Software development in healthcare innovation

An analysis of Beter 2.0 in UMC St. Radboud

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Preface

The following research is done in the context of the Information Science Master's programme. With this research we have designed a method to analyze the development of innovative software in healthcare in order to reveal possible problems occurring. Via Felix Cillessen we could not only execute this research with the help of UMC St. Radboud's Programma Beter 2.0, but also take a very interesting look beneath the hood of Beter 2.0 and UMC St. Radboud itself. Many thanks to Felix Cillessen and Erik Barendsen for all the help and supervision needed to successfully conduct this research.

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Introduction

Labor shortage in the health care sector is growing: the demand is increasing while the health care supply decreases slightly every year. In the near future the demand will even rise to a level where the available supply cannot cover the increase anymore. Ir. D.A.J. Dohmen states some developments and trends in healthcare, shedding light on this circumstance in his dissertation 'De 'e' van e-Health' (2012).

The need of staff in nursing and residential care increases 2 to 3% every year while the number of available people on the labor market age 20 to 64 slightly decreases in the next few years (De Vries, 2006). This will lead to a growing demographic pressure (Centraal Bureau voor de Statistiek, 2010) and with that a shortage of doctors and support staff in all healthcare sectors. In 2017 the number of elderly citizens (age 65 and over) in the Netherlands will reach its peak (the ageing of the 'baby boom' generation) (De Vries, 2006), increasing pressure on the health care system. The number of elderly citizens will increase with 22% over the period 2005 - 2015 (CBS, 2010), increasing the health care volume with 34% in the same period of time (De Vries, 2006). In other words, the future will bring us an increase in health care demand, but at the same time a decrease in health care supply.

One of the possible solutions to deal with this upcoming problem is to use IT in an innovative way to release pressure from the doctors by making their work less labor-intensive (like for instance remote care, also known as telecare) or even let the patient do certain tasks without the help of doctors (like self monitoring or self management tools). To anticipate on these solutions UMC St. Radboud, the medical center of the Radboud University Nijmegen, has introduced Programma Beter 2.0. Beter 2.0 is an enhancement program of the medical centre stimulating development of their patient care, education and research by deploying IT in an innovative way. Working close with Productgroep ICT (the IT department) Beter 2.0 monitors the present IT systems of UMC St. Radboud to take into account whether requested new IT projects are needed and desirable following the Management of Portfolio principle. The program introduces and assists new IT projects in the four domains *'Infra 2.0'*, *'EPD 2.0'*, *'Stuurinfo 2.0'* and *'Radboud 2.0'*. The Infra 2.0 domain contains the projects regarding infrastructural matters, EPD 2.0 covers the projects regarding the new Electronic Health Record, Stuurinfo 2.0 contains projects regarding control information to the domain EPD 2.0, and Radboud 2.0 covers all the miscellaneous projects not belonging to one of the other three domains.

Aim of the research

In the current way of working Beter 2.0's customers struggle with the implementation of IT innovations: projects fail, doctors give resistance, people create products without involving Beter 2.0 etcetera. Beter 2.0 is not unique in this matter: software products often fail. The Marketing Science Institute, an organization supporting academic marketing research, states that more than 50% of new products fail (Gourville, 2005). The odds are even worse for innovative products. The high failure rate makes it unprofitable to invest high amounts of time and money in innovations. In Beter 2.0's case it is very risky to implement IT innovations through their rather extensive and time consuming process, for it is very uncertain if the product will actually be successful.

Although a lot of struggles show, Beter 2.0 does not know where the root of the problem lies. In order to solve these problems and ease these struggles Beter 2.0 needs to know what is going on exactly. Therefore, the main question of this research is:

What is the nature and cause of the problems that occur with the implementation of innovative IT projects by Beter 2.0?

In order to answer this question we will look at several sub questions:

- *What problems can be determined from a software engineering perspective?*
- *What problems can be determined from an innovation perspective?*
- *What problems can be determined from a health care perspective?*

First of all we will give a summary of the literature used to conduct this research. The 'Method' chapter contains the steps taken to acquire the results of this research followed by the 'Results' chapter which contains the actual results. In the 'Conclusion' chapter we solve the main question by solving the three sub questions, followed by future work to complete this research in the 'Discussion' chapter. In the appendix the process description of Beter 2.0 and the full results of the stakeholder interviews can be found. The remaining results (like the transcriptions of the interviews and the example documentation) are available electronically and can be requested.

Theoretical Framework

The focus of this research lies on health care innovations. Therefore, first part of the theoretical framework will cover what health care innovations exactly are. In order to get some more insight in Beter 2.0's way of working the Management of Portfolio principle will be explained in the subsequent part. Lastly, to provide an image of common troubles concerning innovative IT health care projects we will explain two software development methodologies and discuss the pitfalls and success factors on which this research is based.

Innovations in health care

Innovation can be defined as *"the intentional introduction and application within a role, group, or organization, of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, or wider society"* (West, 1990). This definition is largely accepted among researchers in the field (Anderson, De Dreu, & Nijstad, 2004), as it captures the most important three characteristics of innovations: a) novelty, b) an application component and c) an intended benefit. In line with the definition, innovations in healthcare organizations are typically new services, new ways of working and/or new technologies. From the patient's point of view, the intended benefits are either better health or less suffering due to illness (Faulkner & Kent, 2001). From an organizational point of view, the desired benefits are often enhanced efficiency of internal operations and/or the quality of patient care (Länsisalmi, Kivimäki, Aalto & Ruoranen, 2006).

The Advisory Committee on Measuring Innovation in the 21st Century Economy (2007) defines innovation as —the design, invention, development and/or implementation of new or altered products, services, processes, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm. Varkey, Horne and Bennet (2008) define innovation as the successful implementation of a novel idea in a way that creates compelling value for some or all of the stakeholders.

Omachonu and Einspruch (2010) define specific healthcare innovation as "*the introduction of a new concept, idea, service, process, or product aimed at improving treatment, diagnosis, education, outreach, prevention and research, and with the long term goals of improving quality, safety, outcomes, efficiency and costs."*. Innovations in health care are related to product, process, or structure (Varkey, Horne and Bennet, 2008). The product is what the customer pays for and typically consists of goods or services (for example, clinical procedure innovations). Process innovation entails innovations in the production or delivery method. According to Varkey, Horne and Bennet (2008), the customer does not usually pay directly for process, but process is required in order to deliver a product or service. A process innovation, therefore, would be a novel change to the act of producing or delivering the product that allows for a significant increase in the value delivered to one or more stakeholders. Structural innovation usually affects the internal and external infrastructure, and creates new business models.

The attitudes toward innovations in the healthcare sector, as in other industries, are in general, positive. However, healthcare innovations seem to represent a unique and rather complex case. Several researchers have suggested that it is difficult to change the behaviors of clinicians (Greco & Eisenberg, 1993), current medical practices, and healthcare organizations (Shortell, Bennett, & Byck, 1998). Innovations in patient care, treatment practices and hospital procedures may include significant health risks related to financial, social, and ethical issues (Faulkner & Kent, 2001). The adoption of healthcare innovations is often regulated by laws, making changes more laborious (Faulkner & Kent, 2001). Moreover, in healthcare organizations performance gaps, typical starting points of an innovation process, may lead to death, disability, or permanent discomfort. This, together with the clinicians' tendencies to protect their individual autonomy and reputation, can promote a culture of blame and secrecy that inhibits organizational learning and the generation of innovations (Huntington, Gilliam, & Rosen, 2000). Furthermore, in medicine new practices in patient care are traditionally examined thoroughly in their early development phases, so potentially harmful innovations are not adopted (Faulkner & Kent, 2001). Clinicians are, thus, familiar with experimental research methods feasible for clinical research.

Management of Portfolio

Verdonck, Klooster & Associates (2009) state Portfoliomanagement is a continuous process determining which set of projects make the biggest contribution to the company goals, considering new project ideas and ongoing projects alike. Dependent of these goals the Portfolio Manager sets up a guideline, subdividing projects based on their properties. This way it will be transparent what kind of projects are currently active and what kind of projects were carried out in the past. The Portfolio Manager can decide through this analysis what kind of projects get appointed in the future. This will prevent the company from focusing all resources on a certain domain, neglecting other domains. Knowing what is implemented and what is not will also encourage the recycling of IT. Management of Portfolio results in a balanced set of projects and dependencies.

In Portfoliomanagement the relevant domains of which the portfolio should exist must be defined. Because every organization has its own set of goals, every portfolio-classification is unique. However, some categories are present in almost every portfolio. After this every project can be categorized by assigning scores based on certain criteria, for instance matching organizational goals and the amount of risk. The project with the highest score in the domain will have the highest priority.

Software methodology

Waterfall software methodology

Huo, Verner, Zhu & Ali Babar (2004) state that the Waterfall model is the oldest software development process model. The model is suitable for both large and small software intensive projects but is especially successful for large and complex engineering projects. The Waterfall model divides the software development lifecycle into five linear stages. Any of these stages should not start until the previous stage has finished and the results are approved. The five stages of the Waterfall software methodology are:

1. requirements analysis and definition
2. system and software design
3. implementation and unit testing
4. integration and system testing
5. operation and maintenance

The main disadvantage of Waterfall software development is the inflexibility towards changing requirements. Besides this, Waterfall-based projects will always be highly ceremonious, regardless of the nature and size of the project. These disadvantages are also present in some of the other traditional development approaches. (Huo, Verner, Zhu & Ali Babar, 2004)

Agile Model

Garg (2009) describes Agile software development as a group of software development methodologies that are based on similar principles that allow rapid delivery of high-quality software in alignment with the customer needs. Development iterations, teamwork, collaboration and process adaptability are promoted in the Agile lifecycle. Instead of working with large increments with long-term planning, the Agile development uses small increments and minimal long-term planning: *"Each iteration is worked on by a team through a full software development cycle, including planning, requirements analysis, design, coding, unit testing, and acceptance testing. This helps to minimize the overall risk, and allows the project to adapt to changes more quickly. Team composition in an Agile project is usually cross-functional and self-organizing."* (Garg, 2009)

In comparison to the Waterfall software methodology the Agile software methodology delivers product releases in a much shorter period of time. The most notable techniques used with the Agile software methodology are:

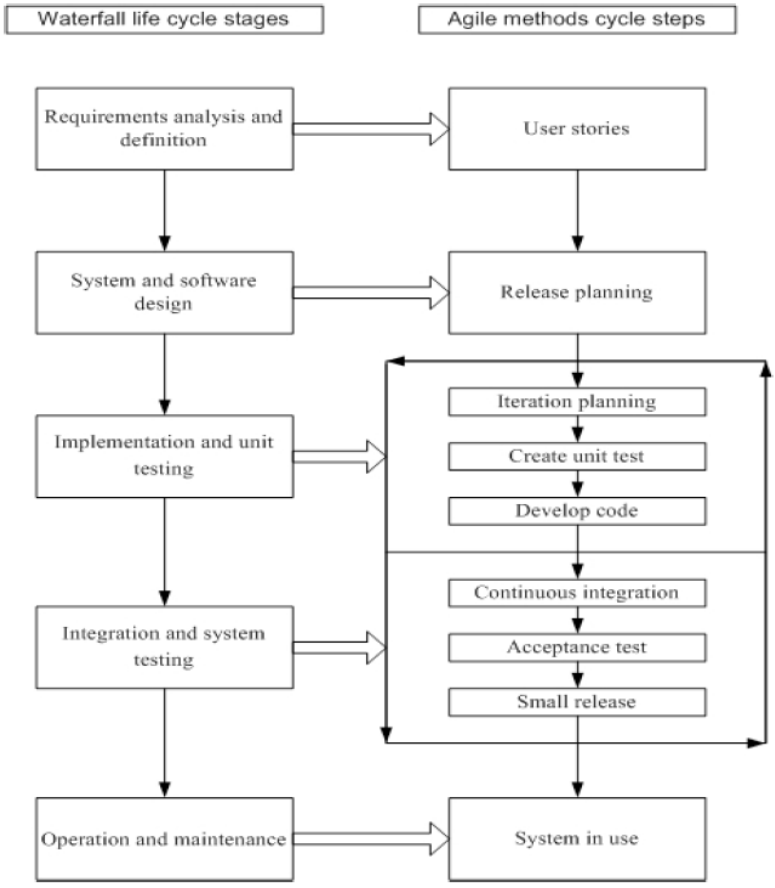
1. simple planning
2. short iteration
3. earlier release
4. frequent customer feedback

(Huo, Verner, Zhu & Ali Babar, 2004)

Agile vs. Waterfall

Figure 1 lists a short comparison between the Waterfall model and Agile methods. (Huo, Verner, Zhu & Ali Babar, 2004)

Figure 1



Pitfalls and success factors

Causes of troubled software projects in general

Project Management Solutions made a survey in 2011 regarding project recovery. PM Solutions has conducted this benchmark to help identify the factors that may lead to the development of strategies for successful project recovery. In this research PM Solutions also show common causes of troubled projects.

A common thread in addressing the major causes of troubled projects is the ability of the project manager to effectively deal with the following issues, mitigate some of the risk in these areas and be a strong enough leader to stand up to senior management or go to bat to manage expectations and resources. The top five causes of troubled projects were:

1. Requirements: Unclear, lack of agreement, lack of priority, contradictory, ambiguous, imprecise.
2. Resources: Lack of resources, resource conflicts, turnover of key resources, poor planning.
3. Schedules: Too tight, unrealistic, overly optimistic.
4. Planning: Based on insufficient data, missing items, insufficient details, poor estimates.
5. Risks: Unidentified or assumed, not managed.

Software methodology preference

In the presentation 'Agile - Waterfall - How to choose', the Project Management Institute of Northeast Ohio (2008) has made a distinction to show what situation favors what software methodology. They state the Agile software methodology is usually better for new concepts. Its strengths include flexibility, the prediction of all needs in advance being optional, better knowledge transfer, more team cohesion (although based on small teams) and the early recognition of potential design flaws. Waterfall is usually better for modifications to existing systems, building large scale items, and following a proof of concept or prototype. Its strengths include an easier gap analysis to potential changes (because of the level of documentation detail), better coordination of larger teams (even if they are geographically distributed) and being better suited for working within precise dollar budgets (Project Management Institute of Northeast Ohio, 2008).

The following six deliberations advice which software methodology is best for which situation:

1. If your client knows what they want in high detail Waterfall is preferred. If your client knows what they want in low to moderate detail Agile is preferred
2. A client who can be involved and is flexible on a low to moderate level favors Waterfall. A client who can be involved and is flexible on a moderate to high level favors Agile.
3. If a high level of documentation detail is required Waterfall is preferred. If a low level of documentation detail is required Agile is preferred.
4. If you do not have a lot of power to make decisions for the project Waterfall is preferred. If you do have a lot of power to make decisions for the project Agile is preferred
5. If a low amount of tracking, control and reporting is required Agile is preferred. If a high amount of tracking, control and reporting is required Waterfall is preferred.
6. If it is unlikely you will be able to change or modify the end product Waterfall is preferred. If it is likely you will be able to change or modify the end product Agile is preferred.

Innovation pitfalls

Kanter (2006) has made a summary of a collection of common innovation traps and how to avoid them. These traps are subdivided in four categories: strategy mistakes (hurdles too high, scope too narrow), process mistakes (controls too tight), structure mistakes (connections too loose, separations too sharp) and skills mistakes (leadership too weak, communication too poor).

Strategy mistakes

Executives often seek blockbuster innovations because of the potential for premium prices and high margins. This may cause for the rejection of opportunities for small innovations, while many small innovations combined can have the same impact as one big innovation.

Process mistakes

A second set of classic mistakes lies in process. Businesses often strangle innovation with tight controls. In the inherent uncertainty of the innovation process however, sidetracks and unexpected turns are inevitable, meaning the two do not fit together. Besides this companies often reward people for doing what they committed to do and discourage them from making changes as circumstances warrant.

Structure mistakes

Companies should be careful how to structure fledgling enterprises and the established business. While holding them to the same processes is dangerous, when people operate in silos companies may miss innovation opportunities altogether. Game-changing innovations often cut across established channels or combine elements of existing capacity in new ways. Companies should be wary for a culture clash between 'those who have all the fun' and 'those who make all the money'.

Skills mistakes

Top managers frequently put the best technical people in charge, not the best leaders. These technically oriented managers, in turn, mistakenly assume that ideas will speak for themselves if they are any good, so they neglect external communication. Even the most technical of innovations requires strong leaders with great relationship and communication skills.

Figure 2 shows a summary of the traps and their categories.

Figure 2

The Lessons of Innovation

Innovation goes in or out of fashion as a strategic driver of corporate growth, but with every wave of enthusiasm, executives make the same mistakes. Most of the time, they stumble in their R&D efforts because they are engaged in a difficult balancing act: They need to protect existing revenue streams while coaxing along new ones. But "corporate entrepreneurship" doesn't have to be an oxymoron. Innovation can flourish if executives heed business lessons from the past.

Strategy Lessons

- Not every innovation idea has to be a blockbuster. Sufficient numbers of small or incremental innovations can lead to big profits.
- Don't just focus on new product development: Transformative ideas can come from any function – for instance, marketing, production, finance, or distribution.
- Successful innovators use an "innovation pyramid," with several big bets at the top that get most of the investment; a portfolio of promising midrange ideas in test stage; and a broad base of early stage ideas or incremental innovations. Ideas and influence can flow up or down the pyramid.

Process Lessons

- Tight controls strangle innovation. The planning, budgeting, and reviews applied to existing businesses will squeeze the life out of an innovation effort.
- Companies should expect deviations from plan: If employees are rewarded simply for doing what they committed to do, rather than acting as circumstances would suggest, their employers will stifle and drive out innovation.

Structure Lessons

- While loosening formal controls, companies should tighten interpersonal connections between innovation efforts and the rest of the business.
- Game-changing innovations often cut across established channels or combine elements of existing capacity in new ways.
- If companies create two classes of corporate citizens – supplying the innovators with more perks, privileges, and prestige – those in the existing business will make every effort to crush the innovation.

Skills Lessons

- Even the most technical of innovations requires strong leaders with great relationship and communication skills.
- Members of successful innovation teams stick together through the development of an idea, even if the company's approach to career timing requires faster job rotation.
- Because innovations need connectors – people who know how to find partners in the mainstream business or outside world – they flourish in cultures that encourage collaboration.

Cooper's blockers and success factors

In 1999 Robert G. Cooper wrote an article in which he "*lowers the microscope on the state of product innovation... on the fact that product innovation does not happen as well as it should*". In his research he found common blockers of innovation and actionable critical success factors to ensure successful innovations. The blockers are potential reasons why innovation projects go wrong, take too long or are not carried out well. The success factors are common denominators of successful new product projects. The seven blockers are:

1. Ignorance: our people simply don't know what should be done in a well-executed project.
2. Lack of skills: we don't know how to do the key tasks - for example, the market research know-how and business analysis acumen are missing; and we often underestimate what's involved in these tasks.
3. Faulty or misapplied new product process: we have a process, but it doesn't work: it's missing key elements; it's laden with bureaucracy; and it's over applied.
4. Too confident: we already know the answers, so why do all this extra work?
5. A lack of discipline: no leadership.
6. Big hurry: we're in a rush, so we cut corners!
7. Too many projects and not enough resources: there's a lack of money and people to get the job done.

The eight success factors are:

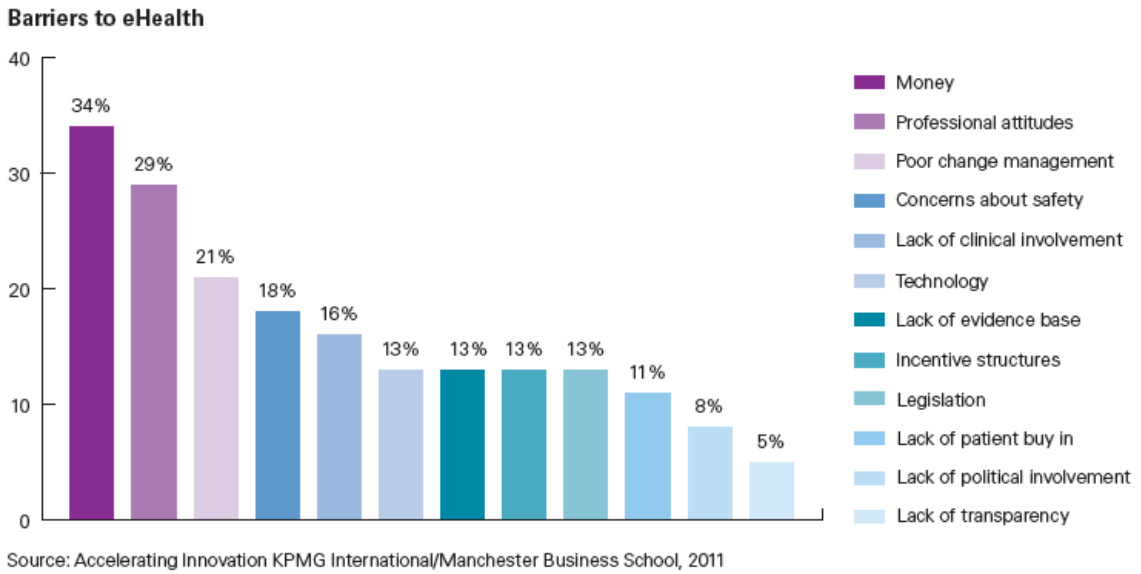
1. Solid up-front homework - to define the product and justify the project.
2. Voice of the customer - a slave-like dedication to the market and customer inputs throughout the project.
3. Product advantage - differentiated, unique benefits, superior value for the customer.
4. Sharp, stable, and early product definition - before development begins.
5. A well-planned, adequately resourced, and proficiently executed launch.
6. Tough go/kill decision points or gates - funnels, not tunnels.
7. Accountable, dedicated, supported cross-functional teams with strong leaders.
8. An international orientation - international teams, multi-country market research, and global or "glocal" products.

eHealth bottlenecks

In 2012 Ir. D.A.J. Dohmen attempted to make an optimal implementation model for the implementation of technology in healthcare at home. In this dissertation he also summarized and interpreted the top seven eHealth bottlenecks according the KPMG study 'Accelerating innovation: the power of the crowd'. Figure 3 shows a complete overview of the bottlenecks.

- Money (34%): eHealth doesn't get reimbursed or investments are too high to gain without a licensed payment structure.
- Professional attitude (29%): healthcare professionals have clinical objections against, or do not see the added value of eHealth.
- Poor change management (21%): implementation programs take too much time and are too much focused on technological implementation and too little on change management.
- Concerns about safety (18%): there are a lot of uncertainties in the field of security, in particular in the field of privacy and data-exchange.
- Lack of clinical involvement (16%): healthcare professionals are hardly involved in clinical arrangement, use and / or evaluation.
- Technology (13%): throughout the project technological problems occur, stopping future scaling and hurting trust in the application.
- Lack of evidence base (13%): there is hardly any scientific validation of the effects.

Figure 3



Source: Accelerating Innovation KPMG International/Manchester Business School, 2011

Method

In this research we have analyzed three different types of data from three different perspectives. This triangulation enhances the validity of the research. First of all we have collected the three sources: the description of Beter 2.0's process of implementing IT projects, three example documents of projects and interviews with five different stakeholders. Next we analysed the data using various indicators for pitfalls and success factors. With the obtained results we drew conclusions and answered the research question. Because the chosen indicators overlap the data analyses we will describe them before describing the actual analyses.

Indicators

In order to analyze the data we designed three different perspectives in attempt to reveal the root of the problems. The first perspective is the software engineering perspective, which is two-fold. On the one hand this perspective focuses on projects which failed in the past. If the causes of these failures are revealed a comparison can be made with the current projects by Beter 2.0 to determine possible similarities. If these are actually present we will know the problem lies with how Beter 2.0 implements their projects. The criteria required to make this comparison are selected in reference to the top five causes of troubled software projects according to PM Solutions Research (2011):

Nr	Indicator	Corresponds to pitfall
S1	Quality of requirements	Requirements: unclear, lack of agreement, lack of priority, contradictory, ambiguous, imprecise.
S2	Amount of resources	Resources: lack of resources, resource conflicts, turnover of key resources, poor planning.
S3	Quality of schedules	Schedules: too tight, unrealistic, overly optimistic.
S4	Quality of planning	Planning: based on insufficient data, missing items, insufficient details, poor estimates.
S5	Awareness of risks	Risks: Unidentified or assumed, not managed.

On the other hand the software engineering perspective focuses on the software development methodology used by Beter 2.0 and whether or not this is the best choice. For instance, if we see a Waterfall-like way of working while concluding an Agile approach suits better, this could be part of the problem. To determine whether or not the used development methodology is the best approach we used the following set of indicators, based on the presentation 'Agile - Waterfall - How to choose' (Project Management Institute of Northeast Ohio, 2008):

Nr	Indicator	Corresponds to consideration
S6	Amount of client knowledge	If your client knows what they want in high detail Waterfall is preferred. If your client knows what they want in low to moderate detail Agile is preferred
S7	Amount of client involvement	A client who can be involved and is flexible on a low to moderate level favors Waterfall. A client who can be involved and is flexible on a moderate to high level favors Agile.
S8	Level of documentation detail	If a high level of documentation detail is required Waterfall is preferred. If a low level of documentation detail is required Agile is preferred.
S9	Presence of power to make decisions	If you do not have a lot of power to make decisions for the project Waterfall is preferred. If you do have a lot of power to make decisions for the project Agile is preferred.

The second perspective is the innovation perspective. This perspective focuses on common troubles during the implementation of innovative projects. If these problems are recognized in Beter 2.0's implementation of innovative IT projects we will know the innovation component itself is one of the sources of the problems. In order to determine these common troubles we set up indicators based on 'Innovation: the classic traps' by Kanter (2006) and 'The invisible success factors in product innovation' by Cooper (1999):

Nr	Indicator	Corresponds to pitfall
I1	Magnitude of innovation	Not every innovation idea has to be a blockbuster. Sufficient numbers of small or incremental innovations can lead to big profits.
I2	Amount of control	Tight controls strangle innovation. The planning, budgeting, and reviews applied to existing businesses will squeeze the life out of an innovation effort.
I3	Acceptance of deviations	Companies should expect deviations from plan: If employees are rewarded simply for doing what they committed to do, rather than acting as circumstances would suggest, their employers will stifle and drive out
I4	Acceptance of innovation	While loosening formal controls, companies should tighten interpersonal connections between innovation efforts and the rest of the business.
I5	Amount of segmentation	Game-changing innovations often cut across established channels or combine elements of existing capacity in new ways.
I6	Quality of leadership	Even the most technical of innovations requires strong leaders with great relationship and communication skills.

Nr	Indicator	Corresponds to success factor
I7	Amount of preparations	Up-front homework pays off - to define the product and justify the project.
I8	Knowledge of customer desires	Build in the voice of the customer - a slave-like dedication to the market and customer inputs throughout the project.
I9	Quality of product definitions	Sharp, stable and early product definition before development begins.
I10	Presence of go/kill points	Build tough go/kill decision points into your process.
I11	Usage of Cross-functional project teams	Organize around true cross-functional project teams.

Nr	Indicator	Corresponds to blocker
I12	Amount of ignorance	Our people simply don't know what should be done in a well-executed project.
I13	Lack of skills	We don't know how to do the key tasks.
I14	Amount of bureaucracy	The process is too bureaucratic.
I15	Amount of self-confidence	We already know the answers.
I16	Lack of discipline	No 'pressure from above' to follow the complete process
I17	Amount of time pressure	In just too big a hurry
I18	Amount of budget	A lack of money and people to do the job

The third and last perspective is the health care perspective. Where the previous two perspectives are general for large companies this perspective focuses on specific aspects of health care. It is possible these aspects react to innovation in a unique way. These unique reactions are a potential source of health care specific problems. The presence of such problems indicates issues regarding the connection between innovative IT and the people working with it. The criteria to determine whether or not these specific health care problems occur are selected in reference to the top seven barriers of eHealth according to KPMG (2012):

Nr	**Indicator**	**Corresponds to barrier**
H1	Amount of investments	eHealth doesn't get reimbursed or investments are too high to gain without a licensed payment structure.
H2	Professional attitude	Healthcare professionals have clinical objections against, or do not see the added value of eHealth.
H3	Lack of change management	Implementation programs take too much time and are too much focused on technological implementation and too little on change management.
H4	Presence of safety concerns	There are a lot of uncertainties in the field of security, in particular in the field of privacy and data-exchange.
H5	Lack of clinical involvement	Healthcare professionals are hardly involved in clinical arrangement, use and / or evaluation
H6	Presence of technology problems	Throughout the project technological problems occur, stopping future scaling and hurting trust in the application.
H7	Lack of evidence base	There is hardly any scientific validation of the effects.

Process description

The summary of the implementation process of IT projects by Beter 2.0 describes the process from request to product. The primary source of this summary is the online wiki for Beter 2.0 employees. This wiki contains templates and explanations of the different steps, documents etcetera. However, the information on this wiki was outdated in some areas. This is why we planned informal interviews with the IT Portfolio Manager and the Senior Projectcontroller to update the info and to add an extra level of detail. Furthermore, the Senior Projectcontroller provided us with workflows of the different phases of the project implementations and templates of the documents referred to in the summary. This helped creating an as complete as possible summary of the implementation process. The analysis of this summary was done top-down. This means we analyzed the summary in order to find similarities between the text and the indicators of the pitfalls and success factors.

We used the indicators S1 to S5 to determine whether or not common pitfalls of troubled software projects are applicable to the implementation process. In the analysis of the description of the implementation process we scored these indicators based on the amount of control on these areas by Beter 2.0. For instance, if it is mandatory to include extensive risk management in the documents we grade the indicator *'Awareness of risks'* as 'high'. If Beter 2.0 does not monitor the planning of the project throughout the implementation process we will grade the indicator *'Quality of planning'* as 'low'.

Next we deduced what kind of methodology would be best for Beter 2.0 by using indicator S6 to S9. The description of the implementation process describes the different actions of the different stakeholders, on which we based the grades given to the indicators. For instance, by knowing the client needs to fill in an extensive Intake Form we could grade the indicator *'Amount of client knowledge'* as 'high'. Next we analysed what kind of methodology is used by Beter 2.0 to see if it corresponds findings based on the scores of indicator S6 to S9. This was the main focus of the analysis of the summary of the implementation process. Besides the software engineering perspective we analyzed the summary from the innovation perspective. We deemed indicators applicable if a corresponding aspect was mentioned in the description of the implementation process. Based on the content of the mentions we appropriately graded the associated indicator. For example, based on the extensive documentation, the review / approve rounds and the extensive planning of the implementation process we graded the indicator *'Amount of control'* as 'high'. We saw no added value in analyzing the text from the health care perspective because the indicators concern the content and attitude of health care professionals while the summary of the implementation process is purely regarding the way of working.

Example documents

The second data source contains three example documents of past IT projects provided by the Senior Projectcontroller. The first document is a Mandate Document of a project to enhance mobile non-Wifi communication. In this document the assignment gets defined, the possible solutions are listed, risks are listed etcetera. The second document is a Project Proposal of a project to realize speech recognition in the UMC. This document is an extension of the Mandate Document including an initial business case. The last document is a Project Initiation Document of a project to set up a new storage architecture. This document is basically the same as the Project Proposal but in greater detail. In this PID the project team will elaborate the assignment and the possible solutions for the problem, decide which solution will be implemented and define and plan the final product.

Because the example documents are in fact specific interpretations of the implementation process, the analyses of the two data types were similar. The analysis of the example documents was done top-down, the same as the previous analysis, only now regarding the content of the projects rather than Beter 2.0's way of working. The focus of the software engineering perspective was on the common troubles of software projects in general, unlike the focus on the used software methodology in the analysis of the implementation process. We graded the indicators based on the amount of attention that was given to the different aspects. Extensive attention granted a good score, negligence granted a bad score. For instance, if requirements meet the SMART criteria we grade the indicator *'Quality of requirements'* as 'high'. Most of the pitfalls and success factors of the innovation perspective were similar to the ones found in the analysis of the implementation process description, save for the specific content related indicators like possible ambiguity of the requirements. Again we saw no added value in analyzing the documents from the health care perspective because of the indicators being regarding the content and attitude of health care professionals while the example documents focus purely on the content of the project itself.

Stakeholder interviews

The last data source consists of interviews with five different stakeholders. Although the stakeholders' functions vary, they are all customer of Beter 2.0 and active in health care innovation. This is the reason why Beter 2.0's IT Portfolio Manager selected these specific stakeholders for interviews. The purpose of these interviews was to get a clear image of what the stakeholders think the nature and cause of the problems and struggles regarding implementing innovative IT projects are. In preparation for the interviews we had an informal meeting with one of the stakeholders to get an indication of the nature of the struggles. On the basis of this information we conducted desk research to find the indicators for common pitfalls and success factors regarding the three perspectives.

For the actual interviews we planned one hour, including introduction and explanation of the purpose prior to the interview itself. Because the nature and cause of the problems and struggles were still unclear (in fact, it was the sole purpose of these interviews to actually reveal them) it was hard to ask specific question regarding these problems. This is why we asked open and general questions like "Can you please tell us something regarding ...". We did prepare some questions based on the common pitfalls and success factors to encourage the subjects to complement their story (like "And what about communication?"), but these were purely meant as guidelines: the main part of the interview consisted of responding to what the subject said and asking supplementary questions based on this information in attempt to expose all the facets of the stakeholder's opinion. This way, instead of just answering question the stakeholders gave us an extensive sketch of the situation from their point of view. With the explicit approval of the subject we recorded the interview with an audio recorder. This way we could transcribe the interviews into easy analyzable text documents. We saved the audio files for future replaying or possible validation of the transcription and analysis.

After transcribing the interviews to text we boiled the opinions down to a set of standardized opinions, making a bottom-up grounded theory analysis. For this we used Gate Developer, a tool to create different coloured tags to assign to pieces of text. Every piece of text containing an opinion was tagged with an already existing matching tag (from one of the preceding interviews) or with a newly created tag (if the opinions did not match one of the already existing tags). An example of such tags is 'Communication: be open to other people's problems'. The standardizing of the opinions reduced the ambiguity of the opinions, allowing us to compare the opinions of the different stakeholders with each other.

We processed the set of standardized opinions in an excel document. In this document we ordered the opinions in four different ways. First of all we noted how many different stakeholders hold a certain opinion. We for instance noted that four of the five stakeholders think the innovations should be 'more from the patient perspective instead of from the technology perspective'. On the other hand only one of the stakeholders thought there was a 'lack of strong leadership'. This does not has to mean the second opinion is less true than the first one (because four stakeholders hold the first opinion and only one holds the second), but it does show the level of agreement per opinion.

The opinions were also ordered based on the time they represent in the implementation process: before, during, after or throughout the whole implementation. This way we can see if one period of time in the implementation process contains more problems than another. Besides this the opinions were ordered to show if the problem is specific for a domain (for instance specific for health care organizations) and to categorize the opinions (for instance the category 'Too structured' contains 'not enough freedom' and 'not enough budget'). These divisions are made to keep a clear picture of the opinions and associated properties.

In the analysis of the stakeholder interviews we focused on the opinions of the stakeholders regarding these aspects. If they ventilate certain opinions corresponding to the indicators we appropriately graded that associated indicator. For instance, if a stakeholder says 'there are just too many rules to follow', we can grade indicator *'Amount of bureaucracy'* as 'high'. It often occurred the stakeholders' opinions covered more than one indicator. For example we take the opinion 'There has to be a balance between creativity and structure'. We can link this opinion to the following indicators:

- Amount of control
- Acceptance of deviations
- Amount of bureaucracy

This way we were able to conclude what success factors and/or pitfalls occur during the implementation according to the stakeholders of the innovation projects. All perspectives proved applicable to the analysis of the transcribed interviews.

Results

Process description analysis

Software engineering perspective

Troubled software projects in general

Quality of requirements. Unclear, contradictory, ambiguous and imprecise requirements with a lack of agreement and priority prove to be the main cause for failing software projects in general. Project Control strictly monitors documents like the Project Proposal on readability, clearness, quality etcetera. Potential causes for the number one pitfall will be spotted in an early stage, preventing it from actually taking place. Therefore, this pitfall does not apply for the Beter 2.0 way of working.

Amount of resources. The most common problem regarding this area is a lack of resources. Beter 2.0 is especially established for the implementation of IT projects and Portfolio Management manages everything regarding time, staff and budget. Another problem covered by this pitfall is poor planning. Just like a lack of resources, poor planning gets prevented by the extensive documentation of the process. The Intake Form for instance covers the need of resources at an early stage (Portfolio Management checks this for feasibility) and the Project Initiation Document contains an extensive planning of the different phases. Because of this we can conclude these problems do not occur.

Quality of schedules and planning. Schedules are possibly too tight, unrealistic or overly optimistic because they are based on insufficient data, missing items, insufficient details and/or poor estimates. These problems are possible but unlikely in Beter 2.0's way of working. Because documents like the Project Initiation Document get reviewed by Project Control, stakeholders, Portfolio Management etcetera, the schedules are realistic and thought-out. If the planning does prove to be unrealistic it will show in the Progress Reports, after which it will be adjusted via a Deviation Report. In other words, there is only a small chance of scheduling- and planning problems and Beter 2.0 is flexible enough to solve these if they do occur.

Awareness of risks. The lack of identifying and managing risks proves problematic in an implementation process. Every document of Beter 2.0's implementation process covers risk management. The risks are mentioned and measures are clarified in case they do occur. These risks and measures also get evaluated by the steering committee among others. Because of this we conclude the last pitfall does not occur.

Software development methodology

Beter 2.0's implementation process clearly shows Waterfall-based influences. The five distinct linear stages - *1. requirements analysis and definition 2. system and software design 3. implementation and unit testing 4. integration and system testing 5. operation and maintenance* (Huo, Verner, Zhu & Ali Babar, 2004) - are recognizable in the current way of working. Any of these stages should not start until the previous has finished and the results from the previous stage are approved. The most notable indicators of the Agile software methodology are not present in the process. We see extensive planning, long iterations, one big final release and only moderate customer feedback. These indicators are the contrary of the Agile indicators: simple planning, short iteration, earlier release and frequent customer feedback (Huo, Verner, Zhu & Ali Babar, 2004). The only Agile influence shown is the Deviation Report: a way to fall back to adjust the requirements and all associated matters. Besides this we can conclude the Beter 2.0 implementation process is predominantly Waterfall-based. Based on the four software engineering indicators we can determine if the implementation of IT projects by Beter 2.0 favors the Waterfall development strategy or the Agile development strategy.

Amount of client knowledge. Since it is the client's task to fill in the extensive Intake Form we can state the client does know in detail what they want the project to look like. This may however vary per client. Of course it is also disputable if the vision of the client is the best way to go. It is common for clients to stare blindly at their solution while their problem will be much better solved by another solution. We will score it high, which means the situation favors the Waterfall methodology.

Amount of client involvement. The client makes a request by filling in the Intake Form, can review (and if necessary comment on) the Project Proposal and the Project Initiation Document and finally test the product through the User Acceptation Test. However, this indicator does not aim at how flexible and involved the client is, but how flexible and involved the client can be. Through the stakeholder interviews we learned the client certainly is prepared to be involved and flexible. Higher client involvement seems not necessary however: the highly detailed intake form combined with the ability to review the Project Proposal and the Project Initiation Document seems sufficient for the project team. We do have to take in account any possible informal meetings with the client. The possibility of the client to be involved and flexible is moderate to high, which means the situation favors the Agile methodology.

Level of documentation detail. Because of the large range of health care laws and regulations it is necessary to keep extensive documentation. Besides this it is desirable to keep structured and extensive documentation because of the Management of Portfolio principle. Besides the regular documents like the Project Proposal and the Project Initiation Document occasional matters need to get documented too, for example the Deviation Report and the monthly Progress Report. Because of this we can conclude that a high level of documentation is required which favors the Waterfall methodology.

Presence of power to make decisions. During the stakeholder interviews we learned there is a lot of freedom regarding decision making throughout the project. However, every change in the implementation process needs to be approved by a number of different committees (Steering Committee, Program Management etcetera). In other words there is in fact a lot of freedom, but it is controlled and monitored nonetheless. Therefore we score it low to moderate, favoring the Waterfall methodology.

Innovation perspective

Not all of the innovation perspective's pitfalls and success factors are applicable to the analysis of the implementation process description. Some of the pitfalls and success factors concern the content of innovations and not the process of innovations (which is the focus of this analysis). Only the pitfalls and success factors regarding the process of innovations will be treated in this analysis.

Amount of control. Tight controls are clearly present in the implementation process, for example the extensive documentation, the review / approve rounds and the extensive planning. According to this pitfall these tight controls can have a negative influence on innovation.

Acceptance of deviation. Deviations are possible in the implementation process but they will always be controlled and reviewed through a Deviation Report. These controlled deviations are however not the kind of deviations meant in the associated pitfall. The lack of deviation expectation suggests a negative effect on implementing innovations.

Amount of segmentation. We do see signs of segmentation in Beter 2.0's way of working. An innovative idea will always sprout from a single department of the medical centre (in the form of an Intake Form), for instance gynecology or geriatrics. The option to make a request through a collaboration of different departments seems not present, retaining the ability to cut across established channels.

Amount of preparations. From the very first document, the Intake Form, the details are very extensive. Besides trivial information like name of the applicant and the actual topic, the applicant needs to fill in specific information like motivation, goals and a small cost-benefit analysis. This level of details continues throughout the rest of the documents, proving Beter 2.0 meets this success factor.

Knowledge of customer desires. There are some measures for the client to give feedback (review rounds, User Acceptation Test etcetera), but not enough to call them 'a slave-like dedication to the market and customer inputs'. As concluded before there is only moderate client involvement in the implementation process.

Quality of product definitions. Sharp, stable and early product definition should be defined before development begins. The process analysis is not suitable for the analysis of the sharpness and stableness of the product definitions, but is suitable for analyzing how early these definitions get defined. The Project Proposal and all subsequent documents have a product definition. Because the Project Proposal is the first document after deciding which of the several possible solutions will become the final product, this is the first document in which it is actually possible to state the product definitions. This means Beter 2.0 defines the product definition as soon as possible.

Presence of go/kill points. Beter 2.0's PRINCE2-like implementation process has a minimum of two phases: the initiation phase (phase 0) and every subsequent phase (phase 1 to N, where N is whatever number is necessary). This design is made in order to have frequent evaluations (after every phase) to decide if the team continues working on the project or not (for whatever reason). This means the implementation process meets this success factor for innovation. We do however know the killing of projects after one of the phase evaluations very rarely happens. Beter 2.0 wants this to happen more often where necessary and is working on this, but it is still uncommon to kill a running project. The first steps to this success factor are detectable but the success factor is still not fully met.

Amount of ignorance and lack of skills. These indicators are not at issue seeing as none of the other, non-innovation IT projects show any trace of them. This proves these two blockers do not apply on the implementation process.

Amount of bureaucracy. This indicator does show in the analysis of the description of the implementation process. Coherent with earlier mentioned tight controls (for example the extensive documentation, the review / approve rounds and the extensive planning) we can determine the process is fairly bureaucratic. It is disputable when the process becomes 'too bureaucratic' and having a negative effect on innovations.

Amount of confidence is an indicator regarding the content of the projects and therefore not suitable for this analysis.

Lack of discipline is not at issue, again because none of the other, non-innovation IT projects show any trace of this blocker, proving it does not apply on the implementation process. Besides this leadership is clearly present in the implementation process (there's a project leader who is responsible for documents, review rounds etcetera).

Amount of time pressure. Beter 2.0's projects are divided in N stages. Seeing as one of the N phases can range from a week to nine months and N is whatever number is necessary, the project is finished when it is actually finished and no sooner. This means the amount of time pressure is low.

Amount of budget is regarding the content of the projects and therefore not suitable for this analysis.

Documentation analysis

Some of the indicators found while analyzing the example documents coincide with the ones found analyzing the description of the implementation process. In this analysis only the additional indicators will be handled.

Quality of requirements. Project Control strictly monitors documents like the Project Proposal on readability, clearness, quality etcetera. Potential causes problems regarding this indicator will be spotted in an early stage, preventing it from actually taking place. This can be confirmed by the example PID. Following is an example of these requirements:

> *Huidige gebruikers van IntraSpeech (digitaal dicteren) kunnen met de invoering van werkplek 2.0 op 1-8-2013 gebruik blijven maken van een digitaal-dicteer oplossing. Deze oplossing zal per 27-1-2014 worden uitgefaseerd.*

The requirement is clear, unambiguous and precise with its SMART-like notation. We can conclude the pitfall is not at issue for this reason, backed up by the conclusion of the process description analysis. There is however a lack of structure in the documents regarding requirements. The requirements become clear throughout the document in general and in chapters like 'Doelstellingen' and 'Productomschrijving' but the documents lack a specific chapter 'Requirements' with a structured list of all the requirements. In other words, the requirements are clear but not structured. We do not think this is one of the factors causing trouble though, because the review rounds prove everyone agrees the requirements are clear. It is a point for improvement however.

Amount of resources. Costs and benefits are monitored in the three documents. Every subsequent document increases in extensiveness, the Mandate Document being the least extensive and the Project Initiation Document being the most extensive. Seeing as the documents give an image of how many resources are needed and these documents get approved, we can conclude there is a sufficient amount of resources to cover the projects. However, there was no progress report available to actually confirm this.

Quality of schedules and planning. All example documents contain an extensive planning. The Mandate Document and the Project Proposal Document contain the start- and end dates of the sub deadlines of Phase 0. The Project Initiation Document also contains the start- and end dates of the sub deadlines of the subsequent phases. However, these two indicators concern the quality regarding the content of the planning. Because of the lack of a progress report it is impossible to check the planning of the documents on these criteria.

Awareness of risks. Risk management is present in the three documents. Again, every subsequent document increases in extensiveness, the Mandate Document being the least extensive and the Project Initiation Document being the most extensive. Both the Project Proposal Document and the Project Initiation Document contain risk management including:

1. Type of risk (organization, project or phase),
2. Chance of occurring (low or high)
3. Impact (low or high)
4. Priority (chance of occurring times impact)
5. Conclusion (accept, avoid, reduce or transfer)
6. Measure for this risk.

Following is an example risk from the Project Proposal Document:

T[1]	Risico	K[2]	I[3]	P[4]	C[5]	Maatregelen
P	Integratie van Pathologie in Epic is naar alle waarschijnlijkheid niet mogelijk voor livegang plateau 1, meeliften op Radiologie integratie dus ook niet	2	1	2	A	Alternatief scenario wordt aangehouden voor PA.

Because of this extensive approach we graded this indicator as high.

Quality of product definitions. In the process description analysis we concluded the product definitions are defined as soon as possible. The process description analysis proved not suitable for the analysis of the sharpness and stableness of the product definitions however. The analysis of the example documentation does proof suitable of the analysis of the sharpness and stableness of the product definitions. Analyzing the example Project Proposal we do see the products mentioned but not very extensive. The 'what' of the product gets defined stable and sharp (for instance '*In Epic geïmplementeerde spraakherkenning voor Radiologie en Nucleaire Geneeskunde*'), but nothing is said about how it will be realized and what the product consists of. The documents are indeed sharp and stable but it could be more extensive.

Amount of self-confidence. These documents only show the results of the implementation process, not if these results actually meet the wish of the customer. However, we can imply these two meet because the customer can review (and if necessary comment on) the Project Proposal and the Project Initiation Document and finally test the product through the User Acceptation Test. It is possible the wishes of the customer (i.e. the physician) do not match the actual wishes of the patient (because the physicians think "we already know the answers" or "we already know the wishes of the patient"). As stated before this would not show in these documents.

Amount of budget. Because these example documents are regarding non-innovative IT projects they are not suitable to conclude whether there is a lack of money and people to do the job. This blocker can only be identified by either documentation of an innovative IT project or by having insight in the UMC's policy regarding innovation. Looking at the other analyses we have no reason to believe this blocker is at issue though, but it is impossible to substantiate this through these documents.

Interview analysis

The transcriptions of the stakeholder interviews were analyzed by assigning tags to sections of text. Corresponding opinions of the stakeholders were given the same tag. This way, the stakeholders' opinions were boiled down to a set of 41 different standardised opinions. These opinions were processed in a document to show how many times they occur and what pitfalls and success factors could be recognized in a structural way:

Mening	Komt voor:	Troubled Software Projects	Agile vs. Waterfall	Innovation	Cooper's Succes Factors	Cooper's Blockers	eHealth
Creativiteit vs. Structuur	4		S8	I2, I3		I14	
Niet vanuit patiënt gedacht	4	S1			I7, I8	I15	
Artsen zijn terughoudend	3		S7				H3
Diffusion of innovation (Rogers)	3						
Medische wereld is terughoudend	3						H3
Paradigma-shift IT afdeling	3						
Te weinig draagvlak	3						H3
Arts denkt voor de patiënt	2	S1			I7, I8	I15	
Artsen prefereren voorspelbaarheid	2		S7		I9		H3, H4

With this structural summary we could describe the results extensively.

Software engineering perspective

Troubled software projects in general

Quality of requirements. The main issue regarding this indicator is the lack of the patient's involvement. To overcome the future shortage of workforce in the health care sector an optimal balance between what patients want and actually can do should be found. According to the stakeholders this balance is not realized yet in the Dutch health care sector. This is because the health care professionals think to know what the patient wants and therefore makes decisions in their name. In many cases 'what the health care professional thinks the patient wants' and 'what the patient actually wants' does not match though:

> *"En dan hebben ze een mooi ding liggen en dan vragen we "ja maar wat vindt de patiënt daarvan?" en dan kijken ze ons vragend aan. "Dat weten wij wel" zeggen ze dan. "Ja dat weten we dat jullie dat denken" zeggen wij dan, "maar weten jullie het ook écht?". Dus dan schrijven wij op wat de professional dénkt wat er aan de hand is, en dan gaan we naar de patiënt toe, vragen we het ze nog een keer, dan leggen we die twee dingen naast elkaar en dan beginnen mensen met een brok in hun keel te praten: "maar dat wisten we helemaal niet!""*

This is problematic for the acceptation of innovative eHealth products by the patient, because the product does not matches the patient's desires. We learned this also affects the implementation process itself. Through the stakeholder interviews we came to know some people anticipate on these struggles to get the discussion going to identify what is the actual root of the problems. They do not want to patch up the problems right away, they want to maintain the struggles until the actual cause of these struggles are identified. This way the cause of the struggle can be fixed instead of struggle itself. These discussions often show the current way of working has a technology driven approach ('what is technically possible?') instead of a patient driven approach ('what does the patient actually want?').

Amount of resources. We determined conflicting opinions in the stakeholder interviews. Some stakeholders state there is a sufficient amount of budget and people assigned to the implementation of innovation. They say the board of directors have a very positive attitude towards innovation and provide enough budget and freedom to make it happen. However, other stakeholders state there is in fact too little budget to properly implement innovations.

Quality of schedules and planning. These specific indicators did not show in the analysis, but we did determine similar problems in this area. Some of the stakeholders believe you should not over-plan innovative projects. You should work in a dynamic, flexible way where you should try to implement in small steps instead of in one giant leap. Because the outcome of innovations are unpredictable and challenging (Gourville, 2005) you should explore what catches on and what does not by making small steps towards an innovative product.

Software development methodology

The stakeholders seem to disagree with the used software development methodology. They do not disagree with the Waterfall based software methodology chosen for the current way of working per se, but they do suggest certain changes in the implementation process causing a way of working favouring Agile based methodology.

Amount of client involvement. The stakeholders state the wrong client gets involved in the implementation process: in the current way of working the healthcare professional gets involved while the patient should be involved instead. Besides this, the implementation process should be more flexible and dynamic. This approach favours the Agile methodology.

Level of documentation detail. We also determined the stakeholders think the level of documentation detail should be lower. The implementation plan should define the direction of the project goal instead of the goal itself. This approach favours the Agile methodology.

Presence of power to make decisions. The stakeholders state employees do have enough freedom to make their own decisions but it is uncontrolled and vague. This causes the employees to not fully optimize the freedom's potential. If they could predicate their actions on a certain framework within this freedom the potential could be fully optimized. The optimization of the power to make decisions prefers the Agile methodology.

Innovation perspective

Magnitude of innovation. As mentioned above some stakeholders have indeed the opinion that you should work in a dynamic, flexible way where you should try to implement in small steps instead of in one giant leap:

> *"Ik denk dat de grote kracht zit in veel kleine innovaties die dezelfde kant op gaan. Veel speedboatjes in plaats van één grote olietanker. Dat je niet te veel moet plannen maar gewoon aan de slag moet gaan met kleine projecten, ik denk dat dat het beste is. Als de richting maar gedragen wordt."*

Amount of control. The stakeholders identified the battle of creativity versus structure. In this battle you can see two extremities: the centralized approach and the decentralized approach. The centralized approach is where one group of people decide the rules and the way of working. Everybody can do their job provided they follow these rules and way of working, but because of this it often becomes very cumbersome and bureaucratic. The decentralized approach is where for instance every department can make their own rules without the need of following the rules and way of working of other departments, making it very loose and uncontrolled. As some stakeholders state, you cannot chose one of the two as 'the best choice': both sides have advantages and disadvantages. The centralized approach is very structured and enhances the connections between different systems. It can however have a negative influence on innovations:

> *"Dus als je zegt 'oh ik heb ineens een idee, zo en zo kan het', dan zou je eigenlijk acuut ergens binnen moeten lopen en zeggen 'goh is er iemand die er mee kan denken' en dan moet je de opportunity nemen om daar iets moois van te maken. En als je dan eerst alle formulieren moet invullen en alles moet kloppen en dan moet er budget voor zijn en het moet goedgekeurd zijn door en het moet passen in het plan. Dan ben je vaak weer zo veel verder dat de energie alweer uit het plan is."*

This problem will not occur with the decentralized approach. With this approach you will not have the cumbersome rules and dependencies which have a negative influence on innovation. The downside of the decentralized approach is the lack of structure and connectivity between the different systems, causing a proliferation of systems not communicating with each other:

> *"En dan, dat heb je ook in zo'n instelling, dan zegt iedere afdeling 'ja, dat is mooi, daar wil ik heel graag aan meewerken, maar alleen als jullie mijn model kiezen. Want dat ben ik gewend, dat hebben ze in Zwitserland ook en daar doen wij zaken mee'. En na afloop van overleggen heb je nog steeds twaalf systemen lopen die niet met elkaar praten, niks met elkaar doen en waardoor je een aantal dingen gewoon niet kunt."*

Most of the stakeholders simply do not know what is the best approach. One of the interviewees did have a clear vision of this however, combining the two approaches:

"Of course you need some centralized basics. There has to be only one authentication protocol for instance, which is a centralized approach. However, everything not included in these basics should be 'loosened', so doctors can fill in these matters by themselves. Off course you need frameworks for these matters, but they should be more vague. Think of it as making a pizza: doctors should get provided with a pizza bottom and different kinds of toppings. It is mandatory to use the pizza bottom as a base (like the authentication protocol and other centralized basics) but you can decide for yourself which toppings you use, how much, in what order etcetera. If after a certain amount of time it shows that everybody wants tomato sauce on their pizza you can include it to the bottom. Of course you need to define what is bottom and what is topping really precise. The current way of working has way too much pizza bottom and way too few toppings: you can't innovate with pizza bottoms."

Acceptance of deviations. Related to this we learned it is usually unacceptable to fail in Dutch companies in general:

"[…] maar Nederland kent niet zo'n cultuur dat mislukte innovaties ook successen zijn, en innovaties mislukken nu eenmaal vaak. Ze staan er dan als de kippen bij om te wijzen dat het niet geslaagd is. Dat is in Amerika heel anders, daar mag je mislukken, sterker nog daar is het goed als je een paar keer mislukt bent, dat heb je in ieder geval ondernomen."

This factor is also present in the following opinion of one of the stakeholders:

"Hierbij speelt prestatiedrang ook een grote rol. Succes wordt beloond terwijl je van falen juist heel veel kunt leren. Deze prestatiedrang betekent echter dat onderzoekers óók de gebaande paden gaan bewandelen, en dit staat haaks tegenover innovatie."

Acceptance of innovation. Most of the stakeholders agree with the idea that innovation should not be something on the side which you do because it must be done. It should be part of the regular business instead. In the current way of working it is not part of the regular business which means if something goes wrong, like an unforeseen lack of budget, first thing getting cut down is innovation. If it becomes part of the regular business it will not be seen as 'something fun to do because we can' anymore but as vital for the company.

Amount of segmentation. One of the stakeholders identifies a high amount of segmentation in the following quote:

"En nu wordt er nog heel veel vanuit specialisme en vanuit afdelingen en vanuit hokjes gedacht… Dus ik denk dat afdelingen een autonomie hebben dat is ingezet, maar dat zorgt er ook voor dat je muurtjes gaat optrekken. Een innovatie wordt juist gekenmerkt door het ontbréken van muurtjes en door een vrij speelveld waarin dingen kunnen gebeuren [...]Het Beter 2.0 programma zit in een eigen gebouw met open workspaces waar mensen elkaar heel erg makkelijk kunnen ontmoeten. Dat draagt bij aan innovatie. Dus je moet mensen denk ik ook weghalen uit hun vertrouwde omgeving, bewust in een andere omgeving zetten, een andere setting, anders aansturen, meer ondersteunend, meer randvoorwaarden creërend. En dat is natuurlijk anders dan in het dagelijkse werk waarin wordt gestreefd naar voorspelbaarheid."

Quality of leadership. Most opinions regarding this indicator were not about leadership directly, but focused more on the communication part of this area. One of the stakeholders did however state there is a lack of leadership regarding the guidance of the process. There is a lack of evaluation of the process steps and often a project gets rushed to a start when the process has not been thought through completely. The other opinions confirm communication is an important part of the success of innovations. It is very important you can convey enthusiasm to your colleagues and being open to other people's problems:

> *"Ik denk dus dat ook tijdens het proces er niet actief geluisterd wordt naar 'wat willen ze me nu eigenlijk zeggen?'. Ik ben hier op de afdeling gekomen en daar liepen ook een aantal innovaties. Als je niet waardevrij bereid bent om te luisteren naar wat mensen je proberen te zeggen over wat er fout gaat dan gaan ze wel in de onderstroom tegenhangen. Dat win je dus nooit."*

Amount of preparations and knowledge of the customer desires. The opinions regarding these indicators only show the discussion of technology driven approach versus patient driven approach in these factors which is already covered in the software engineering perspective.

Quality of product definitions. On this area the stakeholders disagree with the indicators. The success factor states you should define *'sharp, stable and early product definition before development begins'*. The stakeholders state this is actually what happens: doctors are reticent, stuck in their own way of working, not open to new methods, the kind of people who prefer predictability. This notion gets supported by Greco & Eisenberg (1993), Shortell, Bennett, & Byck (1998). This is why everything is indeed defined sharp and stable at an early state. However, the stakeholders think this is the wrong approach. Innovation is something you should not over-plan and should not define sharp and stable at an early stage because it can behave very unpredictable. When you do try to make it predictable you kill the creativity and hence the success of the innovation. One of the stakeholders even stated you should not define the goal of the project but the direction of the goal in order to make little steps towards a desirable end product, constantly changing and improving the product to match the patient's desires.

Amount of bureaucracy. This refers to the earlier mentioned battle between creativity and structure.

Amount of self-confidence. This corresponds with the health care professionals incorrectly thinking to know what the patient wants and therefore making decisions in their name, covered in the software engineering perspective.

Lack of discipline. This is also already covered in the analysis of the implementation process.

Health care perspective

Amount of investments. On this subject the stakeholders have opposite views. Some stakeholders state there is a sufficient amount of budget and people assigned to the implementation of innovation. They say the board of directors have a very positive attitude towards innovation and provide enough budget and freedom to make it happen. However, other stakeholders state there is in fact too little budget to meet the high investments and properly implement innovations.

Professional attitude. Through the stakeholder interviews we learned health care professionals want to protect the privacy of the consulting room.

> *"Als wij bijvoorbeeld zeggen dat we man-power te kort krijgen, dat we meer met tele-medicine gaan doen, dan verstoort dat de arts-patiënt-relatie. Wat zij alleen maar zien is dat ze minder uren contact met de patiënt zullen krijgen, zien niet het grote plaatje dat op een gegeven moment, vanwege de man-power zal het schip toch gaat keren, dus ze zullen verzet voeren: "mijn patiënten hebben de behoefte om mij te zien, en hoe kan ik dat nou via een schermpje doen?"."*

A lot of physicians see the privacy of the consulting room as one of the most important parts of their job. Because innovations regarding the labor shortage harms this intimacy (for instance with telemedicine instead of examination on site) most physicians will oppose these innovations. This opposing attitude can cause a lot of struggles. We also recognize this lack of flexibility in the next pitfall concerning change management. The projects are too much focused on technological implementation and too little on change management, causing inflexibility:

> *"Maar ik geloof dus dat je gaandeweg moet kunnen bijstellen, dat je adaptief moet kunnen zijn, dat je goed contact moet kunnen houden met je doelgroep: waar doe ik het voor? Dat was voorheen ook niet altijd, he... Dat je moet kunnen leven met onvoorspelbaarheid. En dat je ook vooral aan de gang moet gaan. Gaandeweg merk je dan 'hé, dit werkt niet en dit werkt wel'. Dus ook veel doen. Ik geloof dus niet in een maakbare wereld in dat opzicht. Maar ik geloof wel in een maakbaar innovatieproces."*

Lack of change management. This again shows the technology driven approach (‘what is technically possible?’) instead of a patient driven approach (‘what does the patient actually want?’).

Lack of clinical involvement. The stakeholders believe it is very important you can convey enthusiasm to your colleagues and to be open to other people's problems, as already concluded in the innovation perspective.

Summary

The following table shows what indicators where recognized as either occurring or detectably not occurring during the analysis of the three data types. The indicators not recognized were left blank.

		Process description	Documentation	Interviews
Software engineering	**Quality of requirements**	High	High but unstructured	High quality but not based on patient's desires
	Amount of resources	High	High	Conflicting opinions
	Quality of schedules	High	Quality N/A, extensive	Planning too tight
	Quality of planning	High	Quality N/A, extensive	Planning too tight
	Awareness of risks	High	High	
	Amount of client knowledge	High		
	Amount of client involvement	Moderate/High		High, but wrong client involved and it should be more flexible
	Level of documentation detail	High		Too high
	Presence of power to make decisions	Low/Moderate		High but too loose
Innovation	**Magnitude of innovation**			Too large
	Amount of control	High	High	High
	Acceptance of deviations	Low		Low
	Acceptance of innovation			Low
	Amount of segmentation	Moderate/High		High
	Quality of leadership			Too little communication and guidance of the process
	Amount of preparations	High	High	High
	Knowledge of customer desires	Moderate		Desires of patient should be known
	Quality of product definitions	Quality N/A, defined early	Quality N/A, defined early	Too high and over-planned
	Presence of go/kill points	Low		
	Usage of Cross-functional project teams			
	Amount of ignorance	Low	Low	
	Lack of skills	Low	Low	
	Amount of bureaucracy	High	High	High
	Amount of confidence			Too high
	Lack of discipline	Low		Too little communication and guidance of the process
	Amount of time pressure	Low		
	Amount of budget			
Health care	**Amount of investments**			Conflicting opinions
	Professional attitude			Too reticent
	Lack of change management			High
	Presence of safety concerns			
	Lack of clinical involvement			High
	Presence of technology problems			
	Lack of evidence base			

Conclusion

The main question of this research is:

What is the nature and cause of the problems that occur with the implementation of innovative IT projects by Beter 2.0?

In order to answer this question we looked at the following sub questions:

- *What problems are determined from a software engineering perspective?*
- *What problems are determined from an innovation perspective?*
- *What problems are determined from a health care perspective?*

After analyzing the three different data sources through the three different analyses different possible causes of the problems occurring at the implementation of innovative IT projects by Beter 2.0 were determined. We have also learned what common pitfalls are not the cause of these problems and what success factors are already applied in the process. There are a lot of nuances among the possible causes, so we will not mention all of them in this conclusion.

Software engineering perspective

Beter 2.0's implementation process clearly shows Waterfall-based influences. Three of the four software development indicators state the current implementation process indeed does favor the Waterfall method. Only one of the four indicators suggests the Agile development method would be better. The stakeholders do not fully agree however. They do not disagree with the Waterfall based software methodology chosen for the current way of working per se, but they do suggest certain changes in the implementation process causing a way of working favouring Agile based methodology. The desire of using an Agile way of working while maintaining a Waterfall way of working can be the cause of some problems.

One of the main causes of the problems as seen from the software engineering perspective is the technology driven approach of innovations. Most innovations are from the technology perspective: 'what can we make with new technologies to help patients?'. This way, instead of implementing something matching the patient's desires, the patients get forced to use something which does not match their desires. This is why the projects should have a more patient driven approach. If you actively involve the patient in the innovation process you will know exactly what the patient's desires are, favoring the success of the project. UMC St. Radboud is already working on this but it can still be improved.

Innovation perspective

The main cause of the problems we recognized from the innovation perspective is the balance between creativity and structure. If the company emphasizes more on creativity innovation will not be restrained by the lack of tight controls and regulations. However, this results in an uncontrolled and loose way of working with incoherent systems and a lack of collaboration between different departments. If the company emphasizes more on structure the systems will be coherent and controlled, encouraging collaboration between these different systems and between different departments. This can however result in a cumbersome and bureaucratic way of working, which is discouraging for innovation. It is possible the momentum of the innovation gets nipped in the bud because of this structural approach. We see Beter 2.0's way of working emphasizes more on structure which can be one of the possible causes of the running struggles.

Another possible cause of the problems is Rogers' Diffusion of Innovation (1962). As the theory states, at first only the innovators will pick up the innovation, rest of the population will only give resistance. In the course of time the rest of the population will also accept the innovation, so in the end the problem (the resistance of the population) solves itself. The only thing you can do is accept the resistance, be open to other people's problems and try to convey enthusiasm to your colleagues in order to let the innovation survive. UMC St. Radboud can work on these measures to ease the process, but can obviously not take any other actions to completely solve these struggles.

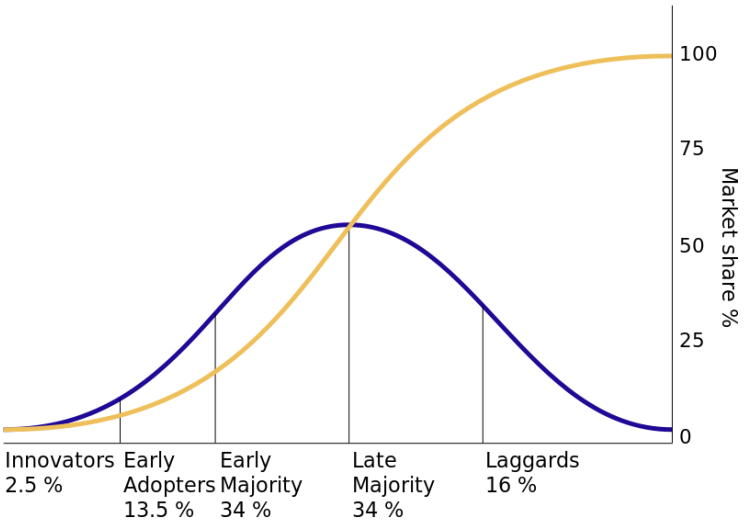
Health care perspective

From the last perspective we have seen some specific health care issues. First of all we have learned health care professionals are a reticent people. Most of these professionals see the intimacy and privacy of the patient-physician relationship as the most important part of their job. Because they do not see the future problems regarding labor shortage they will only see innovations like telemedicine as a threat to this patient-physician relationship. This opposing attitude can cause a lot of struggles. Until they will understand the innovations are vital for the medical centre's future these struggles will continue to exist. This is why innovation should not be seen like something 'nice on the side' but as part of the organization's standard pursuits. We see UMC St. Radboud is working on this but it is still far from optimal.

As mentioned above innovations also often do not match the desires of the patient. One of the reasons is health care professionals often being wrong when they claim to know what the patient's desires are. Patients tend to refrain from complaining during a consult and therefore not tell what they really want and how they really want it, meaning the health care professional's vision is based on wrong or incomplete assumptions. In other words, if the patients are not involved in the innovation the implemented products will not meet the patients' wishes. Evaluative discussion groups can be a good start to get a clear view of the patients' desires. In these discussion groups the health care professionals listen but are not allowed to respond. UMC St. Radboud is improving in this area but this too is still far from optimal.

Discussion

Some of the stakeholder opinions did not correspond with the predetermined pitfalls and success factors. These opinions can be interpreted by means of literature regarding other insights.



Some stakeholders blamed the classic Diffusion of Innovation theory by Rogers (1962) for the problems occurring with the implementation of innovations. This theory states how new ideas and technologies get picked up by a population. The people in the small group picking up the innovation are called the innovators. This small group can feel resistance from the people who do not support the innovation. If the innovators survive these oppositions the innovation can catch on, get accepted by the early adopters and eventually by the whole population. The implementation of innovations works the same way: the innovators receive a lot of resistance, but if they manage to survive this resistance the innovation can bloom and get accepted by every department of the medical centre. Because of this some stakeholders state you just cannot do anything against these struggles: it has always been this way and it will always be like this.

Besides this we also learned a possible cause specific for the Radboud UMC. With the start of Beter 2.0 the paradigm of the IT department changed radically. Before the establishment of Programma Beter 2.0 health care professionals had the power: they gave the IT department an assignment and after a certain amount of time it was done. In other words: the health care professionals had the power to decide what the IT department should and should not make. With the coming of Beter 2.0 this changed. Now the health care professional can only request new products or services while Beter 2.0 actually decides (according to the Management of Portfolio principle) what the IT department should and should not make. Some of the current struggles are possibly caused by the health care professionals who still need to get used to not calling the shots anymore. This would mean that in time some of these struggles should solve themselves.

Four of the predetermined indicators did not show in any of the data sources. The first indicator is *usage of cross-functional project teams*. This indicator probably did not show because it concerns the actual skills of the project teams. These skills are impossible to identify through the description of the implementation process or the example documents, and did not belong to the scope of the stakeholder interviews. *Presence of safety concerns* did not show either. A possible reason for the lack of problems in this area is the special attention the Radboud University pays to cyber security. Third is *presence of technology problems*. We could not determine what was the reason this indicator did not show during the research. Last is *lack of evidence base*. Problems regarding scientific validation of the effects are probably non-existent simply because the Radboud University is a research university, already anticipating on these matters. Besides these reasons, a possible reason applicable to all four of these indicators not shown is it just was not mentioned during the interviews. The limited time per interview could be the cause of incompleteness in the results.

Because of the magnitude of the research no validity- and reliability tests have been conducted. The next step is conducting these tests to rule out subjectivity regarding interpretation, preference and vision of the analyst. An inter-observer reliability test could be executed to guarantee validity and reliability of this research. In such a test a second analyst performs the same analysis as described in this research on parts of the three different types of data. Comparing the two analyses with each other will show the percentage of inter-observer reliability with which can be concluded whether or not the research is viable and reliable. Although this research lacks this kind of validation, a certain level of validity is reached through the triangulation of the research. While some results were contradictory, others were confirmed by the remaining data resources.

The research is based on a set of viable indicators referring to viable pitfalls and success factors. However, there are numerous more pitfalls and success factors to be found. It is impossible to prove a change of pitfalls and success factors has no effect on the outcome of the research. If this change does have effect on the outcome it could imply subjectivity of the used perspectives. In order to prove this is not the case the data should be analyzed using different pitfalls and success factors. If this does not affect the outcome of the research we can prove it is objective.

To complete this research more interviews could be performed and more areas of the implementation process could be covered. Besides this the influence of the background of the stakeholders could be investigated. In the current research, instead of selecting different stakeholders from the different areas of the implementation process we selected five of the stakeholders most involved with UMC St. Radboud's innovation of health care. Because most of the five stakeholders were from the same area of the implementation process the data retrieved from the interviews can be subjective. Through informal meetings and conversations we learned stakeholders from different areas of the implementation process do have a different view on the problems occurring than the stakeholders interviewed in this research. In future research all areas of the implementation process should be included. Besides this it will be desirable to expand the number of example documents to analyze. In this research three documents of non-innovative IT projects were analyzed while it will be more accurate to have documents of both innovative and non-innovative IT projects in order to find potential differences.

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Appendix

Beter 2.0 process description

Intake Form

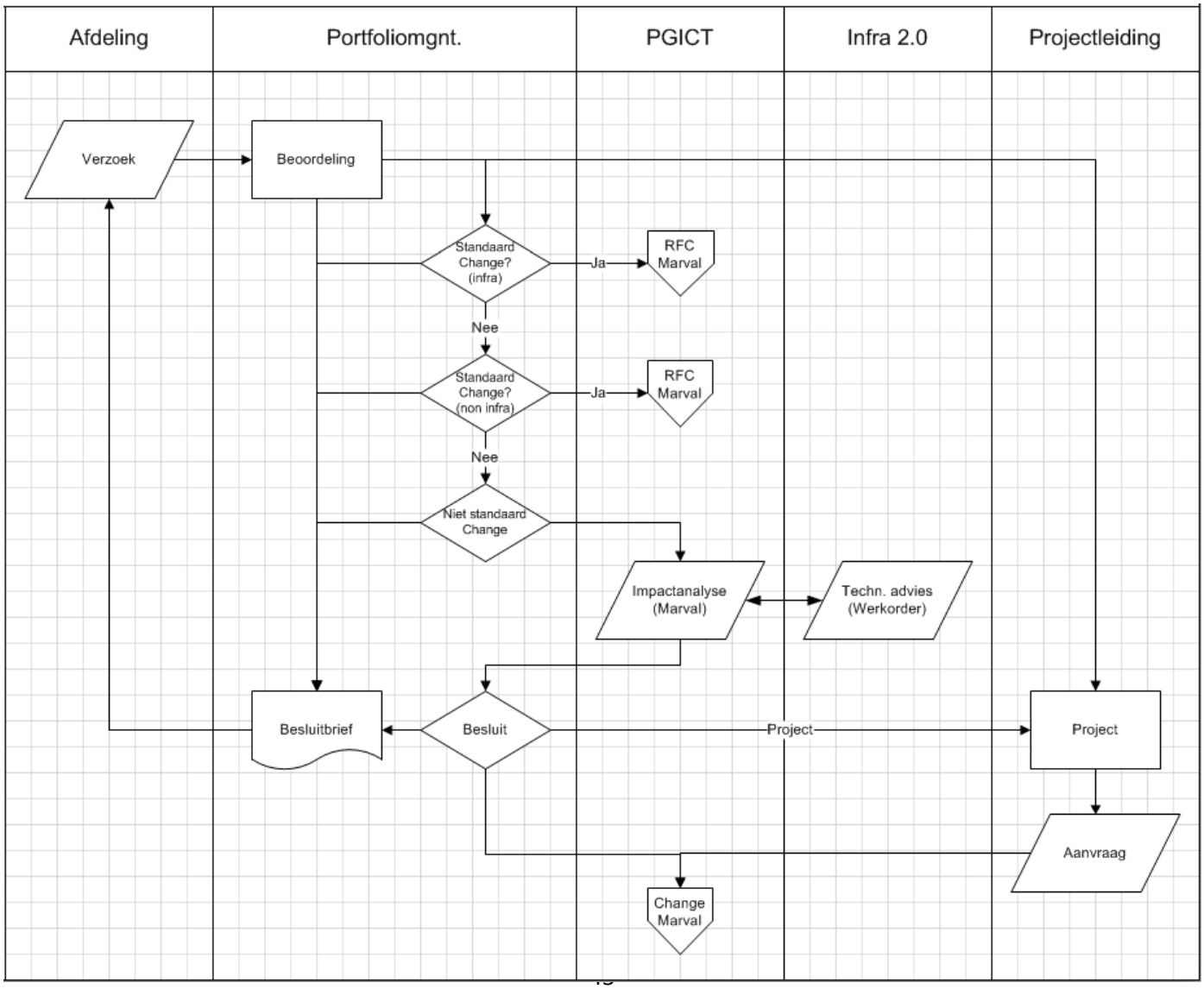
Beter 2.0 is responsible for satisfying the needs of the departments of the Radboud UMC in the field of IT. To obtain a clear image of these needs, Beter 2.0 has created an online platform for requests. With the consent of the head of the department, staff members can fill in an Intake Form to request a change in the digital workplace. This can range from purchasing a new printer for the department to for instance the realization of speech recognition. To get a clear image of the problem, the Intake Form is made fairly extensive. Besides trivial information like name of the applicant and the actual topic, the applicant needs to fill in specific information like motivation, goals and a small cost-benefit analysis. Portfolio Management reviews the form for policy and project criteria as well as ambiguity of the problem. Besides this it will get a check if it meets the SMART criteria. The problem has to be very clear before any actions will be taken. By investing time in clearly formulating the problem, matching the problem with different kinds of solutions and mapping the consequences of the implementation, time is saved with the execution of the project. Furthermore, the chance of setbacks in projects is reduced and the investment of this extra time doesn't compare to the extra costs of a thoughtless solution.

After the review Portfolio Management will advice the program director of Beter 2.0 in deciding whether the Intake Form meets the requirements above. Portfolio Management will also decide if the problem can be solved by already present technology or if it's necessary to make a new product. If the problem can be solved by already present technology (i.e. the problem can be solved with an either domain-based or non-domain-based standard change) Portfolio Management will ask the management organization 'Productgroep ICT' (or short PGICT) to realize this change without setting up a new project. If the problem isn't considered a standard change, Portfolio Management will initiate an Impact Analysis which will be carried out by the Management Organization. Based on this document, Portfolio Management will decide if the problem shall be realized through a project (If the request will take more than a certain amount of turnaround time, more than a certain amount of money and/or a new product is needed to solve the problem) or through a non-standard change (i.e. not via a project). Of course the program director can also decide to deny or delay the request. If a request scores on one of the following so-called Knock-out Criteria it will automatically get rejected:

- Doesn't meet new law and regulations
- Doesn't meet the architectural reference
- Functionality already existing in current IT systems
- Functionality already existing in new EHR
- Alternative without the use of IT present
- High risk
- Not described in UMC-templates (request, Intake Form etc.)

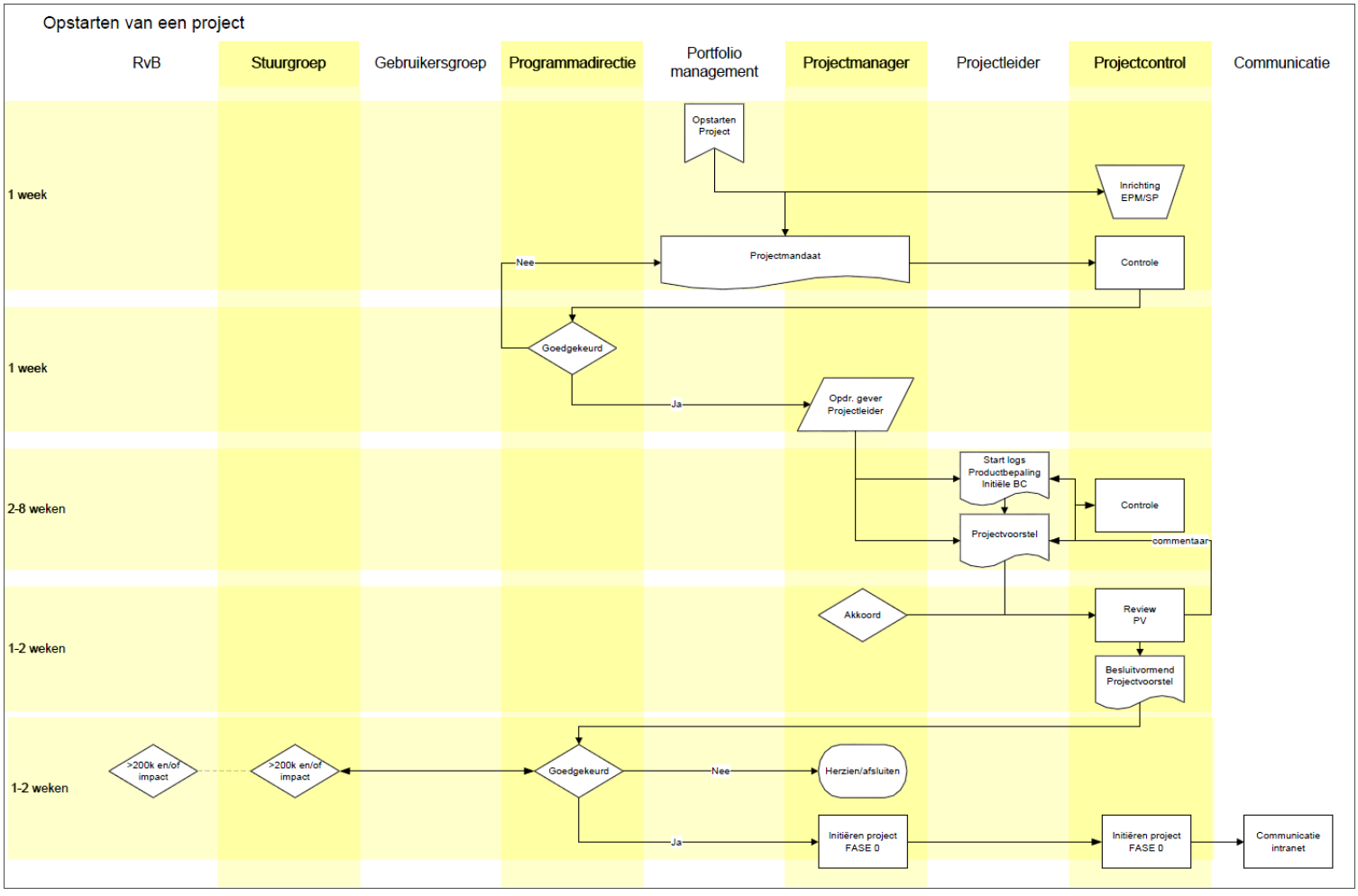
In order to determine the priority of the upcoming project, Portfolio Management will score the request according to the following criteria. The higher the request scores, the higher the priority.

- Contribute to convergence and consolidation
- Financial cover by departments is present
- Implementation is provided
- Knowledge and skills present
- Minimal risk
- Not present in new EHR and no alternative available
- Meets new law and regulations
- Supports innovation
- Gets realized six months or more before the new EHR
- UMC-wide functionality
- Enhances business significantly
- Enhances patient security significantly
- Diminishes (the complexity of) management
- Meets new norms of IGZ
- Preparation for new EHR.



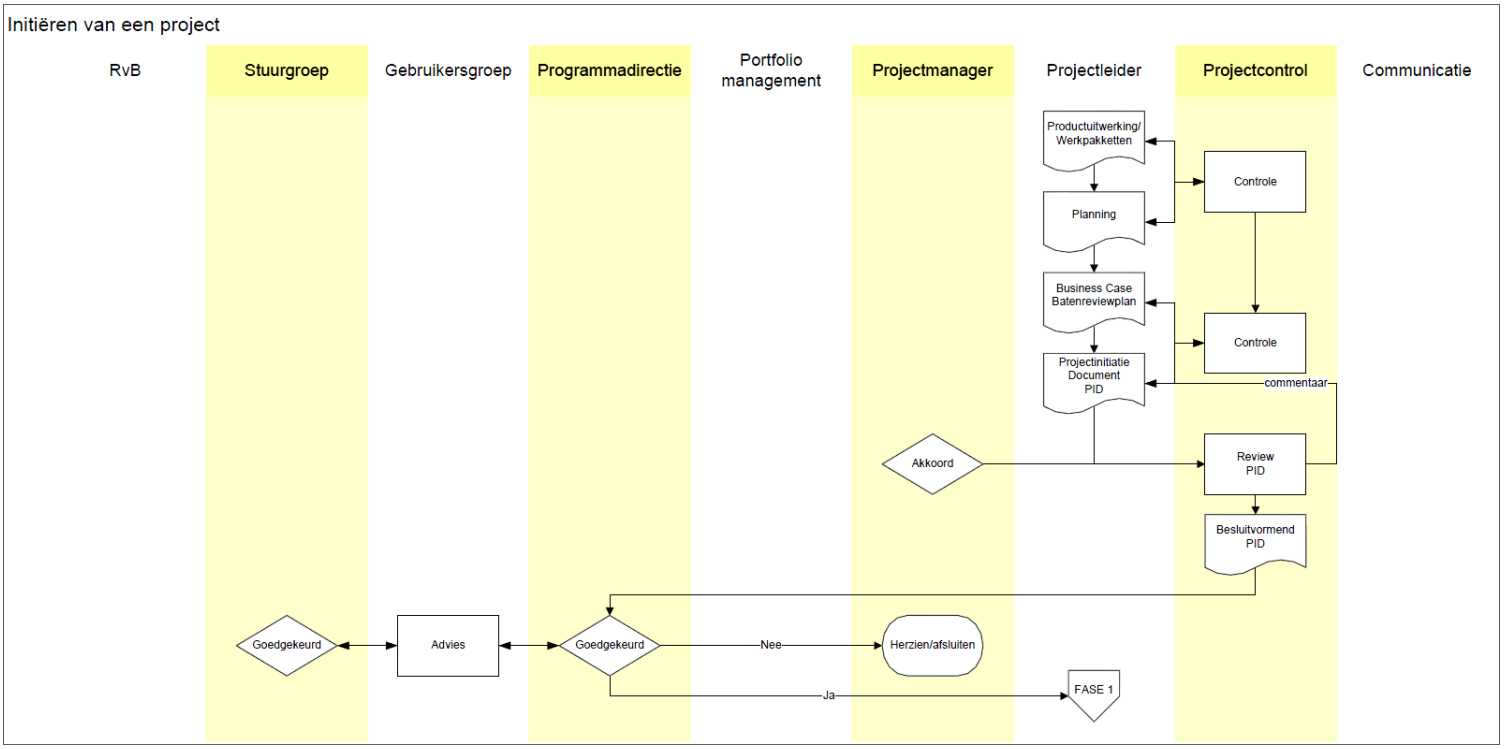
Mandate Document

If Portfolio Management has decided to start a project to realize the request, Project Control will trigger some practical issues like arranging an EPM environment (which is basically a server-based tool to manage projects) and classifying the project to one of the four domains of Beter 2.0. After this Portfolio Management will set up the Mandate Document in consultation with the project manager of the concerning domain. In this document the assignment gets defined, the possible solutions are listed, risks are listed etcetera. The document will be reviewed by Project Control to check if it's clear enough. Project Control will pass the document to Program Management if necessary and the project manager will assign the client and the project leader. This project leader will make preparations for the project by making a Project Proposal including an initial business case. Keeping logs is not mandatory but it is desirable. The Project Proposal gets reviewed by Project Control to see if it contains all the mandatory aspects and meets the quality standard. After this review the proposal can be reviewed by everyone having inside knowledge of the project like the security officer, the management organization, the client etcetera. This is their own responsibility: they can review the proposal for two weeks. The project leader can either adjust the proposal according to the comments or clarify the ambiguities. If the project leader made a lot of adjustments he can request a new review round. If everything is clear the proposal will be presented to Program Management for approval. The steering committee and the board of directors need to approve too if the project will have a big impact on the organization. If Program Management doesn't approve the proposal it will either get fully revised or canceled. If the proposal does get approved the project can be initiated. Based on the PRINCE2 way of working, the project will be divided in phases: phase 0 (the initiation phase), phase 1 (the implementation phase) and if necessary phase N (i.e. phase 2, 3, 4 etcetera, whatever number is required). These phases can vary from one week to nine months. The purpose of these phases is to have regular go/no go evaluations (after every phase).

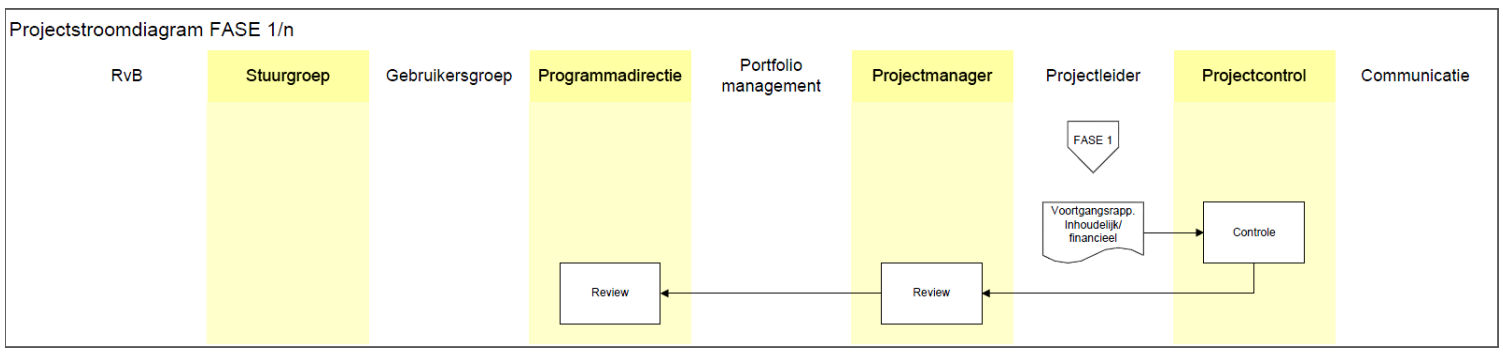


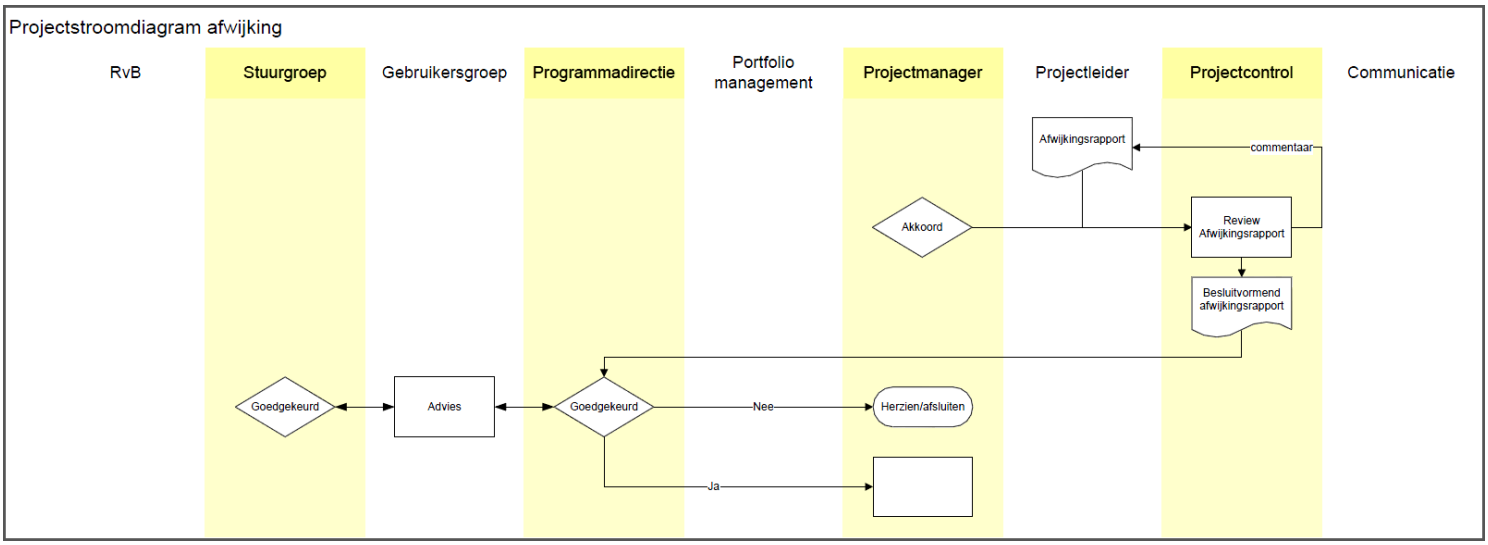
Project Initiation Document

During the initiation phase the Project Initiation Document, or PID, will be made. The PID is basically the same as the Project Proposal but in greater detail. In this PID the project team will elaborate the assignment and the possible solutions for the problem, decide which solution will be implemented and define and plan the final product. This final product usually consists of a number of smaller product. Think of the final product as a house and the smaller products as the foundation, walls, windows etcetera. Realizing each of these smaller products (for instance building up the foundation or placing the windows) is one of the N phases. Furthermore, each product will be planned, the business case will be elaborated, a benefit review plan will be included (describing how the benefits will be realized). The PID gets reviewed just like the Project Proposal and if it gets approved the team can launch phase 1.



Phase 1 and every subsequent phase are basically the same: carrying out the project plan according to the planning in the PID and making a monthly progress report regarding the content. This progress report shows the state of the products, if the team realized the milestones, what went wrong etcetera. This is the project leader's own responsibility and it has to be controllable to be as transparent as possible. Financial Control will make the financial progress report. These reports are sent to Program Management to evaluate. If this evaluation shows a deviation compared to the original project plan (for instance a scope change or a big change in planning) a Deviation Report needs to be created to reveal these changes. This report gets processed just like the Project Proposal and the PID and will become part of the PID when approved.





When the product is finished the project team will test the new product to see if it meets all the demands. If the team agrees the functionality of the product matches the requirements the client will also be able to test it (the so called User Acceptation Test). If the client also agrees the Management Organization will make a planning for the implementation. This planning will take into account what departments will be affected by the implementation to prevent problems at for instance the OR or Intensive Care. After the implementation the product gets registered at the Configuration Management Database, or CMDB, containing all components of the information systems and technology. After making the end reports the product has become part of the hospitals portfolio and will be taken into account when new requests are made.

Results stakeholder interviews

Total scores

Mening	Komt voor:	Troubled Software Projects	Agile vs. Waterfall	Innovation	Cooper's Succes Factors	Cooper's Blockers	eHealth
Creativiteit vs. Structuur	4		S8	I2, I3		I14	
Niet vanuit patiënt gedacht	4	S1			I7, I8	I15	
Artsen zijn terughoudend	3		S7				H3
Diffusion of innovation (Rogers)	3						
Innovatie moet in staande overlegstructuur verweven zitten	3			I4			H3
Medische wereld is terughoudend	3						H3
Paradigma-shift IT afdeling	3						
Te weinig draagvlak	3						H3
Arts denkt voor de patiënt	2	S1			I7, I8	I15	
Artsen prefereren voorspelbaarheid	2		S7		I9		H3, H4
Co-creatie	2						
Communicatie: actief luisteren / openstaan voor problemen van anderen	2			I6			H5
Dynamischer / flexibeler te werk gaan	2	S3	S7	I2, I3		I14	H3
IT afdeling is terughoudend	2						
Je mag niet mislukken	2			I3			
Je moet enthousiasme kunnen overbrengen naar anderen	2			I6			

Marktwerking gezondheidszorg	2				I7		
Minder plannen, je kunt niet alle wedstrijden winnen	2	S3, S4		I2, I3			
Nieuwe dingen in plaats van oude	2						
Te weinig budget	2	S2		I2		I18	H1
Verkokering	2			I5			
Als je wil overleven moet je innoveren	1						
Artsen beschermen intimiteit spreekkamer	1					I15	H2
Discussie op gang brengen om wensen helder te krijgen	1	S1			I7, I8		
Er moet een optimale balans zijn tussen wat patiënten willen en kunnen	1	S1			I7, I8		
Genoeg vrijheid maar kaders onduidelijk	1		S9	I2, I3			
Implementatieplan zou richting doel ipv doel zelf moeten bevatten	1		S8		I9		
IT afdeling: we hebben nu veel minder beheerders nodig dan vroeger	1						
Je kunt beter kort cyclisch werken	1						
Klant onvoldoende betrokken	1	S1	S7		I7, I8	I15	
Leiderschap / begeleiden proces mist	1			I6		I16	
Managers zijn terughoudend	1						
Meer ervaringen uitwisselen	1						

Minder hiërarchisch, meer organisch: specifiek voor grote organisaties in het tijdperk waarin we leven	1			I2, I3, I4		I14	
Minder plannen, meer uitproberen in kleine stapjes	1	S3, S4		I2, I3			
Niet teveel beloven	1						
Overgangen lopen altijd stroef	1						
Sommige dingen zijn niet te veranderen	1						
Te veel dingen in één systeem willen hebben	1						
Veel kleine innovaties i.p.v. weinig grote	1			I1			
Wrijving geeft glans', hoeft niet helemaal opgelost te worden	1						

Time of occurrence

Voor implementatie
Creativiteit vs. Structuur
Niet vanuit patiënt gedacht
Artsen zijn terughoudend
Medische wereld is terughoudend
Te weinig draagvlak
Arts denkt voor de patiënt
Artsen prefereren voorspelbaarheid
IT afdeling is terughoudend
Minder plannen, je kunt niet alle wedstrijden winnen
Te weinig budget
Artsen beschermen intimiteit spreekkamer
Implementatieplan zou richting doel ipv doel zelf moeten bevatten
Managers zijn terughoudend
Minder plannen, meer uitproberen in kleine stapjes
Te veel dingen in één systeem willen hebben

Voor / tijdens implementatie
Communicatie: actief luisteren / openstaan voor problemen van anderen
Je moet enthousiasme kunnen overbrengen naar anderen
Klant onvoldoende betrokken
Niet teveel beloven

Tijdens implementatie
Leiderschap / begeleiden proces mist

Gehele proces
Diffusion of innovation (Rogers)
Innovatie moet in staande overlegstructuur verweven zitten
Paradigma-shift IT afdeling
Dynamischer / flexibeler te werk gaan
Je mag niet mislukken
Marktwerking gezondheidszorg
Nieuwe dingen in plaats van oude
Verkokering
Co-creatie
Genoeg vrijheid maar kaders onduidelijk
Minder hiërarchisch, meer organisch: specifiek voor grote organisaties in het tijdperk waarin we leven
Overgangen lopen altijd stroef
Sommige dingen zijn niet te veranderen
Je kunt beter kort cyclisch werken
Als je wil overleven moet je innoveren
Discussie op gang brengen om wensen helder te krijgen
Er moet een optimale balans zijn tussen wat patiënten willen en kunnen
IT afdeling: we hebben nu veel minder beheerders nodig dan vroeger
Meer ervaringen uitwisselen
Veel kleine innovaties i.p.v. weinig grote
Wrijving geeft glans', hoeft niet helemaal opgelost te worden