

Towards Fast and Engaging Health Care Innovation by Desgin

Master Thesis

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Master Thesis
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04-06-2021
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Acknowledgements

This thesis marks the completion of a seven-year journey at the faculty of Industrial Design Engineering at the Delft University of Technology.

I remember my physics teacher almost fainting when I told him I was going to study in Delft, but here I am, with a clear view of the finish line. What an incredible experience it has been, both at the university and outside of the university. I have had so many amazing opportunities and experiences but sadly have to say goodbye to life as a student.

This project has asked a lot of me but has been one of the biggest learning experiences so far. It taught me many things about innovation in general and the innovation process but especially about what it takes to bring change to a large organization.

First of all, I want to thank my supervisory team for making this project possible. Frido, although I did not always understand what exactly you were trying to tell me, I enjoyed every single conversation with you. You are an inspirational person with extensive knowledge on the topic of organizational innovation. I am really glad you were my supervising professor, and I could not have done it without your support.

Carlijn, I want to thank you for being available 24/7, no matter the topic of my question. You have helped me a lot in processing the gigantic amount of information by helping me to keep structuring my thoughts. It was a blessing having you as my mentor, and I really enjoyed the, sometimes unexpected, presence of your newborn son.

Rob, since our first call, we have had a great connection. Maybe it is because we both really like board games, or maybe it is because we like to challenge each other in the discussion

on the topic of innovation. You have opened many doors for me within the organization, and you contributed a great deal to the result of this project.

Mark, although our agendas did not offer us the possibility to talk to each other a lot, we must not forget that you were one of the biggest supporters of this project from the beginning. Thanks for giving me the opportunity to work on this project.

Second of all, I would like to thank my family and friends for supporting and motivating me. There are some people I would like to thank in particular.

I want to start by expressing my gratitude towards my parents. Dad, you meant a great deal in reading my thesis over and over again. Mom, you took great care of me and provided us with the most delicious and nutritious meals so I could go on four hours during the final round. Thanks a lot for all the support and being able to stay with you for two weeks straight.

I also would like to thank my girlfriend for listening to my exhausting stories and always helping me to relativize and see the sunny side of each setback. I love you Bé!

At last, I want to say thanks to my roommates. Tijmen, it was a delight to share our frustrations about graduating from your bedroom. Good luck on finalizing your thesis while I am out enjoying the sun. Lars, I can not imagine what it must have been like, living together with two people graduating. Somehow you managed to listen to all of our stories and were able to make us laugh on stormy days.

It has been a blast! Thanks again everyone, we will keep in touch.

Executive summary

This report describes a graduation project for the MSc Program Strategic Product Design. The client of this project is a University Medical Centre in the Netherlands. Due to privacy, the client is referred to as: “the Dutch UMC.”

The Dutch UMC wants to become an innovating leader in health care but faces many problems during the act of innovation. Because the organization is struggling to locate, describe and tackle the encountered problems, a research project was set up to provide the organization with new tools to properly organize innovation. Therefore, the research question of this project is defined as: “how can the Dutch UMC realize innovation?”.

This research resulted in defining seven problem areas which, each in their own way, have a negative impact on the innovation process. The shared cause for the defined problems is a defect in the current innovation process. Cooper

(1993) divides the innovation process into six stages. When comparing these stages to the current process within the Dutch UMC, it becomes visible how the first three stages are neglected or skipped. These early stages of the innovation process are also referred to as the pre-development stages or the fuzzy front end (Hestatt and Verworn, 2004).

Apart from sharing this insight with the organization, an innovation framework was created to organize the front end of the innovation process. This framework is based on design thinking, which is proposed as the most suitable method for non-design organizations to structure the front end of innovation.

The framework delivers the required input to start the conversation on re-organizing innovation and start a transformation towards fast and engaging health care innovation by design.

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INTRODUCTION

introduction to the research project

0. INTRODUCTION

This is a graduation report of the faculty of Industrial Design Engineering within the Delft University of Technology. In this introduction, the organization, problem context, and project approach will be elaborated on.

0.1 Organization

This project has been conducted on behalf of one of the University Medical Centres within the Netherlands. Due to privacy issues, the organization will from now on be referred to as: “the Dutch UMC.”

Internationally seen, UMC’s are unique collaborations in which health care, health care research, and health care education are merged into one organization. UMC’s are partly financed by the Dutch government (VSNU, 2021) in order to protect the high quality of health care within the Netherlands. The Dutch UMC is nationally and internationally known for its ground-

breaking research and is currently defending a top 35 position in the best global universities for clinical medicine studies (US News, 2020). This research project, however, will mainly focus on health care operations within the organization instead of research and education.

The type of health care provided by the Dutch UMC is called specialized healthcare or third-line health care. Specialized health care is health care for those who cannot or no longer be treated in other hospitals. Figure 1 illustrates the different types of health care in the Netherlands.

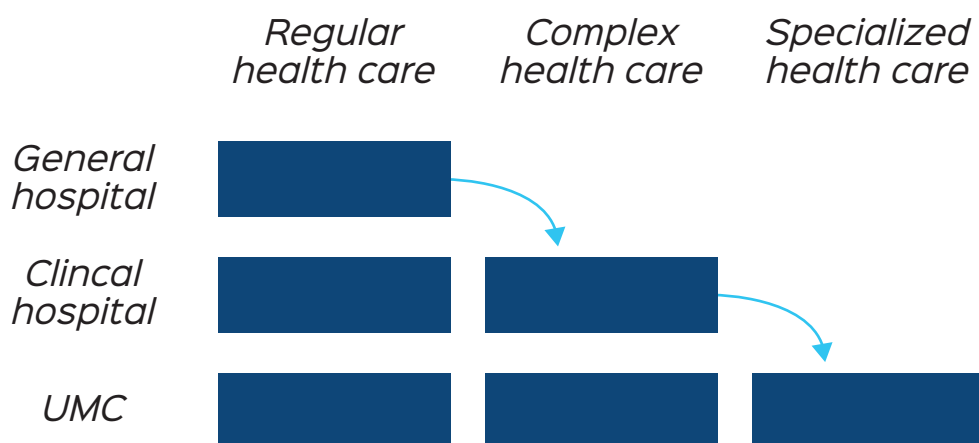


Figure 1: Types of healthcare in the Netherlands

0.2 Project context

Health care is under a lot of pressure. Since 2017, the absenteeism percentage of employees has been the highest for this sector, and especially in hospitals, operational staff experience an excessive workload (CBS, 2020). On average, one out of six people working in the health care sector in the Netherlands will eventually show stress or burnout symptoms (van den Tooren et al., 2019).

In the specific case of UMC employees, over 40% indicates the current workload being too high (Hooftman et al., 2018). The two main reasons for this are the shortage of employees and the increasing administrative burden. A promising solution for both problems would be the use of technology to digitalize health care processes. This vision is shared by the Dutch UMC, who has made digital innovation a top priority in the current strategy (internal document, 2018).

This project was set up to get closer to this vision by investigating the possibilities and boundaries of digital innovation within the Dutch UMC.

0.3 Problem context

The initial research question of this project has developed a lot over time due to gaining a deeper understanding of both problem and problem context. A large part of the research was spent on finding the actual problem to solve, and this chapter briefly describes what steps have been taken in the process before the primary analysis. To conclude this chapter, the final research question and sub-questions are defined.

0.3.1 The initial research question

This project has been initiated by a physician and an information manager within the Dutch UMC. They share the concern about how the current way of working with patient data is contributing to the excessive workload of health care staff and, at the same time, how little is done with the continuously growing amount of patient data that is gathered every day. Therefore, the initial scope of this research project was to explore new ways of working with patient data and develop a future concept, illustrating the role of data-driven decision-making in patient care.

To understand the main problems and desires of health care staff regarding this topic, this project started by conducting qualitative research in which three physicians, four people of the internal IT staff, and an external software supplier were interviewed. Instead of finding the expected answers guiding towards a design vision, the interviewees had difficulties understanding the questions and questioned the reason for this project. Therefore the assumption arose the wrong problem was being solved. To validate this assumption, the data was divided into tangible pieces of information and clustered to find similarities. This led to three main conclusions which were presented to the organization after which the research question was adapted.

The first conclusion is a very practical issue, withholding the possibility of implementing innovative solutions regarding the processing of patient data. All patient data is collected and stored in an Electronic Health Record system (EHR system). At the start of the digitization of patient data, the Dutch UMC developed its own solutions

for storing patient data digitally but in time, dedicated companies arose, offering all-in-one solutions for storing and sharing patient data digitally within health care organizations: EHR systems. Like all other renowned Dutch hospitals, the Dutch UMC decided to switch to one of these systems in 2017. When interviewing health care staff however, all current problems regarding the processing of patient data are a direct result of design flaws in this system. With implementation costs being around 40 million euros it is however unlikely to think the Dutch UMC will be switching to another solution very soon. Above this all, the external software supplier indicated all major EHR-systems to show these problems.

“None of the current EHR-systems were ever developed to really support health care staff. They are simply just billing machines”

Finding the most problematic patient data related areas and develop a conceptual solution would therefore be of more value to the EHR-system developer than to the Dutch UMC.

Second of all, the development of health care innovations is not part of the core business of the Dutch UMC. Although the initial research question might have resulted in a brilliant idea, it would mostly have been used as inspiration. In fact, when sharing this concern with the internal initiators of this project, they indicated the chance of a proper follow-up in actual development to be a long shot.

Lastly and probably most important the envisioned solution to this research question does not solve an actual problem. Especially health care staff indicated not to fall short on ideas on how to shape the future of health care and especially what role patient data could play. Adding an additional vision can be helpful but the actual problem seemed to be revolving around following up on these ideas and developing the solutions most wanted by health care staff.

0.3.2 Redefining the research question

Based on these three conclusions, the research question was reviewed. Although the excessive workload is recognized as a significant problem that needs to be solved, it appears to be a direct consequence of defects in the current design of healthcare systems and the organization's inability to develop the solutions required. Therefore, a future concept would be inspirational to the organization but is not likely to solve the encountered problems regarding digital innovation. Various conversations with the project team and additional

interviews with employees of the Dutch UMC strongly indicated that the fundamental challenges are manifested in moving from idea to implementation of the actual solution, thus: the digital innovation process.

Within the organization, however, there is little understanding of what specific problems are causing the challenges within the innovation process, how they are related to each other, and where exactly these problems are manifested. Therefore, the proposed research question for this project is:

“How could digital innovation be realized within the Dutch MC?”

This research question is accompanied by four sub-questions:

- *What are the main problems for digital innovation?*
- *What is the root cause of these problems?*
- *What is needed to solve this issue?*
- *How would this be applicable to the Dutch UMC?*

0.4 Project approach

The structure of this research is based on the double diamond approach, as proposed by the British Design Council (2005). This approach is structured by two alternating diverging and converging phases, which together form two diamonds. The shape of this structure is illustrated in figure 2.

Although this structure may look like a linear process, in design projects, this is merely the case. The arrows indicate how projects do not necessarily move from the first phase to the second phase to the third phase to the fourth phase but are free to move around in any desired order. Nevertheless, this structure serves as a solid framework for this research project. The main characteristics of all four phases, specifically for this research project, will be described.

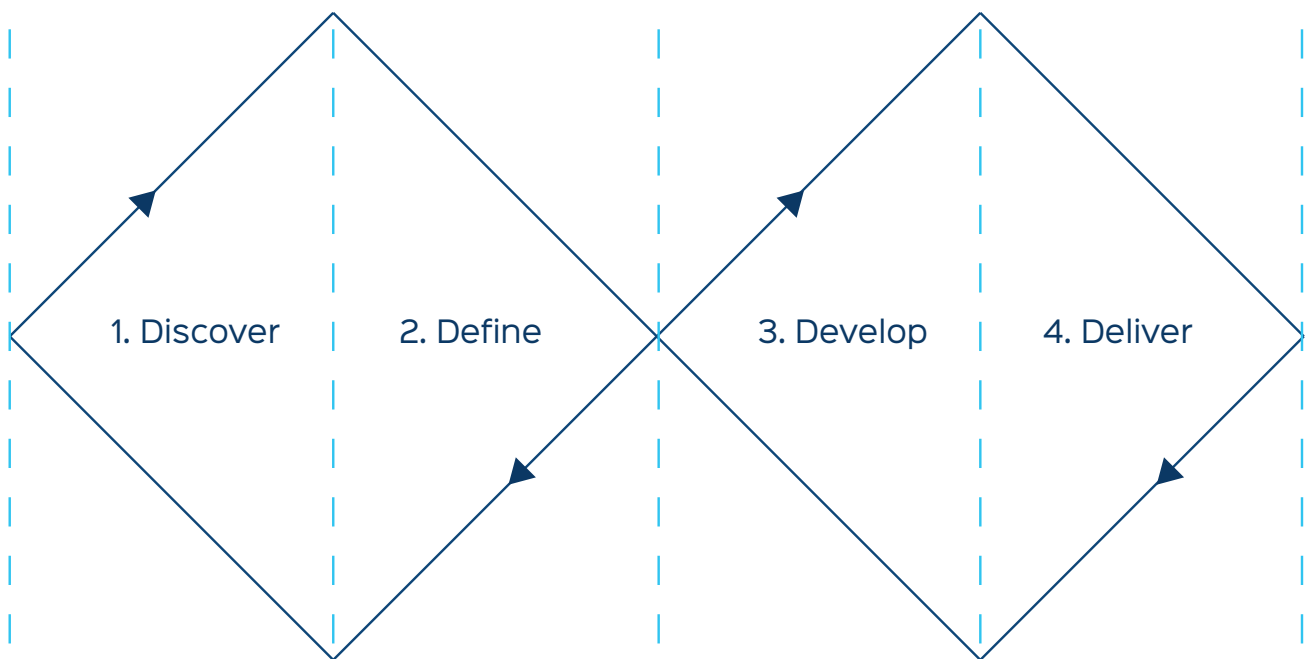


Figure 2: The double diamond approach

Discover

Since it is not clear what keeps digital innovation from happening, this project's discovery phase revolves around gaining a deeper and broader understanding of the current innovation process, the involved stakeholders, and the main problems for digital innovation. This phase's divergent character indicates welcoming all information that could help define the problem to solve.

Define

In this phase, all gathered knowledge from the discovery phase is combined to define the design brief. The design brief

specifies the problem scope, the solution scope, the client, and the design criteria.

Develop

In this phase, the solution space is explored utilizing a literature study and additional qualitative research. In this way, a clear outline is created for the final design. The design brief is used to guide the research in this phase.

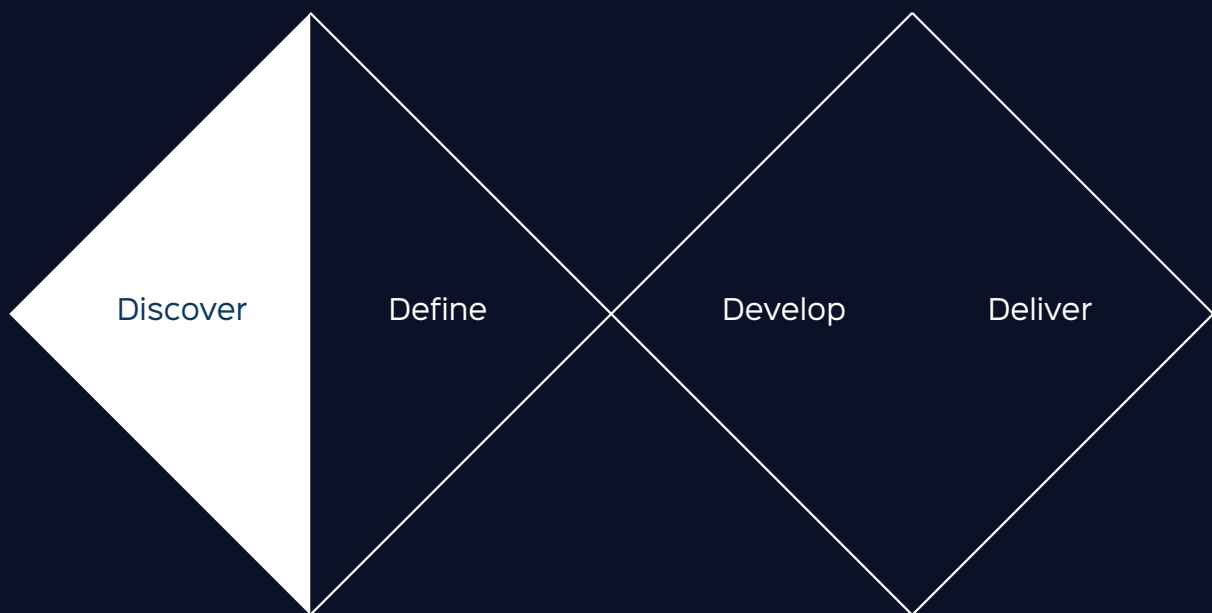
Deliver

In this phase, the final solution is delivered to the organization. The solution will be presented and reviewed on usability and on how it connects to the problem.

PHASE 1: DISCOVER

creating a deeper understanding of the problem context

The Dutch UMC encounters many challenges for digital innovation. However, they are not able to pinpoint what is causing these challenges. In this project phase, a deeper understanding is created of the problem context by analyzing the current innovation process, stakeholders, and challenges.



1. Introducing discover

In this first phase of the research, the main challenge for digital innovation is defined. This is done by means of answering four supportive questions, which are illustrated in figure 3.

A literature study, three case studies, and qualitative research have been conducted to answer these questions. The answers to these questions are provided in four separate chapters, each introduced by referring to which question is answered. The key findings are summarized at the end of each chapter, and a fifth chapter will present the overall conclusion of this research phase.

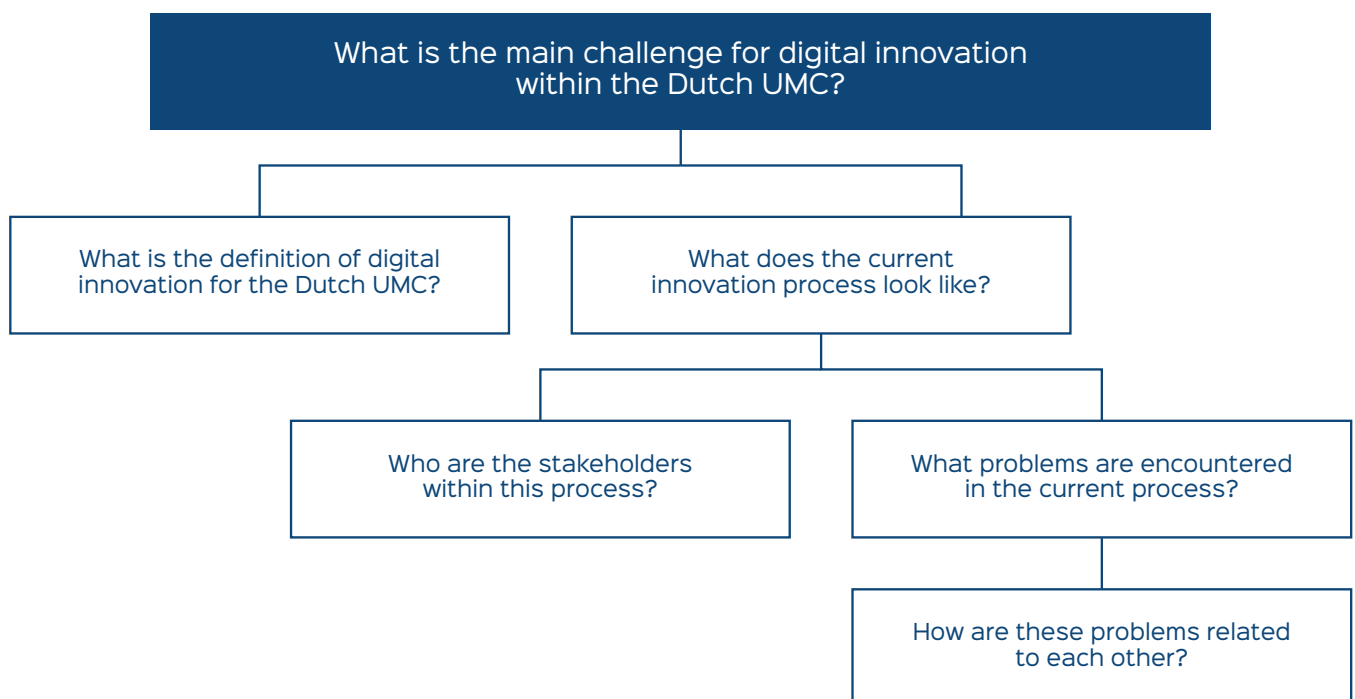


Figure 3: The sub-questions of discover

2. The definition of digital innovation

The problems which the Dutch UMC faces are manifested within the digital innovation process. Before analyzing the current process, the definition of digital innovation for the Dutch UMC has been defined.

There are many different definitions of innovation. A study that analyzed over 60 definitions of innovation from various disciplinary kinds of literature captured the meaning of innovation in a diagrammatic overview, as shown in figure 4 (Baregheh et al., 2009). This diagram clearly illustrates how innovation, for every situation, can be defined differently.

For digital innovation, technology is used as the means. Ciriello et al. (2018) describe the three characteristics of digital technology that change the nature of innovations. First of all, when information is digitalized, it can be shared, stored, and modified by any digital appliance. Second of all, digital information can be re-programmed and linked to other digital systems or

respond to accustomed user demands. Lastly, digital technology is the outcome of digital innovation as it is needed to establish digital innovation.

The aim of digital innovation within the Dutch UMC is not so much to differentiate from or compete with other health care institutions but to succeed in providing the best quality health care possible.

Digital innovation, for the Dutch UMC, can therefore specifically be defined as: “the generation, creation, development, implementation, and adoption of new, improved or changed products, services or processes through the means of digital technology to provide the best quality of health care as possible.”

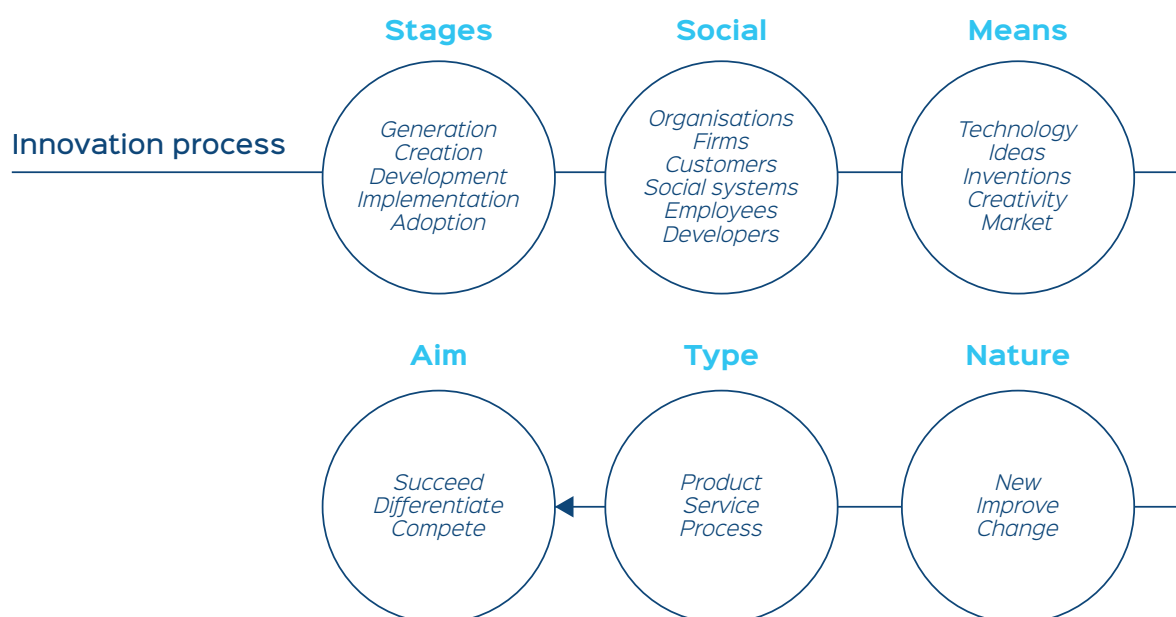


Figure 4: The definition of innovation

3. The current innovation process

The Dutch UMC has indicated to face several problems within the process of digital innovation. Before defining these problems, the current process was evaluated by conducting three case studies. These case studies consisted of analyzing three different digital innovation projects through interviewing the initiators of each project. The three projects that were selected each differed in topic, result, and terms of progress.

The first project, which had just been initiated, revolved around the use of speech recognition software for conversations between physicians and patients. The second project focussed on developing a platform to realize long-distance medical care and was about halfway along the process. The last project had already finished. In this project, an application was developed to support in mental care for the youth. Due to the content's sensitivity, the transcripts of these conversations have **not** been added to this report.

3.1 The structure of the current innovation process

The case studies provide a general understanding of how the digital innovation process is currently structured. The findings will be presented and supported by anonymized quotes and illustrations.

First of all, the interviews confirmed that digital innovation within the Dutch UMC is indeed very challenging. Each interviewee emphasized how they felt to be facing constant resistance along the process.

“What seemed to be a simple and fun project became the most frustrating and lengthy challenge I ever faced within this organization.”

“I feel like I am constantly wasting my time and energy by explaining the same things over and over again.”

A possible explanation for the challenges in digital innovation might be that little agreements have been made on the structure of the process. All interviewees mentioned how they had little clue on where to start or what to expect, resulting in a process existing of a series of improvised activities. Although no real agreements have been made to structure the

process, many resemblances were identified between the three cases. These resemblances have been used to shape an image of the current process.

What the cases have in common is how digital innovation seems to start with one person that has an idea about how certain technology can be used to improve patient care. These ideas mostly seem to emerge from trying to solve current problems, the rise of new technologies, or newly acquired knowledge from research. The diverse roles of the interviewees indicate that these ideas can come from anyone within the organization.

The next step in the process, as identified in all three cases, is to seek approval to work on this idea. What happens is that the idea owner shares the idea with its manager to find the support which is needed to pursue it. This is a crucial step in the process since it can be the end when the idea is rejected. If the idea comes from a person that has a management function, this step is obviously skipped. For this reason, digital innovation project teams mostly exist of the idea owner and its manager or a manager as the idea owner who

involved one of its employees. In none of the example cases, the team was expanded after this phase. In addition, the interviewees indicated not to be aware of any project in which this has been the case.

When the idea owner and manager agree on the added value of the idea, two main activities can be identified. First of all, a budget must be obtained to develop the idea, and second of all, a supplier must be found to develop the idea. Although there is no agreed-upon order for these two activities, logically, most cases start by obtaining a budget. Nevertheless, these two activities often end up being done simultaneously.

A budget is either provided by the concerned department or obtained through health care subsidies. To

support teams in finding the right subsidy, the Research Development Office has been initiated. The main task of this department is to connect available subsidies to initiatives within the organization. Suppliers are most of the time easy to find since it is a profitable collaboration in which the final product, in most cases, becomes the property of the supplier. The supplier is, therefore, able to sell the same product to different health care organizations.

When a budget is secured, and a supplier has been found, the idea can be developed. In many cases, the supplier is in charge of the final design since they bring the expertise on development. Prior to deciding on the final design, a final pilot or test run is performed. To make sure that the product which is being developed

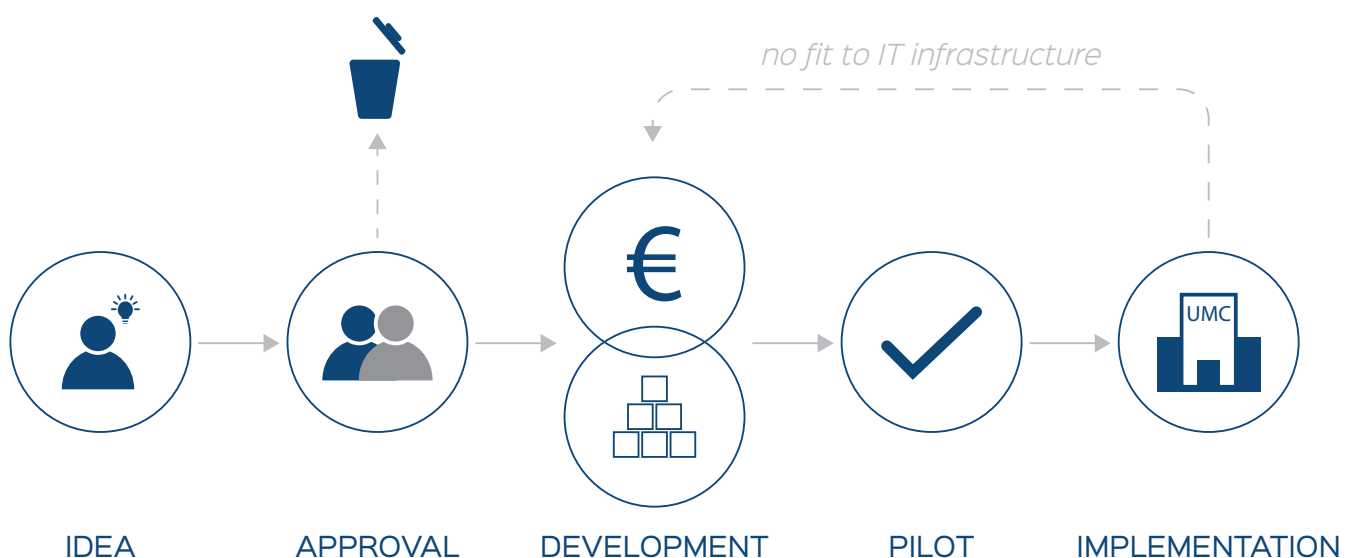


Figure 5: the current innovation process

is complementary to the current IT infrastructure, the internal IT Organization should be involved at this point in the process. The IT department which is responsible for steering towards a smooth implementation is Information Management (IM). However, in many cases, the development has started before getting in touch with IM, bringing many complications to the actual implementation.

The current digital innovation process as derived from the case studies has been illustrated in figure 5.

Although the digital innovation process has not been officially organized or structured, consistencies in prior projects offer a rough outline of steps and activities.

4. Stakeholders within digital innovation

In this chapter, the characteristics and roles of the stakeholders of the digital innovation process are defined. The stakeholders are based on the information provided during the case studies.

For digital innovation within the Dutch UMC, four stakeholders can be identified: the idea owner, the internal IT organization, the supplier, and the user. As described in the previous chapter, the idea owner can be anyone within the organization. The internal IT organization is responsible for integration to the current IT infrastructure where the supplier is responsible for the development of the idea. The user is the person or group that will be using the final product.

The idea owner can at the same time be the user, but this does not necessarily have to be the case. For example, a physician could think of an idea to solve one of his personal problems or one of his patient's problems.

When comparing these four stakeholders to the place where Brown (2008) indicates the sweet spot for innovation to be located, a resemblance can be found. Brown suggests that the most significant opportunities

lie where people's desires meet with what is technologically feasible and viable within the organization's business strategy. A fourth additional variable can be added to this trinity, being: usability. Next to the fact that a solution should be desired, the solution must be the most effective or efficient possibility for the specific context, hence: usability.

Based on Brown's model, each stakeholder should be equally involved in the digital innovation process to ensure the best possible outcome. Figure 6 illustrates the touchpoints of the stakeholders.

To scope this project, the research is delimited to digital innovation processes in which operational health care staff are the users. Since physicians are the people stimulating the most current innovation projects, they will be representing this group during interviews.

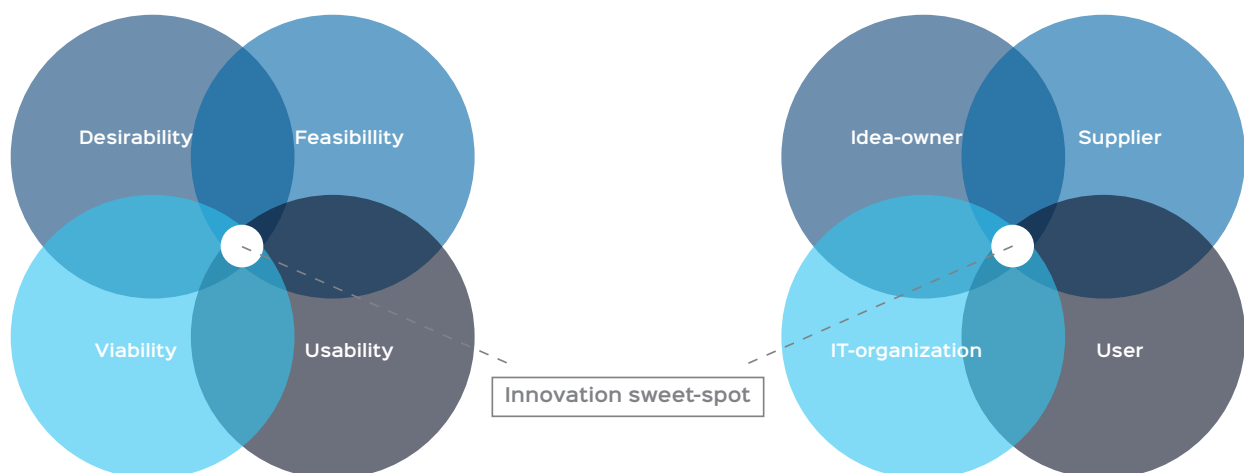


Figure 6: The innovation sweet spot

As explained, anyone within the organization can be an idea owner. Due to the limitations of this research project, the group of idea owners has also been narrowed down. During further interviews, physicians and IT employees will, next to representing the IT organization and the users, also answer questions from the perspective of idea owners.

Based on these decisions, the next part of this chapter will elaborate on specifically physicians, the IT organization as a whole, and suppliers.

4.1 Locating the stakeholders

Before elaborating on each stakeholder individually, their positions within the organization are defined. Figure 7 shows the organization's organogram, in which patient care, the IT organization, and external parties can be distinguished.

The organization can be split up into two main divisions: patient care and service organization. Patient care represents

all medical themes, and therefore, physicians can be located within the complete left side of the organogram. The service organization is where all non-medical departments are located, responsible for running the business. The IT organization is part of the service organization. All external parties, including the suppliers, are located outside the organization.

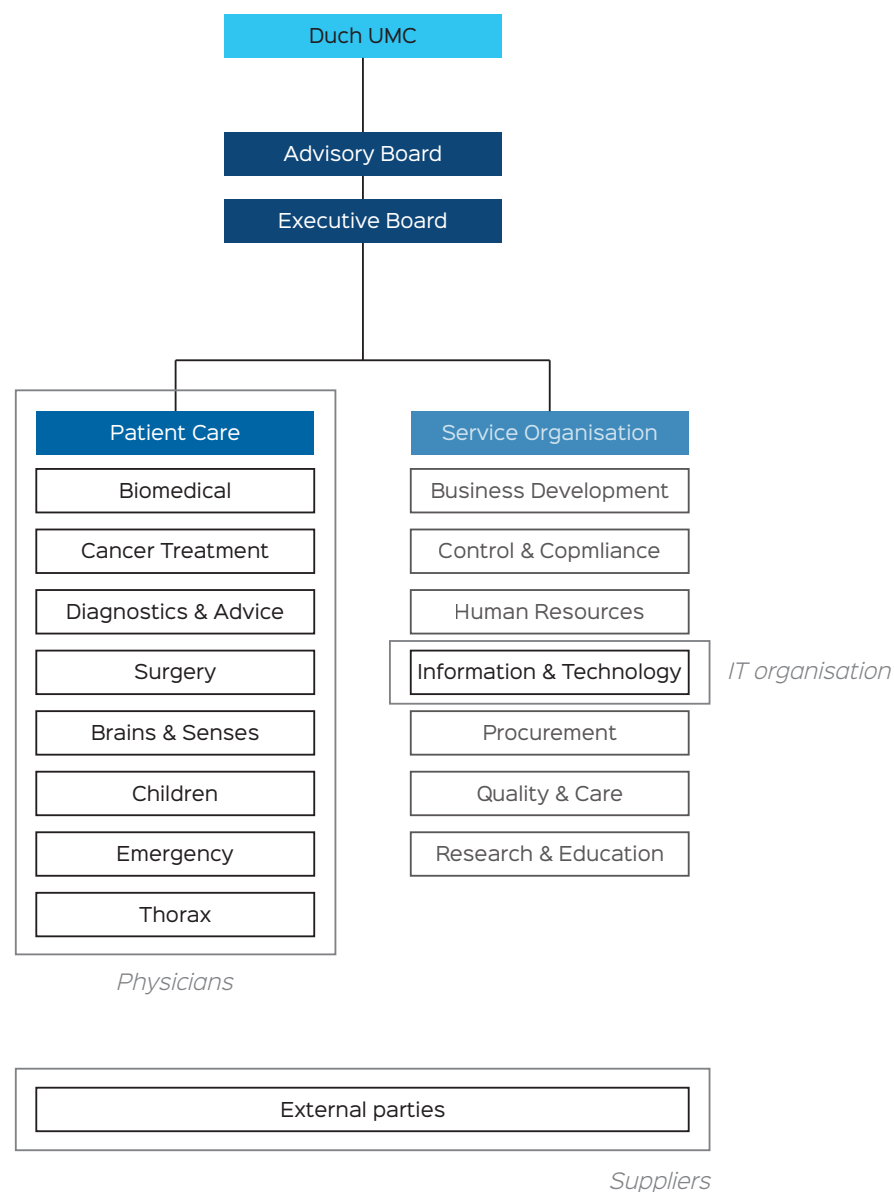


Figure 7: The location of the main stakeholders

4.2 Physicians

Figure 8 indicates how patient care is divided into eight different divisions, which serve as an umbrella for multiple health care departments. Within the Dutch UMC, these divisions are called: “themes.” A theme covers multiple health care departments in similar fields of patient care. Figure 8 illustrates how these themes are organized. Although this figure might impose four health care departments within every theme, this number is different for every theme.

As shown in this figure, each theme is led by a theme board, existing of the department heads of every department, a theme manager, and a theme director. Every department houses multiple physicians, including those in training. Department heads, as well as theme managers, are by definition physicians. The theme director, however, in most cases, is not a physician and purely sticks to a managing role.

4.3 The IT organization

The entire IT organization is divided into four main divisions: information management, medical technology, IT services, and projects. This is illustrated in figure 9.

Digital innovation mainly touches upon Information Management (IM) and the projects department (projects). Both IM and projects are relatively new departments due to the reorganization of the IT organization in 2016.

IM is responsible for capturing the current needs and wishes within the themes to translate these, if necessary, into IT projects. With multiple information managers responsible for their theme, this department functions as a conduit between patient care and the IT organization.

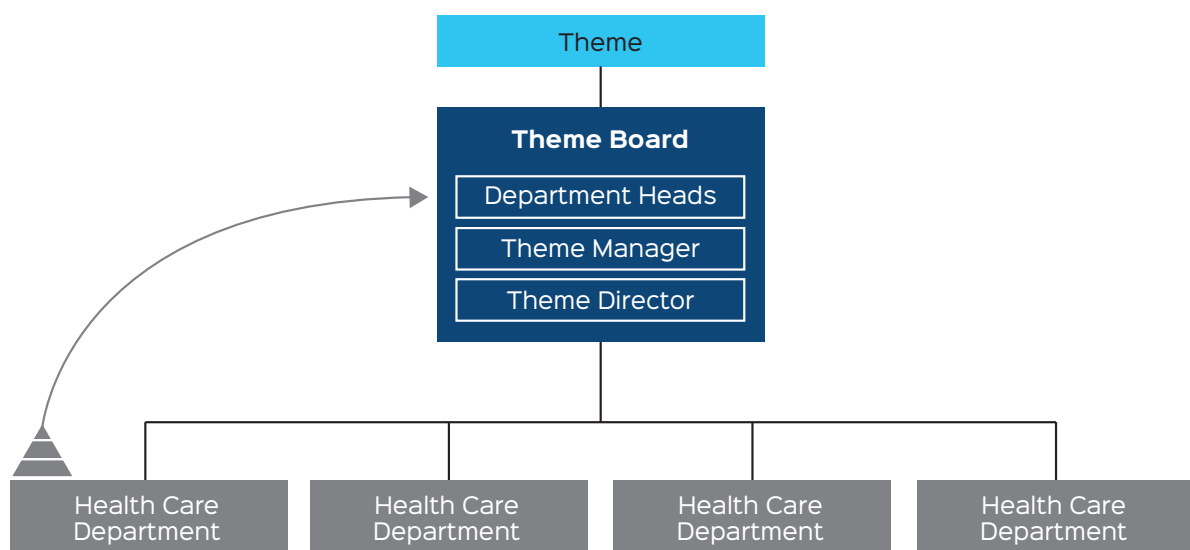


Figure 8: The organogram of the health care departments

4.4 Suppliers

In theory, a supplier could be any company willing to work together with the Dutch UMC. Before being able to collaborate, though, every company has to comply with strict privacy and safety regulations. Organizations that have already collaborated with the Dutch UMC before are known as: “preferred suppliers.” Working together with one of the preferred suppliers means that the often lengthy approval has already taken place and can therefore be skipped. To speed up the process, an obvious choice would be to work together with a preferred supplier. Therefore, it is not necessarily the case that the organization always works together with the most promising or innovative company.

4.5 Conclusion

Four main stakeholders have been identified within the current digital innovation process: the idea owner, the internal IT Organization, the supplier, and the user. The idea owner and user can be the same person or group of people, but this does not necessarily have to be the case. This research will focus on digital innovations of which operational health care staff are the users. This group will be represented by physicians during further interviews. The group of idea owners will be represented by both physicians and IT employees.

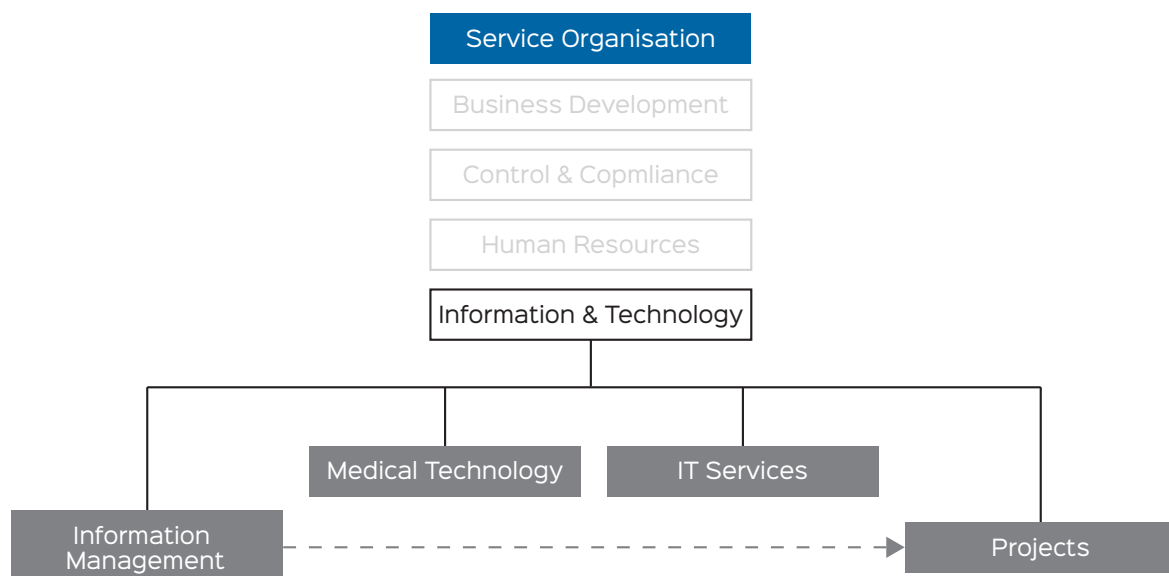


Figure 9: The organogram of the IT organization

5. The seven problem areas for digital innovation

With a clear picture of how digital innovation is currently organized and a general understanding of which stakeholders are involved, the main problems for digital innovation can be identified. To find these problems, qualitative research was conducted among the different stakeholder groups.

This research consisted of 26 in-depth, semi-structured interviews with 12 IT employees and six suppliers. The group of physicians can be equally divided into operational physicians and physicians in a management position. Within the IT organization, every information manager, the IT director, the CMIO, and the management of the Research Development Office were interviewed. The group of suppliers mostly consists of preferred suppliers, complemented with some companies who are active within the domain of digital healthcare that had not yet worked together with the Dutch UMC.

The participants were selected through snowball sampling, starting from the initiators of this project. Every interview was recorded and reheard to document the key findings. These key findings were broken down and clustered into different categories. From these clusters, seven problem areas have been defined, describing the main challenges for digital innovation within the Dutch UMC.

The key findings of each interview can be found in appendix A.

Each problem area will be discussed and substantiated with anonymized quotes in the next parts of this chapter.

5.1 There is a lack of support

The first problem area which has been defined is the lack of support for digital innovation. This problem area is defined by two sub-problems which are mainly experienced by the idea owners and IT Organization. Both problems will be defined, and the main complication rising from this problem area is demonstrated.

The first identified sub-problem, which illustrates a lack of support for digital innovation, is due to the absence of a dedicated department for digital innovation. This results in the fact that no one is held responsible for the quality or output, employees do not have a place to go with innovative ideas, and project teams are not guided in their process. Without anyone keeping an overview of the progression and results of digital innovation, the process will never be revised or improved.

“The complete project felt like an obstacle course in which I had to figure out every step on my own.”

– Physician

The second sub-problem is described by how employees are not being awarded time to spend on innovation projects. Since participating in innovation projects is not mandatory, it is seen as a trivial activity, leaving no choice but to do this in your free time. Especially for physicians, who already experience a very busy schedule, this is a significant boundary, keeping them from engaging in projects like these.

“I am doing overtime because I feel the urge to keep on innovating our sector.”

– Physician

“How much I would like to, I simply do not know where to find the time to work on innovation projects.”

– Physician

The main complication arising from not guiding digital innovation is the decentralization of innovation projects. This decentralization leads to similar projects being set up at different departments within the organization, resulting in the development of solutions that do already exist. Time and money are wasted while employees lose interest or enthusiasm to partake in innovation projects.

“After I spent a lot of time on setting up this project, I discovered that one of my colleagues had been doing the exact same thing for the past couple of months.”

– IT employee

If there is no guidance and very little time for innovation, it makes sense that project teams fully improvise on the process. First of all, the people engaging in innovation projects are no experts on this topic and, without guidance, will just do what feels best. Second of all, if there is insufficient time, concessions must be made, and the process is rushed through.

5.2 Implementing new technology is the goal of innovation

The second problem area revolves around the goals that have been set for digital innovation. Although the current strategy describes digital innovation to be a top priority, the means to reach the goal of becoming a leading digital innovator so far seem to purely stick to implementing the newest technologies.

By addressing the implementation of new technologies as the goal of digital innovation, technologies like artificial intelligence, machine learning, and robotics are fired at the organization regardless of the problem it is solving. Instead of using innovation as a method, with the goal of solving complex health care problems, showing off new technologies has become the goal.

“We forgot what the actual goal of innovation is”

– IT employee

The result of not having defined clear goals for innovation is an IT organization that believes the best way to innovate is by pushing new technologies into patient care. The actual user, however, is surprised by solutions to non-existing or sub-problems.

“To put it bluntly, innovation projects today are projects for which it is most important to have a fancy-looking result”

– IT employee

“For a couple of years now, hospitals are coming to us, arguing they should implement artificial intelligence. But why? What is the goal? The goal cannot just be to implement artificial intelligence.”

– Supplier

“I am not waiting for augmented reality, just to be able to say I am working with augmented reality”

– Physician

By turning digital innovation into a self-contained goal, the result is the development of technological gimmicks: products that meet the latest technology standards but bring only very little value to the organization.

5.3 There is no distinction in project setup

The third problem area, which has been derived from the interviews, describes how innovation projects are set up as if they are conventional management projects. There are two main complications in structuring the innovation process in this way. These complications, which mostly seem to be affecting physicians, will be discussed one by one.

"We treat innovation projects like they are regular projects which can be scheduled and have a predefined outcome."

– IT employee

First of all, in conventional project management, outcomes are fixed or at least very predictable. Therefore, a project can be scheduled into detail, awarding a specific amount of time and money to every step in the process. Innovation processes are, however, anything but predictable. Since innovation is about developing something new or non-existent, the outcome can never be predicted. By pushing the result of an innovation project towards the desired or most obvious outcome, very little room is left for creativity.

Second of all, due to the high predictability in the progression and outcome of conventional projects, suppliers can be involved, and budgets can be obtained right from the start. With an unknown outcome, however, the costs for development or required supplier can only be guessed at in the early stages of an innovation process. By making investments and agreements with suppliers before the

beginning of a project, it becomes really hard to pivot from the initial idea, again pushing the project in a fixed direction.

"I do not want to be working on an idea for six months and only then find out it does not solve the right problem."

- Physician

"Instead of giving ideas the chance to evolve and being able to assess the fruitfulness, we go all or nothing from the beginning"

- Physician

Structuring innovation projects in the same way as conventional management projects kill creativity and leave little room for ideas to develop over time. Mainly physicians, in their role of idea owners, experience these problems since the IT organization is held responsible for the planning and structure of innovation projects. projects kill creativity and leave little room for ideas to develop over time. Mainly physicians experience these problems since the IT organization is held responsible for the planning and structure of innovation projects.

5.4 Departments and project teams work in isolation

The fourth problem area, which is defined, addresses the fact that both departments and project teams work in isolation. There are two different reasons for departments and project teams to work in isolation, each leading to a different problem.

The Dutch UMC is organized as a traditional management organization, divided into silos which each has very well-defined responsibilities as part of the daily operations. This clear distribution of tasks requires only very little collaboration or interaction between different departments. Because the organization is not used to working together with people outside their department, communication, and interconnected processes, which are required for efficient innovation, are cumbersome and take a lot of time.

“To gain approval for the development of a very straightforward application, I needed to contact 10 different departments by myself.”

– Physician

Above all this, every department has its own management, own budget, and own wishes for innovation. Instead of finding common goals or widely spread problems to solve, investments are made for personal benefits, resulting in very specific solutions instead of broadly applicable products.

“We all work on our own little island, minding our own business.”

– IT employee

“Instead of having my lab research done at our internal scientific department, it was cheaper, faster and more convenient to fly my samples to Australia”

– Physician

“It is every department for its own. There is very little intercommunication and zero joint projects.”

– Physician

The reason for project teams to work in isolation is a direct result of what has just been described. To avoid the complicated and time-consuming processes resulting from working together with multiple departments, teams often decide to work on a project independently. However, not involving the right stakeholders leads to complications during implementation. Since only the project team has been involved in the design of the solution, there is a big chance it fails to comply with the restrictions or regulations of the organization.

Innovation happens in isolated groups which are invisible to the organization. Sooner or later, however, they will face difficulties when trying to implement their solution.”

– IT employee

Working in isolation negatively impacts the process and result of digital innovation. Interdepartmental processes take too long for innovation processes to flourish, overly specific problems are solved for small user groups, and innovation project teams become detached from the system, experiencing significant issues when implementing the developed solution.

5.5 Physicians are disconnected from the IT organization

The fifth problem area indicates how physicians are disconnected from the IT organization. There is little trust, resulting in physicians keeping ideas on how technology could improve health care to themselves. The two main reasons for this strong division will be demonstrated.

First of all, a widely spread feeling within patient care is the IT organization's uncooperative and unsupportive attitude towards health care departments. Most physicians do not feel heard since they are often dismissed by IT employees when sharing their vision.

"The two things we usually get back from IT is: we cannot do that, and we do not do that"

– Physician

These negative experiences have built up a clouded relationship between these two. Due to bad publicity, this negativity towards the IT organization only keeps on growing among physicians.

"My colleagues explicitly told me not to have any hopes for the support of the IT organization"

– Physician

A second reason for physicians to grow apart from the IT organization is the lack of awareness about the different IT departments and assigned responsibilities. An unpleasant experience with, for example, IT services creates a negative image for the IT organization as a whole. A malfunctioning computer, however, is not tackled by the same department that initiates innovation projects to improve patient care.

"I do not think the IT organization has the ability to innovate at all. They were not even able to update the computers in our department."

– Physician

The department which is responsible for answering innovation challenges is Information Management. As a bridge between patient care and the IT organization, it is their responsibility to collect the most urgent needs and turn these into a project. As learned from the initial interviews, Information Management is fairly new and unknown to a large number of physicians. Even those that are familiar with this department do not exactly know their role. Therefore, information managers are often not informed until a project is facing a dead end.

"It would have saved me lots of time, wasted energy and headaches, if I would have known about the existence of the information manager before starting this project."

– Physician

A combination of unclear communication and a lack of trust resulted in a troubled relationship between the IT organization and patient care. The innovation process is affected by this since health care staff stopped sharing innovative ideas, assuming no serious follow-up will occur.

5.6 There is a strong hierarchy within the organization

The sixth problem area describes how the strong hierarchy within the organization influences the number of ideas that are picked up. This hierarchy can be mainly identified within patient care but is also visible within the rest of the organization. How this hierarchy affects digital innovation is illustrated with the three following examples.

Throughout the entire organization, there is solid top-down management. For an idea to land, it must first be picked up by someone at the management level. Within patient care, for example, if the department head does not see any value in an idea, there simply will be no follow-up.

“Some of my colleagues have fascinating ideas on improving our daily routines. Our department head, however, does not share this vision. Therefore we stick to what we know.”

– Physician

Most managers within the organization are experienced employees who bring a lot of expertise. Although it makes sense to have people in charge who know what they are talking about, it is hard to break the ingrained habits they bring along. Ideas that challenge the status quo are evaluated from the perspective that not too much should change within the organization and, therefore, are often dismissed. Above all this, the culture within health care organizations, where experience is highly respected, makes it even harder to propose ideas that evoke a discussion.

“It feels rude to propose ideas that would criticize the current way of working for someone who just got here.”

– Physician

The consequence of this all is that a very select group of people decides on which ideas deserve a follow-up and which not. This group, which exists of managers and directors only, has a limited view of the actual problems health care employees are facing each day. Therefore, making it harder to understand.

“The wrong people are in charge. Top management is deciding on what is needed on the floor.”

– IT employee

It can be concluded that the top-down structure within the organization results in congestion of ideas. A select group of managers and directors, separated from the organization, decides what ideas are valuable to patient care. Employees on the floor are often excluded from these decisions and criticized for proposing a different perspective.

5.7 There are limited budgets for innovation

The final problem area illustrates the shared frustration of all stakeholders about the limited budgets for digital innovation. Although the digital innovation strategy intensively explains how the newest technologies must be applied to the organization, the budget that has been cleared to support the related activities is far from sufficient.

“There is a big opportunity in this idea; both patient care and management are highly enthusiastic. When asking for a budget to back up the project, however, everyone steps aside.”

– Information manager

Although innovation projects do not require significant investments until the actual development of the product within the organization, it is common knowledge that obtaining a budget is one of the main barriers to innovation. This has a demotivating effect on employees to get involved in innovation projects.

Limited budgets also negatively impact collaborations with suppliers which are responsible for the development. New technologies, which are crucial to innovation according to the current strategy, are expensive to incorporate into solutions. The limited budgets will, therefore, always result in having to cut in the final delivery.

“Hospitals address us with the biggest wishes for developing new software solutions but in the end never seem to have the budget for realization.”

– Supplier

Although not every innovation requires heavy investments, the inconsistency between strategy and budget slows down innovation within the Dutch UMC and negatively impacts relationships with suppliers.

5.8 The impact of the seven problem areas

The interviews present seven different problem areas, each having its own effect on the digital innovation process. A connection between the problem areas can be found when reviewing the current digital innovation process.

The current digital innovation process has been compared to the stage-gate model, as proposed by Cooper (1990). The stage-gate model is a proven approach to structure the idea-to-implementation innovation process, which divides the innovation process into six stages, divided by five complementary gates. Each gate is a quality control checkpoint that is characterized by a set of deliverables and quality criteria. The model is often illustrated as a funnel, highlighting how the innovation process starts with many ideas, of which only a few make it to implementation. Figure 10 shows a slightly adapted version of this funnel.

When plotting the current digital innovation process onto this model, a few things directly stand out. First of all, the discovery stage seems to be a lot more cramped since the process usually starts with one idea instead of many ideas. Second of all, Instead of having agreed-upon criteria to measure this initial idea, the first gate

is currently represented by the opinion of one person, the manager. Thirdly, after passing the first gate, the process seems to be directly moving towards the fourth stage: development. Instead of a preliminary investigation and a design stage, a straight movement from ideation towards obtaining a budget and connecting to a supplier is identified in the current process. The differences between Cooper's stage-gate model and the current process are illustrated in figure 11.

The deficiencies in the process as compared to the stage-gate model are directly related to most of the defined problem areas, as illustrated in figure 12. This insight shows how the main challenge for digital innovation within the Dutch UMC is caused by neglecting the discovery, scoping, and design stage within the digital innovation process.

To propose the right solution to this problem, the effect of not including

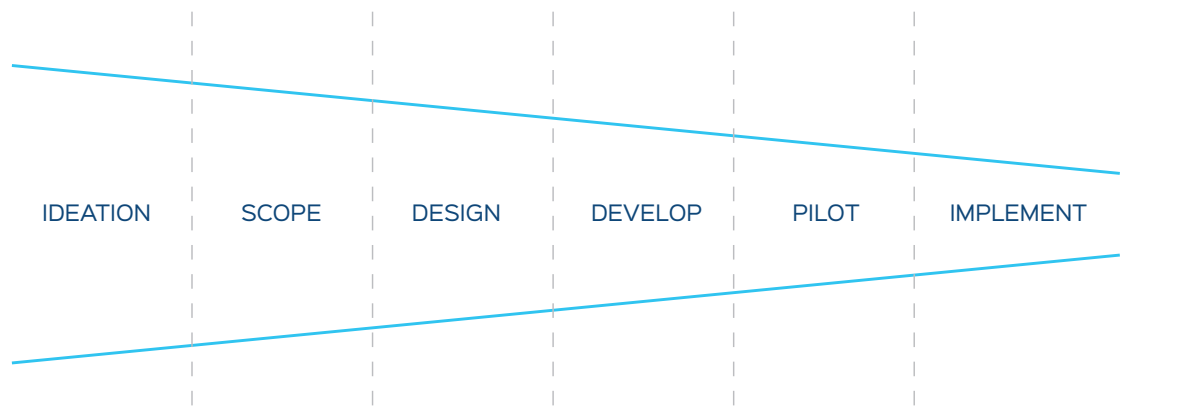


Figure 10: The stage-gate funnel (source: Cooper, 1990)

these stages in the digital innovation process should be investigated for the Dutch UMC. This is done in the second phase of this report: “define.”

Apart from finding the main challenge for digital innovation, an even more striking observation can be made. When looking at the defined problem areas, there is a strong indication that these are not limited to digital innovation alone but seem to apply to the organization as a whole. Although the interviews specifically focussed on digital or technological innovation, discussing projects which required interference of the IT Organization, it is more than likely to say that the support and project set-up is not very different from regular innovation projects. Also, the complete organization is divided into silos; this is not something that only applies to the IT Organization.

Therefore, there is a high probability that the hierarchy which comes with dividing the organization into silos can be found throughout the full organization.

It is questionable whether this project should stick to only addressing digital innovation. When considering the problem areas, presumably, the early stages of innovation, in general, are neglected. The solution which is provided in this project should therefore be applicable to the innovation process as a whole. Although the client of this project will still be the IT Organization, the users of the proposed solution are spread throughout the full organization. Therefore, instead of referring to the digital innovation process, the next parts of this report will refer to the “innovation process” and “innovation.”

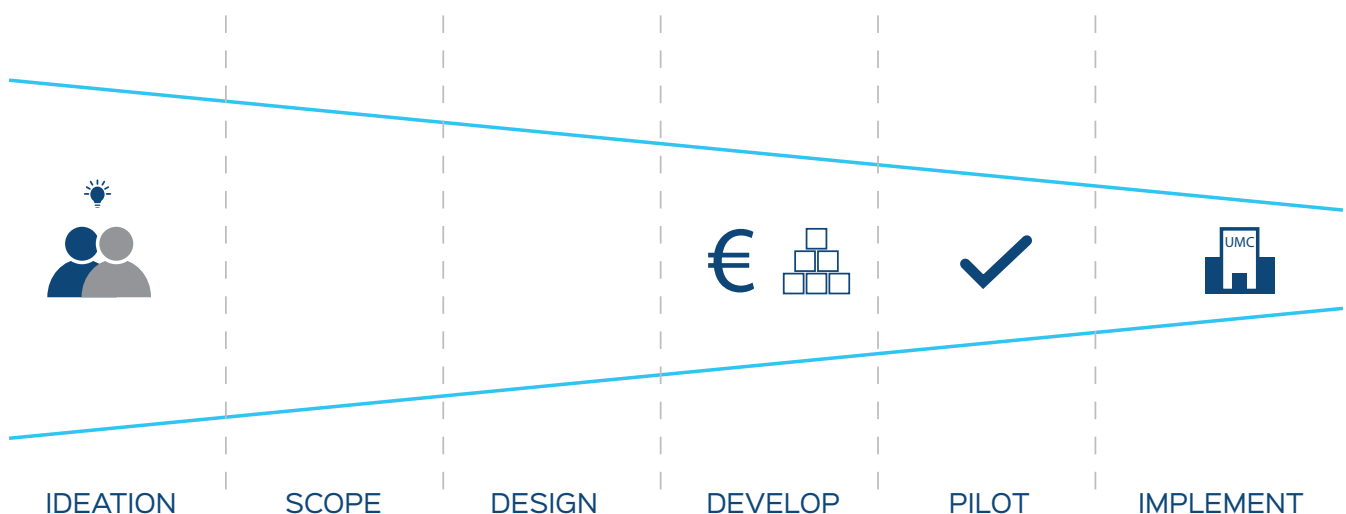


Figure 11: The current process versus the stage-gate model

5.8 Conclusion

Seven problem areas have been defined that each in their own way affects the innovation process. The different problem areas show resemblance in how, together, they result in neglecting the early stages of the innovation process, moving directly from the ideation stage to the development stage. On top of this, the seven problem areas seem to apply to the full organization, indicating that the encountered problems do not stick to digital innovation only but affect the innovation process as a whole. The solution which is offered in this project, therefore, should focus on realizing innovation in general.

Lack of support	<i>By simply not guiding teams through the process, project teams fully improvise</i>
Technology as goal	<i>The starting point of a project has become the development of technology</i>
Project distinction	<i>Regular projects do not require an ideation or design stage</i>
Isolation	<i>The early stages of the innovation process require collaboration of different departments</i>
Disconnection	<i>The early stages of the innovation process require collaboration of different departments</i>
Hierarchy	<i>By killing ideas in an early stage, there is no chance to evolve</i>
Budget	<i>The goal of the early stages is to prevent useless investments</i>

Figure 12: The problem areas in relation to the early stages

6. Concluding discover

This research phase aimed to find the main challenge for digital innovation. To do this, five sub-questions were answered by conducting a literature study, three case studies, and qualitative research with the stakeholders involved in the innovation process. The answers to each of these five questions will be presented conclusively.

What is the definition of digital innovation for the Dutch UMC?

Digital innovation for the Dutch UMC can be defined as: “the establishment, implementation, and acceptance of new, improved or changed products, services or processes through the means of digital technology to improve the quality of health care.”

What does the current innovation process look like?

The Dutch UMC has not consciously organized or structured digital innovation. Therefore the current innovation process looks different for every project and is mostly improvised. However, multiple consistent activities can be identified throughout different digital innovation projects

Who are the stakeholders for digital innovation?

For the digital innovation process, four main stakeholders are identified: the idea owner, the IT Organization, the user, and the supplier. To scope this project, physicians will represent the user group in this research, while a combination of IT employees and physicians will represent the idea owners.

What barriers can be identified in the current innovation process?

Seven problem areas have been defined, each challenging the digital innovation process:

1. There is a lack of support
2. Implementing new technology is the goal of innovation
3. There is no distinction in project setup
4. Departments and project teams work in isolation
5. Physicians are disconnected from the IT organization
6. There is a strong hierarchy within the organization
7. There are limited budgets for innovation

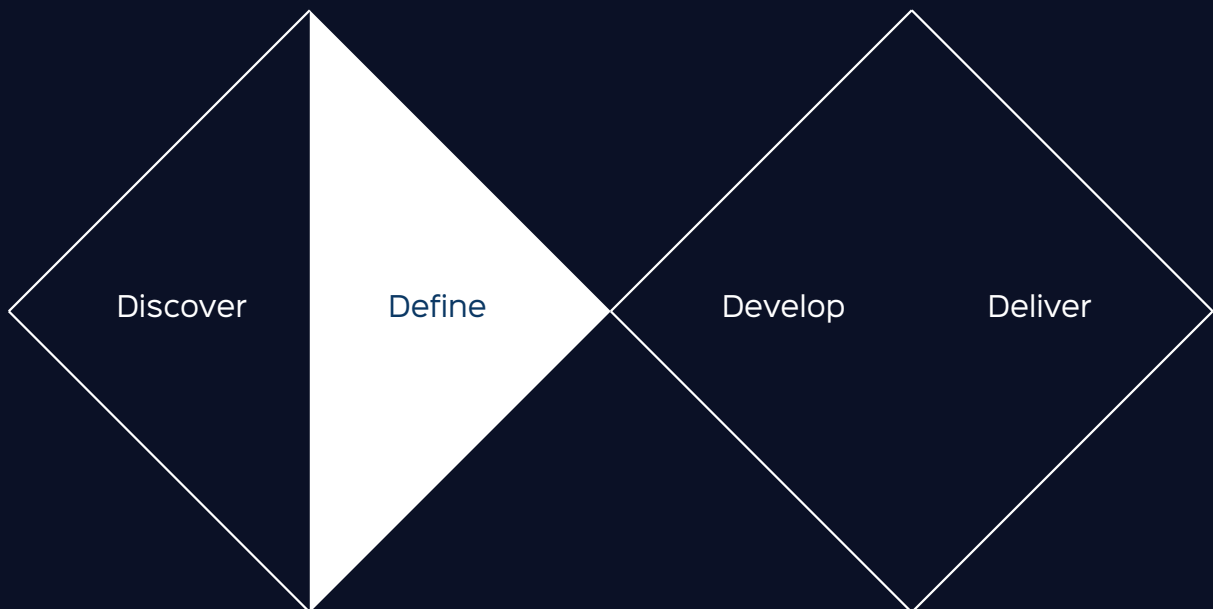
How are the problems related to each other?

The seven problem areas together result in an innovation process that neglects the ideation, scoping, and design stage. These three stages are described as the early or pre-development stages of the innovation process. However, these problem areas do not stick to only digital. Therefore, the proposed solution should address innovation and the innovation process in general.

PHASE 2: DEFINE

creating the design brief

In the first phase of this research project, a deeper understanding of the current innovation process, stakeholders, and encountered problems has been required. These insights will be used in this phase to create the design brief. The design brief defines the final design challenge for this project and is considered to be a framework to structure and guide this research project's final phases.



7. Introducing define

Now that the main challenge has been defined as neglect of the ideation, scoping, and design stage of the innovation process, it is important to investigate how this affects the outcome of innovation projects, what a possible solution might look like, what design criteria can be defined and for whom the solution is being developed.

These questions are answered in the design brief, which consists of the four elements: the problem scope, the solution scope, the design criteria, and the client. To create the design brief, four corresponding questions have been answered, which are illustrated in figure 13.

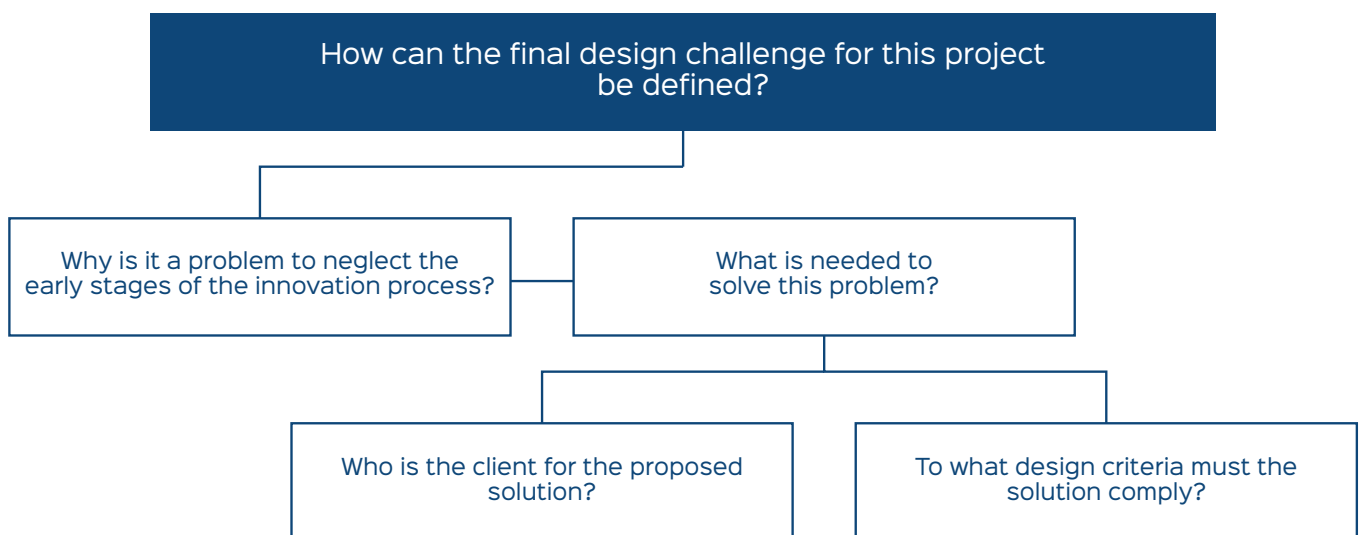


Figure 13: The sub-questions of define

8. Problem scope

In this chapter, the actual problem of neglecting the early stages of the innovation process is discussed. The three stages will quickly be introduced before elaborating on why it is a problem to neglect these stages.

8.1 The ideation, scoping and design stages

Ideation

The first stage of the process, the ideation stage, is where ideas enter the process. As illustrated, the process can be viewed as a funnel. The amount of ideas that come in at the beginning strongly affects the number of successful implementations. Therefore, Innovation processes tend to start by collecting and creating as many ideas as possible, increasing the chance of success.

Scoping

The scoping stage is meant to decide on the rough boundaries of the project. This stage is characterized by quick and trivial research into the problem, user demands, technological possibilities, and the possible fit to the organization's strategy. The scoping stage is meant to filter out groundless ideas early on in the process.

Design

During the design stage, the input of the scoping phase is used to shape the initial idea into an actual concept. Through multidisciplinary teamwork and testing with real users, this stage focuses on making the idea fit within the organization.

These three stages together are referred to as the early stages or the pre-development stages. Together they are equally important, if not more important than the second half of the innovation process since this is where the initial problem-solution fit is established.

8.2 The importance of the early stages

The early stages of the innovation process are all about shaping ideas into optimal solutions by understanding what problem is being solved. Dorst (2011) defines two dimensions within innovation processes, being the problem-space dimension and the solution-space dimension. To establish the right problem-solution fit, both dimensions should simultaneously be explored, which “involves a period of exploration in which problem and solution spaces are evolving and are unstable until fixed by an emergent bridge which identifies a problem-solution pairing” (Dorst, 2001). This process is referred to as “creative design.”

What Dorst means by this can best be imagined as a spiraling motion between defining the problem and creating the solution until the position is reached in which they perfectly fit together. This is illustrated in figure 14.

In the current process, the organization jumps to conclusions based on the opinion of one person. By skipping the activities in which the problem-space and solution-space are explored, the Dutch UMC is significantly increasing the chance of solving irrelevant problems and developing incompetent solutions.

A second consequence of neglecting the early stages of the innovation process is the trouble that is currently faced during the implementation stage. Because current innovation projects start from the development stage, without involving the people or departments that are relevant for implementation, products are developed which do not comply with the required criteria of the Dutch UMC. Instead, non-compatible products are dropped into the organization, facing a lot of resistance, resulting in delay or even cancelation.

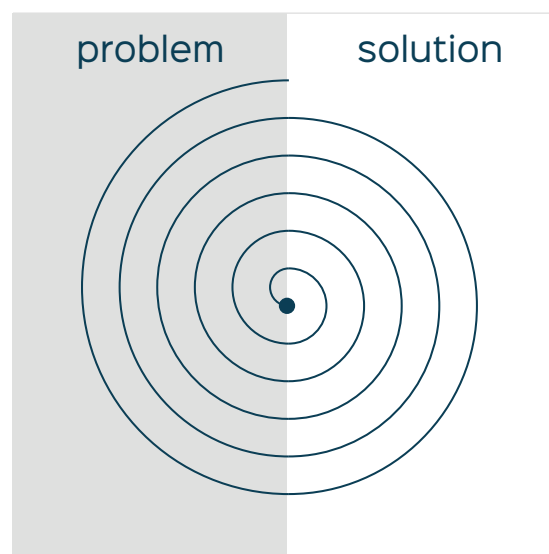


Figure 14: Spiraling motion between the two spaces

In design terminology, the early phases of the innovation process are also referred to as: “the fuzzy front-end of innovation” (Hestatt and Verworn, 2004). “In general, the front-end ranges from the generation of an idea to either its approval for development or its termination” (Khurana and Rosenthal, 1997). The front-end is the least well-structured part of the innovation process (Hestatt and Verworn, 2004), hence the adjective: fuzzy. The front-end process is arduous to manage or plan and often has a chaotic, unpredictable, and informal character. Sanders and Stappers (2008) illustrate the fuzzy front-end in a straightforward yet striking way, as shown in figure 15.

The innovation process’s front-end typically consists of a collection of creative activities like idea generation, rapid prototyping, and concept creation (Hestatt and Verworn, 2004). By working in multi-disciplinary teams and by actively involving the user, these activities are designed to prevent the above-described problems from happening, securing the design of feasible, viable, and desirable solutions.

It is not only the Dutch UMC that is struggling with the complexity of this phase of the innovation process. High failure rates in innovation can often directly be linked to a poorly executed front-end of the innovation process. Still, most organizations focus on the final phases of the innovation process. Hestatt and Verworn (2004) state that the front-end is the biggest pitfall in innovation due to underappreciating the impact of the pre-development activities.

A final observation that is made is that for most organizations like the Dutch UMC, money is seen as a barrier to innovation. However, a better-organized front-end of the innovation process results in saving money by preventing unnecessary investments. Von Hippel (1993) illustrates how changes to the product characteristics in the front-end of innovation have the highest impact, while the associated costs are lowest. Figure 16 shows a slightly modified version of Von Hippel’s graph.

Fuzzy front-end



Figure 15: The fuzzy front end

8.3 Conclusion

By neglecting the early stages of the innovation process, large areas of the problem-space and solution-space are unexplored. The risk this brings is to be solving an insignificant problem or developing an inferior solution. Next to this, the early stages are characterized by creative activities which are performed in larger and more diverse groups that represent

multiple aspects of the organization. By working together like this, the chances of developing non-compatible solutions significantly decrease.

In the end, better organizing the early stages or front-end of the innovation process results in better innovation, satisfied users, and saving money.

Characteristics

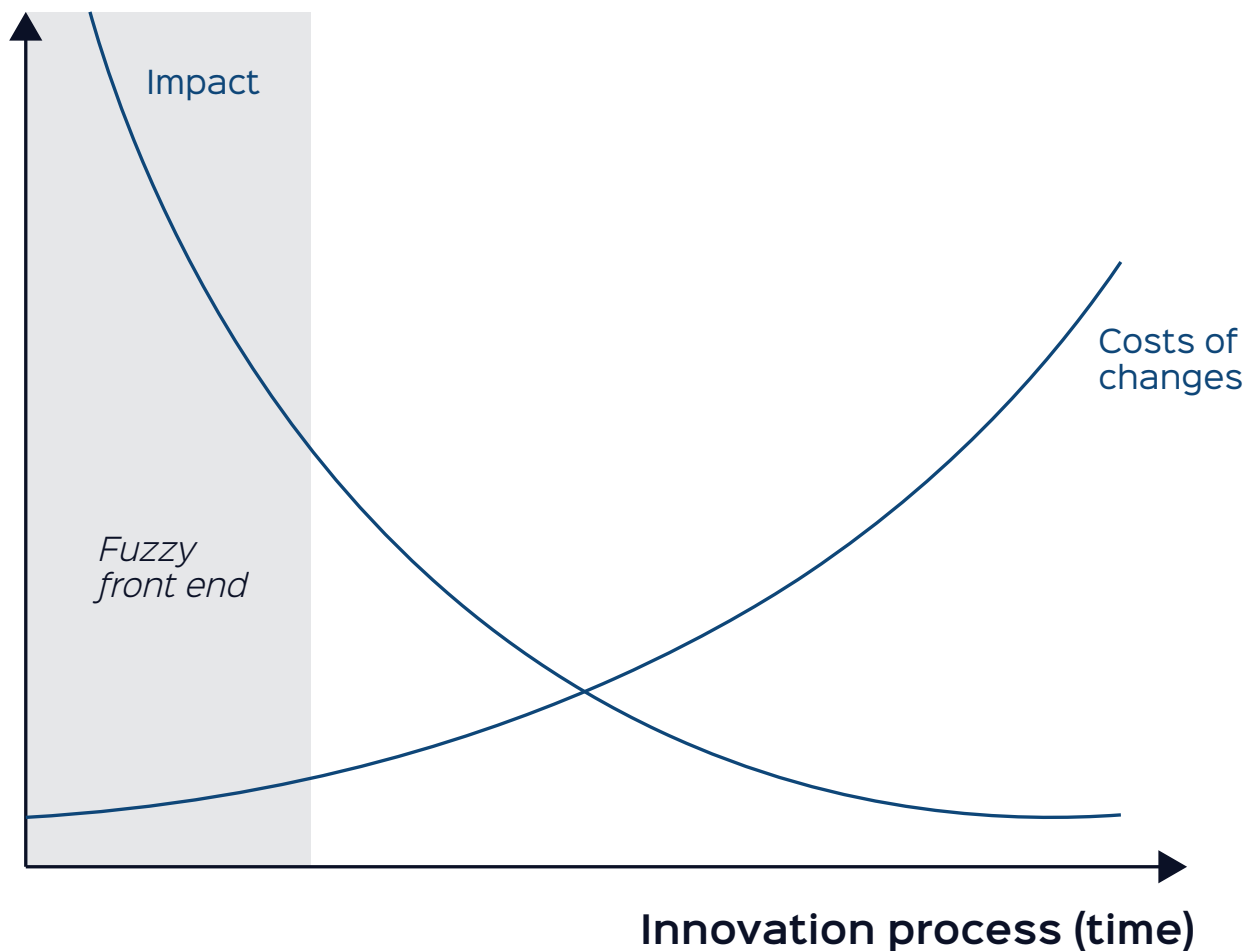


Figure 16: Impact versus costs of changes (source: Von Hippel, 1993)

9. Solution scope

As this project is a design project or even an innovation project in itself, instead of jumping directly onto the defined problem, the solution space has been explored. Although the defined problem clearly illustrates why innovation projects are facing so many challenges, instead of providing different solutions to all seven problem areas, the root cause has been defined.

9.1 Root cause analysis workshop

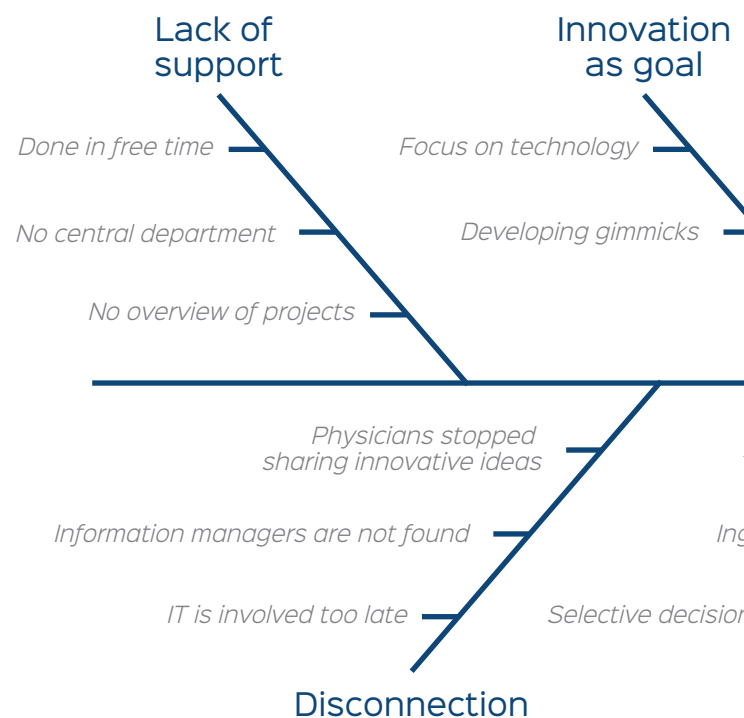
To find the root cause for neglecting the early stages of the innovation process, a root cause analysis workshop was conducted. A focus group was composed to participate in this workshop, representing multiple aspects of the organization. The focus group consisted out of one information manager, two IT managers, and a physician.

As proposed by Kaoru Ishikawa (Ishikawa, 1976), the fishbone diagram was used as a framework to present the defined problem areas to the workshop participants. The fishbone diagram or Ishikawa diagram is a “problem-solving quality tool to help teams identify and discuss all potential causes of an effect” (Perry, 2006). The diagram, which has a fishbone structure, hence the name, starts by defining the main problem and divides the primary causes into tangible topics or themes.

Usually, a project team would compose the diagram jointly, but since research into the problem areas was conducted in advance, the diagram was composed before the workshop. The diagram illustrates the seven problem areas as defined in the previous research phase, and every problem area is divided into sub-problems. The diagram in itself does not present the root cause of the problems but is purely used to structure the problem. Figure 17 shows the diagram.

The participants were asked to select the four most impactful problems to apply the five-why technique to. This

is a simple yet very effective way of finding the root cause of a problem (Serrat, 2017). Like the name indicates, for every problem, you ask “why?” five times in a row.



9.2 Definition of the root cause

Although it may look like this analysis is mainly focused on defining the problem better, the workshop provided valuable insights into why the early stages of the innovation process are neglected and, therefore, how the solution must be shaped.

The five-why technique looks like a simple task but is actually pretty challenging since it is easy to end up in a circle of arguments. Especially when trying to answer why the early stages of the innovation process are not organized, the easy answer to give is: “because we never did.” Since not everyone participated in the workshop at the same time, the final conclusions were collected and merged into the following root cause:

“The Dutch UMC has not organized the early stages of the innovation process because there is a lack of knowledge about the importance and way of doing this”

After the participants agreed on this conclusion, the root cause was used to shape the solution scope by answering this need:

“The Dutch UMC is in need of the tools which make them understand how to structure the early stages of the innovation process and why this is so important.”

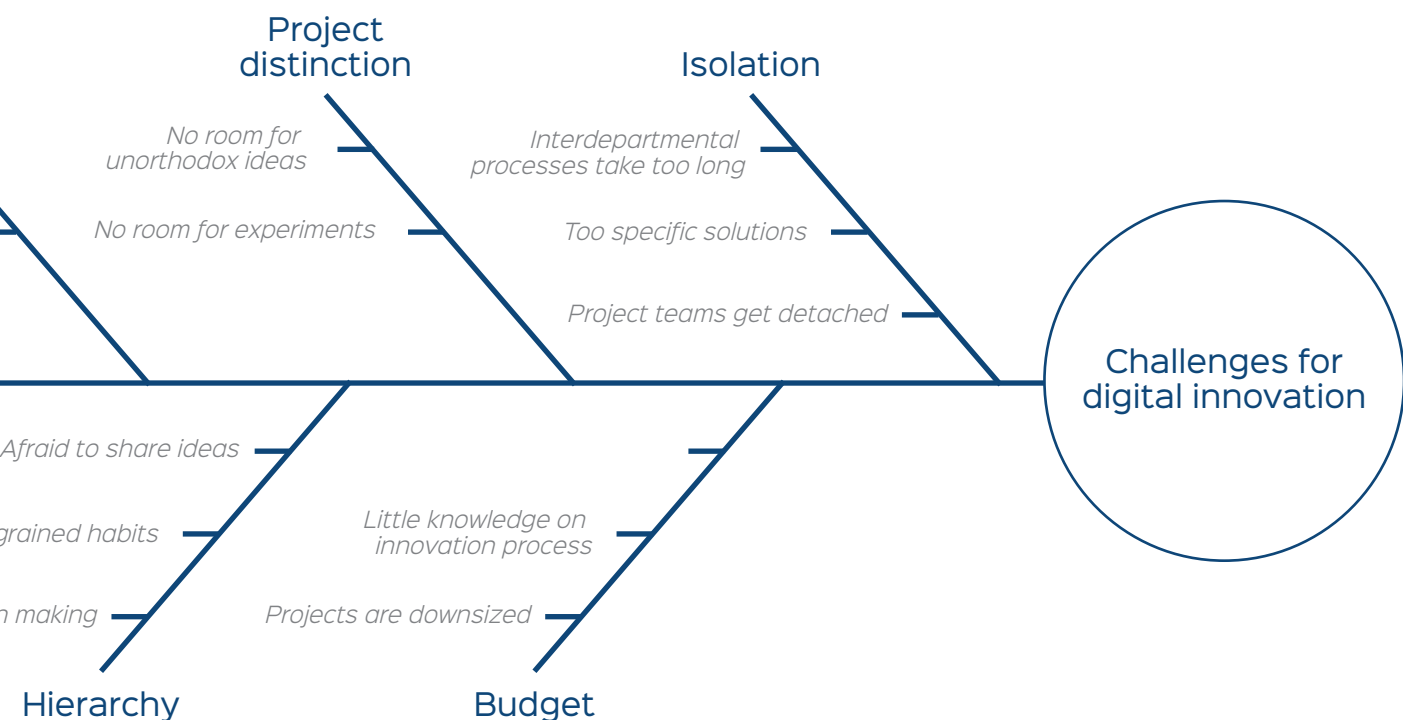


Figure 17: The fishbone diagram

9.3 The client

To create an understanding and ensuring actions will be taken upon these insights, a client must be found to receive and share this information.

Logically the client would be the initiators of this project: an information manager and a physician within the Dutch UMC. However, it is not their responsibility to convince the organization of a new way of working. Therefore, the conclusion was made that the client must be present at the top of the organization. During conversations with the management, however, an additional problem was brought up. Due to the situation regarding the Covid-19 pandemic, schedules are very tight, leaving little room for participation in this project.

A solution to this problem was found in developing a tool that can be used by a different group to transfer the required knowledge to management. The in-between user who was presented is a group of people known as the “innovation club.” This group is already very active in discussing topics related to innovation within the Dutch UMC, recognizes the problem, and is supportive of change. The only drawback is that this group exists of solely IT employees instead of a mix which would have better represented the organization as a whole.

9.4 Design criteria

After appointing the innovation club as the user, multiple meetings were arranged to better define the solution. Ultimately, the decision was made to divide the solution into two parts: an innovation framework and a boundary object. These deliverables will be discussed one by one.

The innovation framework

Since there is little knowledge on the importance of organizing the early stages of the innovation process and at the same time no idea on how to do this, the first deliverable will be an innovation framework. The goal of the innovation framework is for the Dutch UMC to be able to structure the early stages of the design process in a standardized way. The framework should also bring a common language to the organization to make it less complicated to talk about the topic of innovation in all layers of the organization. Thereby, regular terminology often has a different meaning within health care settings, causing confusion.

The boundary object

The second deliverable is a boundary object. Carlile (2004) defines a boundary object as “a means of representing, learning about, and transforming knowledge to resolve the consequences that exist at a given boundary.” These knowledge boundaries can often be recognized between specialized domains within organizations (Carlile, 2002). In this case, the boundary object

is developed to bridge the gap between the domain of innovation and health care, as illustrated in figure 18.

Boundary objects are not limited to any shape or form. The objects can be abstract or concrete, as long as they can transfer the required knowledge between two domains.

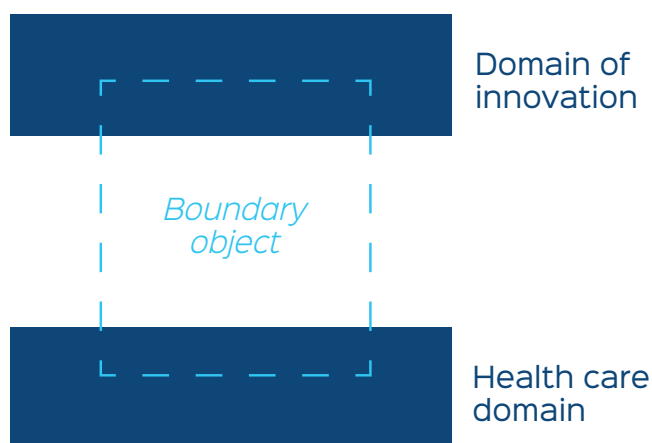


Figure 18: The boundary object

9.5 Conclusion

The solution which will be provided to the Dutch UMC must bring knowledge about the need of organizing the early stages of the innovation process and support in the execution. The solution is therefore divided into two separate deliverables, which are developed for the innovation club.

The decision was made to offer this solution in two separate deliverables,

which are developed for the innovation club. The first deliverable will be an innovation framework, and the second deliverable will be a boundary object which can be used to transfer knowledge on innovation into the health care domain. The task of the innovation club is to use these tools in proposing new ways to organize innovation to the management of the organization.

10. Concluding define

In this research phase, four questions were answered by means of prior research findings, additional interviews, a literature study, and a workshop. The answers to these four questions together provide the design brief for this project:

Why is it a problem to neglect the early stages of the innovation process?

Neglecting the early stages of the innovation process brings along two major problems. First of all, large areas of the problem-space and solution-space are unexplored, and second of all, by skipping the creative activities that characterize these stages, there is a high chance of developing non-compatible solutions.

What is needed to solve this problem?

The Dutch UMC is in need of tools to make them understand how the early stages of the innovation process should be structured and why this is so important

Who is the client for the proposed solution?

Because of very busy management, the solution is developed for and with the innovation club. This is a group of IT employees that are already actively involved in how to re-shape innovation within the organization.

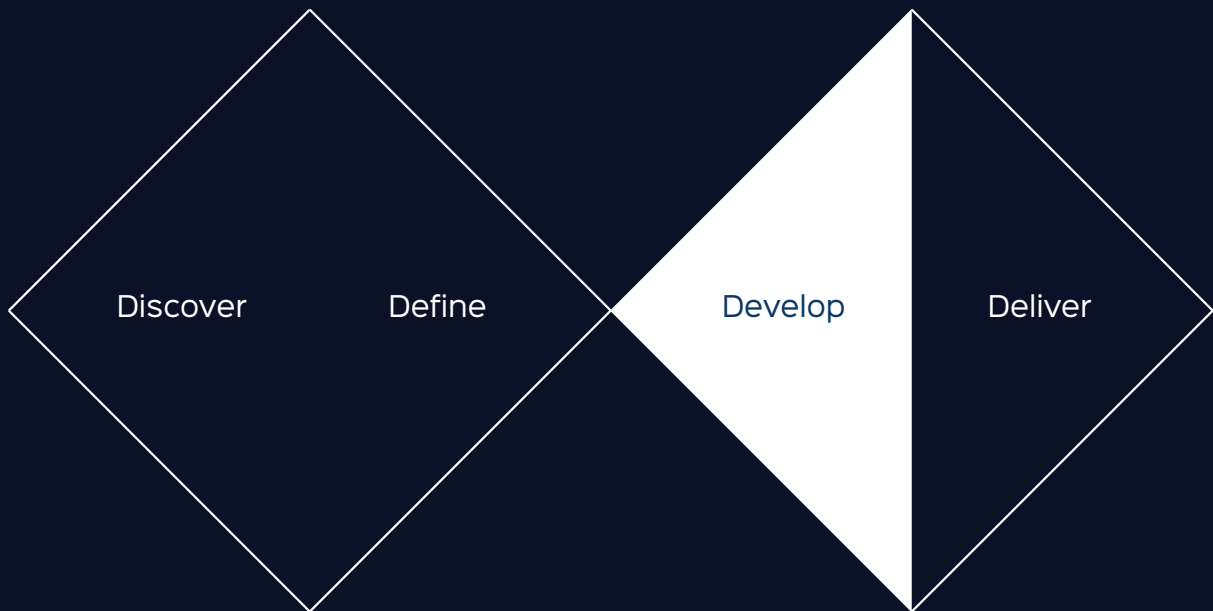
To what design criteria must the solution comply?

Two tools or deliverables will be delivered to the innovation club. The first deliverable will be an innovation framework that can be used to organize the early stages of the innovation process in a standardized way, and the second deliverable will be a boundary object to transfer knowledge from the innovation domain to the domain of healthcare. The tools will eventually be used by the innovation club to propose new ways of organizing innovation within the Dutch UMC to the management of the organization.

PHASE 3: DEVELOP

shaping the innovation framework and boundary object

The design brief serves as a clear starting point for the exploration of the solution space. Since there have been no efforts by the Dutch UMC to structure the front-end of digital innovation yet, the process must be developed from the ground up. Therefore, this phase aims to research and review the possibilities of structuring the front-end of digital innovation by addressing the available literature on this topic.



11. Introducing develop

In this third phase of the research, the most promising method to structure the front-end of digital innovation is defined. To find this most promising method, five sub-questions were answered by conducting a literature study. The sub-questions are illustrated in figure 20.

This phase exists of two chapters, of which the first addresses how the most promising method has been found and the second chapter what this method entails and how it could be applied to the Dutch MC. Each chapter will be concluded by summarizing the key findings, and a third chapter will present the overall conclusion of this research phase.

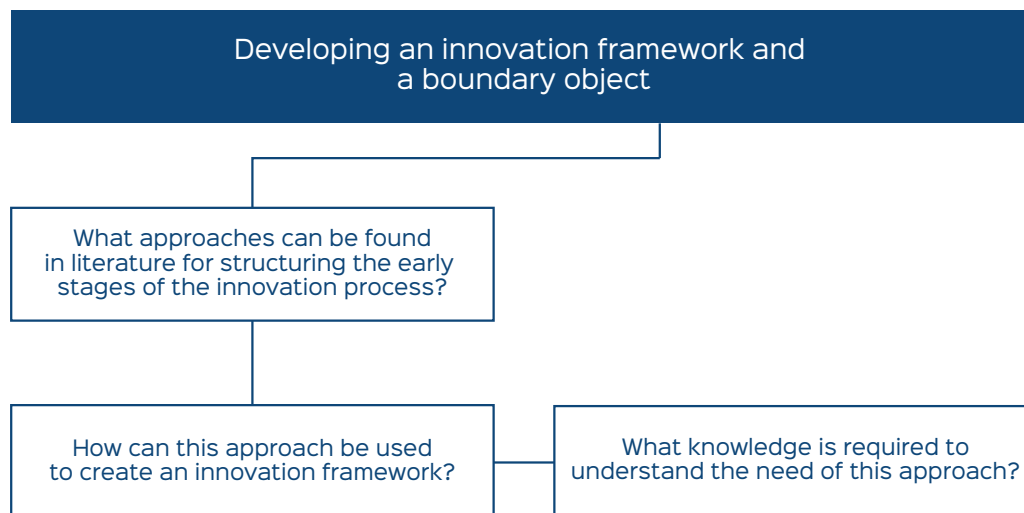


Figure 19: The sub-questions of develop

12. Structuring the early stages of innovation

Literature research has been conducted to select user-centered design as the most suitable approach to structure the early stages of the innovation process. In this part of the report, this decision will be substantiated by reviewing the different possible types of innovation and corresponding approaches. Since user-centered design in itself does not propose a concrete structure that could be used to shape the innovation framework, design thinking, a user-centered design method is analyzed.

12.1 Types of innovation

Innovation can generally be distinguished into two categories: radical innovation and incremental innovation. Radical innovation revolves around creating completely new product propositions and incremental innovations focusing on improving the current situation through subtle changes in products, systems, or processes (Norman and Verganti, 2014). Developing radical innovations is a business model which tends to completely wipe away all existing competition by introducing products of which the market does not exist yet. Radical innovation often has a higher risk than incremental innovation due to a greater chance of failure in product development and customer acceptance. A great example of recent radical innovation would be Netflix. Existing technology was used to create a product proposition for which the market did not exist. This results in Netflix taking up all space in this newly created market while at the same time, previous solutions serving similar customer needs become obsolete. Due to the high risks involved with radical innovation, incremental innovation is more common to large organizations. Instead of demolishing current markets, incremental innovations improve the user experience or lower the production costs of existing solutions by leveraging new technology or applying existing technology in a new context (Norman and Verganti, 2014). Norman and Verganti (2014) illustrate the relationship between incremental and radical innovation for the dimensions of meaning and technology, resulting in

four main types of innovation. Norman and Verganti (2014) address that none of these types can be addressed as the best innovation type. Also, they do not automatically exclude one another. For instance, innovations can be technology-push innovations and, at the same time, market-pull innovations. Organizations, however, tend to focus on one type of innovation, understanding the possible expansion to an adjacent field. Figure 20 illustrates the four types of innovation.

Technology push

Technology push innovations are innovations that show a radical change in technology without changing the product's meaning. As the name indicates, technology push innovations are innovations of which the technology is developed before having defined the application of this technology. The right market and customer value are sought afterward.

Meaning driven

Without involving new technologies, the meaning of a product is radically changed. Meaning-driven innovation is often related to socio-cultural dynamics resulting in words or objects obtaining a new meaning.

Technology epiphanies

Technology epiphanies are innovations that radically change the meaning of a product through the development of new technologies. These are the types of innovations from which the user did not know it was desired.

Markte-pull

Market-pull innovations are innovations that respond to the expressed desires and wishes of the customer. Incremental changes in both technology and meaning result in safe but desired propositions.

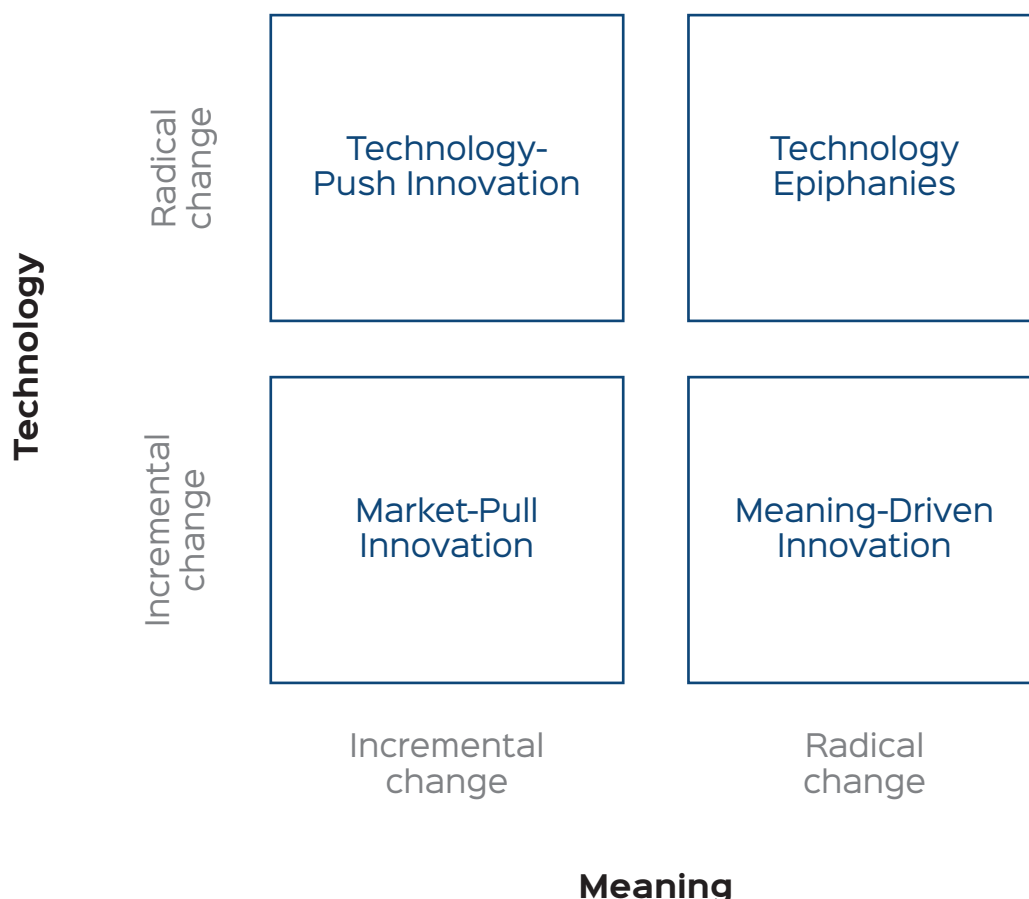
In the current approach of the Dutch UMC, innovation projects are mainly triggered by new types of technology. When locating this approach in the framework of Norman and Verganti, it shows most similarities with technology-push innovation. Whether this is an appropriate strategy for a health care organization is questionable.

To pursue a technology push innovation strategy would at least require a research and development department that knows how to turn new technologies into viable healthcare solutions (Brem and Voigt, 2009). Prior research, however, illustrates how all

development is outsourced due to a buy-over-make policy. Pisano (2015) demonstrates how organizations should focus on developing innovations that leverage an organization's core capabilities. The core capabilities of the Dutch UMC can be found in the enormous knowledge of health care processes and experience in patient care.

Instead of getting hung up on the development of health care technologies, it would be way more effective to benefit from the many competent health care professionals within the organization. There is simply no other organization that could better detect the desires of potential users and opportunities for innovation within health care than the Dutch UMC themselves. A strategy that would fit this vision is to focus on market-pull innovations.

*Figure 21: The sub-questions of develop
(source: Norman & Verganti, 2014)*



12.2 User-centered design

The approach which is described as most suitable for market-pull innovation is user-centered design (Norman and Verganti, 2014). In this chapter, the main characteristics of this approach will be discussed.

User-centered design is not a step-by-step plan but can best be labeled as a mindset or philosophy. Van der Bijl-Brouwer and Dorst (2017) define user-centered design as “a group of methods and principles aimed at supporting the design of useful, usable, pleasurable and meaningful products or services for people.” It is considered a core quality of design and is making its way into tackling innovation challenges. Van der Bijl-Brouwer and Dorst (2017) refer to this approach as “design innovation”. Design innovation uses multiple traditional design practices and humanizes the innovation process by focusing on gaining a deep understanding of the users, their troubles, and desires.

Multiple methods have been developed to apply user-centered design to organizations. Roberts et al.

(2016) argue that there is a significant opportunity for health care systems to tackle their innovation problems based on the design thinking method. Design thinking is a method that is mainly used for the early stages of the innovation process (Brown, 2008) and enables non-design organizations to tackle innovation challenges from a designer’s perspective (Tschimmel, 2012). Apart from being easily accessible, “the integration of a design thinking framework not only offers health systems a way to respond to certain change, but it also offers health systems the opportunity to lead it” (Roberts et al., 2016).

The design thinking method will be reviewed in the upcoming chapters in order to find whether it can be used as a base for the innovation framework.

12.3 Design thinking

Based on the literature, design thinking sounds like a promising method to structure the early stages of the innovation process. In this part of the report, the method itself, the corresponding process, and people will be discussed.

12.3.1 The characteristics of design thinking

Design thinking has been existing for some time but has recently been popularized by the design company IDEO. Design thinking aims to solve concrete human needs as a user-centered approach, stimulate creative thinking, and help organizations quicker solve wicked problems. Dell'Era et al. (2020) describe design thinking as “a formal creative problem-solving method with the intent to foster innovation.”

Design thinking is characterized by developing empathy for the user, systems thinking, radical collaboration, and rapid prototyping (Roberts et al., 2016, Design Council, 2013). Each of the four characteristics will be explained.

Developing empathy for the user

As design thinking is a user-centered design method, the user is literally put in the center of the process. Developing empathy for the user means that the project team devotes their time to trying to understand the situation and problem from the perspective of the user. The reason to really step into the shoes of the user is to make sure that the proposed solution will be inherently desirable (Brown, 2008). Typical tools and activities for developing empathy are observations, interviews, and customer journeys.

Systems thinking

New products or innovations do not affect one person or department

within an organization but complete systems (Roberts et al., 2016). The design thinking method contributes to designing solutions with every touchpoint in mind. Through scenarios, customer journeys, or roleplaying, all interactions of the innovation with the organization can be mapped and incorporated in creating the final design.

Radical collaboration

Design thinking stimulates radical and sometimes unexpected collaboration within organizations. Innovation challenges, especially in organizations sized like the Dutch UMC, cannot be solved by individuals or isolated groups of like-minded people. “The lone creative geniuses have been replaced by the enthusiastic interdisciplinary collaborators” (Brown, 2008).

Rapid prototyping

To prevent the development of poor solutions, the design thinking method encourages project teams to constantly test ideas through rapid prototyping. In engineering, prototypes are often seen as the final model before launching a product. In design thinking, however, a prototype is the least complicated way of demonstrating an idea. “Prototypes should command only as much time, effort, and investment as are needed to generate successful feedback” (Brown, 2008). Some paper, a pencil, and a pair of scissors will do the job in most scenarios.

12.3.2 The design thinking process

As defined in the prior stages of this project, the innovation process, especially the first half, is very hard to structure. With an unknown outcome, new pieces of information keep appearing along the process, steering the solution towards new directions or even proposing a new problem to be solved. Design thinking, however, offers a flexible structure for the early stages of the innovation process.

Design thinking defines five iterative phases without explicitly mentioning a beginning or an end. The institute of design at the Stanford University defines these five stages as empathy, define, ideate, prototype, and test. Figure 21 illustrates these five phases.

Although the illustration might give the impression of a linear process, the design thinking process should be seen as a circular movement that can be joined from any stage. Although the figure already provides a clear illustration of what the process of design thinking looks like, to be more specific, each phase is briefly explained.

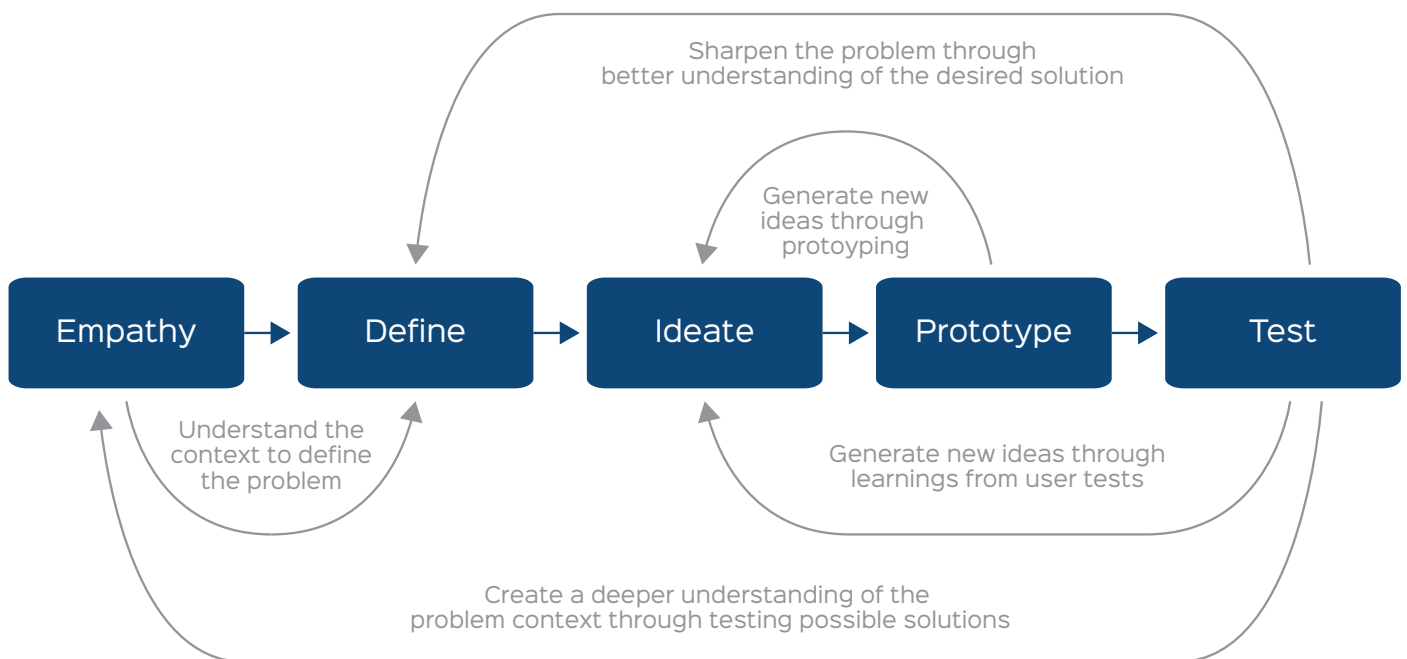


Figure 21: The design thinking process

Empathy

In this stage, the project team involves with the user to get rid of all existing assumptions. By looking through the user's eyes, the problem context is tried to be understood from their perspective.

Define

In this stage, all gathered information on the problem context is used to clearly define the problem to solve, or positively framed: the opportunity for innovation.

Ideate

The ideation stage is characterized by creating as many ideas as possible for the defined problem. In groups, out-of-the-box thinking is stimulated by using design tools such as brainstorming and sketching. This stage usually ends by selecting the most promising ideas.

Prototype

The selected ideas are turned into quick and simple prototypes which can be used to test the idea. Since building prototypes often leads to new or customized ideas, this stage is often seen as an extension of the ideation stage.

Test

The testing stage is meant to quickly evaluate ideas with actual users. In this stage, the prototypes are used to collect the required feedback to adapt, improve or dismiss the idea.

The design thinking process is a comprehensible way of structuring the early stages of the innovation process. Especially for non-designers, this structure can be helpful to understand how not every initial idea is as promising as it looks.

Design thinking types	Design expertise levels
Result focussed	Naïve
Conventional-based	Novice
Situation-based	Advanced beginner
Strategy-based	Competent
Experience-based	Expert
Developing new schema	Master
Redefining the field	Visionary

*Expected level
within the Dutch UMC*

Figure 22: The seven design thinking types

12.3.3 People in design thinking

Although design thinking clearly describes the steps and activities to organize the early stages of the innovation process, without the right people, this method will not be executed correctly.

Most studies indicate that anyone can learn design thinking. Like any other skill, however, it takes time to master. Dorst (2006) states that the best way of acquiring design capabilities is through “practice, application, and experience.” Mosely et al. (2018) distinguish seven design thinking types based on their design expertise.

Since design thinking is an unknown method to the organization, the average level within the organization is expected to be “naïve.” Mosely et al. (2018) define how design thinking types with lower levels of expertise generally “follow the rules of the game.” It is therefore essential to have the process guided by design managers (The Design Council, 2007). Although there are no restrictions

on who is involved in the innovation process, the best results come from diverse collaborations (Roberts et al., 2016). Teams can, therefore, best be made up of different representatives of the organization. The most valued team members are described as “T-shaped professionals” (Demirken and Spohrer, 2015). T-shaped professionals are people who can translate their expertise on a specific topic over a broader domain, as illustrated in figure 23.

Working together in multi-disciplinary teams of T-shaped professionals results in a “smoother landing”. Instead of dropping the solution onto the daily operations, solutions are developed with the corresponding restrictions in mind.

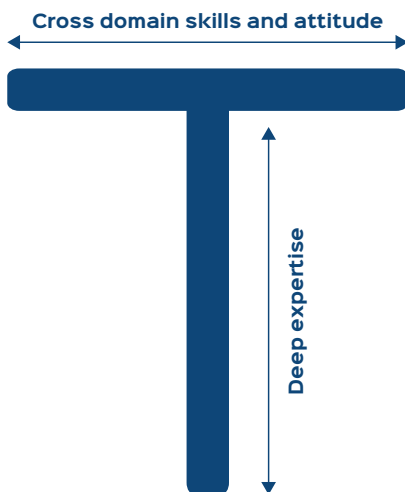


Figure 23: Schematic illustration of a T-shaped professional

12.4 Conclusion

The literature strongly indicates the Dutch UMC is currently focussing on the development of technology push innovations. Although this is not per se a bad strategy, it does not seem to fit to the organization's core capabilities. For this reason, a shift is proposed towards focussing on the development of market-pull innovations.

The most suitable approach in structuring the early stages of the innovation process for this kind of innovation is user-centered design. Because user-centered design in itself does not offer a solid structure to shape the innovation framework, design thinking, a user-centered design method, has been selected as a starting point.

Design thinking is characterized by developing empathy for the user, systems thinking, radical collaboration, and rapid prototyping. The method provides a process to structure the early stages of the innovation process and can be learned by anyone. All in all, design thinking seems to be a very promising method to guide in designing the innovation framework.

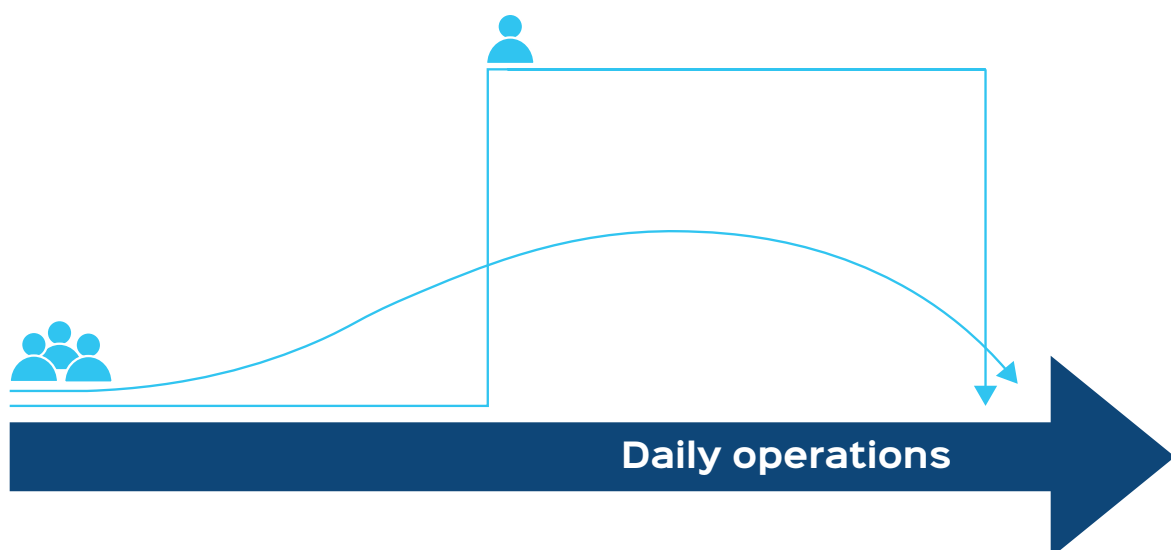


Figure 24: A smoother landing of innovations

13. Boundary of knowledge

The innovation framework will be accompanied by a boundary object which can be used by the innovation club to transfer knowledge about innovation to the organization. To find what information is needed by the innovation club to be able to succeed, their knowledge of innovation processes was weighted. These insights were used to define the crucial elements for the boundary object.

13.1 Investigation of the knowledge gap

The innovation club was invited to two generative sessions in which the project results so far were presented together with an initial introduction to design thinking.

Although the deliverables had been defined in collaboration with the

innovation club, in this session the effectiveness was questioned. At first glance, this looked like taking a step back in the process, but eventually, it benefitted in clarifying the main focus of the boundary object.

13.2 The crucial elements for the boundary object

While discussing the research findings, it quickly became clear that the innovation club was mostly interested in the form in which the deliverables would be presented. The group shared their expectations on the deliverables being technological innovations themselves. For instance, the suggestion was made to present the framework through a virtual reality tour or in an escape room packed with technologies. Despite having just presented a new take on innovation that does not start from new technologies, the group proposed the exact opposite.

Due to pursuing a technology push innovation strategy while neglecting the early stages of the innovation process, non-technical solutions seem to be regarded as inferior. As this project can be seen as an innovation project in itself, the solution has prematurely been shaped in the mind of the innovation club.

By having the innovation club define the goal of the solution themselves, eventually, they understood how technology did not support in reaching

this goal sooner. Instead, they were able to see the difference in approach between including and excluding the early stages of the innovation process and got excited about adopting design thinking. Eventually, the decision was made not to include any technology in the deliverables but to stick to tools that are easy to use and really support the goal of transferring knowledge on this complicated topic to management and others. As most communication currently takes place via video calls, the innovation framework and boundary object will be provided in presentation format.

An additional insight that was created by these discussions is the difficulty of the topic. As the innovation club, which is most knowledgeable on the topic of innovation, already had many difficulties understanding the actual problem and proposed solution, it will only be harder for the rest of the organization. Therefore the complete story about the current situation, the corresponding problems, and added value of the proposed innovation framework must be presented in easy language.

12.4 Conclusion

The innovation framework and boundary object will be provided in presentation format to be able to transfer the required knowledge in a common and accessible manner. The boundary object should provide the complete story about the current situation, the experienced problems, and the added value of the proposed innovation framework.

14. Concluding develop

Through literature study, in this part of the research, three questions were answered. The answers were used to make the final decisions on the design of the proposed solution.

What approaches can be found in the literature for structuring the early stages of the innovation process?

The Dutch UMC currently seems to be pursuing a technology push innovation strategy that is not suitable for the organization. Therefore, a new strategy of pursuing market-pull innovation is proposed. The approach which is promising for health care and fits this strategy is user-centered design. User-centered design can be seen as a philosophy or mindset in which every decision on the design of the innovation is based on the users' wishes and desires. However, the user-centered design approach does not bring a concrete structure to the early stages of the innovation process.

How can this approach be used to create an innovation framework?

Design thinking, a user-centered design method, has been selected to shape the framework. Design thinking offers a clear structure already and is applicable to non-design organizations. The four main characteristics of design thinking, which will be visible in the innovation framework, are: developing empathy for the user, systems thinking, radical collaboration, and rapid prototyping.

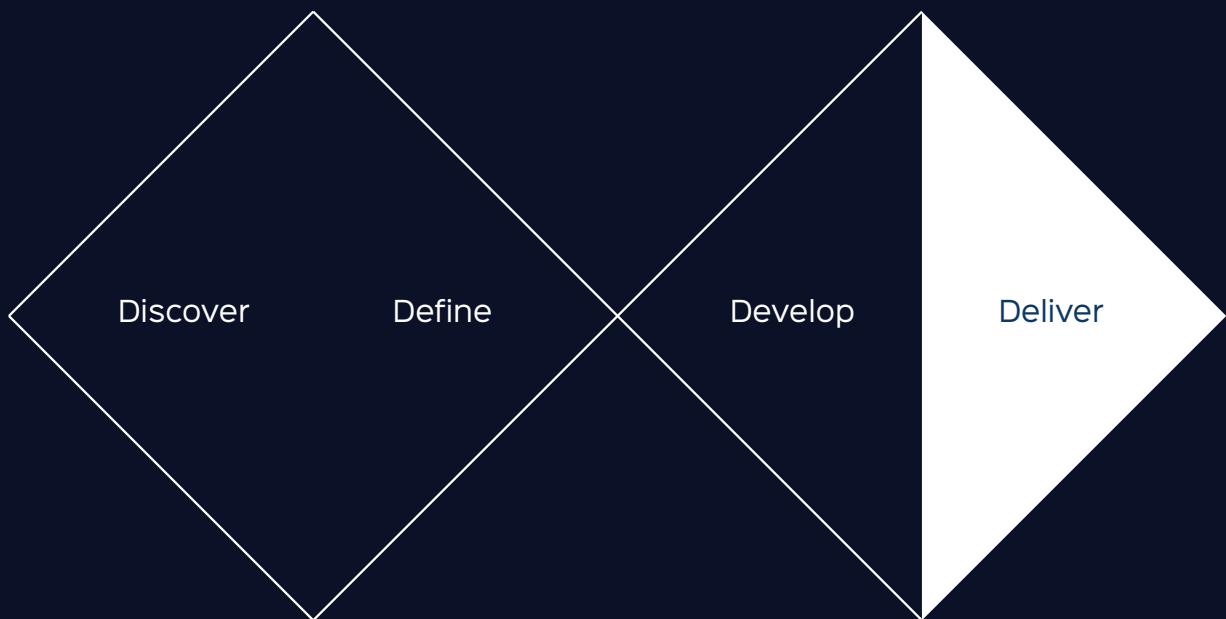
What knowledge is required to understand the need for this approach?

Since the topic of innovation seems to be a very complicated one, to understand this need, the full story should be covered on the current process and corresponding problems and the added value of using a new innovation framework. Therefore, the innovation framework and boundary object will be presented in presentation format. Together with the innovation club, the decision has been made that this is the most common and applicable form.

PHASE 4: DELIVER

proposing the final solution

In this last research phase, the innovation framework and the boundary object are presented. To evaluate the deliverables, they have been reviewed by the innovation club and reflected on from a problem perspective.



15. Introducing deliver

In the final phase of this research, the solution will be presented. The final design of the innovation framework and boundary object will be discussed and substantiated, and both deliverables are reviewed by the innovation club. The four sub-questions, as illustrated in figure 25, will be used to structure this phase.

In this order, the following three chapters will present the innovation framework, the boundary object, and an evaluation of the solution.

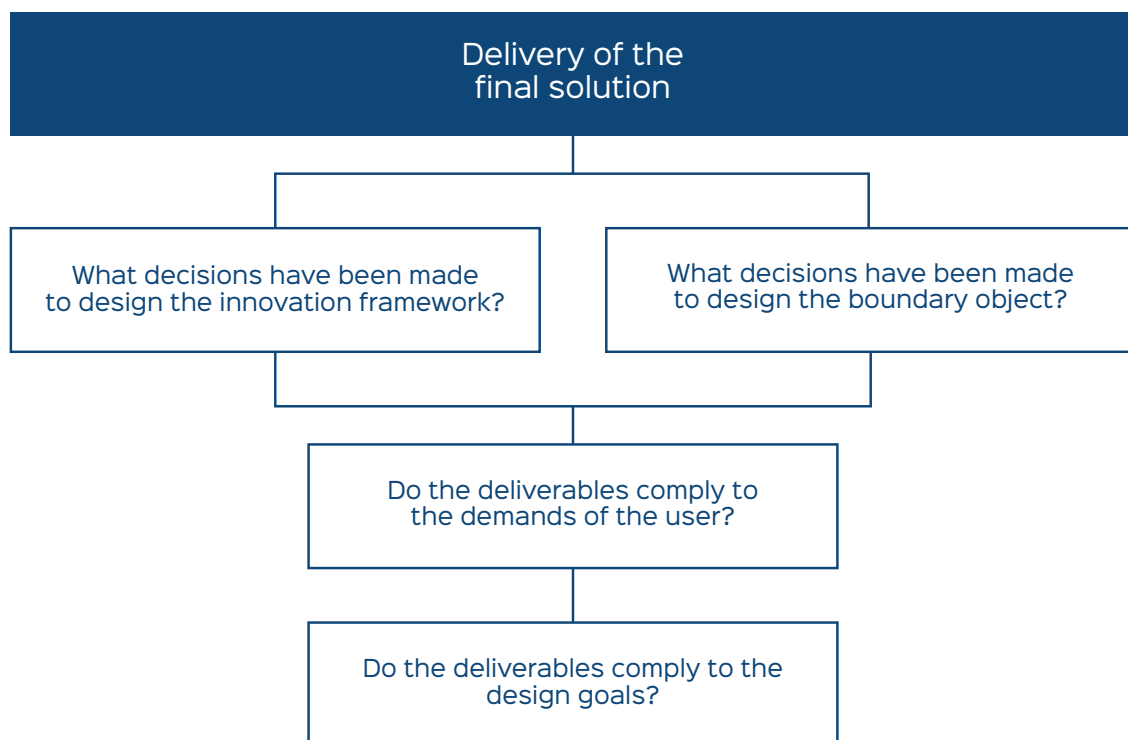


Figure 25: The sub-questions of deliver

16. The innovation framework

The final innovation framework divides the early stages of the innovation process into four stages. The title of each phase is a verb that best describes the main activity of the specific phase. Since all verbs start with a “V”, the innovation framework is referred to as: “the 4V-model”. The 4V-model will be discussed by reviewing the phases one by one.

The 4V-model can be found in figure 26. It is meant as a framework that can be used to shape the early stages of the innovation process as well as providing a language to discuss these stages.

The model divides the first half of the innovation process into four stages: vangen (catch), vragen (collect), vormen (create), and verbinden (connect).

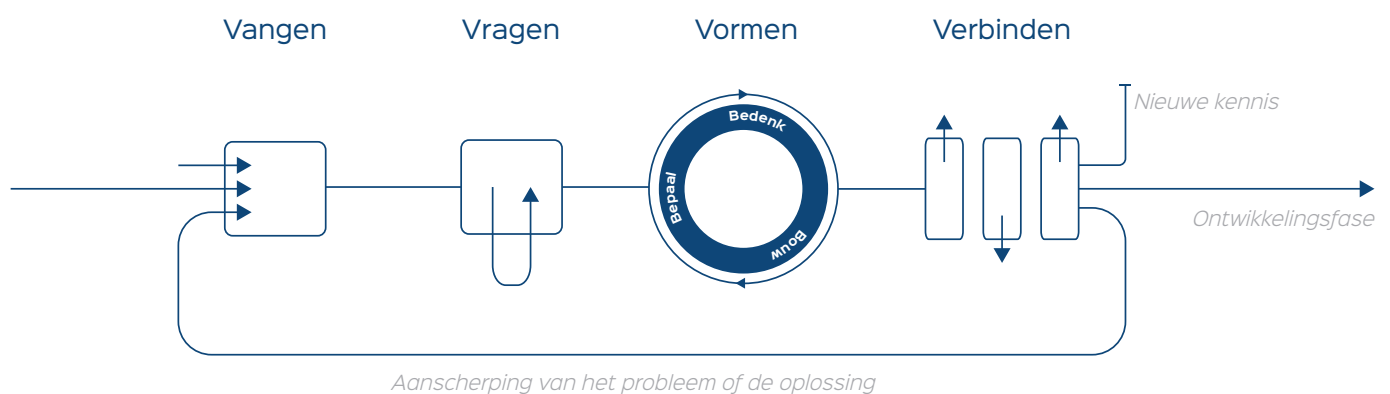


Figure 26: The 4V-model

Vangen

This stage is meant to catch all ideas, problems, and opportunities that live within the organization. In the current process, these are not collected or prematurely dismissed. Therefore, the motto of this phase must be that every idea is welcome. By actively collecting what lives within the organization, the Dutch UMC is able to define the biggest problem areas, steering innovation projects in the right direction.

Vragen

By neglecting the early stages in the current innovation process, ideas are presented as the final solution. The user of the solution, however, is never involved in this process, resulting in the possibility of solving insignificant problems or developing poor solutions. In this stage, project teams interact with the future user to clearly define the problem and problem context.

Vormen

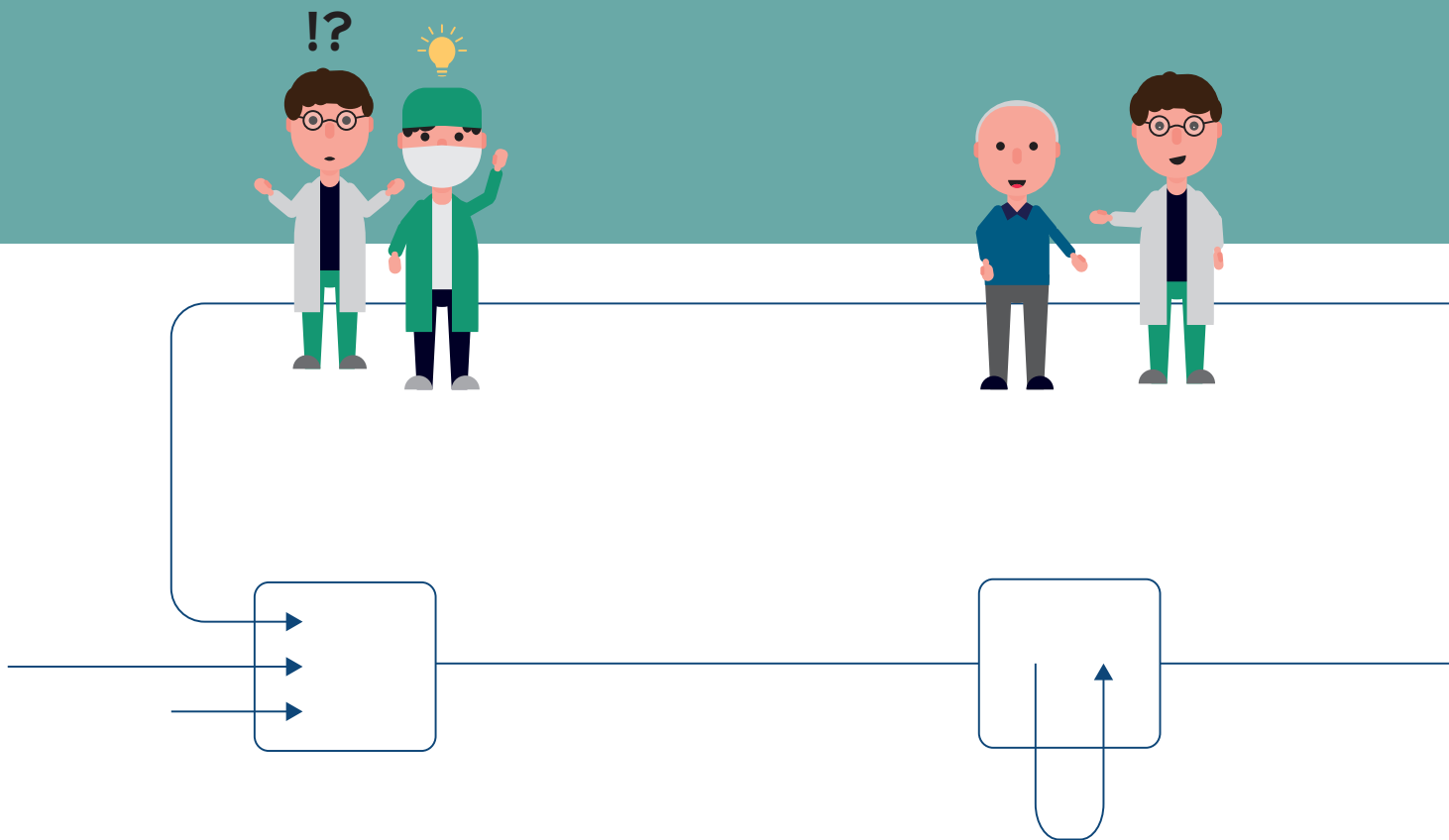
Instead of pushing forward the initial idea, this phase is all about creating

as many ideas as possible for the defined problem. By involving as many stakeholders as possible, multiple aspects of the organization are represented, resulting in desirable, viable, but mostly feasible ideas.

Verbinden

As with design thinking, prototypes of the most promising ideas will be tested with real users. This stage can have three possible outcomes. First of all, the conclusion can be made that the idea does not seem to be as promising as expected and will be dismissed. Instead of having failed, new knowledge has been acquired, which can be used in current and future projects. Second of all, testing the idea can indicate revision of either the problem or solution, meaning to go back to the start of the process. Lastly, the user test shows such a positive result that the idea is passed on to the development stage. Usually, this does not happen during the first user test of an idea, but after going through all 4 V's a couple of times.

The 4 V's together form an innovation framework that can help the Dutch UMC to look differently at innovation and start the conversation about organizing the early stages of the innovation process. To facilitate in this process, a poster has been created describing the key points of the 4V-model. In this way, the innovation framework can be easily shared, presented, or shown to others within the Dutch UMC. The poster is shown in figure 27.



VANGEN

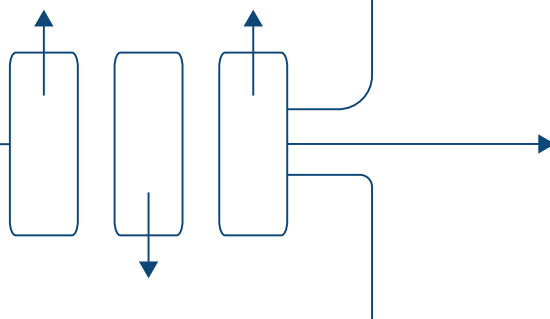
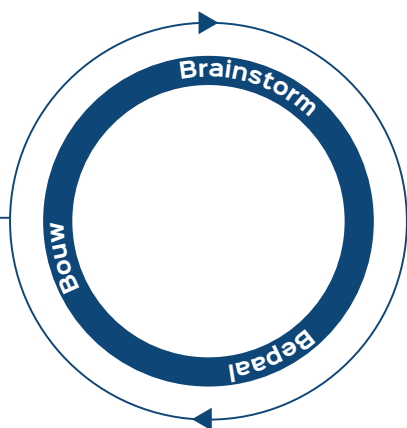
Alle ideeën, problemen
en kansen vanuit de
business worden
opgevangen

VRAGEN

Door in gesprek te
gaan wordt het
probleem gedefinieerd
vanuit het perspectief
van de gebruiker

V

DOOR DESIGN



VORMEN

Tijdens creatieve sessies werken verschillende afdelingen samen om oplossingen te bedenken

VERBINDEN

Voorafgaand aan de ontwikkelingsfase worden oplossingen altijd eerst getest bij de gebruiker

17. The boundary object

The second deliverable is a presentation deck that can be used to transfer knowledge from the innovation domain to the domain of health care. In this chapter, the boundary object will be presented and discussed.

The boundary object is initially created to be used by the innovation club in conveying the need to revise the innovation process to management. The boundary object is made up of a presentation deck that describes the current situation, the need for change, and the benefit of this change in chronological order.

The main concern of the innovation club was to end up with yet some extra paperwork and not so much a tool that triggered excitement. However, as a matter of practicality, it certainly had to be a presentation deck. Together with the innovation club, the information and way of presenting the information

have been defined and refined to eventually end up with a presentation deck that really tells a story. Therefore, the deck can be used in any situation since the viewers do not need to have any prior knowledge on the topic of innovation. Although a well-informed presenter would be able to provide additional information and answer questions, the deck could be provided as plain reading material.

An overview of the presentation deck is provided in figure 28.

The full presentation deck can be found in appendix B.



Figure 26: the presentation deck

De structuur van innovatie

Door deze onvoorspelbaarheid is het innovatieproces zeer lastig te structureren of in te delen in vooraf gedefinieerde fases



Innovatie is het beste te beschrijven als een constante beweging tussen het op te lossen probleem en mogelijke oplossingen

De structuur van innovatie

Hiermee is er dus ook geen vast begin- of eindpunt voor het innovatieproces, het is dus ook niet per definitie verkeerd om vanuit een nieuwe technologie te beginnen



Echter, dient deze wel geleidelijk te worden op het gedefinieerde probleem en zullen er alternatieve oplossingen overwogen worden



De gebruiker centraal

De constante factor in dit onvoorspelbare proces zijn diegenen die het probleem ervaren, zij zullen immers ook degenen zijn die de oplossing gaan gebruiken

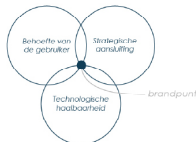


Door de gebruiker centraal te stellen in het innovatieproces wordt het juiste probleem opgelost met de meest effectieve oplossing



Samenwerkingen

Behalve dat innovaties aan moeten sluiten op de behoefte van de gebruiker, moeten deze ook technisch haalbaar zijn en passen binnen de strategie van de organisatie



Dit vraagt om ongebruikelijke samenwerkingen tussen afdelingen die in reguliere processen mogelijk volledig los staan van elkaar

Het 4V-model

Het 4V-model beschrijft een kader dat structuur geeft aan het innovatieproces tot aan de ontwikkelingsfase



In plaats van een vaste volgorde te volgen, kan er in het proces vrij bewegen worden tussen de vier onderdelen:



Vangen

Vangen staat voor het opvangen van alle ideeën, problemen en kansen die gedeeld worden vanuit de zorg, zonder deze direct te beoordelen



De uitkomst van een innovatieproces is immers altijd onbekend. Door te vangen, zorg je ervoor dat eventuele waardevolle informatie niet vroegtijdig verloren gaat



Vragen

Omdat problemen vaak meerdere lagen hebben, moet je tot de kern van het probleem komen voordat de juiste oplossing kan worden voorgesteld

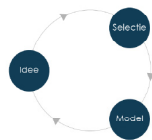


Om deze te versluisen en te kunnen begrijpen vanuit het perspectief van de gebruiker zul je je in hen moeten verplaatsen en continu het gesprek aan blijven gaan



Vormen

Wanneer het duidelijk is welk probleem er opgelost moet worden, begint het creatieve proces waarin zoveel mogelijk oplossingen worden bedacht



De meest kansrijke oplossingen worden geselecteerd en uitgewerkt tot simpele modellen

Vormen

Het vormen van ideeën over mogelijke oplossingen kan worden gedaan aan de hand van groepsactiviteiten zoals brainstorming, superstorming of mind mapping



Voor het beste resultaat moet er samen worden gewerkt in diverse, multidisciplinaire teams en niet in groepen bestaande uit enkel IT'ers of artsen



Verbinden

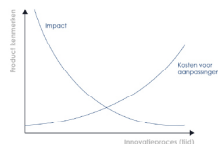
De modellen worden gebruikt om snel te kunnen toetsen of de oplossing aansluit bij de behoefte van de gebruiker



De drie mogelijke resultaten kunnen gebruikt worden als nieuwe input binnen het innovatieproces

HET 4V-MODEL

Door innovatie op deze manier in te richten kunnen de belangrijkste productaanpassingen plaats vinden aan het begin van het proces



De uiteindelijke oplossing sluit hierdoor beter aan op de behoeftes van de gebruiker terwijl onnodige hoge investeringen voorkomen worden

18. Evaluation of the solution

The proposed solution has been evaluated by reviewing both deliverables. First of all, the feedback of the innovation club was analyzed, and secondly, the solution was reviewed from the problem perspective.

18.1 Review of the innovation club

The innovation club was presented with the deliverables for two reasons. First of all, to be able to propose final changes to the content and design, and second of all, to assess whether these tools are adequate in providing them with enough courage to initiate the conversation with management.

Since the deliverables were created in close collaboration with the innovation club, very few changes were proposed, which mainly come down to details. Therefore, these will not be discussed in this report. The final conversations with the innovation club did, however, present some interesting insights. The comments did not only stick to reaching the goal of being able to use the deliverables in talking to management but also reflected on personal learnings.

"This project helped me in being aware of how we want to move too quickly in going from an idea to the implementation."

"I always thought that innovation was a dedicated task for our creative employees... Being part of this project has brought me the understanding of how innovation is a shared responsibility."

"I have come to realize that innovation is not about purely bringing new technology to the organization."

"The 4V-model is a tool which reminds me of how, in every project, we should be constantly aware of what problem is being solved and who will be using the solution."

Although these comments indicate how this project has brought the required knowledge to this specific group, it does not provide any proof of the deliverables actually being adequate in initiating and guiding the conversation with management. Since the innovation club has been aware of this goal and helped to shape the deliverables, this criteria is very hard to assess. However, current activities in which the deliverables are already used indicate these to be succeeding in this goal.

"I am currently promoting the introduction of new roles with the specific responsibility of guiding innovation projects."

"The presentation deck will be brought along to all upcoming MT meetings."

"I plan to organize a theme week which focusses purely on innovation, in which I can present the 4V-model to all management teams."

18.2 Connection to the defined problem

Apart from answering the wishes of the innovation club, the proposed solution is reviewed based on the defined problem. In other words: how does the 4V-model attribute to realizing successful innovation within the Dutch UMC?

Although the proposed innovation framework presents a rough outline on how to structure the early stages of the innovation process, it does not provide a step-by-step approach that can be followed, guaranteeing a successful outcome. Instead, the 4V-model is purely meant as a framework, a way of looking differently at the innovation process.

So, if the solution does not solve the defined problem, what does it solve? As might have become clear by reading this report, innovation is a very complicated activity that is dependent on many different factors. By simply introducing a new method or by just recruiting a handful of design professionals, innovation will not suddenly be successful.

Of course, the 4V-model can bring change to how innovation projects are set up and will, in any case, positively attribute to the result by introducing four additional stages early on in the process. By introducing design activities in the pre-development stages in which the user and other

stakeholders are actively involved, only the very promising ideas will be moved into the development stage. Apart from reducing the risk of investing in the wrong solution, this will speed up the full process.

However, properly organizing these stages takes more than understanding the need alone. It requires the assignment of roles and responsibilities that come with these stages, educating employees on how to execute design activities and experts to guide the process in the initial phases. And still, it asks more from an organization.

Innovation is embedded in the culture of an organization. Adding four additional stages to the process, for instance, will not suddenly break the silos within the organization. Introducing creative activities within the innovation process will also not directly make people apply these in regular health care settings. It requires a combination of the right mindset, people, tools, and methods to create a culture in which innovative behavior has become regular behavior. Organizing innovation is not a one-day job; it is a continuous activity.

Although strictly seen the solution does not solve the complete problem, it does bring the right language to start the conversation within the Dutch UMC on organizing fast and engaging innovation by design.

14. Concluding develop

Due to overlap, instead of answering all four questions separately, the conclusion to this research phase is a combined answer.

Due to overlap, instead of answering all four questions separately, the conclusion to this research phase is a combined answer.

The 4V-model has been created for the Dutch UMC. This model is an innovation framework that divides the first half of the innovation process into four comprehensible stages: vangen (catch), vragen (collect), vormen (create), and verbinden (connect). This framework is accompanied by a presentation deck that explains why the 4V-model is a suitable framework to evaluate innovation. This presentation deck defines the current innovation process, the associated problems, and the added value of reshaping the current process.

These deliverables are meant for the innovation club in discussing innovation with the management of the organization. The innovation club is extremely satisfied with the final result. However, it is questionable whether a framework on itself will solve the overall problem of not properly having organized innovation.

Organizing innovation takes more than only a method or the right tools. The 4V-model, therefore, is not a stand-alone solution but does bring the required language and insights to start the discussion on how to organize innovation.

CONCLUSION

concluding the research project

22. Conclusion

This project started with the assignment of creating concepts for future interaction between patient data and health care staff. The final delivery is a model which can be used to review the innovation process. In this final conclusion, the main findings along this journey will be presented to eventually answer the revised research question: “How could innovation be realized within the Dutch UMC?”

Within health care, a large amount of patient data is collected every day. At this moment, however, very little is done with this data, and for years already, this data is stored in complicated systems which do not use the full potential of this bulk of information. Although the need for change is shared by the vast amount of health care, there are many restrictions resisting this change. Many ideas have already been developed on the future of patient care, but innovative ideas do not seem to land within non-innovative health care organizations. Therefore, instead of proposing innovative concepts, this research focussed on the organization becoming more innovative.

Preliminary research into digital innovation within the Dutch UMC strongly indicated the problems not only to be existent for digital innovation. Instead, they are embedded in the organization, impacting innovation as a whole. For this reason, the scope of the project was broadened from digital innovation to innovation.

Seven problem areas have been defined that each lead back to one cause. Due to little focus on organizing innovation properly, proposed ideas are moved towards the development stage without a thorough evaluation of the desirability, viability, and feasibility of the idea. When looking at how the literature defines innovation processes, the Dutch UMC seems to be neglecting the pre-development stages or front end of the innovation process.

The reason for having these pre-development stages is to make sure

the right problem is being solved, and the best solution is being developed in solving this problem. The pre-development stages are a way of early on discovering whether an idea is valuable or not. This helps in bringing forward the right ideas while saving time and money by not investing in the wrong solution.

The pre-development stages are the least structured stages of the innovation process, and therefore, it is hard to propose a strict method or structure. However, in the literature, design thinking is proposed as a way of bringing some structure to these stages. Design thinking helps non-design organizations in applying design methods to the pre-development stages and is characterized by making decisions through actively involving the user in the design process. Design thinking has been used to shape the 4V-model, an innovation framework to help the Dutch UMC view their innovation process from a designerly perspective.

The 4V-model describes four pre-development stages that should be organized by the Dutch UMC. However, the model does not offer a step-by-step approach to innovative problem solving and is therefore not a solution to failing innovation in itself.

For realizing innovation within the Dutch UMC, a great start would be to reshape the innovation process by introducing four additional pre-development stages. Nevertheless, the management of the organization has so far not realized this need and must therefore be informed. The innovation

club, a group of people within the Dutch UMC that work on the matter of organizing innovation, is appointed to be responsible for this matter.

Apart from management understanding the need to review innovation within the organization, by only introducing an additional four stages or by applying the 4V-model, innovation will not automatically be successful. The answer to how innovation could be realized has many additional layers. Due to the limitations of this project, the 4V-model should really be seen as a jump-start to becoming a more innovative organization. However, from here on, it is the responsibility of the Dutch UMC to use this tool in reorganizing innovation by

introducing additional stages to the process, embracing design tools and methodology, and assigning the right roles and responsibilities within the organization.

The observation can be made that the innovation club experienced a steep learning curve. Being closely involved in this project sparked their enthusiasm to share all new insights with the organization, bringing a lot of trust in a quick follow-up. To become a leading innovator, this is the moment to consider a transformation towards fast and engaging health care innovation by design.

23. Discussion

This project started with the assignment of creating concepts for future interaction between patient data and health care staff. The final delivery is a model which can be used to review the innovation process. In this final conclusion, the main findings along this journey will be presented to eventually answer the revised research question: “How could innovation be realized within the Dutch UMC?”

In the discussion, the limitations of this research will be discussed together, and recommendations will be given for further research.

This project began by analyzing digital innovation specifically. Within the problem interviews, this has therefore been the focus. The problems derived from these interviews, however, seemed to be applicable for innovation as a whole. Although there was a very strong indication of this being the case, additional research can be done into innovation within the Dutch UMC in general.

Although the innovation club at first did not agree with the proposed solution to the problem of failing innovation, after multiple discussions, most of them understood the current situation and reasoning behind proposing a model. Since this took a lot of effort, getting them on board might have influenced the proposed solution and final deliverables.

Thereby, the innovation club is build up from IT employees only. As this group was mostly involved in the second half of the project, involving health care staff is required when realizing the proposed changes.

As discussed, the 4V-model is not a step-by-step approach or a solution that covers all aspects of organizing innovation. Further research is required to define the additional needs for the Dutch UMC to transform the organization into a leading innovator.

24. Reflection

The reflection of this project has been divided into four different parts. In the first part, the goal of this project is discussed based upon the development of the research question. The second part focuses on the fit between the master Strategic Product Design and the research scope. Thirdly, the personal development goals are reviewed, and lastly, the impact of Covid-19 will be shortly discussed.

Project goal

As explained, this project started with a completely different research scope. Although this is not a problem in itself and maybe even characteristic for design or innovation projects, it shows how the organization is struggling on this topic.

Because of adapting the research question and project goal, a lot of resistance was faced by the organization when presenting the results. Although this could be expected by questioning the organization's ability to innovate, it is not necessarily beneficial to the project.

I believe that it should be expected from a master student to be able to deal with situations like this, but it brings the decision on whether to focus on your personal goal: graduation or spending time on educating the client (the Dutch UMC) on the topic of innovation. For me, this decision was easy since the project is carried out on behalf of the Dutch UMC, and it felt like my duty to help the organization embrace the unknown. However, convincing others of a need for change takes up a lot of precious time.

If, however, I would be asked to do this project again, I would make the exact same decisions since it has brought me a lot of new knowledge. Knowledge I would not have gained when not being so passionately involved in the project.

Strategic product design

Since the research scope shifted over time, it is not entirely fair to compare the educational program to the research question. Nevertheless, I think it makes sense to provide a few comments on how I believe the program can be improved.

In the end, this project revolved around innovation as a process within organizations. Although we are educated to live and breathe design and really well understand what it takes to go from problem to solution, for organizations to become innovative, it takes more than designing new products only.

Especially for large organizations like the Dutch UMC, innovation requires a culture that encourages unseen collaborations, entrepreneurial behavior, and creative problem-solving. What this takes, however, is not something that is focussed on within the educational program of Strategic Product Design (SPD). Instead of viewing the design process as an isolated activity, I would have highly benefited from education on topics like change management, process design and business economics before starting my graduation project.

Personal development

Prior to a graduation project, students are asked to define their personal development goals. Although the research goal changed over time, before

starting the project, I wrote down: “I really hope to be able to translate my design skills into tools that the Dutch UMC can use over a long period and contribute to understanding what it means to have the wish of being a leading innovator.”

I think this very accurately defines what I have been able to bring to the Dutch UMC. What it does not address, however, is what this will bring to me. In this part of the reflection, I, therefore, want to elaborate on the learning curve I experienced myself.

Before starting this project, I had not expected it to be so challenging and educational at the same time. As described, the topic of this research does not obviously connect to the educational program of SPD. However, for this reason, I was challenged to dive into the literature on innovation processes and organizational behavior. Apart from reading in on this topic, feeling the urge to really making the organization realize that there are big opportunities ahead when wanting to embrace a different way of working led to many fascinating discussions. These have shown me how complicated it can be to propose changes and people naturally tend to stick to what they know.

Covid-19

At the beginning of this project, unfortunately, the advice was given by the government to not visit the office when not needed. Apart from picking up my staff card and an initial meeting with the initiators of the project, I have not been present at the Dutch UMC. Although the whole world found themselves working at home, it had a major impact on communication. Quick discussions over a coffee or simply dropping by a specific physician you would like to interview was not possible. A graduation project, which is already a solitary job, turns into an even more isolated activity.

Logically covid-19 had an impact on the project but I do not feel like the conclusions or deliverables would have been a lot different. Despite fully digital communication, I was able to collect a large enough amount of data from interviews and online meetings. All in all, I believe this project has brought me a lot of understanding about the difficulties and possibilities of organizing innovation within larger organizations, while the Dutch UMC has been provided with many new insights to rethink innovation.

25. Sources

Baregheh, A., Rowley, J., & Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. *Management Decision*, 47(8), 1323–1339.

Bijl-Brouwer, M. van der, & Dorst, K. (2017, July 8). Advancing the strategic impact of human-centred design. *Design Studies*, 53, 1-53.

Brodny, J., & Kazmierczak, J. (2017). The Design Thinking Method and Its Stages. Brown, T. (2008). *Design Thinking*. Harvard Business Review. <https://doi.org/10.5040/9781474282932.0020>

Carlile, P. R. (2002). A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development. *Organization Science*, 13(4), 442–455. <https://doi.org/10.1287/orsc.13.4.442.2953>

Carlile, P. R. (2004). Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries. *Organization Science*, 15(5), 555–568. <https://doi.org/10.1287/orsc.1040.0094>

Centraal Bureau voor de Statistiek, C. B. S. (2020, September 28). Ziekteverzuim zorg en welzijn hoogst sinds 2003. Centraal Bureau voor de Statistiek. <https://www.cbs.nl/nl-nl/nieuws/2020/40/ziekteverzuim-zorg-en-welzijn-hoogst-sinds-2003>.

Cooper, R. G., & Kleinschmidt, E. J. (1993). Screening new products for potential winners. *Long Range Planning*, 26(6), 74–81. [https://doi.org/10.1016/0024-6301\(93\)90208-w](https://doi.org/10.1016/0024-6301(93)90208-w)

Coyne, R. (2005). Wicked problems revisited. *Design Studies*, 26(1), 5–17. <https://doi.org/10.1016/j.destud.2004.06.005>

Dell’Era, C., Magistretti, S., Cautela, C., Verganti, R., & Zurlo, F. (2020). Four kinds of design thinking: From ideating to making, engaging, and criticizing. *Creativity and Innovation Management*, 29(2), 324–344. <https://doi.org/10.1111/caim.12353>

Demirkan, H., & Spohrer, J. (2015). T-Shaped Innovators: Identifying the Right Talent to Support Service Innovation. *Research-Technology Management*, 58(5), 12–15. <https://doi.org/10.5437/08956308x5805007>

Design Council. (2007). Eleven lessons: managing design in eleven global companies. Dorst, K. (2006). Design Problems and Design Paradoxes. *Design Issues*, 22(3), 4–17. <https://doi.org/10.1162/desi.2006.22.3.4>

Dorst, K., & Cross, N. (2001). Creativity in the design process: co-evolution of problem–solution. *Design Studies*, 22(5), 425–437. [https://doi.org/10.1016/s0142-694x\(01\)00009-6](https://doi.org/10.1016/s0142-694x(01)00009-6)

Evans, R. S. (2016). Electronic Health Records: Then, Now, and in the Future. *Yearbook of Medical Informatics*, 25(S 01). <https://doi.org/10.15265/lys-2016-s006>

Gassmann, O., & Schweitzer, F. (2013). Managing the Unmanageable: The Fuzzy Front End of Innovation. *Management of the Fuzzy Front End of Innovation*, 3–14. https://doi.org/10.1007/978-3-319-01056-4_1

Herstatt, C., & Verworn, B. (2004). The 'Fuzzy Front End' of Innovation. *Bringing Technology and Innovation into the Boardroom*, 347–372. https://doi.org/10.1057/9780230512771_16

Hoofman, W. E., Mars, G. M. J., Janssen, B., de Vroome, E. M. M., Janssen, B. J. M., Pleijers, A. J. S. F., Ramaekers, M. M. M. J., & van den Bossche, S. N. J. (2018). *Nationale Enquête Arbeidsomstandigheden*. TNO CBS-Rapport.

Ishikawa, K. (1998). *Guide to quality control*. Asian Productivity Organization.
Kapsali, M. (2011). Systems thinking in innovation project management: A match that works. *International Journal of Project Management*, 29(4), 396–407. <https://doi.org/10.1016/j.ijproman.2011.01.003>

McNabola, A., Moseley, J., & Reed, B. (2013). *Design for Public Good*. UK Design Council.

Mosely, G., Wright, N., & Wrigley, C. (2018). Facilitating design thinking: A comparison of design expertise. *Thinking Skills and Creativity*, 27, 177–189. <https://doi.org/10.1016/j.tsc.2018.02.004>

Norman, D. A., & Verganti, R. (2014). Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change. *Design Issues*, 30(1), 78–96. https://doi.org/10.1162/desi_a_00250

Onderzoeksprogramma Arbeidsmarkt Zorg & Welzijn. (2019). *Arbeidsmarktproblematiek in de sector Zorg en Welzijn*.

Perry, M. S. (2006). A Fish(bone) Tale. *Quality Progress Milwaukee Magazine*, 39(11).

Khurana, A. and S.R. Rosenthal (1997), Integrating the fuzzy front-end of new product development, *Sloan Management Review*, Cambridge.

Kroth, P. J., Morioka-Douglas, N., Veres, S., Babbott, S., Poplau, S., Qeadan, F., Parshall, C., Corrigan, K., & Linzer, M. (2019). Association of Electronic Health Record Design and Use Factors With Clinician Stress and Burnout. *JAMA Network Open*, 2(8). <https://doi.org/10.1001/jamanetworkopen.2019.9609>

Roberts, J. P., Fisher, T. R., Trowbridge, M. J., & Bent, C. (2016). A design thinking framework for healthcare management and innovation. *Healthcare*, 4(1), 11–14. <https://doi.org/10.1016/j.hjdsi.2015.12.002>

Serrat, O. (2017). The Five Whys Technique. *Knowledge Solutions*, 307–310. https://doi.org/10.1007/978-981-10-0983-9_32

Tschimmel, K. (2012). *Design Thinking as an effective Toolkit for Innovation*. <https://doi.org/10.13140/2.1.2570.3361>

26. Appendices

Due to privacy, appendix A is not publicly shared. In this report the presentation deck, poster and project brief are added.

Appendix B: the presentation deck



INTRODUCTIE

Dit document beschrijft een nieuw innovatiekader voor een Nederlands ziekenhuis. Dit kader is een resultaat van een afstudeeronderzoek.

Dit onderzoek is uitgevoerd vanuit de masteropleiding Strategic Product Design op de Technische Universiteit Delft.

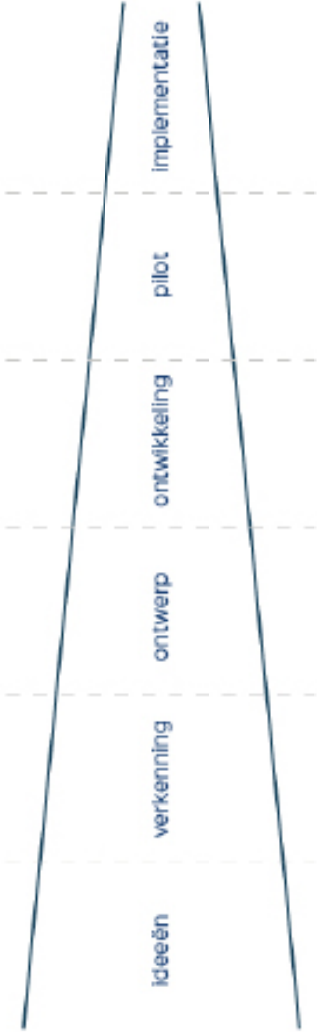
Allereerst zal de huidige situatie en de daarbij horende uitdagingen worden geschetst waarna het kader zal worden geïntroduceerd en toegelicht.

Het innovatieproces

Een gebruikelijke manier om een innovatieproces te structureren is door deze op te delen in een aantal verschillende fases

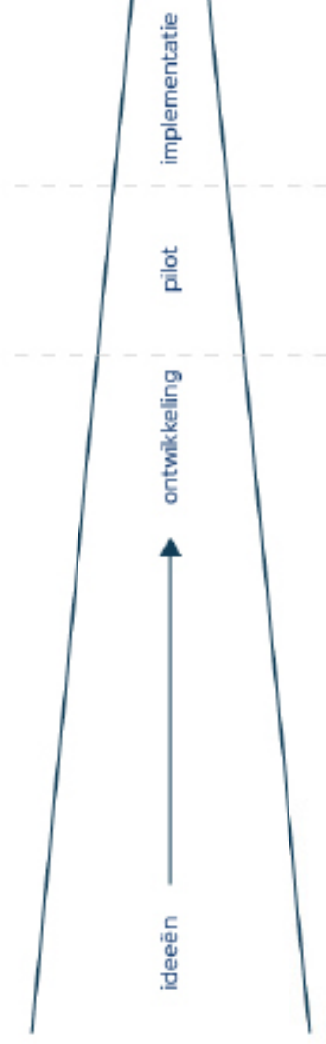


Het proces wordt vaak weergegeven als een trechter omdat je met zoveel mogelijk ideeën wilt beginnen, waarvan slechts een enkele de implementatie haalt



De huidige situatie

Binnen het ziekenhuis herkennen we echter een innovatieproces waarbij een groot gedeelte van deze fases wordt overgeslagen



Vaak worden ideeën bedacht op basis van nieuwe technologie om vervolgens direct doorgeschoven te worden naar de ontwikkelingsfase

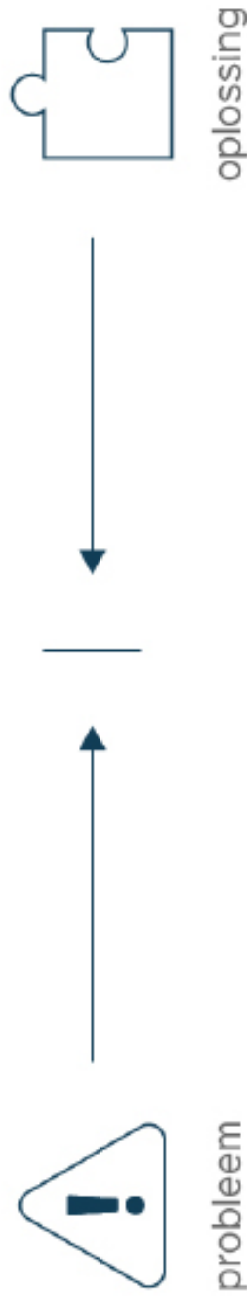


Het probleem

Het nadeel van deze benadering is dat er één oplossing naar voren wordt geschoven
nog voordat het probleem duidelijk in kaart is gebracht

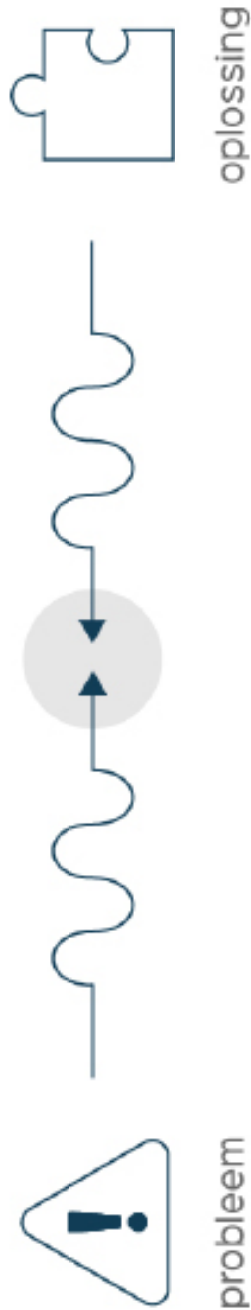


Hiermee loop je het risico slechts een tussenoplossing te ontwikkelen die geen
volledige aansluiting vinden op het daadwerkelijke probleem



De structuur van innovatie

Voordat het probleem en de oplossing samen komen, moeten deze daarom beide de ruimte krijgen om zich te evalueren

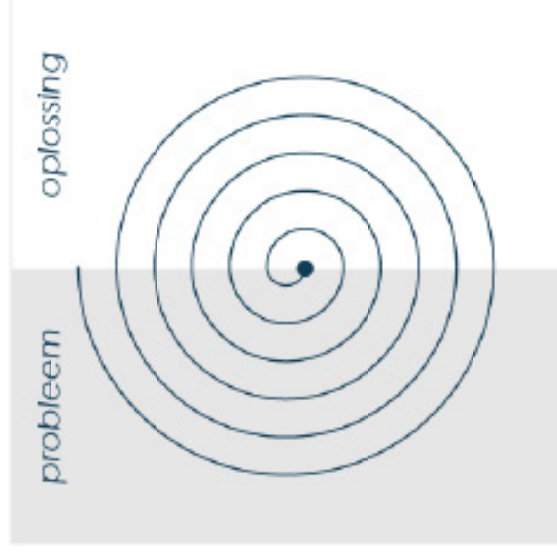


Gezien deze vrijheid is het innovatieproces alles behalve rechtlijnig en wordt deze gekenmerkt door een grote mate van onvoorspelbaarheid



De structuur van innovatie

Door deze onvoorspelbaarheid is het innovatieproces zeer lastig te structureren of in te delen in vooraf gedefinieerde fases



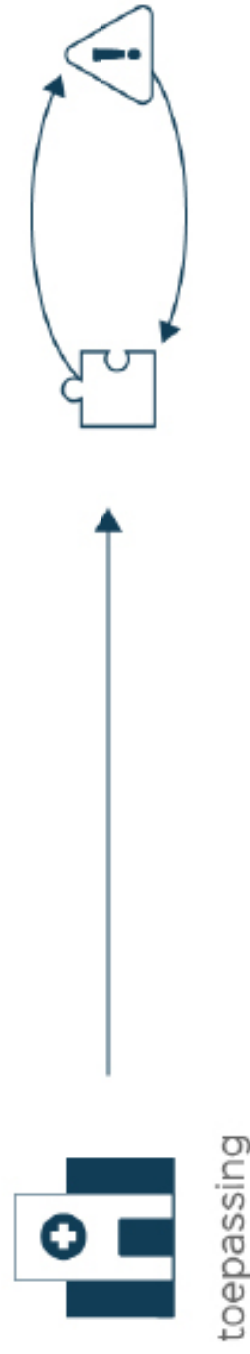
Innovatie is het beste te beschrijven als een constante beweging tussen het op te lossen probleem en mogelijke oplossingen

De structuur van innovatie

Hiermee is er dus ook geen vast begin- of eindpunt voor het innovatieproces, het is dus ook niet per definitie verkeerd om vanuit een nieuwe technologie te beginnen



Echter dient deze wel getoets te worden op het gedefinieerde probleem en zullen er alternatieve oplossingen overwogen worden



De gebruiker centraal

De constante factor in dit onvoorspelbare proces zijn diegenen die het probleem ervaren, zij zullen immers ook degenen zijn die de oplossing gaan gebruiken

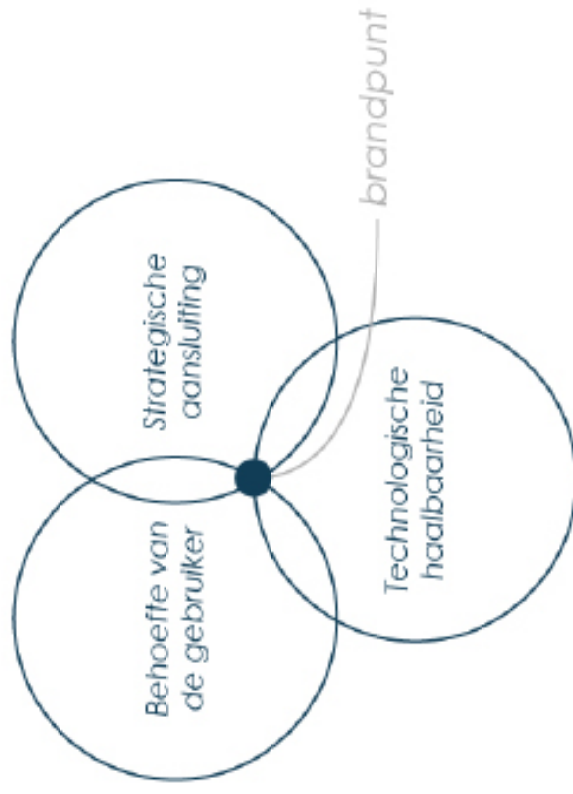


Door de gebruiker centraal te stellen in het innovatieproces wordt het **juiste** probleem opgelost met de **meest effectieve** oplossing



Samenwerkingen

Behalve dat innovaties aan moeten sluiten op de behoefte van de gebruiker, moeten deze ook technisch haalbaar zijn en passen binnen de strategie van de organisatie



Dit vraagt om ongebruikelijke samenwerkingen tussen afdelingen die in reguliere processen mogelijk volledig los staan van elkaar

Het 4V-model

Het 4V-model beschrijft een kader dat structuur geeft aan het innovatieproces tot aan de ontwikkelingsfase



In plaats van een vaste volgorde te volgen, kan er in het proces vrij bewogen worden tussen de vier onderdelen:

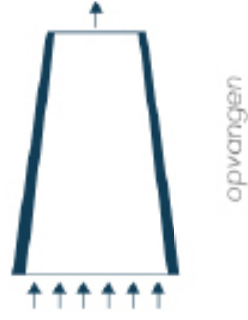


Vangen

Vangen staat voor het opvangen van alle ideeën, problemen en kansen die gedeeld worden vanuit de zorg, zonder deze direct te beoordelen

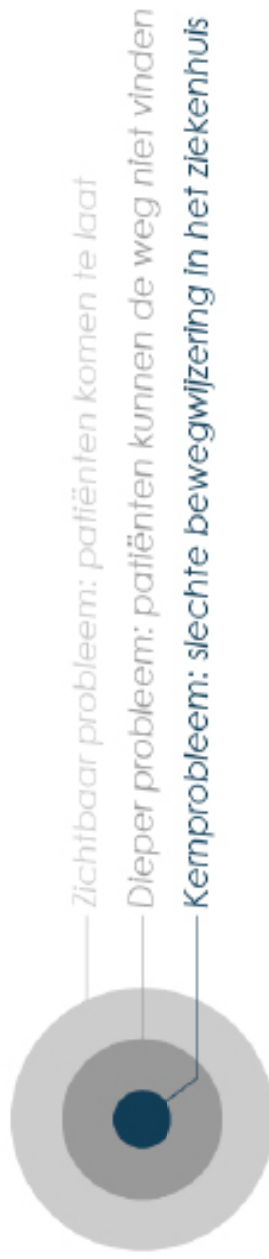


De uitkomst van een innovatieproces is immers altijd onbekend.. Door te vangen, zorg je ervoor dat eventuele waardevolle informatie niet vroegtijdig verloren gaat

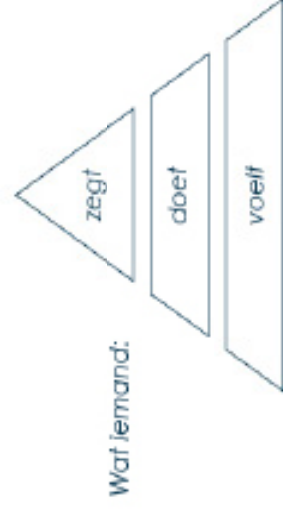


Vragen

Omdat problemen vaak meerdere lagen hebben, moet je tot de kern van het probleem komen voordat de juiste oplossing kan worden voorgesteld

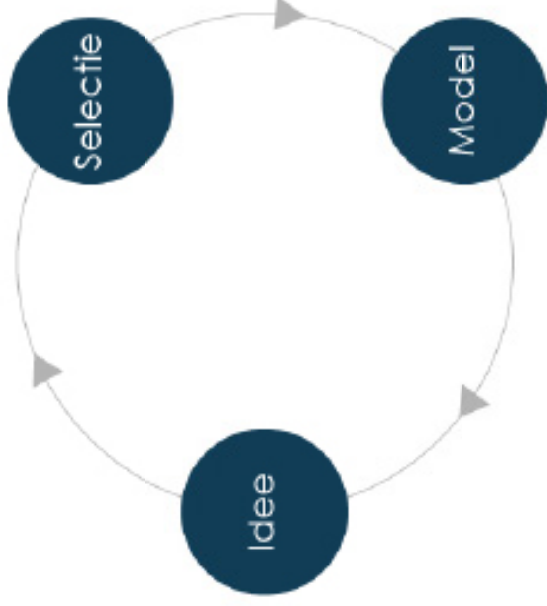


Om deze te vinden en te kunnen begrijpen vanuit het perspectief van de gebruiker zul je je in hen moeten verplaatsen en continu het gesprek aan blijven gaan



Vormen

Wanneer het duidelijk is welk probleem er opgelost moet worden, begint het creatieve proces waarin **zoveel mogelijk** oplossingen worden bedacht



De meest kansrijke oplossingen worden geselecteerd en uitgewerkt tot simpele modellen

Vormen

Het vormen van ideeën over mogelijke oplossingen kan worden gedaan aan de hand van groepsactiviteiten zoals brainstorming, superstorming of mind mapping

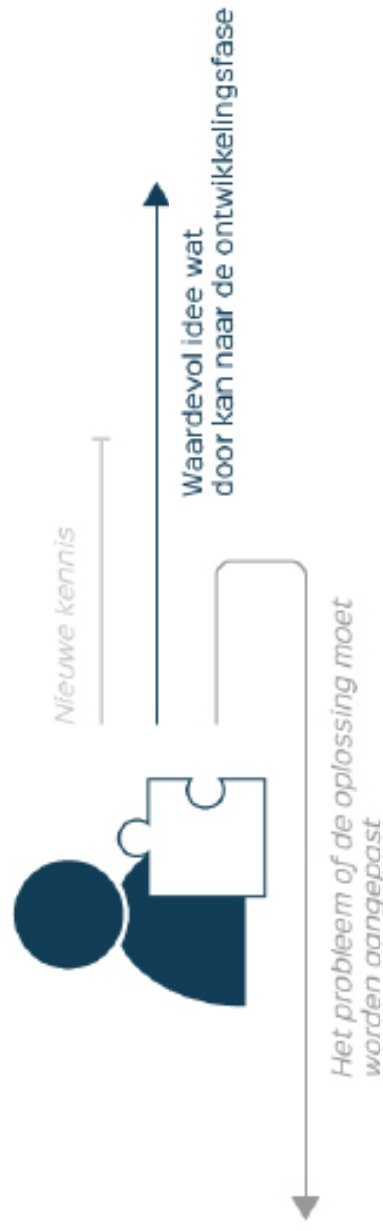


Voor het beste resultaat moet er samen worden gewerkt in diverse, multidisciplinaire teams en niet in groepen bestaande uit enkel IT'ers of artsen



Verbinden

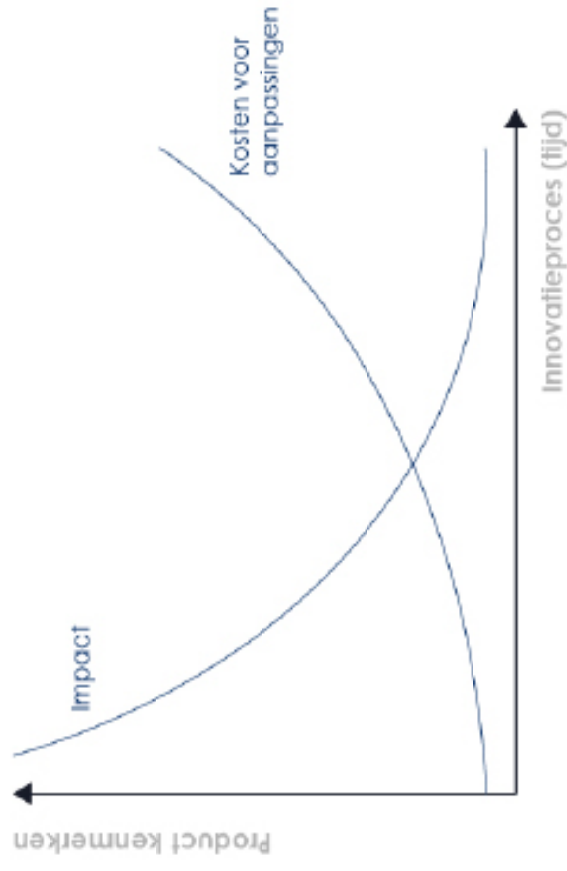
De modellen worden gebruikt om snel te kunnen toetsen of de oplossing aansluit bij de behoefte van de gebruiker



De drie mogelijke resultaten kunnen gebruikt worden als nieuwe input binnen het innovatieproces

HET 4V-MODEL

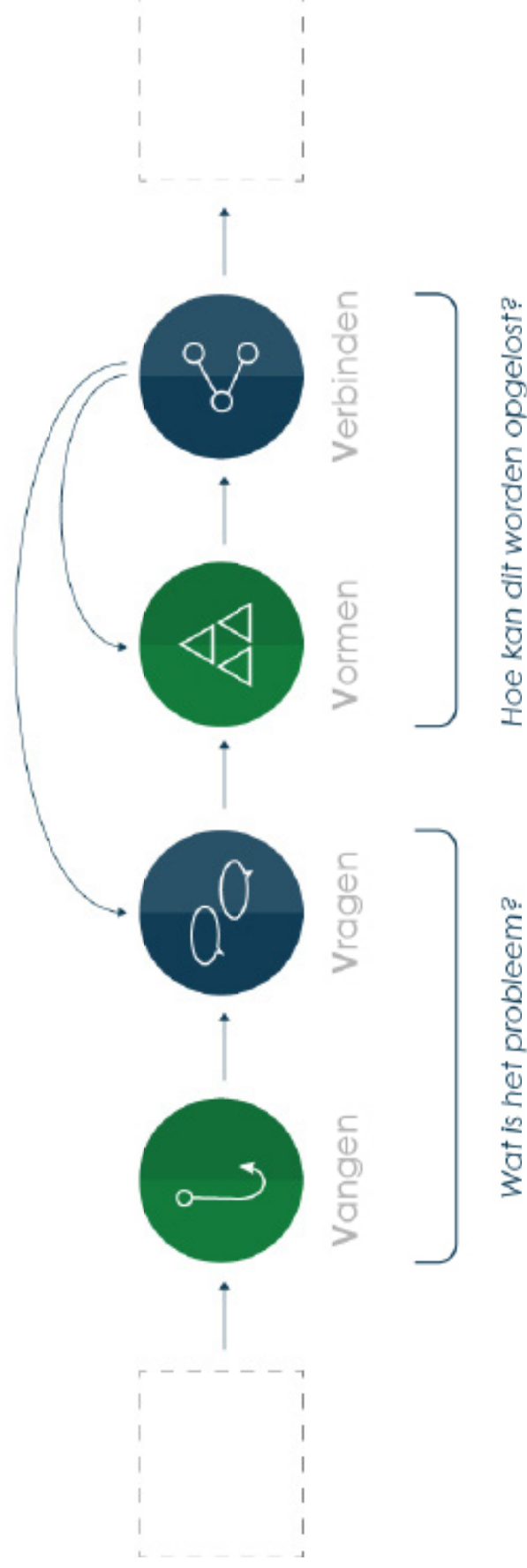
Door innovatie op deze manier in te richten kunnen de belangrijkste productaanpassingen plaats vinden aan het begin van het proces



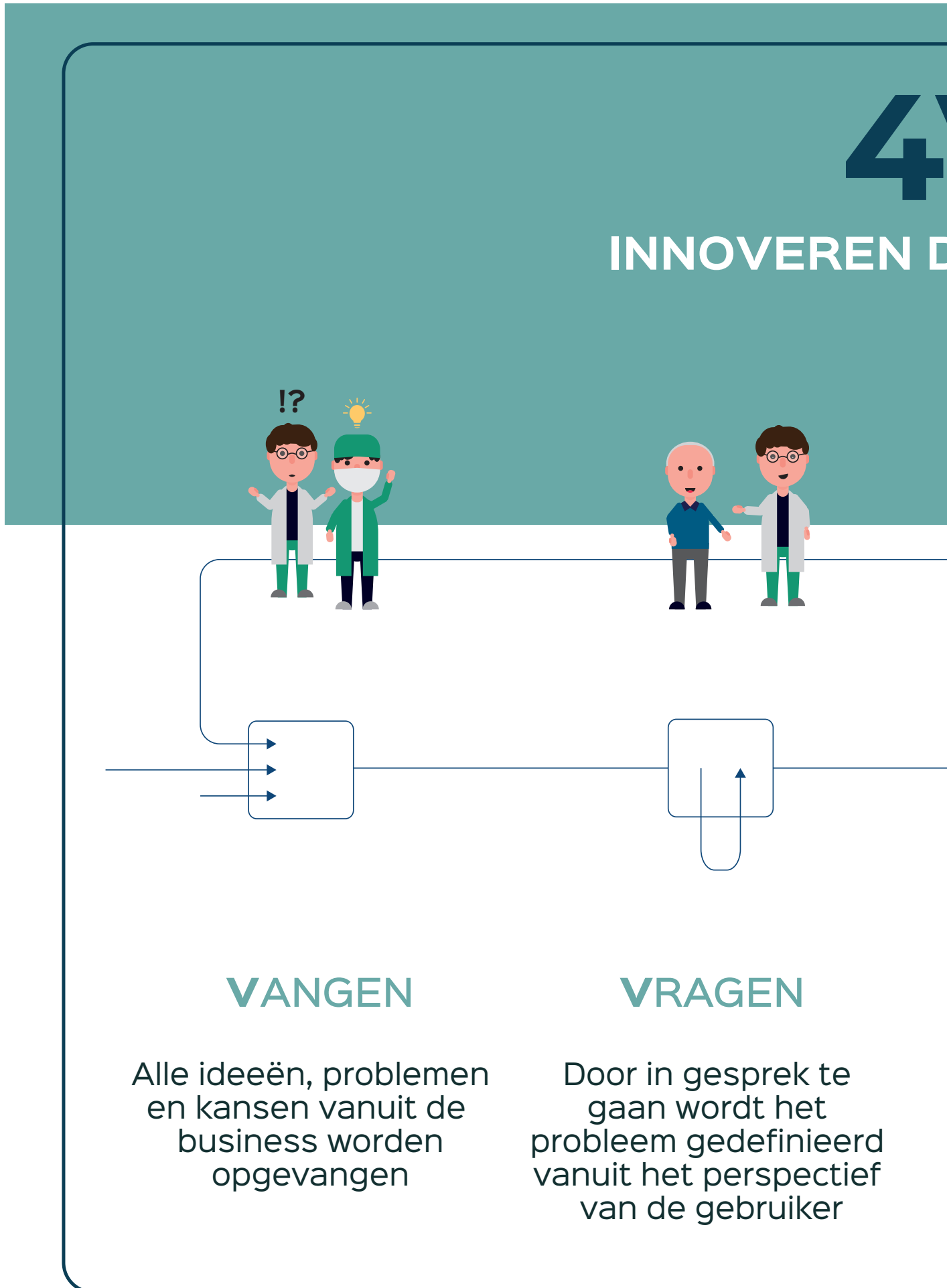
De uiteindelijke oplossing sluit hierdoor beter aan op de behoeftes van de gebruiker terwijl onnodige hoge investeringen voorkomen worden

HET 4V-MODEL

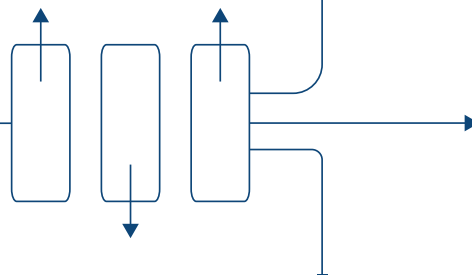
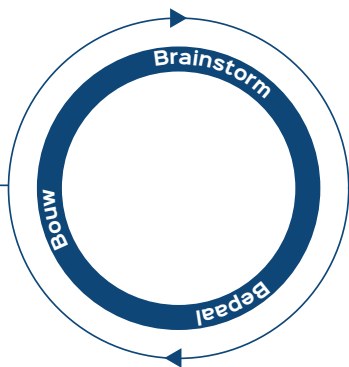
Het 4V-model is echter geen chronologisch stappenplan wat gevolgd kan worden,
het is slechts een hulpmiddel om het innovatieproces in te richten waarbij elk op
zijn eigen manier de vier fases zal doorlopen







V DOOR DESIGN



VORMEN

Tijdens creatieve sessies werken verschillende afdelingen samen om oplossingen te bedenken

VERBINDEN

Voorafgaand aan de ontwikkelingsfase worden oplossingen altijd eerst getest bij de gebruiker

Appendix D: the project brief

DESIGN
FOR OUR
future



IDE Master Graduation

Project team, Procedural checks and personal Project brief

This document contains the agreements made between student and supervisory team about the student's IDE Master Graduation Project. This document can also include the involvement of an external organisation, however, it does not cover any legal employment relationship that the student and the client (might) agree upon. Next to that, this document facilitates the required procedural checks. In this document:

- The student defines the team, what he/she is going to do/deliver and how that will come about.
- SSC E&SA (Shared Service Center, Education & Student Affairs) reports on the student's registration and study progress.
- IDE's Board of Examiners confirms if the student is allowed to start the Graduation Project.

! USE ADOBE ACROBAT READER TO OPEN, EDIT AND SAVE THIS DOCUMENT

Download again and reopen in case you tried other software, such as Preview (Mac) or a webbrowser.

STUDENT DATA & MASTER PROGRAMME

Save this form according the format "IDE Master Graduation Project Brief_familyname_firstname_studentnumber_dd-mm-yyyy". Complete all blue parts of the form and include the approved Project Brief in your Graduation Report as Appendix 1 !



family name	Roorda	Your master programme (only select the options that apply to you):	
initials	C.P.	given name	Coen
student number	4280873	IDE master(s):	☐ IPD ☐ Dfl ☒ SPD
street & no.		2 nd non-IDE master:	
zipcode & city		individual programme:	- - (give date of approval)
country		honours programme:	☐ Honours Programme Master
phone		specialisation / annotation:	☐ Medisign
email			☐ Tech. in Sustainable Design
			☐ Entrepreneurship

SUPERVISORY TEAM **

Fill in the required data for the supervisory team members. Please check the instructions on the right !

** chair	Prof. dr. ir. Smulders, F.E.H.M.	dept. / section:	MOD	Chair should request the IDE Board of Examiners for approval of a non-IDE mentor, including a motivation letter and c.v..
** mentor	Ir. Brinkman, C.	dept. / section:	MCR	
2 nd mentor				
	organisation:			! Second mentor only applies in case the assignment is hosted by an external organisation.
	city:		country:	
comments (optional)	! Ensure a heterogeneous team. In case you wish to include two team members from the same section, please explain why.			

Procedural Checks - IDE Master Graduation

APPROVAL PROJECT BRIEF

To be filled in by the chair of the supervisory team.

chair Prof. dr. ir. Frido Smulders

date 0 - 1 - 2020

signature 

CHECK STUDY PROGRESS

To be filled in by the SSC E&SA (Shared Service Center, Education & Student Affairs), after approval of the project brief by the Chair. The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total: _____ EC

Of which, taking the conditional requirements into account, can be part of the exam programme _____ EC

List of electives obtained before the third semester without approval of the BoE

☒ YES all 1st year master courses passed

☐ NO missing 1st year master courses are:

name _____ date _____ - - signature _____

FORMAL APPROVAL GRADUATION PROJECT

To be filled in by the Board of Examiners of IDE TU Delft. Please check the supervisory team and study the parts of the brief marked **. Next, please assess, (dis)approve and sign this Project Brief, by using the criteria below.

- Does the project fit within the (MSc)-programme of the student (taking into account, if described, the activities done next to the obligatory MSc specific courses)?
- Is the level of the project challenging enough for a MSc IDE graduating student?
- Is the project expected to be doable within 100 working days/20 weeks ?
- Does the composition of the supervisory team comply with the regulations and fit the assignment ?

Content: ☒ APPROVED ☐ NOT APPROVED

Procedure: ☒ APPROVED ☐ NOT APPROVED

comments

name _____ date _____ - - signature _____

Creating an innovation strategy for the DUMC on the use of patient data

project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 05 - 10 - 2020

15 - 04 - 2020

end date

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

With the aim of being a leading innovator in the healthcare industry, the Dutch UMC (DUMC) is exploring new ways to improve healthcare. One of the research areas evolves around the use of patient data: how current ways of working with patient data can be improved and what opportunities emerge from upcoming new technologies.

Patient data is a collection of every patient's medical history and personal data and is used throughout the entire healthcare sector in order to provide patients with the best healthcare possible. Within the DUMC, this data used to be stored in multiple systems, all tailored to its specific user (medical department) and although these solutions worked very well on their own, there was little to no possibility of exchanging patient data between different departments. To overcome this problem, electronic health record (EHR) systems were introduced: standardized and centralized software, aiming to serve as the communication tool within healthcare institutions. As it might have solved a lot of issues regarding patient data exchange, it also created new problems.

With the introduction of one central system per hospital, functionalities that were present in former systems, had suddenly disappeared. The standardization of software did not positively influence the speed and way of working with the system but the ability to exchange patient data throughout a medical institution outweighed the overall user-friendliness. Since EHR systems are of an intangible size, developers have difficulties to keep up with technological developments and changing user demands, they are complex and cluttered and miss key features like a search function. On average it takes ten minutes, 200+ mouse clicks and 700+ keyboard clicks for a physician to extract the required information in a twenty minute consult. At the DUMC specifically, this number might even be worse due to deviating ways of using the system between different departments, resulting in physician stress and burnout.

Another ongoing discussion regarding the use of patient data is about whether data belongs to the observer (the medical institution) or the subject (the patient). Due to privacy issues, patient data currently stays within the protected EHR system of the healthcare institution who recorded it. A patient therefore has very little to no insights in its medical history. What arises from storing patient data in protected systems, is the impossibility of patient data exchange between two different healthcare institutions, irrespective of using the same EHR system. These two issues got so big that they even were addressed in Dutch politics, resulting in a heavy debate on privacy risks and resulting in the withdrawal of new laws regarding a national EHR system only three years after they had been introduced.

Worldwide there are many EHR systems but in the Netherlands the market is pretty much saturated by the systems of Epic and Chipsoft, with the DUMC using HiX by ChipSoft. With the implementation of an EHR system being a very expensive and time-consuming activity, the chance of switching to a new system any time soon, is very low. Meaning that, every innovation regarding the use of patient data, is somehow restricted by the possibilities of current software.

Innovation on the use of patient data within the DUMC is complex, strongly dependent on existing systems and criticized by the many different stakeholders. In order to make innovation work, a clear strategy, not only on technological level but also on organizational level is needed while designs require the constant involvement of different users.

space available for images / figures on next page

Personal Project Brief - IDE Master Graduation

introduction (continued): space for images

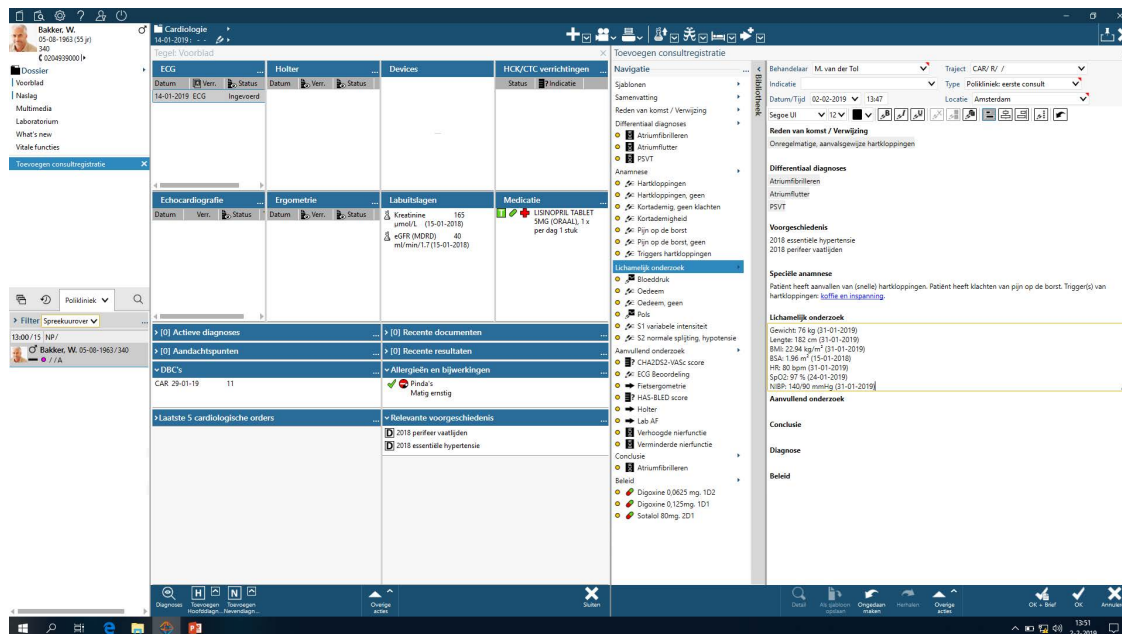


image / figure 1: Fake patient example screen of the EHR system used by the Dutch UMC (HiX)

image / figure 2: __

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

First of all, the DUMC strongly believes that innovation on the use of patient data is beneficial for the quality of healthcare but there is no clear goal or strategy for these innovations due to the many varying opinions on this subject along different stakeholders within the organization. Thereby, the wish of becoming a leading innovator should be accompanied by willing to invest in the necessary resources to reach this goal. However, at this moment there is no concrete action plan for the realization and/or implementation of possible innovations regarding the use of patient data.

Secondly, there is a disconnection between the available technology, the urge to be an innovative organization and the actual users of the tools regarding patient data: the DUMC claims to be an innovative organization but simply acquires the systems that are available instead of co-creating new systems with the main users while existing solutions have difficulties adopting new technologies due to size, outdated foundations and strict medical legislation. Due to this continuous loop of purchasing systems at companies that have difficulties innovating themselves, the healthcare sector is ten years behind.

The DUMC is in need of a shared vision on how and why to innovate on the use of patient data. This vision should be translated into a strategy that is in line with the overall strategy of the DUMC, projecting technological developments, organizational changes and user commitment to reach the innovation goals.

Research should indicate who will be the actual executor of this strategy and thus, who the strategy should be written for: the board, a (new) dedicated team, a specific (combination of) department(s), a third-party or a combination of any of the before mentioned parties.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

Research the desired innovations for the use of patient data and illustrate the benefits per stakeholder. Create a future vision and visualize product and service concepts matching this vision. Put together a roadmap on technology development, organizational changes and user commitment in order to reach the innovation goals.

This project will involve many interviews with stakeholders from within and outside of the DUMC. In order to understand how these stakeholders are positioned, persona's will be created, elaborating on their current engagement with patient data, the issues they face, their authority regarding this subject and their future desires.

The overall strategy of becoming an innovative leader in the healthcare industry will be analysed to find similarities with the stakeholders' desires and possible restrictions and opportunities for this specific field of innovation. The analysis of the current innovation process should point out what methods are used to assess projects, who is involved, in what way they are executed (systemic or not) and how this is communicated within the organization. To do so, case studies on both running and completed innovation projects will be carried out.

The findings of this research will be used to create a vision that illustrates the desired role that patient data will play in the future and how this affects all stakeholders. Design tools like customer journey mapping are used to show the difference between current and future situation.

To illustrate the intended strategy, a roadmap will be put together to show what technological developments and/or organizational changes are needed to turn these concepts into actual products or services.

Personal Project Brief - IDE Master Graduation

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 5 - 10 - 2020 15 - 4 - 2020 end date



Every Monday to Thursday is used for this project. Friday is a day off in which the student focuses on his part time job. During the Christmas holidays, the student will not work on the project as well as the week directly after the green light meeting.

The official kick-off date is the 6th of October and graduation is planned to be on the 15th of April.

MOTIVATION AND PERSONAL AMBITIONS

Explain why you set up this project, what competences you want to prove and learn. For example: acquired competences from your MSc programme, the elective semester, extra-curricular activities (etc.) and point out the competences you have yet developed. Optionally, describe which personal learning ambitions you explicitly want to address in this project, on top of the learning objectives of the Graduation Project, such as: in depth knowledge a on specific subject, broadening your competences or experimenting with a specific tool and/or methodology, Stick to no more than five ambitions.

I am passionate about showing complex organizations the impact of good innovation. During my internship two years ago, I created a training program on how to use design thinking within a large insurance company which was challenging but satisfactory due to the significant impact it had.

In this project I really hope to be able to translate my design skills into tools that the DUMC can use over a long period and contributes to understanding what it means to have the wish of being a leading innovator.

The quantitative nature of this project therefore really fits me since I want to improve my interview skills and prefer interacting with people instead of having to analyze charts and figures. The idea of putting my energy into a noble cause, improving healthcare, makes me even more motivated.

What I would like to achieve with this project:

- Create a better understanding of (innovation within) the healthcare sector
- Co-create ideas or concepts with main stakeholders
- Improve interviewing skills and qualitative data analytics
- Communication of findings and ideas through visuals (limited text)

What skills are beneficial to this project:

- Experience in working for large organizations (Allianz Benelux, Akzo Nobel India)
- Prior projects on product innovation (DSP: Ford & Yanfeng) and innovation strategy (Roadmapping: Grundig)
- Entrepreneurial mindset (MedTech-Based Entrepreneurship, Build Your Startup)

FINAL COMMENTS

In case your project brief needs final comments, please add any information you think is relevant.

