYCLES 03_ADAPTABLE_PLANNING 04_WORKING_DELIVERABLES	PC1 BS1 BS2 HM1 HM2 PC1 BS1 PC2 BS1 BS2 HM1	• "Every Scrummeeting we looked again at what was important this time" (HM1)
4. Communicating	Y	02_SHORT_CYCLES 03_ADAPTABLE_PLANNING 04_WORKING_DELIVERABLES	PC2 HM2 PC1 PC2 BS1 BS2 HM1 BS1 BS2 HM1 HM2	• "In the end you have a demonstration which you can use to explain in the teams and there you are more enthusiastic because you can show it"(BS2)
5. Empowering	Y	02_SHORT_CYCLES 03_ADAPTABLE_PLANNING 04_WORKING_DELIVERABLES	PC1 BS1 BS2 HM1 PC1 PC2 BS1 BS2 HM1 HM2 HM2 BS2	• "You puzzle what can go wrong and what is needed and take that from the workfield to the Scrum. That helps to remove obstacles." (BS2)
6. Short term wins	Y	02_SHORT_CYCLES 03_ADAPTABLE_PLANNING 04_WORKING_DELIVERABLES	PC1 BS1 HM1 PC1 BS1 BS2 HM1 BS2	• "The stop button was directly available for [staff]" (HM2)
7. Consolidating	N			
8. Institutionalize	N			

Step 1

With regard to the first phase of Kotter, all interviewees reported an initial sense of urgency when starting out on this project. This was not due to Scrum but to prior appreciation of the potential that the IMS held. During the project however, short cycles are credited for maintaining the personal sense of urgency even when challenged by other work demands.

The sense of urgency in the wider organization was maintained by regular demonstrations, to which the adaptable planning practice contributed. The changed priorities in the sprintgoals (see Appendix A) reflect the increased priority of demonstration material and demonstrations for clients and staff. In retrospect, the healthcare managers were unsatisfied with the sense of urgency in the wider organization. This might be explained by the fact that many staff members were not immediately involved in and affected by the pilot.

Step 2

The opinions with regard to the guiding team differ. There was a team with organizational power to guide the project which joined the Scrum meetings, but in hindsight healthcare management missed a number of stakeholders and found the product owner role not performed clearly enough. In this case no clear support was found for the contribution of Scrum practices to a guiding team. Only a few hits were found, such as a behavioural scientist who reported that "at the end [when Scrum was no longer applied] I lost sight who was leading the project."

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[1] PC = Personal Coach, BS = Behavioral Scientist, HM = Healthcare Manager

Step 3

With regard to creating a vision, the interviewees responded that during the project a vision emerged and that it became clearer and more focused while working. The Agile practices of short cycles, adaptable planning and working deliverables are credited as contributing to creating and evolving the vision.

Step 4

Communicating the vision was actively done in many different ways (teammeetings, demonstrations, one-on-ones with clients and parents). A comparison of the a priori and a posteriori sprintgoals shows that the priority the development of demonstration material became a necessity during the project. Changes included the development of a portable demonstration suitcase and hands-on support from developers at demonstration sessions. Scrum practices that respondents mentioned are the short cycles, adaptable planning and working deliverables.

Step 5

When discussing the phase of empowerment of others the main response was about the ability to identify obstacles and have them resolved by prioritizing them and adapting the planning. One example was the demand for a mechanism for clients to pause the system when they wanted to, the "red button". Another example was the request for the option to specify time windows for receiving notifications or not. The most quoted Scrum practices were the short cycles and adaptable planning. In our observation the frequent demos also gave staff insight in the effects of the system on their daily work. This often led to exchanges like "For this to work we will need to change our working process. Let's plan a meeting to discuss this with the colleagues."

Step 6

The interviewees saw the short term wins as an extension of the empowerment. Again short cycles and adaptable planning are credited. One manager noted as an unexpected short term win for NOVO a general increase in the awareness of technological possibilities among staff.

The phase of implementing and sustaining the change (steps 7 & 8) was not reached in the case study project. After the main development work Scrum was no longer applied and the momentum faded quickly.

Finally, this first time using an Agile method made an impression on NOVO. Based on the experiences in the IMS project the NOVO management decided to incorporate Agile practices into their organisation-wide innovation policy (Molenaar 2011).

5   Discussion and Conclusion

In our case study we validated our theoretical proposition that Agile is a valid change approach for eHealth innovations. We found support for part of our proposition and our findings are summarized in Table 4. Agile practices do create the envisioned results of Kotter's steps 1, 3, 4, 5 and 6. We did not

find clear support for step 2, the guiding team, although the absence of guidance was felt when the Agile project stopped. The project of our case study did not reach step 7 and 8, and thus we did not find support for these steps.

Table 4: Agile practices supporting Kotter's eight steps in case study

Kotter's steps	Associated Agile practices
1. Sense of urgency	Agile can be used to maintain the sense of urgency among healthcare staff over the duration of the project by the practices of short cycles and adaptable planning.
2. Guiding team	No clear support was found that Agile supports the building of a guiding team.
3. Vision 4. Communicating	Agile can be used to create, evolve and communicate the vision through the Agile practices of short cycles, adaptable planning and working deliverables.
5. Empowering 6. Short term wins	Agile supports empowering of staff by allowing them to bring up potential obstacles and improvements, prioritizing these and adapting the planning of the next cycle if needed.
7. Consolidating 8. Institutionalize	This phase was not reached.

We conclude that Agile methods, in this case Scrum, provide a good part of the change management that is needed to successfully develop and implement eHealth innovations. Agile practices allow for emergence through the short development cycles, the creation of working deliverables that incrementally are further developed and the ability to prioritize the development process according to emerging needs. The sprint demos enforce repeated discussion between the product owner, users and the building team on visible and tangible results that have meaning to both parties. Thus a common understanding and even shared language emerges, bridging the gap between completely different disciplines and solving the difficulty to "speak each other's language". Agile practices facilitate an increase of user self-efficacy because users effectively become co-creators of the product that is under development.

We found again that management support is a critical success factor. In our case, management had created the needed sense of urgency before the project was started. During the project, the management was extremely supportive, but not continuously involved. This hampered the decisiveness of the project and eventually led to suspension. We must conclude that Agile practices do not fill this gap.

In this paper, we have examined the applicability of Agile software development methods as a change approach. Our comparison with the change model of Kotter (1995) and the validation of our proposition through a case study, has shown that the practices of Agile methods can facilitate organizations through the necessary steps of creating a climate of change, engaging and enabling the organization and implementing the change. In other words, Agile practices are a change approach. Currently Agile methods are generally confined to the development phase, thus leading to a loss of momentum in the implementing and sustaining of the change. Continuing Agile practices such as iterations and demonstrations in some form throughout the duration of the implementation could remedy this oversight.

Healthcare organizations now have an additional approach at their disposal, which may lead to an improved success ratio of sorely needed eHealth innovation projects.

6 Limitations and further research

The results presented in this paper have a number of limitations. We have chosen to focus on the Scrum method and did not consider other Agile methods such as eXtreme Programming. However, the

underlying values are the same and Scrum is the most widely used method. From the change management point of view we have chosen to focus on the model of Kotter. This is a widely accepted model which fits the type of change management under discussion. However, other models could be considered.

Another limitation is the amount of practical evidence. The experiences of the participants in the illustration project support our theoretical proposition, but a single case may not be generalized without caution. Furthermore there is researcher bias as the authors participated in the project. Finally the data is secondary, the primary purpose of the project was not to research the relationship between Agile and change management.

Future research could be aimed at systematically investigating eHealth innovation projects with regard to the impact of the software development method on change management, such as a longitudinal multi-case study measuring user acceptance when applying Agile methods. Further research on the applicability of Agile methods in eHealth projects with different characteristics, such as size or application type, would also be a valuable contribution.

References

Abrahamsson, P., Conboy, K. & Wang, X. (2009). 'Lots done, more to do': the current state of Agile systems development research, *European Journal of Information Systems,* vol. 18, no. 4, 281-284.

Beedle, M., Bennekum, A.v., Cockburn, A., Cunningham, W., Fowler, M., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R.C., Schwaber, K., Sutherland, J. & Thomas, D. (2001). *Agile Manifesto*. Available: http://Agilemanifesto.org [2012, 9 April 2012].

Beer, M. & Nohria, N. (2000). Cracking the Code of Change, *Harvard business review,* vol. 78, no. 3, 133-141.

Bouwman, H., Faber, E., Haaker, T., Kijl, B. & De Reuver, M. (2008). Conceptualizing the STOF model, *Mobile Service Innovation and Business Models*, eds. H. Bouwman, T. Haaker & H. De Vos, Springer Verlag, Berlin, 31-70.

Broens, T.H.F., Vollenbroek-Hutten, M.M.R., Hermens, H.J., van Halteren, A.T. & Nieuwenhuis, L.J.M. (2007). Determinants of successful telemedicine implementations: a literature study, *Journal of telemedicine and telecare,* vol. 13, no. 6, 303-309.

Burnes, B. (2009) *Managing Change: a strategic approach to organisational dynamics,* 5th edn, FT Prentice Hall, Harlow.

Burnes, B. (2004). Emergent change and planned change -- competitors or allies?, *International Journal of Operations & Production Management,* vol. 24, no. 9, 886-902.

Dybå, T. & Dingsøyr, T. (2008) Empirical studies of Agile software development: A systematic review, *Information and Software Technology,* vol. 50, no. 9–10, 833-859.

Garcia, R. & Cantalone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: a literature review, *Journal of Product Innovation Management 19, 119-132*.

Hayes, S. & Richardson, I. (2008). "Scrum Implementation Using Kotter's Change Model", *Agile Processes in Software Engineering and Extreme Programming,* , 161-171.

Heeks, R. (2006). Health information systems: failure, success and improvisation, *International journal of medical informatics,* vol. 75, no. 2, 125-137.

Holt, D.T., Armenakis, A.A., Field, H.S. & Harris, S.G. (2007). Readiness for Organizational Change, *Journal of Applied Behavioral Science,* vol. 43, no. 2, 232-255.

Kanter, R.M., Stein, B.A. & Jick, T.D. (1992). *The challenge of organizational change : how companies experience it and leaders guide it,* Free Press, New York.

Kaplan, B. & Harris-Salamone, K.D. (2009). Health IT success and failure: recommendations from literature and an AMIA workshop, *Journal of the American Medical Informatics Association : JAMIA,* vol. 16, no. 3, 291-299.

Kitzmiller, R., Hunt, E. & Sproat, S.B. (2006). Adopting best practices: "Agility" moves from software development to healthcare project management, *Computers, informatics, nursing : CIN,* vol. 24, no. 2, 75-82; quiz 83-4.

Kotter, J.P. (1995). Leading Change: Why Transformation Efforts Fail. *Harvard business review,* vol. 73, no. 2, 59-67.

Krause, P. & de Lusignan, S. (2010). Procuring interoperability at the expense of usability: a case study of UK National Programme for IT assurance process, *Studies in health technology and informatics,* vol. 155, 143-149.

Lee, G. & Xia, W. (2010). Toward Agile: an Integrated Analysis of Quantitative and Qualitative Field Data on Software Development Agility, *MIS Quarterly,* vol. 34, no. 1, 87-114.

LeTourneau, B. (2004). Managing physician resistance to change, *Journal of healthcare management / American College of Healthcare Executives,* vol. 49, no. 5, 286-288.

Lorenzi, N.M. & Riley, R.T. (2003). Organizational issues=change, *International journal of medical informatics,* vol. 69, no. 2–3, 197-203.

Molenaar, T. (2011). Innoveren in de Scrum, *ICT Zorg,* vol. 12, no. 3, 16-17.

Nies, J. & Pelayo, S. (2010). From users involvement to users' needs understanding: a case study, *International journal of medical informatics,* vol. 79, no. 4, e76-82.

Offenbeek, M.A.G.V. & Koopman, P.L. (1996). Scenarios for system development: matching context and strategy, *Behaviour & Information Technology,* vol. 15, no. 4, 250-265.

Palmer, I., Dunford, R. & Akin, G. (2008). *Managing organizational change : a multiple perspectives*

approach, 2nd edn, McGraw-Hill Higher Education, New York, NY.

Prahalad, C.K. & Ramaswamy, V. (2004). Co- creation experiences: The next practice in value creation, *Journal of interactive marketing,* vol. 18, no. 3, 5-14.

Rafferty, A.E. & Simons, R.H. (2006). An Examination of the Antecedents of Readiness for Fine-Tuning and Corporate Transformation Changes, *Journal of Business and Psychology,* vol. 20, no. 3, 325-350.

Roed, K. & Ellingsen, G. (2011). Users as Heterogeneous Engineers-The Challenge of Designing Sustainable Information Systems in Health Care, *hicss*IEEE Computer Society, , 1.

Scandurra, I., Hagglund, M. & Koch, S. (2008). "From user needs to system specifications: multi-disciplinary thematic seminars as a collaborative design method for development of health information systems", *Journal of Biomedical Informatics,* vol. 41, no. 4, 557-569.

Schwaber, K. & Beedle, M. (2002). *Agile software development with Scrum,* Pearson international edn, Pearson Education International, Upper Saddle River, N.J.

Teixeira, L., Ferreira, C. & Santos, B.S. (2012). "User-centered requirements engineering in health information systems: a study in the hemophilia field", *Computer methods and programs in biomedicine,* vol. 106, no. 3, 160-174.

Version One 2010, *, State of Agile Development Survey* [Homepage of Version One], [Online]. Available:
http://www.versionone.com/pdf/2010_State_of_Agile_Development_Survey_Results.pdf [2012, 9 April 2012].

Appendix A

Initial sprintgoals period 1	Realized sprintgoals period 1
Basic rule execution	Basic rule execution
Basic rule editor for behavioral scientist	Basic rule editor for behavioral scientist
Advanced rule editor	Advanced rule editor
GPS-tracking	GPS
Sensorintegration	*User interface personal coach*
Reports	*Refactoring, transfer*
Initial sprintgoals period 2	**Realized sprintgoals period 2**
Web application personal coach	Web application personal coach
Adapting to live pilot	*Demonstration suitcase, protocols*
Reports	*Demonstrations, stop button*
Simulation module	*Refactoring*
To be defined	*Reports*
Transferral to system integrator	Transferral to system integrator